# 79 Cabbage Tree Road, Bayview

## Flora and Fauna Assessment (FFA)

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# Contents

**Executive summary** ..... **ix**

**1 Introduction** ..... **12**
1.1 Study area ..... 12
1.2 Description of the project ..... 12

**2 Statutory framework** ..... **16**
2.1 *Environment Protection and Biodiversity Conservation Act 1999* ..... 16
2.2 *Environmental Planning and Assessment Act 1979* ..... 16
2.3 *Biodiversity Conservation Act 2016* ..... 16
2.4 *Threatened Species Conservation Act 1995* ..... 16
2.5 *State Environmental Planning Policy (SEPP) 44 - Koala Habitat Protection* ..... 16
2.6 *Biosecurity Act 2015* ..... 17
2.7 *Water Management Act 2000* ..... 17
2.8 *Pittwater Local Environmental Plan 2014* ..... 18
2.9 *Pittwater 21 Development Control Plan* ..... 18
2.10 *NSW Fisheries Management Act* ..... 18

**3 Methods** ..... **19**
3.1 Literature review ..... 19
3.1.1 Likelihood of occurrence ..... 19
3.2 Site inspection ..... 20
3.2.1 Vegetation mapping ..... 20
3.2.2 Targeted survey for threatened flora species ..... 20
3.2.3 Targeted survey for *Myotis macropus* (Southern Myotis) ..... 20
3.2.4 Targeted survey for *Cercartetus nanus* (Eastern Pygmy Possum) ..... 20
3.2.5 Targeted survey for *Heleioporus australiacus* (Giant Burrowing Frog) ..... 21
3.2.6 Weather conditions ..... 22
3.3 Impact assessment ..... 23
3.4 Survey limitations ..... 23

**4 Results** ..... **24**
4.1 Literature review ..... 24
4.1.1 Soil and topography ..... 24
4.1.2 Threatened ecological communities ..... 24
4.1.3 Vegetation communities ..... 24
4.1.4 Threatened flora and fauna ..... 24
4.2 Site inspection ..... 29
4.2.1 Vegetation communities ..... 29

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4.2.1.1 Central Coast Escarpment Moist Forest (CCEMF) – PCT 1565 ..... 29
4.2.1.2 Central Coast Escarpment Moist Forest (CCEMF) – PCT 1565 (low condition – primarily Lantana understorey) ..... 30
4.2.1.4 Coastal Warm Temperate Rainforest (CWTR) – PCT 1529 ..... 30
4.2.1.5 Weeds and exotics ..... 31
4.2.1.6 Urban native and exotic plantings and groundcover ..... 31
4.2.1.7 Urban surfaces ..... 31
4.2.2 Flora ..... 31
4.2.2.1 Threatened flora ..... 31
4.2.2.2 Priority weeds and Weeds of National Significance (WoNS) ..... 31
4.2.3 Fauna and fauna habitat ..... 32
**4.2.3.1** Fauna habitat ..... 32
4.2.3.2 Threatened fauna ..... 32
4.2.4 Corridors ..... 33
4.2.5 Streams ..... 34

**5 Impact assessment ..... 36**
5.1 Direct impacts ..... 36
5.2 Indirect impacts ..... 37
5.3 Impact assessment ..... 37
5.3.1 Assessment of Significant (TSC Act) ..... 37
5.3.2 Significance Assessments (EPBC Act) ..... 39
5.4 Referral Guidelines for the vulnerable Koala (EPBC Act - DotE 2014) ..... 40
5.4.1 Pittwater Local Environmental Plan (LEP) 2014 ..... 41
5.5 *Pittwater 21 Development Control Plan* ..... 43

**6 Recommendations ..... 46**

**7 Conclusions ..... 48**

**References ..... 49**

**Appendix A : Likelihood of Occurrence ..... 52**

**Appendix B : Microbat echolocation recording and identification ..... 84**

**Appendix C : Flora and Fauna species list ..... 95**

**Appendix D : Assessment of Significance (TSC Act) ..... 100**

**Appendix E : Assessment of Significance (EPBC Act) ..... 125**

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# List of figures

Figure 1: Study area and regional context ..... 13

Figure 2: Study area, subject site, terrestrial biodiversity layer, and local hydrology ..... 14

Figure 3: Study area, subject site (includes development footprint, and indicative APZ), local hydrology, and riparian buffer ..... 15

Figure 4: Threated flora atlas search records (5 km radius) ..... 26

Figure 5: Threatened fauna Atlas search records (1 km radius) ..... 27

Figure 6: Survey effort, including full floristic / biometric plots, locations of nest boxes and remote cameras (Eastern Pygmy-possum), and location of call play-back (Giant Burrowing Frog) ..... 28

Figure 7: Validated vegetation communities, habitat features, and threatened species records, within the study area ..... 35

Figure 8: Call profile for *Rhinolophus megaphyllus* (Eastern Horseshoe Bat) recorded at 23:56 on SN81081 on 9 November 2017 ..... 89

Figure 9: Possible call profile for *Chalinolobus morio (*Chocolate Wattled Bat*), Vespadelus pumilus (*Eastern Forest Bat*) or Vespadelus vulturnus (*Little Forest Bat*),* recorded at 21:06 on SN882241 on 9 November 2017. ..... 90

Figure 10: Possible call profile for *Miniopterus australis* (Little Bentwing-Bat) or *Vespadelus pumilus (*Eastern Forest Bat*)* recorded at 21:52 on SN81081 on 10 November 2017. ..... 91

Figure 11: Possible call profile for *Mormopterus norfolkensis* (East-coast Free-tailed Bat) or *Mormopterus (Ozimops) ridei* (Ride's Free-Tailed Bat) recorded at 02:05 on SN81081 on 10 November 2017 ..... 92

Figure 12: Possible call profile for *Myotis macropus* (Southern Myotis) *or Nyctophilus* sp. (Vesper Bat species) recorded at 03:56 on SN81081 on 10 November 2017 ..... 93

Figure 13: Possible call profile for *Miniopterus australis* (Little Bentwing-Bat) or *Vespadelus pumilus (*Eastern Forest Bat*)* recorded at 21:50 on SN82241 on 10 November 2017 ..... 94

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# List of tables

Table 1: Weather conditions during the site inspection and targeted surveys ..... 22

Table 2: Vegetation communities, their condition and the corresponding PCTs represented within the study area ..... 29

Table 3: State level determined priority weeds and other weeds of concern present in the site ..... 31

Table 4: Direct impacts to vegetation communities* ..... 36

Table 5: Consideration of assessment criteria in Terrestrial Biodiversity areas ..... 44

Table 6: Likelihood of occurrence and requirement of impact assessment for threatened fauna species ..... 53

Table 7: Likelihood of occurrence and requirement of impact assessment for threatened flora species 76

Table 8: Microbat species diversity recorded in the study area between 9 and 10 November 2017 ..... 86

Table 9: Anabat results for SN81081 placed adjacent to the HBT recorded between 9 and 10 November 2017 ..... 87

Table 10: Anabat results for SN882241 placed adjacent to the small pool recorded between 9 and 10 November 2017 ..... 88

Table 11: Flora species list ..... 95

Table 12: Fauna species list ..... 99

Table 13: Foraging and roosting resources likely to be impacted for Glossy Black-cockatoo ..... 104

Table 14: Foraging and roosting resources likely to be impacted for each potentially affected species ..... 107

**Table 15**: **Objectives and assessment of the Barking Owl and Large Forest Owls recovery plans** ..... 114

Table 16: Foraging and roosting resources likely to be impacted for EPP ..... 118

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# Abbreviations

| Abbreviation | Description |
|---|---|
| AoS | Assessment of Significance |
| APZ | Asset Protection Zone |
| BC Act | *Biodiversity Conservation Act* 2016 |
| CCEMF | Central Coast Escarpment Moist Forest |
| CE | Critically Endangered |
| CWTR | Coastal Warm Temperate Rainforest |
| DA | Development Application |
| DCP | Development Control Plan |
| DEWHA | Department of Environment, Water, Heritage, and the Arts |
| DotE | Department of the Environment |
| DotEE | Department of the Environment and Energy |
| DPI | Department of Primary Industries |
| EEC | Endangered Ecological Community |
| ELA | Eco Logical Australia Pty Ltd. |
| EP&A Act | *Environmental Planning and Assessment Act 1979* |
| EPBC Act | *Environment Protection Biodiversity Conservation Act 1999* |
| EPP | Eastern Pygmy Possum |
| FFA | Flora and Fauna Assessment |
| FM Act | *Fisheries Management Act 1994* |
| GBF | Giant Burrowing Frog |
| HBT | Hollow-bearing tree |
| LEP | Local Environmental Plan |
| LGA | Local Government Area |
| MNES | Matters of National Environmental Significance |
| NSW | New South Wales |
| OEH | Office of Environment and Heritage |
| PCT | Plant Community Type |
| SEPP | State Environmental Planning Policy |
| SMCMA | Sydney Metropolitan Catchment Management Authority |
| TEC | Threatened Ecological Community |
| TSC Act | NSW *Threatened Species Conservation Act 1995* |
| WM Act | *Water Management Act 2000* |

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| Abbreviation | Description |
|---|---|
| WoNS | Weeds of National Significance |

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# Executive summary

Eco Logical Australia (ELA) was commissioned by Aveo Pty Ltd to undertake a Flora and Fauna Assessment (FFA) to accompany a Development Application (DA) for 79 Cabbage Tree Road, Bayview (the study area), located within the Northern Beaches LGA. The study area is part of a large corridor of intact native vegetation which extends from western Mona Vale through to Bayview. A large portion of the study area is currently being utilized as a retirement village, and the proposed works would create additional buildings for this purpose. The proposed works, and specifically the impact footprint (subject site), includes the:

- Development footprint: an area of approximately 1.10 ha, which will involve comprehensive clearance of vegetation,
- Indicative Asset Protection Zone (APZ): an area of approximately 2.75 ha requiring under-scrubbing (removal) of midstorey vegetation, along with the removal of some trees which have canopies in contact with other trees.

The study area is situated within the Terrestrial Biodiversity Layer under the Pittwater Local Environment Plan (LEP), and thus must satisfy the objectives of Clause 7.6 in the LEP.

The site inspections (October and November 2017) mapped the approximate areas of the following vegetation communities and other features occurring within the study area:

- 2.99 ha Central Coast Escarpment Moist Forest (CCEMF) – PCT 1565, consisting of:
    - 1.77 ha CCEMP – good condition – native understorey
    - 0.39 ha CCEMF – low condition – primarily Lantana understorey
    - 0.83 ha CCEMF – exotic understorey
- 0.53 ha Coastal Warm Temperate Rainforest (CWTR) – PCT 1529
- 0.07 ha Weeds and exotics
- 1.21 ha Urban native and exotic plantings and groundcover
- 1.19 ha Urban surfaces.

The CWTR mapped within the study area was not considered part of the endangered ecological community *Lowland Rainforest in the North Coast and Sydney Basin Bioregions* as it does not occur on relatively nutrient rich soils and is adjacent to a patch of Illawarra Escarpment Subtropical rainforest (OEH 2011a).

The proposed works would remove or modify approximately 2.6 ha of native vegetation (which comprises of approximately 0.89 ha of directly impacted and 1.71 ha of under-scrubbed native vegetation within the APZ). This native vegetation is potential habitat for a range of threatened flora and fauna species within the study area. A summary of the likely direct impacts from the proposed works is outlined in **Section 5.1**.

The literature review identified 30 threatened flora species and 89 threatened fauna species listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and / or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) which may have the potential to occur within a 5 km radius of the study area.

A total of eighty-seven (88) flora species, including eighty (80) native flora species, were identified within the study area during the site inspection. No threatened flora species listed under the TSC Act or EPBC Act were recorded during the targeted search.

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Site inspections between August 2017 and January 2018 determined the likelihood of occurrence of threatened flora and fauna species. No threatened flora or fauna species have previously been recorded within the study area. However, the study area contains the following potential habitat features for threatened species:

- *Allocasuarina torulosa* (Forest Oak) provides foraging habitat for a range of fauna species, particularly *Calyptorhynchus lathami* (Glossy Black Cockatoo)
- *Eucalyptus resinifera* (Red mahogany) is listed as a secondary food tree species for Koala species according to the Recovery Plan (DECC 2008). *E. paniculata* is considered an important feed tree for the endangered population (Pittwater LGA) and Koalas in this population may utilise other Eucalypt or Angophora species which are not mentioned in the Recovery Plan (OEH 2017b). However, the study area was deemed not to contain critical habitat to the Koala species or the endangered population (Pittwater LGA) according to the Recovery Plan (DECC 2008) (**Section 5.4**)
- Four (4) medium to large-sized hollow-bearing trees (HBTs), and 3 small HBTs, occur within the subject site, and one additional HBT was recorded within the broader study area. Medium to large-sized HBTs provide potential roosting habitat for large avian species, including Glossy-black Cockatoo, and owls, including *Ninox connivens* (Barking Owl), *Ninox strenua* (Powerful Owl), and *Tyto novaehollandiae* (Masked Owl). Small HBTs provide potential roosting habitat for small mammals such as *Cercartetus nanus* (Eastern Pygmy-possum – EPP), and microbats. Although potential roosting habitat for EPP occurs within the study area, there is a notably low density of high nectar producing flora species which are preferred foraging habitat for EPP
- A small creek-line occurs in the western portion of the study area. This was deemed too small to support foraging habitat for *Myotis macropus* (Southern Myotis). The creek-line supports sandy banks and provides potential marginal breeding habitat for *Heleioporus australiacus* (Giant Burrowing Frog).

Twenty (20) fauna species were recorded during the site inspection. Those threatened and migratory species for which the study area was deemed likely to provide potential habitat for are:

*Amphibian species:*

- *Heleioporus australiacus* (Giant Burrowing Frog).

*Avian species (excluding owls):*

- *Calyptorhynchus lathami* (Glossy Black-Cockatoo)

*Owl species:*

- *Ninox connivens* (Barking Owl)
- *Ninox strenua* (Powerful Owl)
- *Tyto novaehollandiae* (Masked Owl).

*Mammal species (excluding microbats)*

- *Cercartetus nanus* (Eastern Pygmy-possum)
- *Phascolarctos cinereus* (Koala) species and endangered population (Pittwater LGA).

*Microbat species:*

- *Chalinolobus dwyeri* (Large-eared Pied Bat)
- *Miniopterus australis* (Little Bentwing-bat)

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- *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat)
- *Mormopterus norfolkensis* (Eastern Freetail-bat)
- *Myotis macropus* (Southern Myotis)
- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat).

Targeted surveys were undertaken for Giant Burrowing Frog, Eastern Pygmy Possum, and Southern Myotis, but these species were not detected within the study area during these surveys. It is noted that the required amount of rain for Giant Burrowing Frog under the EPBC Survey Guidelines was not met during this targeted survey.

No threatened fauna species were detected during the site inspection. Some calls detected by the microbat ultrasonic recorders were of low quality and not distinguishable to species level, but could be attributed to a range of species. This range of species includes Southern Myotis and Little Bentwing-bat, both listed as *Vulnerable* under the TSC Act. These species were included in the Impact Assessment.

Assessments of Significance under the TSC Act conducted for 14 fauna species determined that the proposed works would not have a significant impact on these species and thus a SIS is not required.

Significance Assessments under the EPBC Act conducted for three fauna species determined that the proposed works would not have a significant impact on these species and thus a referral is not required.

The proposed works were deemed to fulfil the objectives of Biodiversity Clause 7.6 in the Pittwater LEP 2014 if they incorporate the following mitigation measures:

- The APZ and indirect development impacts do not detrimentally impact on the riparian corridor in the west of the study area.
- Retaining HBTs within the APZ (includes 4 medium to large HBTs and 3 small HBTs). These are potential roosting habitat for a number of potentially affected threatened species.
- Prioritize retaining *Allocasuarina torulosa* trees within the APZ which are potential foraging habitat for the Glossy Black Cockatoo.

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# 1 Introduction

Eco Logical Australia (ELA) was commissioned by Aveo Pty Ltd to undertake a Flora and Fauna Assessment (FFA) to accompany a Development Application (DA) for 79 Cabbage Tree Road, Bayview (Lot 20 DP 632081; hereafter referred to as the 'study area').

## 1.1 Study area

The study area (approximately 7.21 ha) is located in Northern Beaches Local Government Area (LGA), and is bound by lots adjacent to Cabbage Tree Road to the north, lots adjacent to Old Samuel Street to the south, and a large area of bushland to the west and south-west (**Figure 1**). The study area is part of a large corridor of intact native vegetation which extends from western Mona Vale through to Bayview. This larger extent is referred to as the 'locality'.

A large portion of the land is currently being utilized as a retirement village, and the proposed works would create additional buildings for this purpose.

The entire study area (excluding a small lot in the north-east corner) has been mapped under the Northern Beaches Council's terrestrial biodiversity layer (Pittwater LEP 2014) (**Figure 2**). This layer covers the vegetated areas of the study area, along with existing buildings, cleared areas, and small golf course.

## 1.2 Description of the project

The proposed works would construct an additional nine buildings and new road access, generally in the north-eastern portion of the study area. The impact footprint (subject site) depicted in **Figure 3** includes the:

- Development footprint: an area of approximately 1.10 ha, which will involve comprehensive clearance of vegetation (provided14 December 2017 Jackson Teece 2017)
- Indicative Asset Protection Zone (APZ): an area of approximately 2.75 ha mapped from bushfire advice provided 19 December 2017 (Peterson Bushfire 2017). This area requires under-scrubbing (removal) of midstorey vegetation along with the removal of some trees with canopies in contact with other trees. The APZ also covers mown grass (part of a min golf course) and existing buildings. Advice received from the bushfire consultant on 13 December 2017 (Peterson Bushfire 2017) states that preliminary bushfire advice supports '*the retention of the 20 m riparian zone within the APZ, which will retain fully-structured rainforest within that corridor.'*

The following terminology has been used in this report:

Study area: the area surveyed for the proposed works (approximately 7.21 ha (**Figure 1**), including those areas likely to be directly or indirectly affected by the proposal (**Figure 3**)

- Subject site: the area of direct impact (approximately 3.21 ha; **Figure 3**), which includes both the development footprint, and the indicative APZ
- Locality: the same meaning as ascribed to local population of a species or local occurrence of an ecological community (as defined by the *Threatened Species Guidelines* (DECC 2007)).

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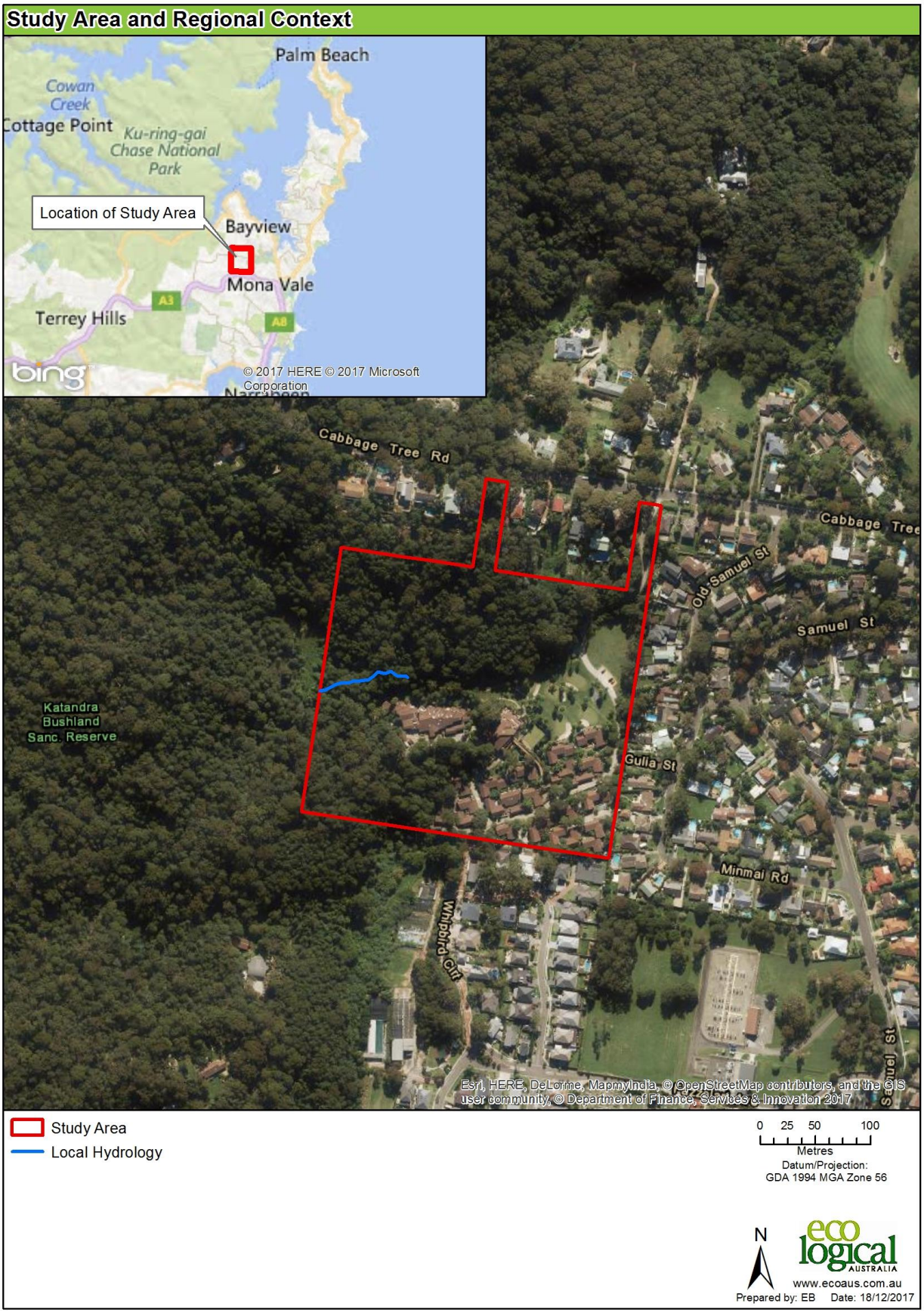


**Figure 1: Study area and regional context**


**Figure 2: Study area, subject site, terrestrial biodiversity layer, and local hydrology**


**Figure 3: Study area, subject site (includes development footprint, and indicative APZ), local hydrology, and riparian buffer**

# 2 Statutory framework

## 2.1 *Environment Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is Commonwealth legislation that deals with Matters of National Environmental Significance (MNES). Impacts to MNES are assessed through application of a significance assessment. Where a development or activity has the potential to have a significant impact on a MNES, a referral is made to the Department of the Environment and Energy (DotEE). The Department determines whether the activity can proceed with no further assessment by the Commonwealth, or whether it will be a controlled action for which an Environmental Impact Assessment must be supplied. The Act also allows for Strategic Assessments which assess a policy, plan or program rather than individual developments.

## 2.2 *Environmental Planning and Assessment Act 1979*

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is the principal planning legislation for NSW, providing a framework for the overall environmental planning and assessment of development proposals. The EP&A Act places a duty on the determining authority to adequately address a range of environmental matters including maintenance of biodiversity and the likely impact to threatened species, populations or ecological communities (under the TSC Act and BC Act– refer below).

## 2.3 *Biodiversity Conservation Act 2016*

In November 2016 the NSW parliament passed the *Biodiversity Conservation Act 2016* (BC Act). This new legislation replaced the *Threatened Species Conservation Act* 1995 (TSC Act) and took effect 25 August 2017. Among other things, the BC Act introduces new requirements for biodiversity assessment and requires proponents to offset significant biodiversity impacts through the purchase and retirement of biodiversity credits. The government has recently exhibited regulations that provide further detail on the changes as well as establish the transitional arrangements.

Transitional arrangements have stated that *'Local developments* [excluding select locations] *will have six months from 25 August 2017 to submit a development application under the previous legislation.'* Thus this DA will be submitted under the TSC Act, detailed below.

## 2.4 *Threatened Species Conservation Act 1995*

The TSC Act was repealed by the BC Act outlined above, but is still operational for six months from 25 August 2017. The TSC Act aims to protect and encourage the recovery of threatened species, populations and communities listed under the Act. The interactions between the TSC Act and the EP&A Act require consideration of whether a development (Part 4 of the EP&A Act), or an activity (Part 5 of the EP&A Act), is likely to significantly affect threatened species, populations, ecological communities or their habitats in accordance Section 5A of the EP&A Act (Assessments of Significance). Submission of a Species Impact Statement is required where a significant impact is considered likely to occur for threatened species, populations and/or ecological communities listed under the TSC Act.

## 2.5 *State Environmental Planning Policy (SEPP) 44 - Koala Habitat Protection*

This Policy aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline:

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- By requiring the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat, and
- by encouraging the identification of areas of core koala habitat, and
- by encouraging the inclusion of areas of core koala habitat in environment protection zones.

This policy applies to Pittwater LGA (SEPP 44 – Schedule 1). SEPP 44 defines *core koala habitat* as:

- an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population.

Neither Koala presence, nor signs (scratches, scats, etc.) were observed during the site inspection (observation or remote camera). There are 90 records of Koala within 5 km of the study area. The two nearest records are within 1 km to the east of the study area, and are dated 1967 and 1972. All records within 5 km of the study area are over 30 years old. The nearest record within the last 30 years is approximately 6 km to the north-west of the study area, in Ku-ring-gai Chase National Park (25 August 2009). It is considered unlikely that a resident breeding population of koalas currently utilizes the study area, and thus the study area is not considered to support *core koala habitat* under SEPP 44.

SEPP 44 defines *potential koala habitat* as:

- areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.

No tree species recorded within the study area during the site inspection are listed as a ‘’Feed tree species’ under Schedule 2 of SEPP 44, and thus the study area is not considered to support *potential koala habitat* under SEPP 44.

## 2.6 *Biosecurity Act 2015*

Under the Act 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.

Specific legal requirements apply to State determined priorities under the Greater Sydney Regional Strategic Weed Management Plan 2017-2022. Weeds listed as ‘other weeds of regional concern’ warrant resources for local control or management programs and are a priority to keep out of the region. Inclusion in this list may assist Local Control Authorities and/or land managers to prioritise action in certain circumstances where it can be demonstrated the weed poses a threat to the environment, human health, agriculture etc.

## 2.7 *Water Management Act 2000*

The WM Act aims to provide for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations. The proposed works (defined under the EP&A Act) are within 40 m of the top of the bank (TOB) bed of a river (i.e. upon ‘waterfront land’) a therefore a controlled activity approval will be required by the Department of Primary Industries (DPI) Water.

One first order watercourses is present in the central western portion of the study area (**Figure 2**). A first order watercourse requires a 10 m vegetation riparian zone on either side measured from the top of the bank. This equates to a 20 m Riparian Corridor (RC) plus the width of the channel (mapped in **Figure 3**).

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The RC should be maintained or rehabilitated with fully structured native vegetation. However, in the RC in first order streams the following is permitted with a controlled activity approval:

- RC offsetting for non-RC uses
- Cycleways and paths
- Detention basins in 50% outer vegetated riparian zone (VRZ) only
- Online detention basins
- Stormwater outlets and essential services
- Stream realignment
- Any road crossings.

In addition, Asset Protection Zones are allowed within the outer 50 % of the vegetated riparian zone (VRZ), as long as offsets are provided in accordance with the averaging rule. This allows for non-riparian works to be authorised within the outer riparian corridor, as long as the average width of the vegetated riparian zone can be achieved over the length of the watercourse within the development site. It is noted in the Guidelines for Riparian Corridors on Waterfront Land that the averaging rule should generally be applied to cleared waterfront land.

This means that a controlled activity approval must be obtained from the Office of Water before commencing the controlled activity.

According to bushfire advice provided 4 December 2017, the RC within the study area can be maintained without impact from the APZ (Figure 3).

### 2.8 *Pittwater Local Environmental Plan 2014*

On 12 May 2016, the NSW Government amalgamated Pittwater, Warringah and Manly councils to form the Northern Beaches Council. Existing environmental planning instruments remain in force until they are repealed. Therefore, the Pittwater Council Local Environmental Plan (LEP) and Development Control Plan (DCP) still apply to this study area. Additionally, the DA needs to consider Clause 7.6 under the LEP (2014) 'Terrestrial Biodiversity layer' which relates to the study area. More information is provided in **Section 5.3**.

### 2.9 *Pittwater 21 Development Control Plan*

The Pittwater 21 Development Control Plan (Pittwater DCP) supports the Pittwater LEP 2014 in regulating land use for future developments.

The proposed works should ensure Development Consent has been granted prior to any disturbance or removal of any vegetation on-site, unless they are listed as exempt species in the DCP or are noxious weeds listed for the former Pittwater Council. This includes *Lantana camara* (Lantana) and *L. sinense* (Small-leaved Privet).

### 2.10 *NSW Fisheries Management Act*

The FM Act provides for the protection, conservation, and recovery of threatened species defined under the Act. It also makes provision for the management of threats to threatened species, populations, and ecological communities defined under the Act, as well as the protection of fish and fish habitat in general.

It is an offence to harm marine vegetation or fish habitat without a permit from NSW Department of Industry and Investment (Fisheries).

A controlled activity approval will be required by the DPI for the proposed works.

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# 3 Methods

## 3.1 Literature review

A review of readily available databases pertaining to the ecology and environmental features of the site and surrounding area and existing vegetation mapping was conducted to identify records of threatened species, populations and communities and their potential habitat. Databases and vegetation mapping that were reviewed include:

- Office of Environment and Heritage (OEH) Atlas of NSW Wildlife 5 km search radius (OEH 2017a – Accessed August 2017) and Threatened Species Profiles (OEH 2017b)
- Department of the Environment and Energy (DotEE) SPRAT Profiles (DotEE 2017a) and Online search for Matters of National Environmental Significance (MNES) with 5 km buffer (DotEE 2017b – Accessed August 2017).
- Sydney Metropolitan Catchment Management Authority (SMCMA): *The Native Vegetation of the Sydney Metropolitan Area* - Vegetation Mapping (OEH 2013)
- Pittwater Council planning instruments
    - Pittwater Local Environmental Plan (LEP) 2012
    - Pittwater 21 Development Control Plan (DCP) 2012.
- *Fisheries Management Act 1994* (FM Act) threatened species search (DPI 2017)
- OEH Threatened Species Profiles (OEH 2017b)
- Aerial mapping to assess the extent of vegetation including the mapped threatened ecological communities (TECs) listed under the TSC Act and / or EPBC Act
- 79 Cabbage Tree Road, Bayview – Preliminary Biodiversity Development Assessment Report (BDAR). Prepared for Aveo Group (ELA 2017)
- Development footprint and Asset Protection Zone (APZ) for proposed works at 79 Cabbage Tree Road, Bayview – Provided by Aveo Pty Ltd (5 December 2017).

### 3.1.1 Likelihood of occurrence

Aerial photography (SIXmaps and Google Earth) of the study area and surrounds were reviewed to identify the extent of vegetation cover and landscape features. In addition, relevant GIS datasets (soil, geology, drainage) were reviewed to guide the site inspection.

Species from the Atlas of NSW Wildlife, FM Act and Protected Matters Search Tool were combined to produce a list of threatened species that may occur within the study area ("subject species") (**Appendix A**). The likely occurrence of threatened species, endangered populations and communities in the study area was determined based on the location of database records, the likely presence or absence of suitable habitat on the subject site, and knowledge of the species' ecology. A list of potentially "affected species" was then identified (those that were defined as "yes", "likely" or having "potential" to occur in the study area).

Five terms for the likelihood of occurrence of species are used in this report:

- "yes" = the species was or has been observed in the study area
- "likely" = a medium to high probability that a species uses the study area
- "potential" = suitable habitat for a species occurs in the study area, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur
- "unlikely" = a very low to low probability that a species uses the study area, and
- "no" = habitat in the study area and in its vicinity is unsuitable for the species.

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Following the site inspection, this list of "potentially affected species" was refined with an understanding of the local environment and available habitat in the study area. The likelihood table in **Appendix A** reflects the final list of species and their likelihood of occurrence.

## 3.2 Site inspection

### 3.2.1 Vegetation mapping

A site inspection was undertaken by ELA ecologists Jennie Powell and Mitchell Scott on 4 October 2017 and 9 November 2017. The purpose of the site inspection was to:

- refine previous ecological constraints mapping (ELA 2017), and condition of vegetation present and / or presence of any endangered ecological communities
- identify habitat for any threatened flora and fauna species
- targeted searches for threated flora species

Six (6) biometric plots were collected within the study area.

### 3.2.2 Targeted survey for threatened flora species

A total of 6 person hours were conducted, in conjunction with biometric plots, to target threatened flora species with the potential to occur within the study area (**Section 4.1.4**). Random meander technique (Cropper 1993) was used throughout the study area, with a focus on the subject site.

### 3.2.3 Targeted survey for *Myotis macropus* (Southern Myotis)

Two (2) microbat ultrasonic recording devices ('Anabats') were used to target *Myotis macrotis* (Southern Myotis). Anabats were trained on the creek line within the study area, and a hollow-bearing tree within 200 m of the creek line, respectively, and deployed for two nights (9 November and 10 November 2017).

The weather during this period is detailed in **Table 1**. A detailed methodology and results of the survey is described in **Appendix B**.

### 3.2.4 Targeted survey for *Cercartetus nanus* (Eastern Pygmy Possum)

*Cercartetus nanus* (Eastern Pygmy Possum; EPP) is listed as *Vulnerable* under the TSC Act. Targeted survey of this species was guided by the following document:

- Department of Environment and Conservation (DEC) 2004. *Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft).* New South Wales Department of Environment and Conservation, Hurstville, NSW.

Nest boxes and baited arboreal remote cameras were deployed to detect EPP.

A total of 10 nest boxes (9 nest boxes within the subject site) were attached to trees within the study area of varying heights up to 3 m high, and checked a total of 4 times (including at removal). Hollow-bearing trees were targeted where possible (**Figure 6**). Trees supporting nest boxes were sprayed with honey water and checked on the following dates:

- 19 December 2017 (nest boxes deployed)
- 4 January 2018 (nest boxes checked)
- 16 January 2018 (nest boxes checked)
- 22 January 2018 (nest boxes checked and collected) (33 total trap nights)

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Six (6) baited arboreal cameras were set on 4 January 2018 and collected on 22 January 2017 (18 total trap nights). The 'universal bait', consisting of peanut butter, honey, and oats, was attached to trees at a height of between 1 m and 3 m. Hollow-bearing trees were targeted where possible.

### 3.2.5 Targeted survey for *Heleioporus australiacus* (Giant Burrowing Frog)

*Heleioporus australiacus* (Giant Burrowing Frog; GBF) is listed as *Vulnerable* under the TSC Act and *Vulnerable* under the EPBC Act. Targeted survey of this species was guided by the following document:

- Department of Environment, Water, Heritage, and the Arts (DEWHA) 2010. Survey guidelines for Australia's threatened frogs. Australian Government.

The survey guidelines require a minimum of 4 nights survey under ideal conditions (within 7 days of >50 mm rainfall) (DEWHA 2010). Survey will include spotlighting in potential habitat, and call play-back.

Call play-back and spotlighting for GBF was conducted on the following dates:

- 4 January 2018 (call play-back and spotlighting)
- 11 January 2018 (call play-back and spotlighting)
- 16 January 2018 (call play-back and spotlighting)
- 22 January 2018 (call play-back and spotlighting)

Nest boxes were checked on the same dates as the call play-back was conducted.

Rainfall during the survey period is detailed in **Table 1**. It is noted that the required amount of rain for Giant Burrowing Frog under the Survey Guidelines was not met within the timeframe of this targeted survey.

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### 3.2.6 Weather conditions

Weather conditions during the survey were clear, with mild temperature and no precipitation (**Table 1**).

**Table 1: Weather conditions during the site inspection and targeted surveys**

| Date | Temperature (°C) | | Rainfall (mm) | Max wind speed (km/h) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Minimum | Maximum | | | VM/Fl | Ana | NB | RC | CPB/Sp |
| 4 October 2017 | 14.4 | 21.7 | 0 | SSE 24 | VM/Fl | | | | |
| 9 November 2017 | 10.0 | 21.5 | 0 | ENE 31 | VM/Fl | AB | | | |
| 10 November 2017 | 12.3 | 21.3 | 0 | E 26 | | AB | | | |
| 19 December 2017 | 21.1 | 35.4 | 0 | NE 44 | | | NB | | |
| 20 December 2017 | 25.3 | 39 | 0 | SSW 44 | | | NB | | |
| 21 December 2017 | 19.2 | 21.3 | 7 | SE 33 | | | NB | | |
| 22 December 2017 | 18.7 | 25.1 | - | ENE 31 | | | NB | | |
| 23 December 2017 | 18.2 | 30.4 | 0.2 | ENE 33 | | | NB | | |
| 24 December 2017 | 19.5 | 39.4 | 0 | SE 44 | | | NB | | |
| 25 December 2017 | 16.2 | 20.5 | 0.2 | SSE 37 | | | NB | | |
| 26 December 2017 | 17 | 21.8 | 2.8 | E 31 | | | NB | | |
| 27 December 2017 | 18 | 26.6 | 0 | ENE 35 | | | NB | | |
| 28 December 2017 | 17.3 | 28.6 | 0.2 | NNE 31 | | | NB | | |
| 29 December 2017 | 19.9 | 32.6 | 0 | ENE 33 | | | NB | | |
| 30 December 2017 | 20.7 | 34.7 | 5 | SE 37 | | | NB | | |
| 31 December 2017 | 18.6 | 24.9 | - | NE 41 | | | NB | | |
| 1 January 2018 | 19.2 | 28.7 | 0 | SE 39 | | | NB | | |
| 2 January 2018 | 18.3 | 26.2 | 0 | ENE 44 | | | NB | | |
| 3 January 2018 | 17.9 | 22.4 | 2.2 | SE 41 | | | NB | | |
| 4 January 2018 | 16.5 | 22.7 | 1.4 | E 26 | | | NB* | RC | CPB/Sp |
| 5 January 2018 | 15.1 | 27.2 | 0.2 | ENE 39 | | | NB | RC | |
| 6 January 2018 | 18 | 34 | 0 | NE 35 | | | NB | RC | |
| 7 January 2018 | 21.6 | 42.7 | 0 | SE 39 | | | NB | RC | |
| 8 January 2018 | 20.6 | 35.7 | 0.2 | NE 30 | | | NB | RC | |
| 9 January 2018 | 20.4 | 28.5 | 28.2 | SW 41 | | | NB | RC | |
| 10 January 2018 | 17.1 | 22.9 | 1.6 | SSE 31 | | | NB | RC | |
| 11 January 2018 | 17.1 | 22.8 | 0.2 | E 28 | | | NB* | RC | CPB/Sp |
| 12 January 2018 | 19.7 | 27.5 | 0 | NE 31 | | | NB | RC | |
| 13 January 2018 | 21.6 | 33.9 | 0 | WSW 50 | | | NB | RC | |

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| Date | Temperature (°C) | | Rainfall (mm) | Max wind speed (km/h) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Minimum | Maximum | | | VM/Fl | Ana | NB | RC | CPB/Sp |
| 14 January 2018 | 13.0 | 22.1 | 3.8 | SSW 69 | | | NB | RC | |
| 15 January 2018 | 14.2 | 23.9 | 0.2 | S 56 | | | NB | RC | |
| 16 January 2018 | 16.3 | 21.5 | 0 | S 61 | | | NB* | RC | CPB/Sp |
| 17 January 2018 | 15.3 | 23.4 | 0 | SSW 35 | | | NB | RC | |
| 18 January 2018 | 13.0 | 27.7 | 0 | ENE 30 | | | NB | RC | |
| 19 January 2018 | 15.8 | 31.6 | 0 | - 24 | | | NB | RC | |
| 20 January 2018 | 15.3 | 34.6 | 0 | NE 35 | | | NB | RC | |
| 21 January 2018 | 17.8 | 29.1 | 0 | NE 41 | | | NB | RC | |
| 22 January 2018 | 19.4 | 35.8 | 0.2 | ENE 43 | | | NB* | RC | CPB/SP |

* Denotes dates nest boxes were checked for presence of EPP.

Weather observations were taken from www.bom.gov.au Terrey Hills AWS (station 066059) (temperature, wind speed and rainfall)

### 3.3 Impact assessment

Threatened species, populations and threatened ecological communities known, likely or with potential to occur in the study area and be adversely affected by the proposed works (as identified in the Likelihood of Occurrence table) were subject to the NSW Assessment of Significance and/or Commonwealth Significant Impact Criteria. These assessments are applied to help determine whether the proposed subdivision will significantly impact these threatened entities.

### 3.4 Survey limitations

This assessment was not intended to provide an inventory of all species present across the site but instead an overall assessment of the ecological values of the site with particular emphasis on threatened species, endangered ecological communities and key fauna habitat features. It is important to note that some species may not have been detected on the site during the inspection as they may be cryptic or seasonal and only detectable during flowering or during breeding. In this case the likelihood of their occurrence on site has been assessed based on the presence of potential habitat.

The site inspection was undertaken using hand-held GPS units. It is noted that these units can have errors in accuracy of up to 20 m (subject to availability of satellites on the day).

It is noted that the required amount of rain for Giant Burrowing Frog under the EPBC Survey Guidelines (DEWHA 2010) was not met within the timeframe of this targeted survey.

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# 4 Results

## 4.1 Literature review

### 4.1.1 Soil and topography

The study area is primarily located on 'Erina Erosional' soil profile. This soil profile occurs on '*undulating to rolling rises and low hills on fine-grained sandstones and clay-stones of the Narrabeen Group. Local relief to 60 m, slopes <20%. Rounded narrow crests with moderately inclined slopes.'* (OEH 2017c).

### 4.1.2 Threatened ecological communities

During the desktop literature review (DotEE 2017a+b), four threatened ecological communities (TECs) were identified as having the potential to occur within the area and surrounds. These include:

- Coastal Upland Swamps in the Sydney Basin Bioregion (Listed as an *Endangered Ecological Community* (EEC) under the TSC Act and *Endangered* under the EPBC Act).
- Littoral Rainforest and Coastal Vine Thickets of Eastern Australia (Listed as an *Endangered Ecological Community* under the TSC Act and *Critically Endangered* (CE) under the EPBC Act).
- *Posidonia australis* seagrass meadows of the Manning-Hawkesbury ecoregion (Listed as *Endangered* under the EPBC Act).
- Subtropical and Temperate Coastal Saltmarsh (Listed as *Endangered* under the EPBC Act).

### 4.1.3 Vegetation communities

Office of Environment and Heritage (2013) vegetation mapping identified the following vegetation communities within the study area:

- *Central Coast Escarpment Moist Forest* (CCEMF) – in the northern and south-western portions of the study area
- *Coastal Warm Temperate Rainforest* (CWTR) – a band in the central western portion of the study area
- *Urban Exotic/Native* – a small portion in the north-eastern portion of the study area.

No TECs were previously mapped within the study area (OEH 2013).

*Coastal Enriched Sandstone Dry Forest* (CCSDR) has been mapped to the west of the study area, but not within the study area. However, based on rapid point surveys and analysis, the vegetation mapped as CCEMF in the north of the study area has been identified as CCSDR.

### 4.1.4 Threatened flora and fauna

A search for threatened species using the Protected Matters Search Tool and Atlas of NSW Wildlife (within a 5 km buffer around the study area) and the review of literature identified a number of threatened flora species, threatened fungi and threatened fauna or migratory species.

The literature review identified 30 threatened flora species and 89 threatened fauna species listed under the TSC and / or EPBC Acts, which may have the potential to occur within a 5 km radius of the study area. Five (5) freshwater species and two (2) dragonfly species listed under the FM Act were also identified by the literature review. An assessment of the likelihood of occurrence of threatened species within the study area is in **Appendix A** and was used to guide the field survey methodology. Note, the likelihood of occurrence provided in **Appendix A** represents the assessment following the field survey results.

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No threatened species have previously been recorded within the boundaries of the study area. Following the likelihood of occurrence analysis, threatened species which have the potential, or are likely, to occur on the study area are:

*Amphibian species:*

- *Heleioporus australiacus* (Giant Burrowing Frog).

*Avian species (excluding owls):*

- *Artamus cyanopterus cyanopterus* (Dusky Woodswallow)
- *Burhinus grallarius* (Bush Stone-curlew)
- *Calyptorhynchus lathami* (Glossy Black-Cockatoo)
- *Daphoenositta chrysoptera* (Varied Sittella)
- *Haliaeetus leucogaster* (White-bellied Sea-Eagle)
- *Hieraaetus morphnoides* (Little Eagle)
- *Lophoictinia isura* (Square-tailed Kite)
- *Ptilinopus superbus* (Superb Fruit-Dove).

*Owl species:*

- *Ninox connivens* (Barking Owl)
- *Ninox strenua* (Powerful Owl)
- *Tyto novaehollandiae* (Masked Owl).

*Mammal species (excluding microbats)*

- *Cercartetus nanus* (Eastern Pygmy-possum)
- *Dasyurus maculatus maculatus* (SE mainland population) (Spotted-tailed Quoll)
- *Phascolarctos cinereus* (Koala species; and endangered population Koala in the Pittwater LGA).

*Microbat species:*

- *Chalinolobus dwyeri* (Large-eared Pied Bat)
- *Miniopterus australis* (Little Bentwing-bat)
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat)
- *Mormopterus norfolkensis* (Eastern Freetail-bat)
- *Myotis macropus* (Southern Myotis)
- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat).

*Flora species*

- *Asterolasia elegans*
- *Cryptostylis hunteriana* (Leafless Tongue Orchid)
- *Grammitis stenophylla* (Narrow-leaf Finger Fern)
- *Macadamia integrifolia* (Macadamia Nut)
- *Microtis angusii* (Angus's Onion Orchid)
- *Syzygium paniculatum* (Magenta Lilly Pilly)
- *Tetratheca glandulosa.*

It should be noted that the results of the Protected Matters Search Tool, which have been included in **Appendix A**, is only a list of species based on habitat modelling. Therefore, not all species listed in **Appendix A** are shown on the maps in this report. The Atlas of NSW Wildlife database records of flora and fauna site are shown in **Figure 4** and **Figure 5** respectively. It should be noted that some sensitive species cannot be displayed at this resolution.

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**Figure 4: Threated flora atlas search records (5 km radius)**

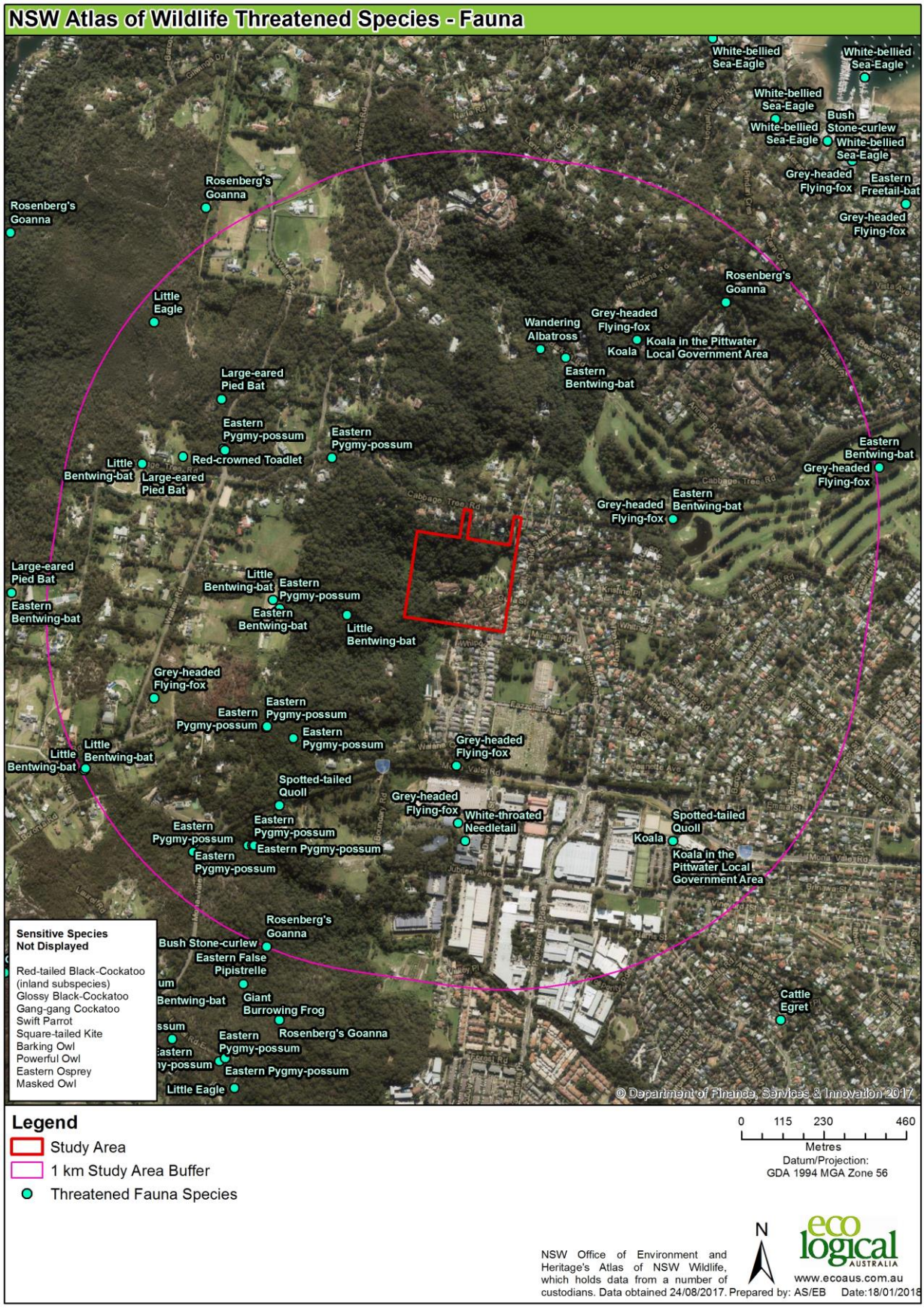


**Figure 5: Threatened fauna Atlas search records (1 km radius)**


**Figure 6: Survey effort, including full floristic / biometric plots, locations of nest boxes and remote cameras (Eastern Pygmy-possum), and location of call play-back (Giant Burrowing Frog)**

## 4.2 Site inspection

### 4.2.1 Vegetation communities

The site inspection, including six biometric plots, identified the presence of two native vegetation communities stratified into vegetation zones of differing condition (**Table 2**). The remaining vegetation within the study area consists of weeds or planted horticultural varieties and do not conform to a native vegetation community. A description of the two vegetation communities and exotic vegetation is provided below.

The validated vegetation mapping is shown in **Figure 7** and a flora species list is provided in **Appendix B**.

**Table 2: Vegetation communities, their condition and the corresponding PCTs represented within the study area**

| Vegetation Community | Condition | Corresponding Plant Type Community and code | Area within study area (ha) |
|---|---|---|---|
| Coastal Coast Escarpment Moist Forest (CCEMF) | good condition – *native understorey* | PCT 1565 - Turpentine - Rough-barked Apple - Forest Oak moist shrubby tall open forest of the Central Coast | 2.99 |
| | low conduction – *lantana-dominated understorey* | | 0.39 |
| | *exotic understorey* | | 0.83 |
| Coastal Warm Temperate Rainforest (CWTR) | good condition | PCT1529 - Lilly Pilly - Coachwood gully warm temperate rainforest on sandstone ranges of the Sydney Basin | 0.53 |
| Weeds and exotics | - | N/A | 0.07 |
| Urban native and exotic plantings and groundcover | - | N/A | 1.21 |
| Urban surfaces | - | N/A | 1.19 |
| **Total** | | | **7.21** |

#### 4.2.1.1 Central Coast Escarpment Moist Forest (CCEMF) – PCT 1565

A total area of 2.99 ha of good condition CCEMF with a native understorey was validated in the south-western and northern portions of the study area (**Figure 7, Table 2**), with difference in species assemblage between the north and south attributed to aspect.

The canopy was dominated by *Syncarpia glomulifera* (Turpentine), *Eucalyptus paniculata* (Grey Ironbark), *Allocasuarina torulosa* (Forest Oak), and *Elaeocarpus reticulatus* (Blueberry Ash).

The dominant midstorey species included *Pittosporum multiflorum* (Orange Thorn), *Cryptocarya microneura* (Murrogun), *Gymnostachys anceps* (Settlers' Twine), regenerating *Livistona australis* (Cabbage Tree Palm), *Parsonsia straminea* (Common Silkpod), *Calystegia marginata*, *Cissus hypoglauca* (Water Vine)

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Dominant species in the ground layer included *Calochlaena dubia* (Soft Bracken), *Blechnum cartilagineum* (Gristle Fern), *Gahnia sieberiana* (Red-fruit saw-sedge), *Geitonoplesium cymosum* (Scrambling Lily), *Hibbertia dentata* (Trailing Guinea Flower), *Lomandra filiformis* (Wattle Mat-rush), *Microlaena stipoides* (Weeping grass), *Entolasia stricta* (Wiry Panic), *Pseuderanthemum variabile* (Pastel Flower), *Lepidosperma laterale*, *Imperata cylindrical* (Blady Grass), *Smilax australis* (Lawyer Vine), *Morinda jasminoides* (Sweet Morinda)

There was a notable sandstone species influence in the north-east of the study area, with the presence of *Angophora costata* (Sydney Red Gum) and a dead *Banksia* sp., although these species were considered to be in a transitional area.

#### 4.2.1.2 Central Coast Escarpment Moist Forest (CCEMF) – PCT 1565 (low condition – primarily Lantana understorey)

Approximately 0.39 ha of CCEMF in the north-east of the study area has a midstorey largely dominated by *Lantana camara* (Lantana). Small patches of Lantana occur throughout the entire study area.

#### 4.2.1.3 Central Coast Escarpment Moist Forest (CCEMF) – PCT 1565 (exotic understorey)

Approximately 0.83 ha of CCEMF with a planted exotic understorey occurred throughout the south-eastern portion of the study area (**Figure 7, Table 2**). This area was mapped by the presence of remnant CCEMF canopy species, primarily *Syncarpia glomulifera* (Turpentine) and *Eucalyptus paniculata* (Grey Ironbark), located throughout the existing buildings within the study area. The mid-storey and understorey consisted of planted exotic garden species.

#### 4.2.1.4 Coastal Warm Temperate Rainforest (CWTR) – PCT 1529

An area 0.53 ha of vegetation in the central west of the study area lining both sides of the creekline was mapped as CWTR (**Figure 7**, **Table 2**). This vegetation had a narrow linear distribution confined generally to the sheltered watercourse and edges. It is likely that its former distribution occurred in a wider band extending further downstream and included parts of the present mini golf-course prior to clearance for the first stage of the retirement village.

The closed canopy was dominated by *Ceratopetalum apetalum* (Coachwood), *Livistona australis* (Cabbage Tree Palm), *Ficus coronata* (Sandpaper Fig), and *Elaeocarpus reticulatus* (Blueberry Ash). The midstorey included *Acmena smithii* (Lilly Pilly), *Cryptocarya microneura* (Murrogun), *Synoum glandulosum* (Scentless Rosewood) and *Callicoma serratifolia* (Black Wattle). The groundcover was dominated by *Blechnum cartilagineum* (Gristle Fern), *Calochlaena dubia* (Soft Bracken), *Lomandra longifolia* (Spiny-headed Mat-rush), *Morinda jasminoides* (Sweet Morinda), and *Sticherus urceolatus* (Fan Fern). The vegetation was in excellent condition with little weed present except for the southern edge which adjoins the village gardens and includes some weedy and planted exotic groundcover species.

Patches of CWTR may form a component of the endangered ecological community Lowland Rainforest in the North Coast and Sydney Basin Bioregions, however a site by site assessment is required. This assessment has concluded that the CWTR does not conform to the Lowland Rainforest endangered ecological community because it does not adjoin Illawarra Escarpment Subtropical Rainforest (as described in OEH 2013) and it occurs on a sandy soil type enriched by shale derived from a Hawkesbury sandstone and Wianamatta shale geology and not a relatively nutrient-rich soil such as basic volcanic or fine-grained sedimentary substrates as described in the Scientific Determination (OEH 2011a).

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#### 4.2.1.5 Weeds and exotics

An area of approximately 0.07 ha of weeds and exotics occurs along the northern boundary of the study area (Figure 7**,** Table 2). The area primarily consists of *Lantana camara* (Lantana) and Senna pendula, but also includes *Ochna serrulata* (Mickey Mouse Plant), *Tradescantia fluminensis* (Trad), *Solanum mauritianum* (Wild Tobacco Bush), and *Ligustrum sinense* (Small-leaved Privet).

#### 4.2.1.6 Urban native and exotic plantings and groundcover

An area of 1.21 ha of the study area was mapped as urban native and exotic plantings (Figure 7**,** Table 2). This included exotic gardens around the buildings in the south-west of the study area, and the golf course in the east of the study area. The golf course was dominated by planted *Livistona australis* (Cabbage Tree Palm).

#### 4.2.1.7 Urban surfaces

Approximately 1.19 ha of the study area was mapped as urban surfaces (Figure 7**,** Table 2).

### 4.2.2 Flora

A total of eighty-seven (88) flora species, including eighty (80) native flora species, were identified within the study area during the site inspection (**Appendix C**). This is not an exhaustive list of species present within the study area but includes those identified during the site inspection. Eight (8) exotic species were recorded within the study area.

#### 4.2.2.1 Threatened flora

No threatened flora species listed under the TSC Act or EPBC Act were recorded during the targeted search.

#### 4.2.2.2 Priority weeds and Weeds of National Significance (WoNS)

The *Biosecurity Act 2015* and regulations provide specific legal requirements for state level priority weeds Table 3.

Of the 8 weeds identified onsite, one has been listed as State level priority weed, and 7 have been listed as Weeds of regional concern. Weed priority listing under the Act, the asset / value at risk and listing as a Weeds of National Significance (WoNS), is presented in Table 3**.**

**Table 3: State level determined priority weeds and other weeds of concern present in the site**

| Scientific Name | Common Name | WoNS | Priority Weed Objective |
|---|---|---|---|
| **State Priority Weed** | | | |
| *Lantana camara* | Lantana | Yes | State priority - Asset protection |
| **Weed of Regional Concern** | | | |
| *Ageratina adenophora* | Crofton Weed | No | Environment, Agriculture |
| *Ligustrum sinense* | Small-leaved Privet | No | Environment, Human Health |
| *Ochna serrulata* | Mickey Mouse Plant | No | Environment |
| *Senna pendula* | - | No | Environment |
| *Solanum mauritianum* | Wild Tobacco Bush | No | Environment, Human Health |

**Asset protection:** These weeds are widely distributed in some areas of the State. As Weeds of National Significance, their spread must be minimised to protect priority assets

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### 4.2.3 Fauna and fauna habitat

#### 4.2.3.1 Fauna habitat

Central Coast Escarpment Moist Forest (CCEMF), and particularly the dominant species *Allocasuarina torulosa,* provides foraging habitat for a range of fauna species, particularly Glossy Black Cockatoo, although this is likely to be marginal relative to the surrounding bushland.

The study area is located within the Central Coast Koala Management Area (DECC 2008). The recovery plan for the Koala (DECC 2008) provides a list of koala food trees categorized as primary, secondary and supplementary for each Koala Management Area.

Vegetation within the subject area includes *Angophora costata* (Smooth-barked Apple), *Eucalyptus paniculata* (Grey Ironbark), *Eucalyptus resinifera* (Red mahogany), and *Eucalyptus umbra* (Broad-leaved White Mahogany). *Eucalyptus resinifera* is a secondary food tree species for Koala. Whilst the other species are not listed as food tree species for Koala within the Recovery Plan (DECC 2008). The study area also contains a high density of *Syncarpia glomulifera* (Turpentine), an important shelter tree for Koala in times of extreme weather (OEH 2017b). Thus, the study area contains potential foraging habitat for Koala.

Four (4) medium to large-sized hollow-bearing trees (HBTs), and 3 small HBTs, occur within the subject site (specifically within the APZ) (Figure 7). Medium to large-sized HBTs provide potential roosting habitat for large avian species, including Glossy-black Cockatoo, and owls, including Barking Owl, Powerful Owl, and Masked Owl.

Small HBTs provide potential roosting habitat for small mammals such as EPP, and microbats. Although potential roosting habitat for EPP occurs within the study area, there is a notable low density of high nectar producing flora species, which are preferred foraging habitat for EPP.

Small waterbodies may be used by microbats as foraging habitat (Churchill 1998). Roosting Southern Myotis require nearby waterways for foraging (Campbell 2009). Although numerous HBTs and stags with potential cracks and crevices occur within the study area and within 200 m of the riparian zone, the largest pool was 3 m by 6 m, and isolated from the creek. The entire creek line has fringing vegetation present, although sometimes marginal, with a low flow, and no fish were observed. Therefore, due to the low flow of the creek, isolated nature of the pools, and fringing vegetation, it is unlikely that Southern Myotis use HBTs or stags within the study area for roosting habitat.

The small drainage line running in the central west of the study area has a low flow, consists of sand-based beds and banks, and contains small pools. This 1st order stream is potential habitat for amphibians, including Giant Burrowing Frog. GBF breed in burrows along creek banks, and forage up to 200 m from breeding sites (OEH 2017b). Thus the riparian corridor is potential breeding habitat for GBF, and the densely vegetated area of the study area surrounding it is potential foraging habitat for GBF.

Small conical diggings were observed within the study area during the site inspection. These are consistent with the common native *Perameles nasuta* (Long nosed Bandicoot).

Twenty six (2) fauna species were recorded during the site inspection (**Appendix C**).

#### 4.2.3.2 Threatened fauna

The targeted survey for Southern Myotis (**Section 3.2.3**) did not record a 'definite' call for this species. Although a 'possible' call was recorded, it is more likely to be a call from the *Nyctophilis* species group (**Appendix B,** Figure 12). A 'possible' call was also recorded for Little Bentwing-bat (listed as *Vulnerable* under the TSC Act), although it was not distinguishable from Little Forest Bat (not listed).

Targeted surveys were conducted for Eastern Pygmy Possum via nest boxes and remote cameras (**Section 3.2.4**) and Giant Burrowing Frog via call play-back and spotlighting (**Section 3.2.5**). Despite targeted surveys these species were not detected within the study area. However, there are several recent BioNet records for these species within the vicinity of the study area (**Figure 5**). As such a precautionary approach was employed and AoS were conducted for the Eastern Pygmy Possum and Giant Burrowing Frog (see **Section 5**).

Based on field and literature review the study area may provide potential habitat for the following threatened and migratory species:

*Amphibian species:*

- *Heleioporus australiacus* (Giant Burrowing Frog).

*Avian species (excluding owls):*

- *Calyptorhynchus lathami* (Glossy Black-Cockatoo)

*Owl species:*

- *Ninox connivens* (Barking Owl)
- *Ninox strenua* (Powerful Owl)
- *Tyto novaehollandiae* (Masked Owl).

*Mammal species (excluding microbats)*

- *Cercartetus nanus* (Eastern Pygmy-possum)
- *Phascolarctos cinereus* (Koala species) and endangered population (Pittwater LGA).

*Microbat species:*

- *Chalinolobus dwyeri* (Large-eared Pied Bat)
- *Miniopterus australis* (Little Bentwing-bat)
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat)
- *Mormopterus norfolkensis* (Eastern Freetail-bat)
- *Myotis macropus* (Southern Myotis)
- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat).

Other threatened species with the potential to utilise the study area are likely to do so only periodically and primarily for foraging. These include *Artamus cyanopterus cyanopterus* (Dusky Woodswallow), *Daphoenositta chrysoptera* (Varied Sittella), *Haliaeetus leucogaster* (White-bellied Sea-Eagle), *Hieraaetus morphnoides* (Little Eagle), *Lophoictinia isura* (Square-tailed Kite), *Ptilinopus superbus* (Superb Fruit-Dove), *Dasyurus maculatus maculatus* (SE mainland population) (Spotted-tailed Quoll)

*Burhinus grallarius* (Bush Stone-curlew) is a conspicuous species that was not observed or heard during numerous surveys of long duration, and thus the study area is unlikely to be important habitat for this species.

If the current footprint changes, other threatened fauna not included in the list below may be impacted.

### 4.2.4 Corridors

The study area is situated within a large bushland corridor of native vegetation. The study area contains approximately 4.74 ha of native vegetation. A desktop analysis of vegetation identified approximate 41.57

ha of native vegetation adjacent to the study area. The study area contributes to approximately 11 % of the native vegetation through the bushland corridor. The native vegetation within the study area is currently not fragmented from the bushland corridor. The majority of the bushland corridor is mapped under the Terrestrial Biodiversity Layer, and includes the study area (**Section 2.8**).

### 4.2.5 Streams

An un-named small creek enters the study area on the western boundary and runs for between 50 m and 100 m. The creek is a 1st order stream with a low flow, isolated still ponds, and fringing vegetation. Under the WM Act, if works are carried out within 40 m of a stream, a controlled activity approval will be required by the Department of Primary Industries (DPI) Water. DPI Water guidelines advise that for a 1st order stream, works should not occur within 10 m of the top of bank (DPI Water 2012). The current footprint does not impact within 10 m of the TOB of the stream, as the bushfire report has outlined that the APZ does not need to under-scrub this area (Peterson Bushfire 2017; **Figure 3**).

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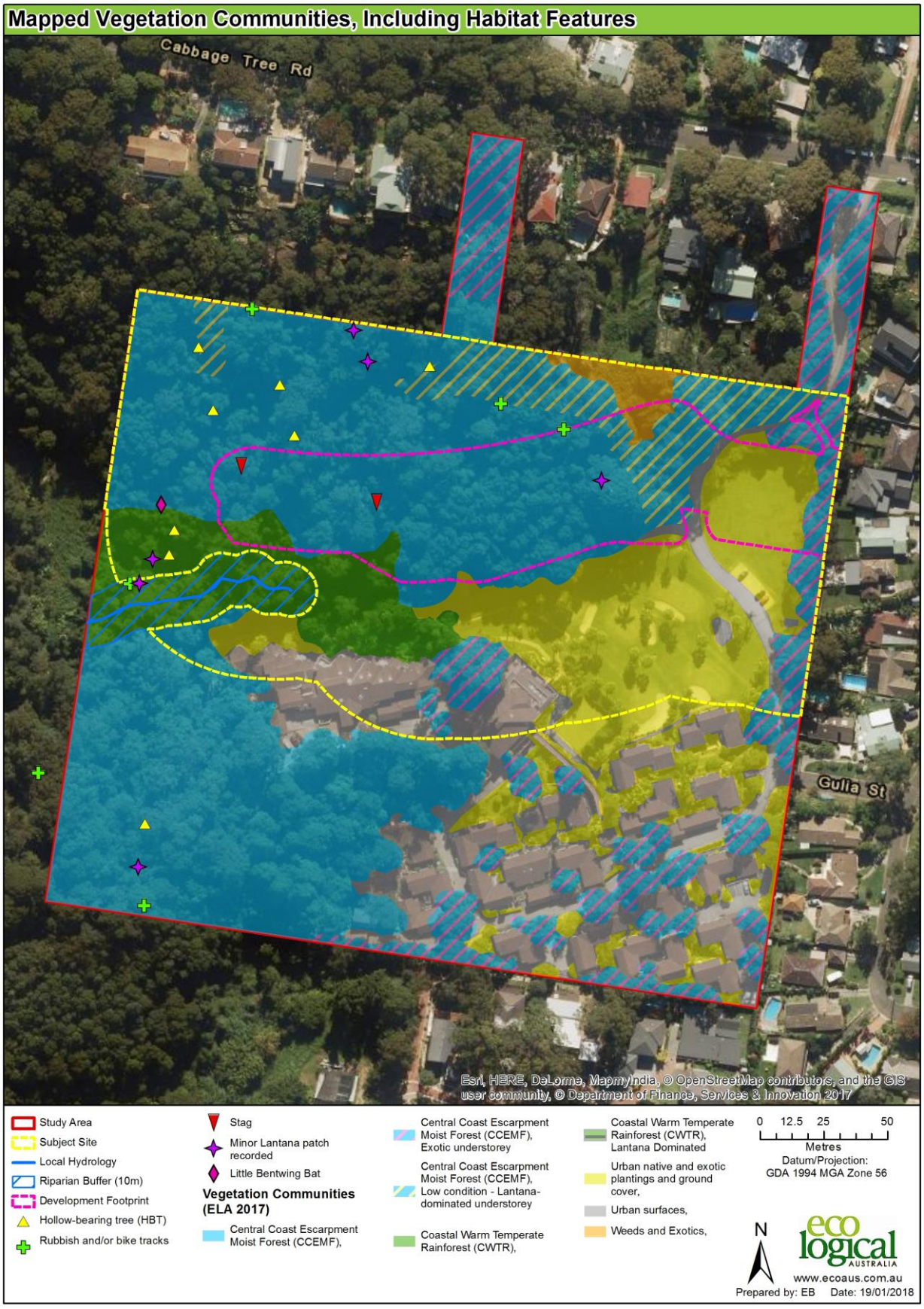


**Figure 7: Validated vegetation communities, habitat features, and threatened species records, within the study area**

# 5 Impact assessment

## 5.1 Direct impacts

An assessment of likely direct impacts from the proposed subdivision has been included below based on the development footprint provided 14 December 2017 (Jackson Teece 2017), and APZ footprint provided 19 December 2017 (Peterson Bushfire 2017).

Under to proposed works a total of 1.10 ha of vegetation will be removed to accommodate the development. This includes 0.89 ha of native vegetation and 0.21 ha of exotic vegetation. An additional 2.75 ha of the remaining vegetation (of which 1.71 ha is native vegetation) will be modified / cleared for the APZ. APZ will include ongoing trimming of native canopy and thinning of shrubs to maintain fuel loads.

A summary of the likely direct impacts is outlined in **Table 4**.

**Table 4: Direct impacts to vegetation communities***

| Vegetation Community | Area within study area (ha) | Area within subject site (ha) | Area within development footprint (ha) | Area within APZ (ha) |
|---|---|---|---|---|
| Coastal Coast Escarpment Moist Forest (CCEMF) | 2.99 | 1.66 | 0.69 | 0.97 |
| CCEMF (low conduction – lantana-dominated understorey) | 0.39 | 0.39 | 0.12 | 0.27 |
| CCEMF (exotic understorey) | 0.83 | 0.22 | 0.04 | 0.18 |
| Coastal Warm Temperate Rainforest (CWTR) | 0.53 | 0.33 | 0.04 | 0.29 |
| **Sub-total native vegetation** | **4.74** | **2.60** | **0.89** | **1.71** |
| Weeds and exotics | 0.07 | 0.07 | 0.02 | 0.05 |
| Urban native and exotic plantings and groundcover | 1.21 | 0.85 | 0.16 | 0.69 |
| Urban surfaces | 1.19 | 0.32 | 0.02 | 0.30 |
| **Total** | **7.21** | **3.85** | **1.10** | **2.75** |

**Figures rounded to two decimal places*

Mitigation measures have been provided in **Section 6** to help avoid these impacts and should be reviewed to ensure their continued relevance at the DA stage.

Mitigation measures include

- preparation of a Vegetation Management Plan (VMP) for the remaining native vegetation
- the retention of HBTs within the APZ
- prioritize retention of *Allocasuarina torulosa* (feed tree for threatened Glossy Black-cockatoo) within the APZ where possible, in the case where trees require removal in this area (for example, where canopies overlap).

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## 5.2 Indirect impacts

The proposed construction of additional buildings and roads may result in indirect impacts. These could include:

- increased sediment, erosion and nutrient flow
- edge effects, such as possible increase in weeds around the proposed footprint
- soil and vegetation disturbance.

Mitigation measures and recommendations are provided in **Section 6** to provide more information and help avoid these impacts and should be reviewed to ensure their continued relevance at the DA stage.

## 5.3 Impact assessment

### 5.3.1 Assessment of Significant (TSC Act)

The EP&A Act states that if a species, population or ecological community listed in Schedules 1, 1A and 2 of the TSC Act is impacted, a review of the factors set out to establish if there is likely to be a significant impact on that species, population, ecological community or habitat, must be undertaken. Section 5A of the EP&A Act sets out seven factors that must be addressed as part of an Assessment of Significance (7 part test). This enables a decision to be made as to whether there is likely to be a significant effect on the species and, hence, if a Species Impact Statement (SIS) is required.

Based on the current proposed works (**Figure 3**), Assessments of Significance (AoS) were conducted for the following (**Appendix D**):

*Amphibian species:*

- *Heleioporus australiacus* (Giant Burrowing Frog).

*Avian species (excluding owls):*

- *Calyptorhynchus lathami* (Glossy Black-Cockatoo)

*Owl species:*

- *Ninox connivens* (Barking Owl)
- *Ninox strenua* (Powerful Owl)
- *Tyto novaehollandiae* (Masked Owl).

*Mammal species (excluding microbats)*

- *Cercartetus nanus* (Eastern Pygmy-possum)
- *Phascolarctos cinereus* (Koala species) and endangered population (Pittwater LGA).

*Microbat species:*

- *Chalinolobus dwyeri* (Large-eared Pied Bat)
- *Miniopterus australis* (Little Bentwing-bat)
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat)
- *Mormopterus norfolkensis* (Eastern Freetail-bat)
- *Myotis macropus* (Southern Myotis)
- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat).

The AoS concluded that a SIS would not be required for the above species, with the following conclusions:

*Amphibian species:*

The proposal is unlikely to significantly impact upon the Giant Burrowing Frog and a SIS is not required, given that:

- The proposed works would remove approximately 0.89 ha of ground and mid-storey native vegetation and woody debris and modify 1.71 ha for APZ within the study area, but would not fragment or isolate potential habitat within the adjacent bushland corridor
- The proposed works will not impact potential breeding habitat
- A targeted survey for GBF did not record the species within the study area, thus it is unlikely to currently occur there.

*Avian species (excluding owls):*

The proposal is unlikely to impose a significant effect on the Glossy Black-Cockatoo and a SIS is not required, given that the proposed works:

- Although the proposed works would remove native vegetation which is dominated by *Allocasuarina torulosa*, a primary feed species for Glossy Black-cockatoo, *A. torulosa* would be retained where possible within the APZ.
- Abundant potential foraging habitat is available to this highly mobile species adjacent to the site
- The proposed works would not remove any medium to large HBTs
- The proposed works would not isolate an area of known habitat from currently interconnecting areas of potential habitat for this highly mobile species.

*Potentially effected Owl and Microbat species:*

The proposal is unlikely to impose a significant effect on threatened Owl and Microbat species listed above, and an SIS is not required, given the following:

- Although the proposed works would remove a total of 0.89 ha of native vegetation, and under-scrub a total of 1.71 ha of native vegetation, considered potential foraging habitat for all potentially affected species, there is ample potential foraging habitat adjacent to the study area in a bushland corridor, accessible to these highly mobile species
- Although the proposed works would remove roosting habitat for potentially affected microbat species (two stags with no obvious hollows but potential cracks and crevices; with the exception of Large-eared Pied Bat) the proposed works would retain seven HBTs within the study area, and there is likely to be additional and abundant potential roosting habitat (HBTs and stags) within the bushland corridor adjacent to the study area
- The proposed works would not remove existing potential roosting habitat for potentially affected owl species
- The proposed works would not fragment or isolate potential foraging habitat for the highly mobile species.

*Mammal species (excluding microbats)*

The proposal is unlikely to impose a significant effect on the Eastern Pygmy Possum, and an SIS is not required, given that the proposed works:

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- Would remove a total of 0.89 ha marginal foraging habitat (including canopy trees), and the potential clearance of up to 1.71 ha marginal foraging habitat (not including canopy trees). This potential habitat is only considered marginal as it does not contain a high density of high nectar-producing flora species
- Retain HBTs (roosting habitat) within the APZ
- Would not isolate an area of known habitat from currently interconnecting areas of potential habitat for this species.

The proposal is unlikely to impose a significant effect on the Koala, and an SIS is not required, given that the proposed works:

- The proposed works would remove a total of 0.89 ha of potential foraging habitat, and the potential clearance of additional canopy trees in an APZ of 1.71 ha. This is small relative to the adjacent bushland corridor (> 50 ha)
- Vegetation proposed to be removed within the subject site includes *Eucalyptus resinifera*, a secondary food tree species for Koala (DECC 2008), *Syncarpia glomulifera*, an important shelter tree species (OEH 2017b), and *Angophora costata*, *Eucalyptus paniculata*, and *Eucalyptus umbra,* all potential foraging habitat (OEH 2017b). There is likely to be similar potential foraging resources located in the adjacent bushland corridor
- The proposed works would not fragment or isolate other potential habitat, as the study area is adjacent to a bushland corridor
- No signs (including scratches or scats) were observed on and around feed trees during the site inspection, and remote cameras did not detect Koala. Although there are numerous records of Koala within 5 km of the study area, no Koala records occur within the bushland corridor adjacent to the study area, and the closest record within 30 years of the study area is approximately 7 km away. Therefore it is unlikely Koala currently utilize the potential habitat within the study area.
- The koala habitat assessment tool (EPBC Act Referral Guidelines) determined that the study area does not contain habitat critical to the survival of the Koala (DotE 2014).

### 5.3.2 Significance Assessments (EPBC Act)

Based on the current proposed works (Figure 3), Significance Assessments were conducted for the following (**Appendix E**):

*Amphibian species:*

- *Heleioporus australiacus* (Giant Burrowing Frog).

*Microbat species:*

- *Chalinolobus dwyeri* (Large-eared Pied Bat)

*Mammal species (excluding microbats)*

- *Phascolarctos cinereus* (Koala).

*Amphibian species:*

The proposed works is not likely to have a significant impact on the GBF for the following reasons:

- An targeted survey did not detect GBF within the study, and thus an important population is unlikely to occur within or adjacent to the study area

- Potential breeding habitat within the study area would not be impacted by the proposed works
- The proposed works would not fragment or isolate potential habitat in the adjacent bushland corridor.

*Microbat species:*

The proposal is unlikely to impose a significant effect on the Large-eared Pied Bat, and a referral is not required, given that the proposed works:

- An important population of LPB is not located within the study area, and is unlikely to occur nearby
- The proposed works would remove a total of 0.89 ha of native vegetation, and under-scrub a total of 1.71 ha of native vegetation, considered potential foraging habitat for this species. This is relatively small compared to the available potential foraging habitat located adjacent to the study area in a bushland corridor.
- Potential roosting habitat (for example caves or abandoned mines) does not occur within the study area.

*Mammal species (excluding microbats)*

The proposal is unlikely to impose a significant effect on the Koala, and a referral is not required, given the following:

- No signs (including scratches or scats) were observed on and around feed trees during the site inspection (direct observation or remote camera). There are no records from the last 30 years that occur within 5 km of the study area. Therefore it is unlikely that an important population of Koala, or Koala individuals, currently utilize the potential habitat within the study area
- Although the proposed works would remove up to approximately 2.6 ha of potential foraging and shelter habitat, similar habitat is likely to occur in the bushland corridor adjacent to the study area
- The proposed removal of vegetation would not fragment or isolate other potential habitat, as the study area is located on the fringe of the bushland corridor
- The koala habitat assessment tool (EPBC Act Referral Guidelines) determined that the study area did not contain vegetation critical to the survival of the Koala (DotE 2014; **Section 5.4**).

## 5.4 Referral Guidelines for the vulnerable Koala (EPBC Act - DotE 2014)

The objectives of the referral guidelines are to:

- Promote avoidance and mitigation of impacts on the Koala.
- Promote a clear, consistent, and transparent approach for making decisions on whether an action is likely to result in a significant impact on the Koala.
- Promote streamlined decision-making and approval processes.
- Promote the recovery of the Koala.

The study area is located in a coastal context (> 800 mm annual rainfall; Terrey Hills AWS station 066059), and primary threats include *'loss, fragmentation and degradation of habitat, including dispersal habitat'* (DotE 2014).

The koala habitat assessment tool was used to determine if the proposed works would impact habitat critical to the survival of the Koala (DotE 2014). The following attributes were considered:

- Koala occurrence: Neither Koala presence, nor signs (scratches, scats, etc.) were observed during the site inspection (direct observation or remote camera). There are 90 Koala records

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within 5 km of the study area, recorded greater than 30 years ago. The two nearest records are within 1 km to the east of the study area, and are dated 1967 and 1972. There are no records within the bushland corridor adjacent to the study area. The nearest record within the last 30 years is approximately 6 km to the north-west of the study area, in Ku-Ring-Gai Chase National Park (25 August 2009). There is no evidence of Koalas occurring in the study area in the last 5 years (Score of 0)

- Vegetation composition: Has forest or woodland with only one species of known koala food tree present (Score of 1)
- Habitat connectivity: The vegetation within the study area is part of a contiguous landscape > 300 ha (Score of 1)
- Key existing threats:
    - Potential habitat within the study area is located directly adjacent to access roads for the retirement village. Therefore there is a chance of Koala mortality from vehicle strike.
    - The study area is located in a residential area (although currently zoned RU2 Rural Landscape). Therefore there is a potential chance of Koala mortality from dog attack (Score of 1).
- Recovery value: It is uncertain whether the habitat within the study area has the potential to be important for achieving the interim recovery objectives in the context of the study area, due to the isolated nature of the bushland corridor from recent records, and the unlikely presence of recent Koalas. Relevant objectives include:
    - Protect and conserve the quality and extent of habitat refuges.
    - Maintain the quality, extent and connectivity of large areas of Koala habitat surrounding habitat refuges (Score of 1).

Based on the above assessment tool, the potential habitat within the study area has a total score of '3'. Impact areas that score less than 5 using the Koala habitat assessment tool do not contain habitat critical to the survival of the Koala (DotE 2014).

### 5.4.1 Pittwater Local Environmental Plan (LEP) 2014

The Pittwater LEP 2014 directly relates to the management of the biodiversity within the study area.

The study area is currently zoned as RU2 Rural Landscape. The objectives of the zone are to:

- *To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.*
- *To maintain the rural landscape character of the land.*
- *To provide for a range of compatible land uses, including extensive agriculture.*
- *To ensure that development in the area does not unreasonably increase the demand for public services or public facilities.*
- *To minimise conflict between land uses within this zone and land uses within adjoining zones.*

The proposal is consistent with the objectives of RU2 zoning to provide a balance between maintaining biodiversity values within the study area while providing residential development within the LGA.

The proposed development should ensure Development Consent has been granted prior to any disturbance or removal of any vegetation on-site, unless they are listed as exempt species in the DCP or are noxious weeds listed for the former Pittwater Council as per Clause 5.9 of the DCP, *Preservation of trees or vegetation*.

Clause 7.6 of the LEP outlines a number of matters which must be taken into consideration before consent is granted to a development application on land identified as "Biodiversity" on the Terrestrial Biodiversity

Map. The consent authority must determine whether the development is likely to have any adverse impact on flora and fauna, and whether it has the potential to fragment biodiversity structure, function and connectivity.

The entire study area, with the exception of portions of the two northern lots (**Figure 2**) is mapped as "Biodiversity" under the Pittwater LEP.

Clause 7.6 states:

*(1) The objective of this clause is to maintain terrestrial, riparian and aquatic biodiversity by:*

*(a) protecting native fauna and flora, and*

*(b) protecting the ecological processes necessary for their continued existence, and*

*(c) encouraging the conservation and recovery of native fauna and flora and their habitats.*

*(2) This clause applies to land identified as "Biodiversity" on the Biodiversity Map.*

*(3) Before determining a development application for development on land to which this clause applies, the consent authority must consider:*

*(a) whether the development is likely to have:*

*(i) any adverse impact on the condition, ecological value and significance of the fauna and flora on the land, and*

*(ii) any adverse impact on the importance of the vegetation on the land to the habitat and survival of native fauna, and*

*(iii) any potential to fragment, disturb or diminish the biodiversity structure, function and composition of the land, and*

*(iv) any adverse impact on the habitat elements providing connectivity on the land, and*

*(b) any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development.*

*(4) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that:*

*(a) the development is designed, sited and will be managed to avoid any significant adverse environmental impact, or*

*(b) if that impact cannot be reasonably avoided by adopting feasible alternatives—the development is designed, sited and will be managed to minimise that impact, or*

*(c) if that impact cannot be minimised—the development will be managed to mitigate that impact.*

Clause 7.6 of the LEP relates to the management of biodiversity on the subject land, as the majority of the study area is mapped as "Biodiversity" on the LEP Terrestrial Biodiversity Map. Although no TECs were mapped within the study area, the study area does support potential habitat for a number of threatened and non-threatened species, and additionally a first order stream.

Consideration of the proposed works relative to Clause 7.6 is outlined in **Table 5**.

## 5.5 *Pittwater 21 Development Control Plan*

The Pittwater 21 Development Control Plan (Pittwater DCP) supports the Pittwater LEP 2014 in regulating land use for future developments.

The study area is not located within the Urban Release Area Map.

A search of the ePlanning portal on the Northern Beaches Council Website (NBC 2017) was undertaken in August 2017 to determine if additional biodiversity controls in the DCP apply to the site, namely, controls contained within Part B4 (Controls Relating To The Natural Environment).

Results from the search indicate that controls from Parts B4.1 – B4.6 do not apply to the subject land and the land is not mapped as:

- Flora and Fauna Conservation Areas (Category 1 and 2)
- Wildlife Corridors.

In addition, Parts B4.1 to B4.6, and B4.11 of the DCP state that land to which these controls apply excludes land which is covered in other Natural Environmental Controls. As described in above, the land is mapped as "Biodiversity" under the Pittwater LEP.

Parts B4.7 to B4.10, and B4.12, to B4.21, do not apply to the subject land as it does not contain or adjoin the described vegetation communities and habitats.

Part B4.22 does apply to the subject land and states that:

- A person shall not ringbark, cut down, top, lop, remove, poison, injure, or wilfully destroy any prescribed tree or bushland vegetation without a Tree and Bushland Vegetation Removal Permit unless authorised by a current Development Consent.

The proposed works will ensure Development Consent has been granted prior to any disturbance or removal of any vegetation on-site, unless they are listed as exempt species in the DCP or are noxious weeds listed for the former Pittwater Council. This includes *Lantana camara* (Lantana) and *L. sinense* (Small-leaved Privet).

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**Table 5: Consideration of assessment criteria in Terrestrial Biodiversity areas**

| Consideration Criteria | Response |
|---|---|
| any adverse impact on the condition, ecological value and significance of the fauna and flora on the land, and | The proposed works would remove 0.89 ha native vegetation (development footprint), including: 0.69 ha CCEMF, 0.12 ha CCEMF (low condition), 0.04 CCEMF (exotic understorey), and 0.04 ha CWTR.<br>Additionally, 1.71 ha of native vegetation would be under-scrubbed (APZ), which may remove some tree species where their canopy is in contact. This includes 0.97 ha CCEMF, 0.27 ha CCEMF (low condition), 0.18 CCEMF (exotic understorey), and 0.29 ha CWTR.<br>Although two stags within the development footprint would be removed, four medium to large HBTs and three small HBTs within the APZ would be retained. *Allocasuarina torulosa,* potential foraging habitat for the Glossy Black Cockatoo, would be prioritized to be retained where possible within the APZ.<br>2.14 ha of native vegetation would be retained within the study area (outside of the subject site) and managed under a VMP.<br>The vegetated understorey within riparian zone (10 m buffer; **Figure 3**) would not be removed or under-scrubbed as per the surrounding APZ.<br>Although the proposed works will result in the removal of native vegetation the majority of the native vegetation in good condition will be retained.<br>No TECs were mapped within the study area during the site inspection. A pre-clearance survey would occur before and during the proposed works to relocate any fauna currently occurring within the subject site, to adjacent habitat.<br>The proposed works would not cause a significant impact to threatened fauna likely to occur within the study area, as assessed under the TSC Act (**Appendix D**) and the EPBC Act (**Appendix E**). |
| any adverse impact on the importance of the vegetation on the land to the habitat and survival of native fauna, and | The importance of the vegetation will not be adversely impacted by the proposal.<br>Although two stags within the development footprint would be removed no HBTs will be removed. The four medium to large HBTs and three small HBTs within the APZ would be retained. These HBTs are potential roosting habitat for a number of potentially occurring threatened species. *Allocasuarina torulosa,* potential foraging habitat for the Glossy Black Cockatoo, would be prioritized to be retained where possible within the APZ.<br>The proposed works would not cause a significant impact to threatened fauna likely to occur within the study area, as assessed under the TSC Act (**Appendix D**) and the EPBC Act (**Appendix E**). |
| any potential to fragment, disturb or diminish the biodiversity structure, function and composition of the land, and | The proposed works would reduce the area of occurrence of vegetation within the study area by 0.89 ha, and under-scrub an additional 1.71 ha of native vegetation within the APZ. However, this is considered unlikely to diminish the structure, function or composition of the vegetation within the study area.<br>Furthermore, 2.14 ha of native vegetation would be retained within the study area (outside of the subject site) and managed under a VMP. The study area |

| Consideration Criteria | Response |
|---|---|
| | occurs adjacent to a large corridor of bushland, and would not fragment the remaining vegetation from this corridor.<br>The vegetated understorey within riparian zone (10 m buffer; **Figure 3**) would not be under-scrubbed as per the surrounding APZ. |
| any adverse impact on the habitat elements providing connectivity on the land, and | A total of 2.14 ha of native vegetation would be retained within the study area (outside of the subject site) and managed under a VMP. The study area occurs adjacent to a large corridor of bushland, and would not fragment the remaining vegetation from this corridor.<br>Thus, the connectivity on the land will not be impacted by the proposal. |
| any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development. | The proposed works historically considered the removal of all native vegetation within the study area (4.74 ha). This has now been reduced by half to 2.6 ha (including APZ).<br>The subject site (impact footprint) includes the only portion of the study area mapped as 'Weeds and Exotics' (Figure 7).<br>The remaining 2.14 ha of native vegetation would be retained within the study area (outside of the subject site) and managed under a VMP.<br>Although two stags within the development footprint would be removed, four medium to large HBTs and three small HBTs within the APZ would be retained. These HBTs are potential roosting habitat for a number of potentially occurring threatened species. *Allocasuarina torulosa,* potential foraging habitat for the Glossy Black Cockatoo, would be prioritized to be retained where possible within the APZ. |

# 6 Recommendations

To prevent and assess indirect impacts from the proposal on vegetation communities and habitat for threatened species within the APZ and adjacent to the subject site during construction, a number of mitigation measures are required. These include the following and should be refined at the DA stage of the project.

Recommendations include:

- The proposed development - should ensure Development Consent has been granted prior to any disturbance or removal of any vegetation on-site, unless they are listed as exempt species in the DCP (**Section 2.9**).
- Preparation of a Vegetation Management Plan (VMP) to guide the management of retained vegetation, applying best management practices for working in native vegetation communities.
    - The VMP will incorporate weed management actions to protect existing ecological values and control the spread of exotic / noxious species. This will minimise potential impacts arising from sediment deposition, alteration of light levels and movement of propagules across the site, which would facilitate weed growth and expansion.
    - The VMP will incorporate pest management actions, where necessary.
    - Areas of landscaping must avoid species that are, or are likely to become, environmental weeds. Species such as *Cenchrus setaceus* (sold as Fountain Grass and syn. *Pennisetum setaceum*) must be avoided. Species such as this are prolific seeders and are highly invasive.

- Removal of native vegetation including stags:
    - Ensure qualified ecologist is on-site during vegetation removal to capture and relocate fauna.

- Management of increased sediment, erosion, and nutrient flow:
    - Ensure additional run-off within the subject site is captured, directed through suitable filtration and not released directly into the small 1st order stream within the study area

- Establishment of an Asset Protection Zone (APZ):
    - When creating the APZ, canopy trees should be retained wherever possible. Primarily ground and mid-storey vegetation should be removed.
    - Hollow-bearing trees (HBTs) within the APZ must be retained. The site inspection mapped seven HBTs within the APZ.
    - *Allocasuarina torulosa* trees (primary feed tree species for Glossy Black Cockatoo) within the APZ should be retained where possible. If *A. torulosa* canopy contacts a different tree species within the APZ, the *A. torulosa* should be strongly considered for retention.

- Implement the following mitigation measures as part of the construction process:

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- Temporary tree protection measures (such as machinery exclusion zones from tree roots or tree trunk protection) should be in place during any construction works, if trees are to be retained on site and to protect adjacent native vegetation
- Establishment of clearly defined areas, such as the works area and any 'no-go' areas within/adjacent to work site boundaries that are not to be in any way disturbed or damaged by the works (e.g. the riparian corridor in the western portion of the study area; Figure 3)
- Construction fencing pre-construction and during construction to ensure that related impacts are contained within the work areas
- Soil and erosion measures such as sediment fencing
- Soil and erosion measures should be inspected regularly (weekly at least), more often during rain periods to ensure that they are in proper working order
- No chemicals or rubbish should be allowed to escape the construction area, especially near the riparian corridor
- All chemicals should be stored as far away from any waterways as possible and should be correctly stored within bunding.

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# 7 Conclusions

The proposed works would remove 0.89 ha of native vegetation and modify 1.71 ha of native vegetation for management as APZ. This native vegetation is potential habitat to a range of threatened flora and fauna species with the potential to occur within the study area.

An area 0.53 ha of Coastal Warm Temperate Rainforest (CWTR) was mapped within the study area, but this was not considered a TEC because it does not occur on relatively nutrient rich soils and adjacent to a patch of adjacent to Illawarra Escarpment Subtropical rainforest.

No threatened flora species were detected during targeted searches within the study area. No threatened fauna species, including Southern Myotis, Eastern Pygmy Possum, or Giant Burrowing Frog, were detected during targeted surveys within the study area. It is noted that the required amount of rain for Giant Burrowing Frog under the EPBC Survey Guidelines was not met during this targeted survey.

Assessments of Significance under the TSC Act conducted for 14 fauna species determined that the proposed works would not have a significant impact on these species and thus a SIS is not required.

Significance Assessments under the EPBC Act conducted for three fauna species determined that the proposed works would not have a significant impact on these species, and thus a referral is not required.

The study area occurs within the Terrestrial Biodiversity Layer under the Pittwater LEP. The proposed works were deemed to be largely consistent with the objectives of Biodiversity Clause 7.6 if they follow mitigation measures, which include:

- The APZ and indirect impacts do not impact on the riparian corridor in the west of the study area
- Retaining HBTs within the APZ (includes 4 medium to large HBTs and 3 small HBTs). These are potential roosting habitat for a number of potentially effected threatened species
- Prioritize retaining *Allocasuarina torulosa* within the APZ, potential foraging habitat for the Glossy Black Cockatoo.

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# Appendix A : Likelihood of Occurrence

An assessment of likelihood of occurrence was made for threatened and migratory species identified from the database search. Five terms for the likelihood of occurrence of species are used in this report. This assessment was based on database or other records, presence or absence of suitable habitat, features of the proposal site, results of the site inspection and professional judgement. Some Migratory or Marine species identified from the Commonwealth database search have been excluded from the assessment, due to lack of habitat. The terms for likelihood of occurrence are defined below:

- "known" = the species was or has been observed on the site
- "likely" = a medium to high probability that a species uses the site
- "potential" = suitable habitat for a species occurs on the site, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur
- "unlikely" = a very low to low probability that a species uses the site
- "no" = habitat on site and in the vicinity is unsuitable for the species.

An assessment of significance was conducted for threatened species or ecological communities that were recorded within the study area or had a higher likelihood of occurring and were not recorded during the site visit. It is noted that some threatened fauna species that are highly mobile, wide ranging and vagrant may use portions of the study area intermittently for foraging. For these fauna species, the habitat present and likely to be impacted is not considered to be important to the threatened species, particularly in relation to the amount of similar habitat remaining in the surrounding landscape. As such, an assessment of significance in reference to State or Commonwealth legislation was not considered necessary.

The records column refers to the number of records occurring within 5 km of the study area, as provided by the Atlas of NSW Wildlife (BioNet) and Protected Matters Search Tool database search.

Information provided in the habitat associations' column has primarily been extracted (and modified) from the Commonwealth Species Profile and Threats Database (DotEE 2017b) and the NSW Threatened Species Profiles (OEH 2017b).

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**Table 6: Likelihood of occurrence and requirement of impact assessment for threatened fauna species**

| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area (Bionet records) | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| **Amphibians** | | | | | | | |
| *Heleioporus australiacus* | Giant Burrowing Frog | V | V | Heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. | 17 | Potential | Yes |
| *Litoria aurea* | Green and Golden Bell Frog | E1 | V | Marshes, dams and stream-sides, particularly those containing Typha spp. (bullrushes) or Eleocharis spp. (spikerushes). Some populations occur in highly disturbed areas. | 2 | Unlikely | No, no potential habitat occurs within the study area |
| *Litoria littlejohni* | Littlejohn's Tree Frog | V | V | Breeding habitat is the upper reaches of permanent streams and perched swamps. Non-breeding habitat is heath-based forests and woodlands. | 0 | Unlikely | No, this species has not been recorded within 5 km of the study area |
| *Mixophyes balbus* | Stuttering Frog | E1 | V | Rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Feed on insects and smaller frogs. | 0 | Unlikely | No, this species has not been recorded within 5 km of the study area |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area (Bionet records) | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| *Pseudophryne australis* | Red-crowned Toadlet | V | | Open forests, mostly on Hawkesbury and Narrabeen Sandstones. | 27 | Unlikely | No, no potential habitat occurs within the study area |
| **Aves** | | | | | | | |
| *Actitis hypoleucos* | Common Sandpiper | | M | Coastal wetlands and some inland wetlands, especially muddy margins or rocky shores. Also estuaries and deltas, lakes, pools, billabongs, reservoirs, dams and claypans, mangroves. | 0 | Unlikely | No, this species has not been recorded within 5 km of the study area, and only marginal potential habitat occurs within the study area |
| *Anous stolidus* | Common Noddy | | M | Marine. | 1 | No | No |
| *Anthochaera phrygia* | Regent Honeyeater | E4A | CE | Eucalypt woodland and open forest, wooded farmland and urban areas with mature eucalypts, | 13 | Unlikely | No, no potential habitat occurs |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area (Bionet records) | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| | | | | and riparian forests of *Casuarina cunninghamiana* (River Oak). | | | within the study area |
| *Apus pacificus* | Fork-tailed Swift | | M | Riparian woodland, swamps, low scrub, heathland, saltmarsh, grassland, Spinifex sandplains, open farmland and inland and coastal sand-dunes. | 2 | Unlikely | No, this species is only likely to occur on the study area intermittently |
| *Ardenna carneipes* | Flesh-footed Shearwater | V | M | Marine. | 1 | No | No |
| *Ardenna pacificus* | Wedge-tailed Shearwater | | | Islands, offshore. | 2 | No | No |
| *Ardenna tenuirostris* | Short-tailed Shearwater | | M | Islands, offshore. | 3 | No | No |
| *Artamus cyanopterus cyanopterus* | Dusky Woodswallow | V | | | 2 | Potential | No, this species is only likely to use the study area intermittently |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area (Bionet records) | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| *Botaurus poiciloptilus* | Australasian Bittern | E1 | E | Permanent freshwater wetlands with tall, dense vegetation, particularly Typha spp. (bullrushes) and Eleocharis spp. (spikerushes). | 3 | Unlikely | No, potential habitat does not occur within the study area |
| *Burhinus grallarius* | Bush Stone-curlew | E1 | | In NSW, it occurs in lowland grassy woodland and open forest. | 10 | Unlikely | No, this conspicuous species was not observed or heard during numerous extensive surveys |
| *Calidris acuminata* | Sharp-tailed Sandpiper | | M | Shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. | 0 | Unlikely | No, potential habitat does not occur within the study area |
| *Calidris canutus* | Red Knot | | E, M | Intertidal mudflats, sandflats sheltered sandy beaches, estuaries, bays, inlets, lagoons, harbours, sandy ocean beaches, rock platforms, coral reefs, terrestrial saline wetlands near the | 0 | No | No |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area (Bionet records) | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| | | | | coast, sewage ponds and saltworks. Rarely inland lakes or swamps. | | | |
| *Calidris ferruginea* | Curlew Sandpiper | E1 | CE, M | Littoral and estuarine habitats, including intertidal mudflats, non-tidal swamps, lakes and lagoons on the coast and sometimes inland. | 0 | No | No |
| *Callocephalon fimbriatum* | Gang-gang Cockatoo | V | | Tall mountain forests and woodlands in summer; in winter, may occur at lower altitudes in open eucalypt forests and woodlands, and urban areas. | 2 | Unlikely | No, only marginal potential habitat occurs within the study area |
| *Calonectris leucomelas* | Streaked Shearwater | | M | Marine. | 0 | No | No |
| *Calyptorhynchus banksii samueli* | Red-tailed Black-Cockatoo (inland subspecies) | V | | Eucalyptus forest and woodlands, especially along watercourses. Also grasslands, scrublands, wetlands and vegetation on floodplains. | 1 | Unlikely | No, only marginal potential habitat occurs within the study area |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area (Bionet records) | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| *Calyptorhynchus lathami* | Glossy Black-Cockatoo | V | | Open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. | 47 | Likely | Yes |
| *Daphoenositta chrysoptera* | Varied Sittella | V | | Inhabits eucalypt forests and woodlands, mallee and Acacia woodland. | 3 | Potential | No, this highly mobile species is only likely to utilize the study area intermittently |
| *Dasyornis brachypterus* | Eastern Bristlebird | E1 | E | Central and southern populations inhabit heath and open woodland with a heathy understorey. In northern NSW, habitat comprises open forest with dense tussocky grass understorey. | 0 | No | No |
| *Diomedea antipodensis* | Antipodean Albatross | V | V | Marine. | 0 | No | No |
| *Diomedea antipodensis gibsoni* | Antipodean Albatross | V | V | Marine. | 0 | No | No |
| *Diomedea exulans* | Wandering Albatross | E1 | V, M | Marine. | 1 | No | No |
| *Diomedea gibsoni* | Gibson's Albatross | V | V | Marine. | 0 | No | No |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area (Bionet records) | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| *Egretta sacra* | Eastern Reef Egret | | | Beaches, rocky shores, tidal rivers and inlets, mangroves, and exposed coral reefs. | 2 | No | No |
| *Fregata ariel* | Lesser Frigatebird | | M | Marine. | 1 | No | No |
| *Fregata minor* | Great Frigatebird | | M | Marine. | 0 | No | No |
| *Fregetta grallaria grallaria* | White-bellied Storm-Petrel | V | V | Marine. | 0 | No | No |
| *Gallinago hardwickii* | Latham's Snipe | | M | Freshwater, saline or brackish wetlands up to 2000 m above sea-level; usually freshwater swamps, flooded grasslands or heathlands. | 1 | Unlikely | No, potential does not occur within the study area |
| *Glossopsitta pusilla* | Little Lorikeet | V | | Dry, open eucalypt forests and woodlands, including remnant woodland patches and roadside vegetation. | 8 | Unlikely | No, only marginal potential habitat occurs within the study area |
| *Grantiella picta* | Painted Honeyeater | V | V | Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. | 0 | No | No, potential habitat does not occur |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area (Bionet records) | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| | | | | | | | within the study area |
| *Haematopus fuliginosus* | Sooty Oystercatcher | V | | Rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries. | 6 | No | No |
| *Haliaeetus leucogaster* | White-bellied Sea-Eagle | V | | Freshwater swamps, rivers, lakes, reservoirs, billabongs, saltmarsh and sewage ponds and coastal waters. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, forest and urban areas. | 35 | Potential | No, this highly mobile species is only likely to utilize the study area intermittently |
| *Hieraaetus morphnoides* | Little Eagle | V | | Open eucalypt forest, woodland or open woodland, including sheoak or Acacia woodlands and riparian woodlands of interior NSW. | 7 | Potential | No, this highly mobile species is only likely to utilize the study area intermittently |
| *Hirundapus caudacutus* | White-throated Needletail | | M | Occur most often over open forest and rainforest, as well as heathland, and remnant vegetation in farmland. | 8 | Unlikely | No |
| *Hydroprogne caspia* | Caspian Tern | | M | Coastal offshore waters, beaches, mudflats, estuaries, rivers, lakes. | 5 | No | No |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area (Bionet records) | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| *Ixobrychus flavicollis* | Black Bittern | V | | Terrestrial and estuarine wetlands. Also flooded grassland, forest, woodland, rainforest and mangroves where permanent water is present. | 12 | Unlikely | No, there is only marginal habitat present within the study area |
| *Lathamus discolor* | Swift Parrot | E1 | CE | Box-ironbark forests and woodlands. | 8 | Unlikely | No, there is no potential habitat located within the study area |
| *Limosa lapponica* | Bar-tailed Godwit | | M | Intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons, bays, seagrass beds, saltmarsh, sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats. Rarely inland wetlands, paddocks and airstrips. | 4 | No | No |
| *Lophoictinia isura* | Square-tailed Kite | V | | Timbered habitats including dry woodlands and open forests, particularly timbered watercourses. | 1 | Potential | No, this species is only likely to occur within the study area intermittently |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area (Bionet records) | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| *Macronectes giganteus* | Southern Giant Petrel | E1 | E, M | Marine. | 0 | No | No |
| *Macronectes halli* | Northern Giant-Petrel | V | V, M | Marine. | 0 | No | No |
| *Melithreptus gularis gularis* | Black-chinned Honeyeater (eastern subspecies) | V | | "Open forests or woodlands dominated by box and ironbark eucalypts, or by smooth-barked gums, stringybarks, river sheoaks and tea-trees." | 1 | Unlikely | No, potential habitat does occur within the study area |
| *Monarcha melanopsis* | Black-faced Monarch | | M | Rainforest, open eucalypt forests, dry sclerophyll forests and woodlands, gullies in mountain areas or coastal foothills, Brigalow scrub, coastal scrub, mangroves, parks and gardens. | 0 | Unlikely | No, this species has not been recorded within 5 km of the study area |
| *Monarcha trivirgatus* | Spectacled Monarch | | | Mountain/lowland rainforest, wooded gullies, riparian vegetation including mangroves. | 0 | Unlikely | No, this species has not been recorded within 5 km of the study area |
| *Motacilla flava* | Yellow Wagtail | | M | Swamp margins, sewage ponds, saltmarshes, playing fields, airfields, ploughed land, lawns. | 0 | Unlikely | No, this species has |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area (Bionet records) | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| | | | | | | | not been recorded within 5 km of the study area |
| *Myiagra cyanoleuca* | Satin Flycatcher | | M | Eucalypt-dominated forests, especially near wetlands, watercourses, and heavily-vegetated gullies. | 0 | Unlikely | No, this species has not been recorded within 5 km of the study area |
| *Ninox connivens* | Barking Owl | V | | Woodland and open forest, including fragmented remnants and partly cleared farmland, wetland and riverine forest. | 19 | Potential | Yes |
| *Ninox strenua* | Powerful Owl | V | | Woodland, open sclerophyll forest, tall open wet forest and rainforest. | 157 | Likely | Yes |
| *Numenius madagascariensis* | Eastern Curlew | | CE, M | Estuaries, bays, harbours, inlets and coastal lagoons, intertidal mudflats or sandflats, ocean beaches, coral reefs, rock platforms, saltmarsh, mangroves, freshwater/brackish lakes, saltworks and sewage farms. | 0 | No | No |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area (Bionet records) | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| *Pandion cristatus* | Eastern Osprey | V | | Rocky shorelines, islands, reefs, mouths of large rivers, lagoons and lakes. | 16 | No | No, potential habitat does not occur within the study area |
| *Phoebetria fusca* | Sooty Albatross | V | V, M | Marine. | 0 | No | No |
| *Pterodroma leucoptera leucoptera* | Gould's Petrel | V | E | "Marine. Nesting habitat is located within steeply sloping rock scree gullies with a canopy of Cabbage Tree Palms." | 0 | No | No |
| *Pterodroma neglecta neglecta* | Kermadec Petrel (west Pacific subspecies) | V | V | Marine. | 0 | No | No |
| *Ptilinopus superbus* | Superb Fruit-Dove | V | | Rainforest and closed forests. May also forage in eucalypt or acacia woodland where there are fruit-bearing trees. | 1 | Potential | No. Only one record in the locality and Impacts to foraging habitat are negligible in comparison to habitat |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area (Bionet records) | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| | | | | | | | available in the locality. |
| *Rhipidura rufifrons* | Rufous Fantail | | M | Wet sclerophyll forests, subtropical and temperate rainforests. Sometimes drier sclerophyll forests and woodlands. | 0 | Unlikely | No, this species has not been recorded within 5 km of the study area |
| *Rostratula australis* | Australian Painted Snipe | E1 | E | Swamps, dams and nearby marshy areas. | 3 | Unlikely | No, potential habitat does not occur within the study area |
| *Sternula albifrons* | Little Tern | E1 | M | Sheltered coastal environments, harbours, inlets and rivers. | 0 | No | No |
| *Thalassarche cauta* | Shy Albatross | V | V | Marine. | 0 | No | No |
| *Thalassarche cauta cauta* | Shy Albatross | V | V | Marine. | 0 | No | No |
| *Thalassarche chrysostoma* | Grey-headed Albatross | | E | Marine. | 1 | No | No |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area (Bionet records) | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| *Thalassarche melanophris* | Black-browed Albatross | V | V | Marine. | 1 | No | No |
| *Tringa nebularia* | Common Greenshank | | M | Terrestrial wetlands (swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans, saltflats, sewage farms and saltworks dams, inundated rice crops and bores) and sheltered coastal habitats (mudflats, saltmarsh, mangroves, embayments, harbours, river estuaries, deltas, lagoons, tidal pools, rock-flats and rock platforms). | 0 | No | No, this species has not been recorded within 5 km of the study area |
| *Tyto novaehollandiae* | Masked Owl | V | | Dry eucalypt forests and woodlands from sea level to 1100 m. | 3 | Potential | Yes |
| *Xenus cinereus* | Terek Sandpiper | V | M | Mudbanks and sandbanks near mangroves, rocky pools and reefs, and occasionally up to 10 km inland around brackish pools. | 2 | No | No, potential habitat does not occur within the study area |
| **Mammals (excluding bats)** | | | | | | | |
| *Cercartetus nanus* | Eastern Pygmy-possum | V | | Rainforest, sclerophyll forest (including Box-Ironbark), woodland and heath. | 77 | Likely | Yes |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area (Bionet records) | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| *Dasyurus maculatus maculatus (SE mainland population)* | Spotted-tailed Quoll | V | E | Rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. | 12 | Unlikely | No, this highly mobile species is only likely to utilize the study area intermittently |
| *Isoodon obesulus obesulus* | Southern Brown Bandicoot (eastern) | E1 | E | Heath or open forest with a heathy understorey on sandy or friable soils. | 18 | Unlikely | No, no potential habitat occurs within the study area |
| *Petaurus norfolcensis* | Squirrel Glider | V | | Mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. | 5 | Unlikely | No, potential habitat does not occur within the study area |
| *Petrogale penicillata* | Brush-tailed Rock-wallaby | E1 | V | Rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges. | 0 | Unlikely | No, potential habitat does not occur within the study area |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area (Bionet records) | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| *Phascolarctos cinereus* | Koala | V | V | Eucalypt woodlands and forests. | 9 | Potential | Yes |
| *Phascolarctos cinereus* | Koala in the Pittwater Local Government Area | E2,V | V | Eucalypt forests and woodlands. Key likely habitats within Pittwater Council are: Swamp Mahogany Forest, ecotone between Spotted Gum Forest & Hawkesbury Sandstone Open-Forest, Northern form of Coastal Sandstone Woodland at Whale Beach, Red Bloodwood - Scribbly Gum Woodland, Bilgola Plateau Forest and the Grey Ironbark - Grey Gum form of the Newport Bangalay Woodland. | 45 | Potential, however, most recent record for this population is 1 July 1987 (OEH 2017a). The population considered unviable (OEH 2011) | No |
| *Potorous tridactylus tridactylus* | Long-nosed Potoroo | V | V | Coastal heaths and dry and wet sclerophyll forests. | 0 | No | No, this species has not been recorded within 5 km of the study area |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area (Bionet records) | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| *Pseudomys novaehollandiae* | New Holland Mouse | | V | Open heathlands, woodlands and forests with a heathland understorey, vegetated sand dunes. | 2 | Unlikely | No, potential habitat does not occur within the study area |
| **Mammals (bats)** | | | | | | | |
| *Chalinolobus dwyeri* | Large-eared Pied Bat | V | V | Wet and dry sclerophyll forests, Cyprus Pine dominated forest, woodland, sub-alpine woodland, edges of rainforests and sandstone outcrop country. | 8 | Potential | Yes |
| *Falsistrellus tasmaniensis* | Eastern False Pipistrelle | V | | Tall (greater than 20m) moist habitats. | 2 | Unlikely | No, potential habitat does not occur within the study area |
| *Miniopterus australis* | Little Bentwing-bat | V | | Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. | 24 | Likely | Yes |
| *Miniopterus schreibersii oceanensis* | Eastern Bentwing-bat | V | | Rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland. | 45 | Likely | Yes |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area (Bionet records) | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| *Mormopterus norfolkensis* | Eastern Freetail-bat | V | | Dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. | 6 | Potential | Yes |
| *Myotis macropus* | Southern Myotis | V | | Foraging habitat is waterbodies (including streams, or lakes or reservoirs) and fringing areas of vegetation up to 20m. | 15 | Potential | Yes |
| *Pteropus poliocephalus* | Grey-headed Flying-fox | V | V | Subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. | 35 | Unlikely | No, only marginal potential habitat occurs within the study area |
| *Saccolaimus flaviventris* | Yellow-bellied Sheathtail-bat | V | | Almost all habitats, including wet and dry sclerophyll forest, open woodland, open country, mallee, rainforests, heathland and waterbodies. | 1 | Potential | Yes |
| *Scoteanax rueppellii* | Greater Broad-nosed Bat | V | | Woodland, moist and dry eucalypt forest and rainforest. | 5 | Potential | Yes |
| **Reptiles** | | | | | | | |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area (Bionet records) | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| *Cacophis harriettae* | White-crowned Snake | V | | Low to mid-elevation dry eucalypt forest and woodland, moist eucalypt forest and coastal heathland. | 1 | No | No, potential habitat does not occur within the study area |
| *Hoplocephalus bungaroides* | Broad-headed Snake | E1 | V | Dry and wet sclerophyll forests, riverine forests, coastal heath swamps, rocky outcrops, heaths, grassy woodlands. | 0 | No | No, this species has not been recorded within 5 km of the study area, and no potential habitat occurs within the study area |
| *Varanus rosenbergi* | Rosenberg's Goanna | V | | Heath, open forest and woodland. | 34 | Unlikely | No, this species is only likely to utilize the study area intermittently |
| **Dragonflies** | | | | | | | |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area (Bionet records) | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| Archaeophya adamsi | Adam's Emerald Dragonfly | E | - | Adam's emerald dragonflies are one of Australia's rarest dragonflies. The species is only known from a few sites in the greater Sydney region. Larvae have been found in small creeks with gravel or sandy bottoms, in narrow, shaded riffle zones with moss and rich riparian vegetation (NSW Department of Primary Industries, 2015). | - | Unlikely | No |
| Austrocordulia leonardi | Sydney Hawk Dragonfly | E | - | The known distribution of the species includes three locations in a small area south of Sydney, from Audley to Picton. The species is also known from the Hawkesbury-Nepean, Georges River and Port Hacking drainages. The Sydney hawk dragonfly has specific habitat requirements, and has only ever been collected from deep and shady riverine pools with cooler water. Larvae are found under rocks where they co-exist with Austrocordulia refracta (NSW Department of Primary Industries, 2015). | - | Unlikely | No |
| **Freshwater fishes** | | | | | | | |
| *Bidyanus bidyanus* | Silver Perch | V | CE | Silver perch are a moderate to large freshwater fish native to the Murray-Darling river system. Present in the Hawkesbury-Nepean as a result of stocking. | - | Unlikely. The stream within the | No |

| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area (Bionet records) | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| | | | | Silver perch seem to prefer fast-flowing, open waters, especially where there are rapids and races, however they will also inhabit warm, sluggish water with cover provided by large woody debris and reeds. Habitat is predominantly in lowland and slope waterways. Adults migrate upstream in spring and summer to spawn. | | study area is isolated from wider channels nearby. | |
| *Maccullochella macquariensis* | Trout cod | E | E | The Trout Cod is endemic to the southern Murray-Darling river system, including the Murrumbidgee and Murray Rivers, and the Macquarie River in central NSW. Present in the Hawkesbury-Nepean as a result of stocking. Migrates wholly within fresh water (potamodromous). Prefers deep flowing freshwaters with woody debris. | - | Unlikely. The stream within the study area is isolated from wider channels nearby. | No |
| *Maccullochella peelii* | Murray cod | - | V | Migrates wholly within freshwater (potamodromous). It utilises a diverse range of habitats from clear rocky streams, such as those found in the upper western slopes of NSW (including the ACT), to slow-flowing, turbid lowland rivers and billabongs. Present in the Hawkesbury-Nepean as a result of stocking. | - | Unlikely. The stream within the study area is isolated from wider channels nearby. | No |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area (Bionet records) | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| *Macquarie australasica* | Macquarie Perch | E | E | Macquarie perch are found in the Murray-Darling Basin (particularly upstream reaches) of the Lachlan, Murrumbidgee and Murray rivers, and parts of south-eastern coastal NSW, including the Hawkesbury and Shoalhaven catchments. Macquarie perch are found in both river and lake habitats, especially the upper reaches of rivers and their tributaries (NSW Department of Primary Industries, 2014). Habitat for this species is bottom or mid-water in slow-flowing rivers with deep holes, typically in the upper reaches of forested catchments with intact riparian vegetation. Macquarie perch also do well in some upper catchment lakes. In some parts of its range, the species is reduced to taking refuge in small pools which persist in midland–upland areas through the drier summer periods. | - | Unlikely. The stream within the study area is isolated from wider channels nearby. | No |
| *Prototroctes maraena* | Australian grayling | E | V | Australian grayling occur in freshwater streams and rivers, especially clear gravelly streams with a moderate flow, as well as estuarine areas. Australian grayling need to migrate to and from the sea to complete their life cycle (catadromous), and the construction of barriers such as dams and weirs | - | Unlikely. The stream within the study area is isolated from wider | No |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area (Bionet records) | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| | | | | has had a major impact on populations in some river systems. | | channels nearby. | |

** TSC Act: E1 = Endangered, E2 = Endangered Population, E4 = Extinct, E4A = Critically Endangered, V = Vulnerable; EPBC Act: Bonn = Listed migratory species under Bonn Convention, CD = Conservation Dependent, CE = Critically Endangered, E = Endangered, V = Vulnerable, X = Extinct; FM Act: E1 = Endangered, E2 = Endangered Population, E4 = Extinct, E4A = Critically Endangered, V = Vulnerable*

***Note: Some marine and migratory species have been excluded from this Likelihood of Occurrence analysis*

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**Table 7: Likelihood of occurrence and requirement of impact assessment for threatened flora species**

| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| *Acacia bynoeana* | Bynoe's Wattle | E1 | V | Heath or dry sclerophyll forest on sandy soils. | 0 | No | No, this species has not been recorded within 5 km of the study area |
| *Asterolasia elegans* | | E1 | E | Hawkesbury sandstone. Found in sheltered forests on mid- to lower slopes and valleys. | 1 | Unlikely | No, a targeted flora survey did not identify the presence of this species |
| *Caladenia tessellata* | Thick Lip Spider Orchid | E1 | V | Grassy sclerophyll woodland on clay loam or sandy soils, or low woodland with stony soil. | 0 | No | No, potential habitat does not occur within the study area |
| *Callistemon linearifolius* | Netted Bottle Brush | V | | Dry sclerophyll forest. | 5 | No | No, potential habitat does not occur within the study area |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| *Chamaesyce psammogeton* | Sand Spurge | E1 | | Fore-dunes, pebbly strandlines and exposed headlands, often with *Spinifex sericeus* (Spinifex) and *Zoysia macrantha* (Prickly Couch). | 2 | No | No, potential habitat does not occur within the study area |
| *Cryptostylis hunteriana* | Leafless Tongue Orchid | V | V | Coastal heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodland, and lowland forest. | 0 | Unlikely | No, a targeted flora survey did not identify the presence of this species |
| *Epacris purpurascens* var. *purpurascens* | | V | | Sclerophyll forest, scrubs and swamps. Most habitats have a strong shale soil influence. | 1 | Unlikely | No, potential habitat does not occur within the study area, and a targeted flora survey did not identify the presence of this species |
| *Eucalyptus camfieldii* | Camfield's Stringybark | V | V | Coastal heath on shallow sandy soils overlying Hawkesbury sandstone, mostly on exposed sandy ridges. | 7 | No | No, potential habitat does not occur |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| | | | | | | | within the study area |
| *Eucalyptus nicholii* | Narrow-leaved Black Peppermint | V | V | Dry grassy woodland, on shallow soils of slopes and ridges. | 3 | No | No, potential habitat does not occur within the study area |
| *Eucalyptus scoparia* | Wallangarra White Gum | E1 | V | Open eucalypt forest, woodland and heaths on well-drained granite/rhyolite hilltops, slopes and rocky outcrops, typically at high altitudes. | 4 | No | No, potential habitat does not occur within the study area |
| *Genoplesium baueri* | Bauer's Midge Orchid | E1 | E | Dry sclerophyll forest and moss gardens over sandstone. | 2 | No | No, potential habitat does not occur within the study area |
| *Grammitis stenophylla* | Narrow-leaf Finger Fern | E1 | | Rainforest and moist eucalypt forest, usually near streams, on rocks or in trees. | 1 | Unlikely | No, a targeted flora survey did not identify the presence of this species |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| *Grevillea caleyi* | Caley's Grevillea | E4A | E | Open forest, generally dominated by *Eucalyptus sieberi* and *E. gummifera* on a ridgetop, in association with laterite soils. | 375 | No | No, potential habitat does not occur within the study area |
| *Haloragodendron lucasii* | | E1 | E | Dry sclerophyll forest and low open woodland on sheltered slopes near creeks, in moist sandy loam soils. | 0 | Unlikely | No, this species has not been recorded within 5 km of the study area |
| *Kunzea rupestris* | | V | V | Shrubland or heathland, in shallow depressions on large flat sandstone rock outcrops. | 1 | No | No, potential habitat does not occur within the study area |
| *Lasiopetalum joyceae* | | V | V | Heath on lateritic to shaley ridgetops over sandstone. | 1 | No | No, potential habitat does not occur within the study area |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| *Leptospermum deanei* | | V | V | Woodland, riparian scrub and open forest on lower hill slopes or near creeks, on sand or sandy alluvial soil. | 0 | No | No, this species has not been recorded within 5 km of the study area |
| *Macadamia integrifolia* | Macadamia Nut | P | V | Drier subtropical rainforest. | 3 | Unlikely | No, a targeted flora survey did not identify the presence of this species |
| *Melaleuca biconvexa* | Biconvex Paperbark | V | V | Damp places, often near streams or low-lying areas on alluvial soils. | 0 | Unlikely | No, a targeted flora survey did not identify the presence of this species |
| *Melaleuca deanei* | Deane's Paperbark | V | V | Heath on sandstone. | 0 | No | No, potential habitat does not occur within the study area |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| *Microtis angusii* | Angus's Onion Orchid | E1 | E | Ingleside location is highly disturbed and dominated by the introduced weeds Coolatai grass (*Hyparrhenia hirta*) and *Acacia saligna*. The area is likely to have originally supported the Duffys Forest Vegetation Community, which ranges from open forest to low open forest and woodland." | 82 | Unlikely | No, a targeted flora survey did not identify the presence of this species |
| *Pelargonium sp. Striatellum (G.W.Carr 10345)* | Omeo Storksbill | E1 | E | Irregularly inundated or ephemeral lakes, in the transition zone between surrounding grasslands or pasture and wetland or aquatic communities. | 0 | No | No, potential habitat does not occur within the study area |
| *Persoonia hirsuta* | Hairy Geebung | E1 | E | Sandy soils in dry sclerophyll open forest, woodland and heath on sandstone. | 1 | Unlikely | No, a targeted flora survey did not identify the presence of this species |
| *Persoonia laxa* | | E4 | X | Presumably heath or dry sclerophyll eucalypt woodland, forest on sandstone, or in coastal sand. | 1 | Unlikely | No, a targeted flora survey did not identify the presence of this species |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| *Pimelea curviflora* var. *curviflora* | | V | V | Woodland, mostly on shaley / lateritic soils over sandstone and shale / sandstone transition soils on ridgetops and upper slopes. | 2 | Unlikely | No, potential habitat does not occur within the study area |
| *Prostanthera densa* | Villous Mint-bush | V | V | Sclerophyll forest and shrubland on coastal headlands and near-coastal ranges, chiefly on sandstone. | 1 | Unlikely | No, potential habitat does not occur within the study area |
| *Prostanthera marifolia* | Seaforth Mintbush | E4A | CE | In or in close proximity to the endangered Duffys Forest ecological community, on deeply weathered clay-loam soils associated with ironstone and scattered shale lenses. | 0 | No | No, potential habitat does not occur within the study area |
| *Syzygium paniculatum* | Magenta Lilly Pilly | E1 | V | Subtropical and littoral rainforest on gravels, sands, silts and clays. | 12 | Unlikely | No, a targeted flora survey did not identify the presence of this species |
| *Tetratheca glandulosa* | | V | | Heath, scrub, woodlands and open forest on upper-slopes and mid-slope sandstone benches. | 34 | Unlikely | No, a targeted flora survey did not identify the |

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| Scientific Name | Common Name | TSC Status | EPBC Status | Habitat | Number of records within 5 km radius of study area | Likelihood of Occurrence | Impact Assessment Required |
|---|---|---|---|---|---|---|---|
| | | | | Soils generally shallow, consisting of a yellow, clayey/sandy loam. | | | presence of this species |
| *Thesium australe* | Austral Toadflax | V | V | Grassland on coastal headlands or grassland and grassy woodland away from the coast. | 0 | No | No, potential habitat does not occur within the study area |

**TSC Act: E1 = Endangered, E2 = Endangered Population, E4 = Extinct, E4A = Critically Endangered, V = Vulnerable; EPBC Act: M = Migratory; Mar = Marine, Bonn = Listed migratory species under Bonn Convention, CD = Conservation Dependent, CE = Critically Endangered, E = Endangered, V = Vulnerable, X = Extinct*

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# Appendix B : Microbat echolocation recording and identification

**METHODS**

Bat calls were analysed using the program AnalookW (Version 3.8 25 October 2012, written by Chris Corben, www.hoarybat.com). A regional based guide to the ultrasonic calls of microbats in New South Wales (Pennay et al. 2004) was used for guidance and reference calls. Calls were identified by ELA ecologist Mitchell Scott under the supervision of Alicia Scanlon who has over ten years' experience in the identification of ultrasonic bat calls. The report was externally reviewed by Greg Ford from Balance Environmental.

Bat calls are analysed using species-specific parameters of the call profile such as call shape, characteristic frequency, initial slope and time between calls (Pennay et al. 2004). To ensure reliable and accurate results, the following protocols (adapted from Lloyd et. al. 2006) were followed:

- Search phase calls were used in the analysis, rather than cruise phase calls or feeding buzzes (McKenzie et al. 2002)
- Recordings containing less than three pulses and which lacked any distinguishing features were not analysed and these sequences were labelled as short (Law et al. 1999)
- Four categories of confidence in species identification were used (Mills et al. 1996), including:
    - definite – identity not in doubt
    - probable – low probability of confusion with species of similar calls
    - possible – medium to high probability of confusion with species with similar calls
    - short – calls containing less than 3 pulses and no distinguishing features, thus cannot be identified to even a species group.
- *Nyctophilus* spp. are difficult to identify confidently from their calls and no attempt was made to identify this genus to species level (Pennay et al. 2004).
- Sequences not attributed to microbat ultrasonic calls do not represent microbat activity at the site and were not included in the analysis.
- Sequences labelled as short were of poor quality and therefore not able to be identified to any microbat species, they can however be used as an indicator of microbat activity at the site.

A survey for hollow-bearing trees (HBTs) and stags was conducted within 200 m of permanent water courses within the study area, as these may provide roosting and breeding habitat for *Myotis macropus* (Southern Myotis), listed as *Vulnerable* under the TSC Act.

One Anabat (Microbat echolocation recording device; SN81081) was set facing a HBT within 200 m of the creekline within the study area, and one Anabat (SN82241) was set facing a small pool within the creekline (**Figure 7**). Both Anabats were left for two nights, 9 November 2017 and 10 November 2017. Stagwatching was not conducted during this survey.

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## RESULTS

A total of 22 sequences (including 12 usable calls) were recorded from the study area between 9 November 2017 and 10 November 2017 (2 nights) (Table 8 **- Table 10; Figure 8 - Figure 13**). The data was gathered from two (2) Anabats angled at a HBT and a small pool respectively (Figure 6).

One microbat species was identified in the data set as either probably or definitely occurring within the study area (Table 8**, Figure 8**):

- ***Rhinolophus megaphyllus* (Eastern Horseshoe Bat)**

One call with a characteristic frequency of 50.96 kHz, displaying a mix of pulses with up-sweeping and down-sweeping tails, was recorded in the data set (**Figure 9**). This call could not be identified to species because it did not display the defining characteristics of any one of the three possible species that call at the observed frequency; *Chalinolobus morio* (Chocolate Wattled Bat), *Vespadelus pumilus* (Eastern Forest Bat) and *Vespadelus vulturnus* (Little Forest Bat).

Five possible calls were recorded with a characteristic frequency approximately 55 kHz, all of which were of poor quality, generally with fragmented pulses and variable pulse shapes. Thus these calls are possibly from *Miniopterus australis* (Little Bentwing-Bat) or *Vespadelus pumilus* (Eastern Forest Bat).

Two calls with less than 3 pulses were attributed as possible call profiles for *Myotis macropus* (Southern Myotis) or *Nyctophilus* sp. (Vesper Bat species). The octaves per second for both calls was less than 200, thus the calls are more likely to come from a species of *Nyctophilus,* although the calls are not long enough to be certain. Southern Myotis is listed as *Vulnerable* under the TSC Act.

Two possible calls were recorded for *Micronomus norfolkensis* (East-coast Free-tailed Bat) or *Mormopterus (Ozimops) ridei* (Ride's Free-Tailed Bat), and notably contained less than 3 pulses. Eastern Free-tailed Bat is listed as *Vulnerable* under the TSC Act.

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**Table 8: Microbat species diversity recorded in the study area between 9 and 10 November 2017**

| Species Name | Common Name | SN81081 | | SN82241 | |
|---|---|---|---|---|---|
| | | 9 and 10 November 2017 | | 9 and 10 November 2017 | |
| | | Positively identified | Probably present | Positively identified | Probably present |
| *Rhinolophus megaphyllus* | Eastern Horseshoe Bat | X | X | | |
| **Species Diversity (Positive identification)** | | **1** | | | |
| **Species Diversity (Possible)** | | | **1** | | |
| **Total (at least) number of species identified positively or probably** | | **1** | | | |

* Threatened species listed under TSC Act.

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**Table 9: Anabat results for SN81081 placed adjacent to the HBT recorded between 9 and 10 November 2017**

| Species Name | Common name | Positively identified | Probable | Possible | Total |
|---|---|---|---|---|---|
| *Chalinolobus morio* / *Vespadelus pumilus* / *Vespadelus vulturnus* | Chocolate Wattled Bat / Eastern Forest Bat / Little Forest Bat | 0 | 0 | 1 | 1 |
| *Miniopterus australis** / *Vespadelus pumilus* | Little Bent-wing Bat / Eastern Forest Bat | 0 | 0 | 4 | 4 |
| *Myotis macropus* / *Nyctophilus* sp. | Southern Myotis / Vesper Bat species | 0 | 0 | 2 | 2 |
| *Mormopterus norfolkensis* / *Mormopterus (Ozimops) ridei* | East-coast Free-tailed Bat / Ride's Free-Tailed Bat | 0 | 0 | 2 | 2 |
| *Rhinolophus megaphyllus* | Eastern Horseshoe Bat | 1 | 0 | 1 | 2 |
| **Short** | | | | | **5** |
| **Useable calls** | | | | | **11** |
| **Total Calls** | | | | | **16** |
| **Percentage usable calls (%)** | | | | | **68.75 %** |

**Threatened species listed under the TSC Act.*

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**Table 10: Anabat results for SN882241 placed adjacent to the small pool recorded between 9 and 10 November 2017**

| Species Name | Common name | Positively identified | Probable | Possible | Total |
|---|---|---|---|---|---|
| *Miniopterus australis** / *Vespadelus pumilus* | Little Bent-wing Bat / Eastern Forest Bat | 0 | 0 | 1 | 1 |
| **Short** | | | | | **5** |
| **Useable calls** | | | | | **1** |
| **Total Calls** | | | | | **6** |
| **Percentage usable calls (%)** | | | | | **16.7 %** |

**Threatened species listed under the TSC Act.*

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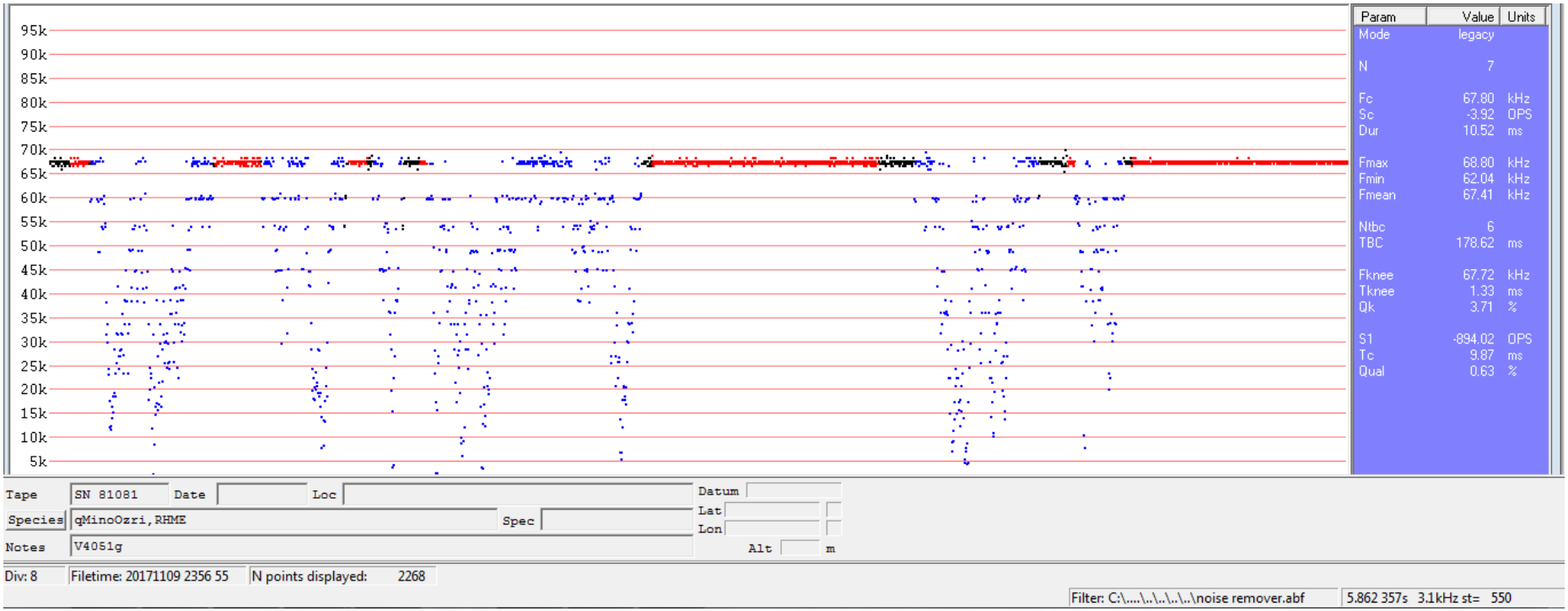


**Figure 8: Call profile for *Rhinolophus megaphyllus* (Eastern Horseshoe Bat) recorded at 23:56 on SN81081 on 9 November 2017**

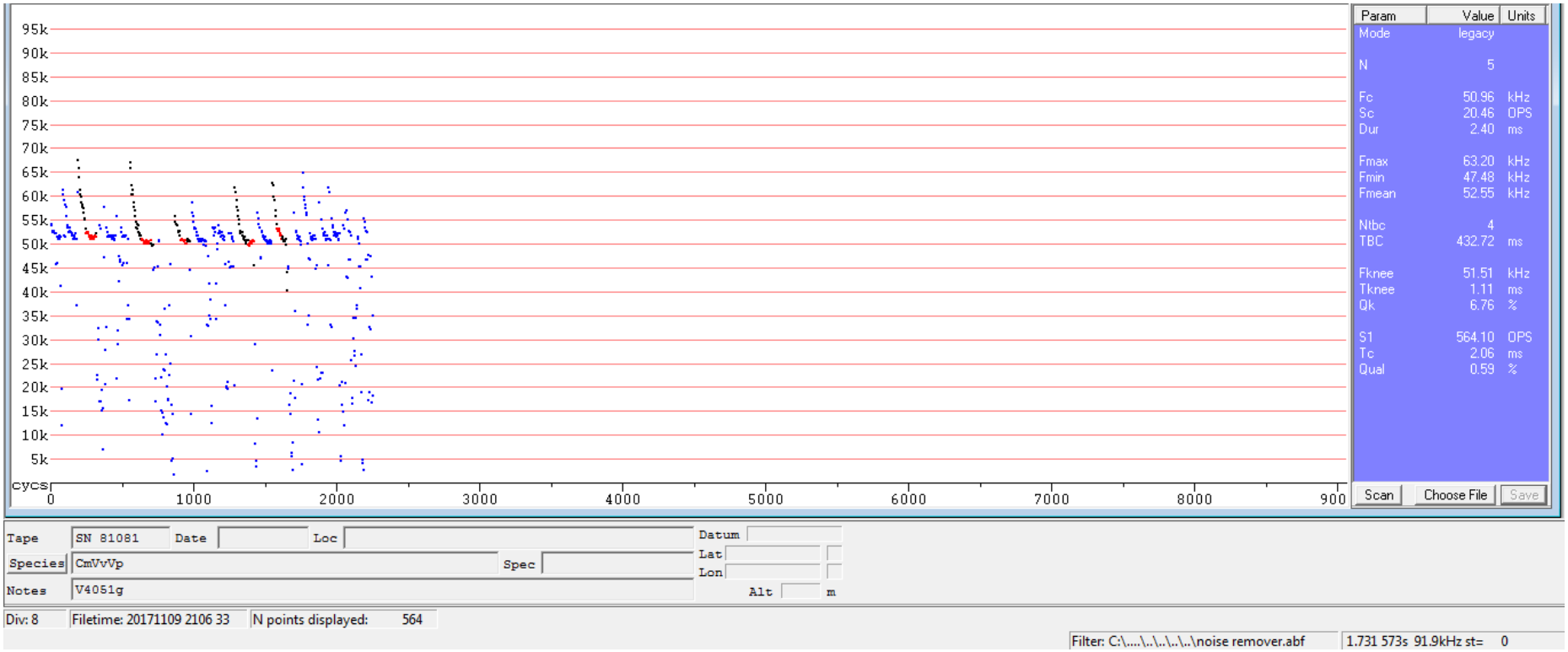


**Figure 9: Possible call profile for *Chalinolobus morio* (Chocolate Wattled Bat), *Vespadelus pumilus* (Eastern Forest Bat) or *Vespadelus vulturnus* (Little Forest Bat), recorded at 21:06 on SN882241 on 9 November 2017.**

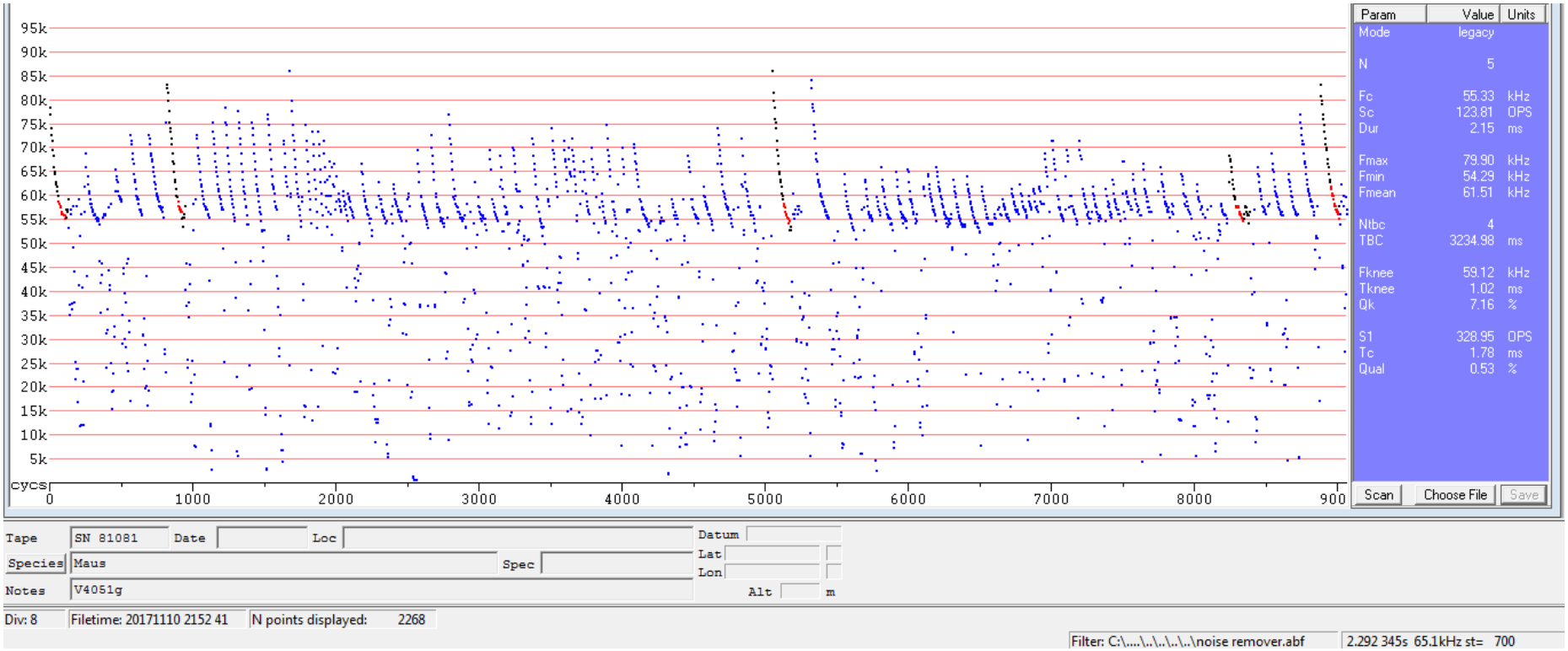


**Figure 10: Possible call profile for *Miniopterus australis* (Little Bentwing-Bat) or *Vespadelus pumilus (*Eastern Forest Bat*)* recorded at 21:52 on SN81081 on 10 November 2017.**

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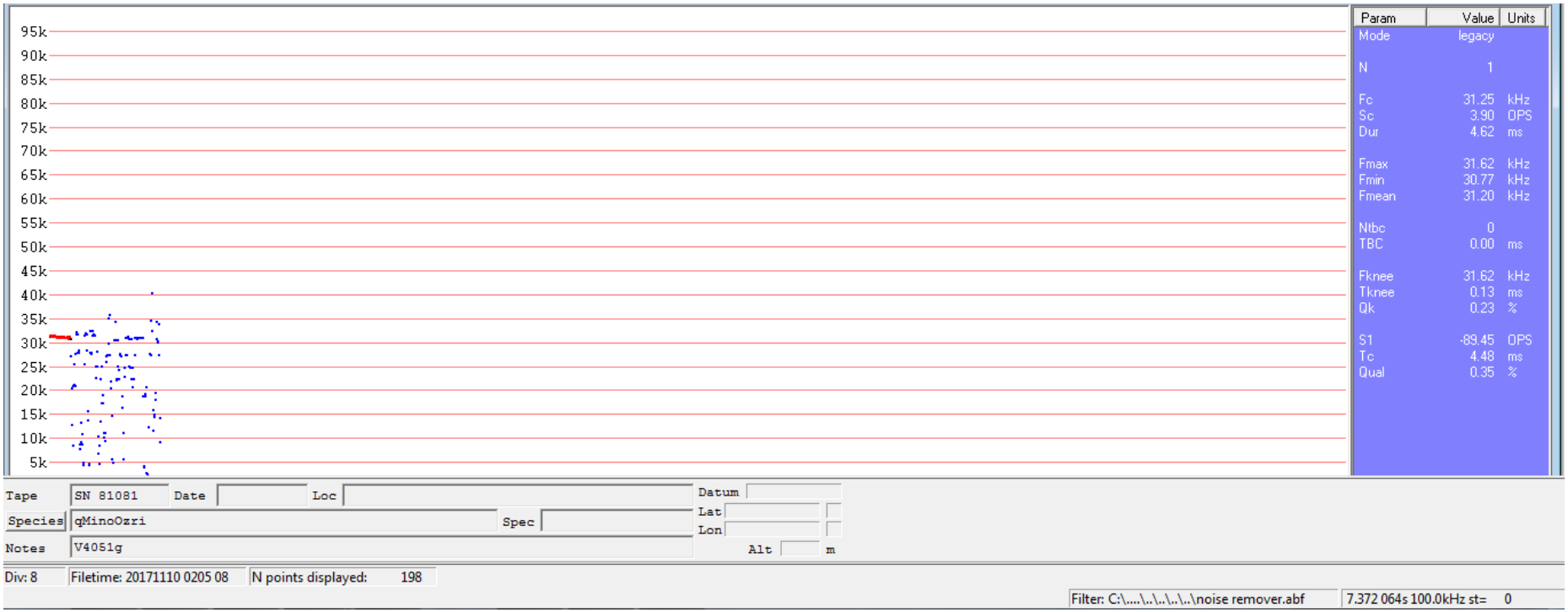


**Figure 11: Possible call profile for *Mormopterus norfolkensis* (East-coast Free-tailed Bat) or *Mormopterus (Ozimops) ridei* (Ride's Free-Tailed Bat) recorded at 02:05 on SN81081 on 10 November 2017**

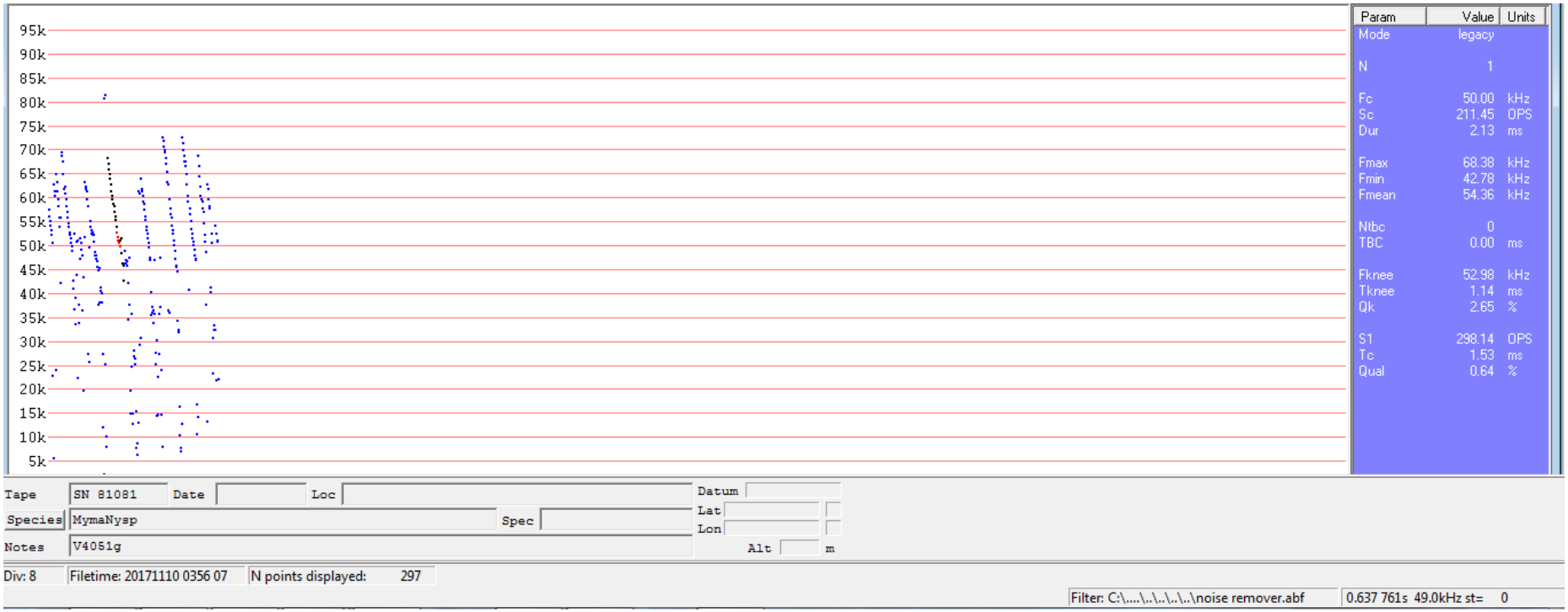


**Figure 12: Possible call profile for *Myotis macropus* (Southern Myotis) *or Nyctophilus* sp. (Vesper Bat species) recorded at 03:56 on SN81081 on 10 November 2017**

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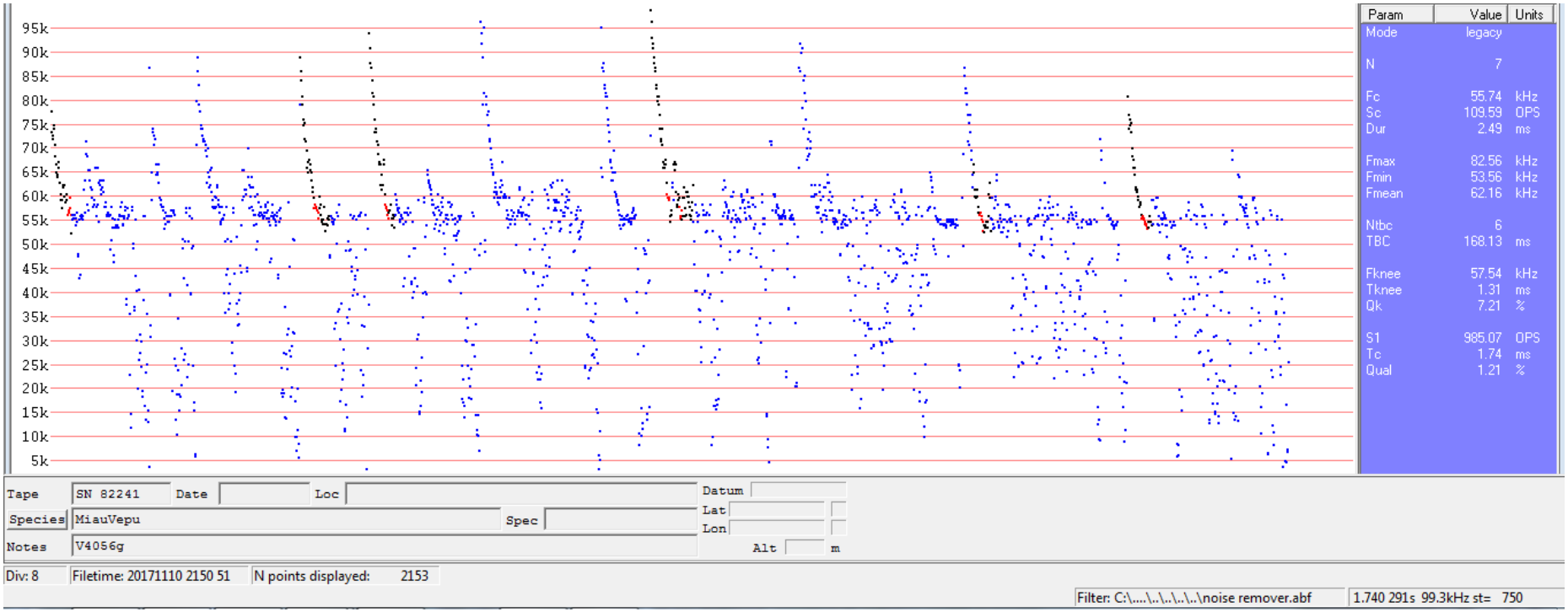


**Figure 13: Possible call profile for *Miniopterus australis* (Little Bentwing-Bat) or *Vespadelus pumilus (*Eastern Forest Bat*)* recorded at 21:50 on SN82241 on 10 November 2017**

# Appendix C : Flora and Fauna species list

**Table 11: Flora species list**

| Family | Species name | Common name | Exotic species (*), Priority Weed, or WONS |
|---|---|---|---|
| Family Fabaceae subf. Mimosoideae | *Acacia longissima* | Long-leaf wattle | |
| Myrtaceae | *Acmena smithii* | Lilly Pilly | |
| Family Ericaceae subf. Epacridoideae | *Acrotriche divaricata* | - | |
| Pteridaceae | *Adiantum aethiopicum* | Common maidenhair | |
| Asteraceae | *Ageratina adenophora* | Crofton Weed | *Priority weed |
| Casuarinaceae | *Allocasuarina torulosa* | Forest Oak | |
| Myrtaceae | *Angophora costata* | Smooth-barked Apple | |
| Araliaceae | *Astrotricha floccosa* | - | |
| Euphorbiaceae | *Bertya brownii* | - | |
| Blechnaceae | *Blechnum cartilagineum* | Gristle Fern | |
| Rutaceae | *Boronia mollis* | Soft Boronia | |
| Phyllanthaceae | *Breynia oblongifolia* | Coffee bush | |
| Dicksoniaceae | *Calochlaena dubia* | Soft Bracken | |
| Convolvulaceae | *Calystegia marginata* | - | |
| Lauraceae | *Cassytha glabella* | - | |
| Vitaceae | *Cayratia clematidea* | Native Grape | |
| Cunoniaceae | *Ceratopetalum apetalum* | Coachwood | |
| Vitaceae | *Cissus antarctica* | Kangaroo Vine | |
| Vitaceae | *Cissus hypoglauca* | Water Vine | |
| Ranunculaceae | *Clematis aristata* | Old man's beard | |
| Ranunculaceae | *Clematis glycinoides* | Headache Vine | |

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| Family | Species name | Common name | Exotic species (*), Priority Weed, or WONS |
|---|---|---|---|
| Lamiaceae | *Clerodendrum tomentosum* | Hairy Clerodendrum | |
| Amaryllidaceae | *Clivia* sp. | - | * |
| Lauraceae | *Cryptocarya microneura* | Murrogun | |
| Orchidaceae | *Cymbidium suave* | Snake Orchid | |
| Phormiaceae | *Dianella caerulea* | Blue Flax-lily | |
| Blechnaceae | *Blechnum neohollandicum (previously Doodia aspera)* | - | |
| Elaeocarpaceae | *Elaeocarpus reticulatus* | Blueberry Ash | |
| Poaceae | *Entolasia marginata* | Bordered Panic | |
| Poaceae | *Entolasia stricta* | Wiry Panic | |
| Myrtaceae | *Eucalyptus paniculata* | Grey Ironbark | |
| Myrtaceae | *Eucalyptus resinifera* | Red mahogany | |
| Myrtaceae | *Eucalyptus umbra* | Broad-leaved White Mahogany | |
| Eupomatiaceae | *Eupomatia laurina* | Copper laurel | |
| Luzuriagaceae | *Eustrephus latifolius* | Wombat Berry | |
| Moraceae | *Ficus coronata* | Sandpaper Fig | |
| Cyperaceae | *Gahnia sieberiana* | Red-fruit saw-sedge | |
| Luzuriagaceae | *Geitonoplesium cymosum* | Scrambling Lily | |
| Phyllanthaceae | *Glochidion ferdinandi* | Cheese tree | |
| Araceae | *Gymnostachys anceps* | Settlers' Twine | |
| Dilleniaceae | *Hibbertia dentata* | Trailing Guinea Flower | |
| Violaceae | *Hymenanthera dentata* | Tree Violet | |
| Poaceae | *Imperata cylindrica* | Blady Grass | |
| Verbenaceae | *Lantana camara* | Lantana | *Priority weed, WONS |
| Cyperaceae | *Lepidosperma laterale* | - | |

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| Family | Species name | Common name | Exotic species (*), Priority Weed, or WONS |
|---|---|---|---|
| Oleaceae | *Ligustrum sinense* | Small-leaved Privet | *Priority weed |
| Arecaceae | *Livistona australis* | Cabbage fan palm | |
| Lomandraceae | *Lomandra filiformis* | Wattle Mat-rush | |
| Lomandraceae | *Lomandra longifolia* | Spiny-headed Mat-rush | |
| Lomandraceae | *Lomandra multiflora* | Many-flowered Mat-rush | |
| Apocynaceae | *Marsdenia suaveolens* | Scented Marsdenia | |
| Celastraceae | *Maytenus silvestris (synonum Denhamia silvestris)* | Narrow-leaved Orangebark | |
| Poaceae | *Microlaena stipoides* | Weeping grass | |
| Rubiaceae | *Morinda jasminoides (syn. Gynochthodes jasminoides)* | Sweet Morinda | |
| Lomariopsidaceae | *Nephrolepis cordifolia* | Fishbone Fern | |
| Oleaceae | *Notelaea longifolia* | Large Mock-olive | |
| Ochnaceae | *Ochna serrulata* | Mickey Mouse Plant | *Priority Weed |
| Poaceae | *Oplismenus imbecillis* | Creeping Beard Grass | |
| Asteraceae | *Ozothamnus diosmifolius* | Rice flower | |
| Bignoniaceae | *Pandorea pandorana* | Wonga wonga vine | |
| Apocynaceae | *Parsonsia straminea* | Common Silkpod | |
| Pittosporaceae | *Pittosporum multiflorum* | Orange Thorn | |
| Pittosporaceae | *Pittosporum revolutum* | Wild Yellow Jasmine | |
| Pittosporaceae | *Pittosporum undulatum* | Native Daphne | |
| Family Fabaceae subf. Faboideae | *Podolobium ilicifolium* | Prickly Shaggy Pea | |
| Phyllanthaceae | *Poranthera microphylla* | - | |
| Lobeliaceae | *Pratia purpurascens* | Whiteroot | |
| Lamiaceae | *Prostanthera denticulata* | Rough Mint-bush | |
| Lamiaceae | *Prostanthera scutellarioides* | - | |

| Family | Species name | Common name | Exotic species (*), Priority Weed, or WONS |
|---|---|---|---|
| Acanthaceae | *Pseuderanthemum variabile* | Pastel Flower | |
| Dennstaedtiaceae | *Pteridium esculentum* | Common Bracken | |
| Menispermaceae | *Sarcopetalum harveyanum* | Pearl Vine | |
| Cyperaceae | *Schoenus brevifolius* | Zig-zag Bog-rush | |
| Family Fabaceae subf. Caesalpinioideae | *Senna pendula* | - | *Priority weed |
| Smilacaceae | *Smilax australis* | Lawyer Vine | |
| Smilacaceae | *Smilax glyciphylla* | Sweet Sarsaparilla | |
| Solanaceae | *Solanum mauritianum* | Wild Tobacco Bush | *Priority weed |
| Menispermaceae | *Stephania japonica* | Snake Vine | |
| Gleicheniaceae | *Sticherus urceolatus* | Fan Fern | |
| Myrtaceae | *Syncarpia glomulifera* | Turpentine | |
| Meliaceae | *Synoum glandulosum* | Scentless Rosewood | |
| Commelinaceae | *Tradescantia fluminensis* | Trad | * |
| Ulmaceae | *Trema tomentosa var. aspera* | Peach-leaf Poison-bush | |
| Family Ericaceae subf. Epacridoideae | *Trochocarpa laurina* | Tree Heath | |
| Apocynaceae | *Tylophora barbata* | Bearded Tylophora | |
| Violaceae | *Viola hederacea* | Ivy-leaved Violet | |
| Monimiaceae | *Wilkiea huegeliana* | Veiny Wilkiea | |
| Rutaceae | *Zieria smithii* | Sandfly Zieria | |

*^WONS = Weed of National Significance*

**Table 12: Fauna species list**

| Family | Species name | Common name |
|---|---|---|
| Amphibian | | |
| Hylidae | *Litoria fallx* | Eastern Sedge-frog |
| Aves | | |
| Megapodiidae | *Alectura lathami* | Brush Turkey |
| Meliphagidae | *Anthochaera carunculata* | Red Wattlebird |
| Cacatuidae | *Cacatua galerita* | Sulphur-crested Cockatoo |
| Campephagidae | *Coracina novaehollandiae* | Black-faced Cuckoo-shrike |
| Climacteridae | *Cormobates leucophaea* | White-throated Treecreeper |
| Alcedinidae | *Dacelo novaeguineae* | Eastern Laughing Kookaburra |
| Coraciidae | *Eurystomus orientalis* | Dollarbird |
| Meliphagidae | *Meliphaga lewinii* | Lewin's Honeyeater |
| Menuridae | *Menura novaehollandiae* | Superb Lyrebird |
| Pachycephalidae | *Pachycephala pectoralis* | Golden Whistler |
| Pachycephalidae | *Pachycephala rufiventris* | Rufous Whistler |
| Pardalotidae | *Pardalotus punctatus* | Spotted Pardalote |
| Pardalotidae | *Pardalotus striatus* | Striated Pardalote |
| Podargidae | *Podargus strigoides* | Tawny Frogmouth |
| Rhipiduridae | *Rhipidura albiscapa* | Grey Fantail |
| Cuculidae | *Scythrops novaehollandiae* | Channel-billed Cuckoo |
| Halcyonidae | *Todiramphus sanctus* | Sacred Kingfisher |
| Mammals | | |
| Dasyuridae | *Antechinus stuartii* | Brown Antechinus |
| Macropodidae | *Wallabia bicolor* | Swamp Wallaby |
| Muridae | *Rattus rattus* | Black Rat* |
| Phalangeridae | *Trichosurus vulpecula* | Common Brush-tail Possum |
| Pteropodidae | *Pteropus poliocephalus* | Grey-headed Flying-fox** |
| Rhinolophidae | *Rhinolophus megaphyllus* | Eastern Horseshoe Bat |
| Reptiles | | |
| Agamidae | *Intellagama lesueurii* | Eastern Water Dragon |
| Fish | | |
| Anguillidae | *Angulla australis* | Shortfin Eel |

* Denotes exotic species ** Listed as Vulnerable under the TSC Act and EPBC Act

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# Appendix D : Assessment of Significance (TSC Act)

The Assessment of Significance is applied to species, populations and ecological communities listed on Schedules 1, 1A and 2 of the TSC Act and Schedules 4, 4A and 5 of the Fisheries Management Act. The assessment sets out 7 factors, which when considered, allow proponents to undertake a qualitative analysis of the likely impacts of an action and to determine whether further assessment is required via a Species Impact Statement. All factors must be considered and an overall conclusion made based on all factors in combination. A Species Impact Statement (SIS) is required if, through application of the assessment, an action is considered likely to have a significant impact on a threatened species, population or ecological community.

The following threatened fauna species have been assessed:

*Amphibian species:*

- *Heleioporus australiacus* (Giant Burrowing Frog).

*Avian species (excluding owls):*

- *Calyptorhynchus lathami* (Glossy Black-Cockatoo)

*Owl species:*

- *Ninox connivens* (Barking Owl)
- *Ninox strenua* (Powerful Owl)
- *Tyto novaehollandiae* (Masked Owl).

*Microbat species:*

- *Chalinolobus dwyeri* (Large-eared Pied Bat)
- *Miniopterus australis* (Little Bentwing-bat)
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat)
- *Mormopterus norfolkensis* (Eastern Freetail-bat)
- *Myotis macropus* (Southern Myotis)
- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat).

*Mammal species (excluding microbats)*

- *Cercartetus nanus* (Eastern Pygmy-possum)
- *Phascolarctos cinereus* (Koala) species and endangered population (Pittwater LGA).

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### *Heleioporus australiacus* (Giant Burrowing Frog)

*Heleioporus australiacus* (Giant Burrowing Frog; GBF) is listed as *Vulnerable* under the TSC Act. The Giant Burrowing Frog is distributed in south-eastern NSW and Victoria occurring predominately on the sandstone geology of the Sydney Basin extending as far south as Jervis Bay and as isolated 'pockets' from about Narooma south into eastern Victoria (OEH 2017b).

Within the Sydney Sandstone environment this species prefers sandstone ridgetop habitats and broader upland valleys. It is associated with small headwater creeklines and along slow flowing to intermittent creeklines. The preferred vegetation is typically woodland, open woodland and heath and may be associated with 'hanging swamp' seepage lines and where small pools form from the collected water. They have also been observed occupying artificial pond structures such as farm dams, gravel 'borrows', detention basins and box drains that have naturalised over time and are still surrounded by other undisturbed habitat (OEH 2017b).

The Giant Burrowing Frog often spends significant periods of time burrowed underground during unfavourable conditions and to avoid detection during the day. It has an ability to range widely, frequently being recorded at considerable distance from suitable riparian breeding, or other moist habitat (OEH 2017b). Breeding occurs mainly between mid-summer to autumn, although calling has also been recorded between August and March.

This species is threatened by a number of processes including habitat loss, clearing of vegetation for agricultural purposes, erosion and sedimentation of headwater creeklines, disturbance to forest habitat and breeding sites and fire is known to have direct effects on the frog. Other potential threats include: predation by feral and domestic animals, high nutrient flows and associated weed infestations, pH changes due to urban runoff, and infection by the amphibian chytrid fungus.

A targeted survey did not record this species within the study area. There are 17 records of GBF within 5 km of the study area. The nearest record is approximately 1 km to the south of the study area (1/1/1997).

Approximately 0.18 ha of potential breeding habitat for this species occurs in the western portion of the study area, within the riparian area along the small creek-line. This habitat would not be impacted by the proposed works, as it is excluded from the APZ.

GBF can travel up to 300 m to forage (OEH 2017b), and thus all native vegetation within the study area is potential foraging habitat for the GBF. Approximately 2.6 ha of potential foraging habitat (ground and midstorey vegetation) would be impacted by the proposed works. This includes removal of 0.89 ha of native vegetation and ongoing modification of 1.17 ha for APZ.

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

Factors likely to have an adverse effect on the life cycle of Giant Burrowing Frog would include a substantial loss and/or fragmentation of foraging and breeding habitat, and changes to hydrology and water quality.

GBF can travel up to 300 m to forage (OEH 2017b), and thus all native vegetation within the study area is potential foraging habitat for the GBF. Approximately 2.6 ha of potential foraging habitat (ground and midstorey vegetation) would be removed by the proposed works. A large portion of potential habitat in the form of a bushland corridor will be retained to the south of the creek-line.

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Approximately 0.18 ha of potential breeding habitat was identified within the study area, however, no works will impact upon potential breeding habitat for this species.

Therefore, as the proposal will not directly impact upon the breeding habitat for this species and a riparian buffer of 10m will be retained within the study area, the proposal is unlikely to have an adverse effect on the life cycle of the GBF and place a viable population at risk of extinction.

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

Not applicable. The Giant Burrowing Frog has not been listed as an endangered population.

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

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

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

The Giant Burrowing Frog is not an endangered ecological community therefore, this question does not apply.

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

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

The proposed works will result in the removal of approximately 0.26 ha of potential foraging habitat for the Giant Burrowing Frog. The extent of the impact of this habitat removal is expected to be minimal when considering the large areas of similar habitat available in the adjacent bushland corridor.

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

Potential breeding habitat for GBF occurs within the riparian corridor of the creek-line, in the western portion of the study area. The potential foraging habitat to be removed is located primarily to the north of the creek-line. Potential foraging habitat would be retained to the west and south of the creek-line. Thus overall potential habitat for GBF is unlikely to become fragmental by the proposed works.

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

The study area contains 0.18 ha of potential breeding habitat, although this habitat will not be impact upon by the proposed works. Additionally, breeding habitat extends outside the study area into conservation lands (Katandra Sanctuary Reserve). The study area also contains potential foraging and sheltering habitat. It is considered that this area is not likely to be crucial habitat for the species due to its small size and that no breeding habitat is likely to be impacted.

A targeted survey did not record GBF within the study area and thus it is unlikely to currently occur there.

**e) Whether the action proposed is likely to have an adverse effect on critical habitat.**

No critical habitat has been declared for the Giant Burrowing Frog.

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

No Recovery Plan or Threat Abatement Plans have been prepared for the Giant Burrowing Frog. Additionally, the proposal does not conflict with any of the 19 Priority Actions identified for this species.

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

A key threatening process is defined under the TSC Act as "*a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities*". The proposal constitutes two key threatening processes listed under Schedule 3 of the TSC Act which relevant to the Giant Burrowing Frog, clearing of native vegetation and removal of dead wood.

The clearing of native vegetation and removal of dead wood would reduce foraging and sheltering habitat for the Giant Burrowing Frog. The proposed works would remove 2.6 ha of ground and midstorey native vegetation, including large woody debris. This area is considered potential foraging habitat, adjacent to potential breeding habitat (small creek-line).

However, the scale of this impact upon the Giant Burrowing Frog is considered minor due to the scale of the disturbance, its location and the large areas of similar bushland in the surrounding landscape. A targeted survey did not detect GBF within the study area, and thus it is unlikely to currently occur there.

**Conclusions**

The proposal is unlikely to significantly impact upon the Giant Burrowing Frog given that:

- The proposed works would remove approximately 2.6 ha of ground and mid-storey native vegetation and woody debris from within the study area, but would not fragment or isolate potential habitat within the adjacent bushland corridor. This removal of habitat is considered minimal in regards to the expanse of available habitat in the adjacent bushland
- The proposed works would retain approximately 0.18 ha of potential breeding habitat (creek-line riparian corridor)
- A targeted survey for GBF did not record the species within the study area, thus it is unlikely to currently occur there.

On the basis of the above considerations, it is not likely that the proposed works would result in a significant impact on the survival of Giant Burrowing Frog. Consequently, a Species Impact Statement is not required for the proposal with respect to this species.

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### *Calyptorhynchus lathami* (Glossy Black-Cockatoo)

*Calyptorhynchus lathami* (Glossy Black-Cockatoo) is listed *Vulnerable* under the TSC Act. It inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of she-oak species, particularly *Allocasuarina littoralis* (Black She-oak), *A. torulosa* (Forest She-oak) or drooping *A. verticillata* (She-oak), occur. It feeds almost exclusively on the seeds of several species of *Casuarina* and *Allocasuarina* species (She-Oak), shredding the cones with its bill. The species is dependent on large hollow-bearing eucalypts for nest sites. One or two eggs are laid between March and August (OEH 2017a).

The Glossy Black-Cockatoo is threatened by a number of processes including habitat clearing and fragmentation, loss of mature hollow bearing trees, and inappropriate fire regimes which reduce its range and remove nesting and feeding resources.

The Glossy Black-Cockatoo was not recorded during the surveys, although there are 47 records within a 5 km radius of the study area, and potential foraging habitat within the study area. There is potential for the species to utilize the study area for foraging (*A. torulosa* trees present) and breeding (medium to large HBTs present).

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

Factors likely to have an adverse effect on the life cycle of the Glossy Black-Cockatoo would include a substantial loss and/or fragmentation of foraging habitat and loss of suitable nesting and roosting habitat.

As the Glossy Black-Cockatoo is a foraging specialist, suitable habitat for this species relates to the presence of Allocasuarina species (in the study area *Allocasuarina torulosa*). Although the proposed works will involve the removal of 0.89 ha of native vegetation, only a small portion of this includes suitable foraging habitat for this species. Likewise, the implementation of the APZ will result in the thinning of some canopy species which may include suitable foraging habitat for this species (**Table 13**). However, it is noted that *A. torulosa* feed trees will be retained wherever possible, reducing the clearance of foraging habitat, and that feed trees do not constitute the entire clearing area.

**Table 13: Foraging and roosting resources likely to be impacted for Glossy Black-cockatoo**

| | Foraging resources | | Roosting resources | |
|---|---|---|---|---|
| Species | Impacted | Type | Impacted | Type |
| Glossy Black-cockatoo | Yes | 0.89 ha native vegetation cleared (development footprint), including: 0.69 ha CCEMF, 0.12 ha CCEMF (low condition), 0.04 CCEMF (exotic understorey), and 0.04 ha CWTR. This vegetation includes feed species *Allocasuarina torulosa.*<br>1.71 ha native vegetation under-scrubbed (APZ), which may remove some tree species with canopy in contact. This including: 0.97 ha CCEMF, 0.27 ha CCEMF (low condition), 0.18 CCEMF (exotic understorey), and 0.29 ha CWTR. This vegetation includes feed species *Allocasuarina torulosa.* Retention of *A. torulosa* would be prioritized in this area. | No | 4 medium to large HBTs within the APZ will be retained |

The proposed works will retain 2.14 ha of native vegetation within the study area that contains *A. torulosa* as a dominant species (i.e. potential habitat). Potential foraging habitat is also abundant in the corridor adjacent to the study area. Thus the proposed works is unlikely to put a viable local population of this highly mobile species at risk of extinction.

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

Not applicable. The Glossy Black-Cockatoo is not an endangered population.

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

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

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

Not applicable. The Glossy Black-Cockatoo is not an endangered ecological community.

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

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

The proposed works involves the clearance of a total of 0.89 ha foraging habitat (dominated by *Allocasuarina torulosa*), and the potential clearance of up to 1.71 ha foraging habitat within the APZ area (Table 13). However, it is noted that *A. torulosa* feed trees will be retained wherever possible within the APZ.

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

The proposed works will not fragment of isolate potential foraging habitat for this highly mobile species.

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

The study area contains suitable foraging habitat for the Glossy Black-cockatoo. No breeding habitat has been identified for this species within the study area. No individuals have been recorded during the recent field survey or from BioNet wildlife records. However, due to the presence of foraging habitat the vegetation within the study area was considered potential habitat for this species. However, the habitat is not considered important to the survival for this species given the lack of records and the fact large areas of suitable habitat is conserved in the adjacent Council lands.

**e) Whether the action proposed is likely to have an adverse effect on critical habitat.**

No critical habitat for this species has been declared by the Director-General of DECC.

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

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No Recovery Plan or Threat Abatement Plans have been prepared for the Glossy Black-Cockatoo.

Although the proposed works would remove native vegetation which is dominated by *Allocasuarina torulosa*, a primary feed species for Glossy Black-cockatoo, *A. torulosa* would be retained where possible within the APZ, and potential foraging habitat is available adjacent to the site. The proposal does not conflict any on the nine Priority Actions identified for this species.

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

A key threatening process is defined under the TSC Act as "*a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities*". Two key threatening processes listed under Schedule 3 of the TSC Act are relevant to the current proposal and may pose a threat to the Glossy Black-Cockatoo, clearing of native vegetation and loss of hollow bearing trees.

The proposed works would not result in the loss of any medium to large HBTs but would result in the modification of native vegetation representing foraging habitat.

Although the proposed works would remove native vegetation which is dominated by *Allocasuarina torulosa*, a primary feed species for Glossy Black-cockatoo, *A. torulosa* would be retained where possible within the APZ, and abundant foraging habitat is available adjacent to the site. The proposal does not conflict any on the nine Priority Actions identified for this species.

**Conclusions**

The proposal is unlikely to impose a significant effect on the Glossy Black-Cockatoo given that the proposed works:

- Although the proposed works would remove native vegetation which is dominated by *Allocasuarina torulosa*, a primary feed species for Glossy Black-cockatoo, *A. torulosa* would be retained where possible within the APZ.
- Abundant potential foraging habitat is available to this highly mobile species adjacent to the site
- The proposed works would not remove any medium to large HBTs considered potential roosting or breeding habitat
- The proposed works would not isolate an area of known habitat from currently interconnecting areas of potential habitat for this highly mobile species.

On the basis of the above considerations, it is not considered likely that the proposal will result in a significant impact on the survival of a viable local population of the Glossy Black-Cockatoo. Consequently, a Species Impact Statement is not required for the proposal with respect to this species.

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### Threatened Owls and Microbats

For the purpose of the following Assessment of Significance (AoS), the following species when assessed collectively will be referred to as the *"potentially affected species".*

- *Ninox connivens* (Barking Owl)
- *Ninox strenua* (Powerful Owl)
- *Tyto novaehollandiae* (Masked Owl)
- *Chalinolobus dwyeri* (Large-eared Pied Bat)
- *Miniopterus australis* (Little Bentwing-bat)
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat)
- *Mormopterus norfolkensis* (Eastern Freetail-bat)
- *Myotis macropus* (Southern Myotis)
- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat).

Where obvious differences occur in foraging or roosting behaviour or perceived impacts, they will be discussed separately. Table 14 below describes the presence and type of potential foraging and roosting resources for each of the potentially affected species. Each species profile (listed below) gives a more comprehensive description of the way in which the species are likely to utilise the study area and how they would potentially be impacted.

The local occurrence for all potentially affected species is considered to be all native vegetation communities contiguous with the study area and as mapped by the Native Vegetation of the Sydney Metropolitan Area mapping (OEH 2013). The accuracy of this mapping has not been validated during field survey and is considered an estimate.

**Table 14: Foraging and roosting resources likely to be impacted for each potentially affected species**

| | Foraging resources | | Roosting Resources | |
|---|---|---|---|---|
| Species | Impacted | Type | Impacted | Type |
| *Owl species* | | | | |
| Barking Owl | Yes | 0.89 ha native vegetation cleared (development footprint), including: 0.69 ha CCEMF, 0.12 ha CCEMF (low condition), 0.04 CCEMF (exotic understorey), and 0.04 ha CWTR.<br>1.71 ha native vegetation under-scrubbed (APZ), including: 0.97 ha CCEMF, 0.27 ha CCEMF (low condition), 0.18 CCEMF (exotic understorey), and 0.29 ha CWTR. | No | Four medium to large HBTs within the APZ will be retained |
| Powerful Owl | Yes | | No | |
| Masked Owl | Yes | | No | |
| *Microbat species* | | | | |

| | Foraging resources | | Roosting Resources | |
|---|---|---|---|---|
| Species | Impacted | Type | Impacted | Type |
| Large-eared Pied Bat | Yes | 0.89 ha native vegetation cleared (development footprint), including: 0.69 ha CCEMF, 0.12 ha CCEMF (low condition), 0.04 CCEMF (exotic understorey), and 0.04 ha CWTR.<br>1.71 ha native vegetation under-scrubbed (APZ), including: 0.97 ha CCEMF, 0.27 ha CCEMF (low condition), 0.18 CCEMF (exotic understorey), and 0.29 ha CWTR. | No | This species roosts in caves, of which there are none within the study area |
| Little Bentwing-bat | Yes | | No | Four medium to large HBTs and three small HBTs within the APZ will be retained. |
| Eastern Bentwing-bat | Yes | | No | |
| Yellow-bellied Sheathtail-bat | Yes | | No | |
| Greater Broad-nosed Bat | Yes | | No | |
| Southern Myotis | Yes | | No | The drainage line in the study area is unlikely to be sufficient to support Southern Myotis roosting within the study area. Southern Myotis was not recorded during a targeted survey (**Appendix B**).<br>Four medium to large HBTs and three small HBTs within the APZ will be retained. |

**Owl species profiles**

The following three species of threatened owl are regarded as having potential to utilise the study area.

***Ninox connivens (Barking Owl)***

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

This species inhabits eucalypt woodland, open forest, swamp woodlands and, especially in inland areas, timber along watercourses. Denser vegetation is used occasionally for roosting. During the day they roost along creek lines, usually in tall understorey trees with dense foliage such as Acacia and Casuarina species, or the dense clumps of canopy leaves in large Eucalypts. Territories range from 30 to 200

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hectares and birds are present all year. Three eggs are laid in nests in hollows of large, old eucalypts including *Eucalyptus camaldulensis* (River Red Gum), *Eucalyptus albens* (White Box), *Eucalyptus polyanthemos* (Red Box) and *Eucalyptus blakelyi* (Blakely's Red Gum).

There are 19 records for the Barking Owl within a 5 km radius of the study area (OEH 2017a). This AoS assesses the removal of potential foraging and roosting habitat within the study area, outlined in Table 14**.**

***Ninox strenua* (Powerful Owl)**

*Ninox strenua* (Powerful Owl) is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria and occurs at low densities. In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered, mostly historical records on the western slopes and plains gully (OEH 2017b).

Powerful Owls occur primarily in densely vegetated gullies of open and tall open forest, but they are also found in a wider range of habitats, including forests and woodlands within the metropolitan regions of cities. However, optimal habitat requires large tracts of forest or woodland habitat, including a tall shrub layer and abundant hollows supporting high densities of arboreal marsupial prey species gully (OEH 2017b).

This species roosts in dense mid-canopy trees (such as *Syncarpia glomulifera* (Turpentine), She-oaks and rainforest trees), or tall shrubs in sheltered gullies, typically on wide creek flats and at the heads of minor drainage lines. Nesting occurs from late autumn to mid-winter in large hollows (greater than 45 cm wide and greater than 100 cm deep) in eucalypts in unlogged, unburnt gullies and lower slopes within 100 m of streams or minor drainage lines. Nest trees are typically emergent, and are often the largest and oldest in a stand. Powerful Owls are faithful to traditional nesting hollows but can also use other hollows within the nesting gully (OEH 2017b).

There are 157 records for the Powerful Owl within a 5 km radius of the study area (OEH 2017a). This AoS assesses the removal of potential foraging and roosting habitat within the study area, outlined in Table 14**.**

***Tyto novaehollandiae* (Masked Owl)**

*Tyto novaehollandiae* (Masked Owl) is listed as *Vulnerable* under the TSC Act. They occur in undulating wet-dry forests of the coast and dry eucalypt forests of the tablelands, with optimal habitat including a mosaic of sparse (grassy) and dense (shrubby) groundcover on gentle terrain gully (OEH 2017b).

Roosts are located in live or occasionally dead hollow eucalypts, dense foliage in gullies and caves and recesses in cliffs. They require mature forest or woodland with large hollow trees and dense trees or shrubs for fledglings to shelter in. Hollows greater than 40 cm wide and 100 cm deep in trees at least 90 cm dbh are used. Masked Owls are faithful to traditional nest trees but may use alternative hollows within the breeding territory in different years. Home ranges are estimated to be 400-1000 ha, varying with habitat productivity gully (OEH 2017b).

It is a specialist predator of terrestrial mammals, including rodents and rabbits in disturbed areas and dasyurids in forested areas. Arboreal mammals (e.g. Sugar Glider), birds and bandicoots also supplement the diet. The species forages preferentially in ecotones within forests or along forest edges but also in open areas, and usually hunts from a perch at or near ground level, sometimes near the edges of roads gully (OEH 2017b).

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There are three records for the Masked Owl within a 5 km radius of the study area (OEH 2017a). This AoS assesses the removal of potential foraging and roosting habitat within the study area, outlined in Table 14**.**

**Microbat species profiles**

The following six microbat species are regarded as having potential to utilise the study area.

***Chalinolobus dwyeri* (Large-eared Pied Bat)**

*Chalinolobus dwyeri* (Large-eared Pied Bat) is listed as *Vulnerable* under the TSC Act. It is a small to medium-sized bat with long, prominent ears and glossy black fur. The lower body has broad white fringes running under the wings and tail-membrane, meeting in a V-shape in the pubic area. The species is found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes (OEH 2017b).

Large-eared Pied Bat roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the *Hirundo ariel* (Fairy Martin). Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves. They remain loyal to the same cave over many years (OEH 2017b)

Large-eared Pied Bat is found in well-timbered areas containing gullies. It frequents low to mid-elevation dry open forest and woodland close to caves, crevices in cliffs, old mine workings and disused mud nests of Fairy Martin. The relatively short, broad wing combined with the low weight per unit area of wing indicates manoeuvrable flight. This species probably forages for small, flying insects below the forest canopy (OEH 2017b).

There are eight records for the Large-eared Pied Bat within a 5 km radius of the study area (OEH 2017a). This AoS assesses the removal of potential foraging and roosting habitat within the study area, outlined in Table 14**.**

***Miniopterus australis* (Little Bentwing-bat)**

Little Bent-wing Bat is listed as *Vulnerable* under the TSC Act. The species is generally found in well-timbered areas, including moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats (Churchill 1998; OEH 2017b).

There are 24 records for the Little Bentwing Bat within a 5 km radius of the study area (OEH 2017a). A 'possible' call for Little Bent-wing Bat was recorded in the western portion of the study area during the site inspection, although it was not distinguishable from Little Forest Bat (**Appendix B**). This AoS assesses the removal of potential foraging and roosting habitat within the study area, outlined in Table 14.

***Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat)**

Eastern Bentwing-bat is listed *Vulnerable* under the TSC Act. This species occupies a range of forested environments (including wet and dry sclerophyll forests), along the coastal portion of eastern Australia, and through the Northern Territory and Kimberley area (subject to subdivision of this species) (OEH 2017b).

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This species has a fast, level flight exhibiting swift shallow dives. It forages from just above the tree canopy, to many times the canopy height in forested areas, and will utilise open areas where it is known to forage at lower levels. Moths appear to be the main dietary component. This highly mobile species is capable of large regional movements in relation to seasonal differences in reproductive behaviour and winter hibernation. Though individuals often use numerous roosts, it congregates in large numbers at a small number of nursery caves to breed and hibernate. Although roosting primarily occurs in caves, it has also been recorded in mines, culverts, stormwater channels, buildings, and occasionally tree-hollows. This species occupies a number of roosts within specific territorial ranges usually within 300 km of the maternity cave, and may travel large distances between roost sites (OEH 2017b).

There are 45 records for the Eastern Bentwing Bat within a 5 km radius of the study area (OEH 2017a). This AoS assesses the removal of potential foraging and roosting habitat within the study area, outlined in Table 14.

***Mormopterus norfolkensis* (Eastern Freetail-bat)**

Eastern Freetail-bat is listed *Vulnerable* under the TSC Act. It is found along the east coast from south Queensland to southern NSW in dry eucalypt forests, woodlands, swamp forests and mangrove forests where they forage for insects among canopy gaps and on edges of vegetation and mainly roost in hollow-bearing trees. This species will utilise paddock trees and remnant vegetation in farmland where these are in proximity to larger forest remnants. This species usually forages within a few kilometres of its roost (OEH 2017b).

There are six records for the Eastern Freetail-bat within a 5 km radius of the study area (OEH 2017a). This AoS assesses the removal of potential foraging and roosting habitat within the study area, outlined in Table 14**.**

***Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat)**

Yellow-bellied Sheathtail-bat is listed as *Vulnerable* under the TSC Act. The species forages in most habitats across a very wide range, with and without trees and appears to defend an aerial territory. Yellow-bellied Sheathtail-bats roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows (OEH 2017b).

There is one record for the Yellow-bellied Sheathtail-bat within a 5 km radius of the study area (OEH 2017a). This AoS assesses the removal of potential foraging and roosting habitat within the study area, outlined in Table 14**.**

***Scoteanax rueppellii* (Greater Broad-nosed Bat)**

The Greater Broad-nosed Bat is listed as *Vulnerable* under the TSC Act. This species utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. It is generally associated with gullies and river systems. The species primarily roosts in tree hollows (OEH 2017b).

There are five records for the Greater Broad-nosed Bat within a 5 km radius of the study area (OEH 2017a). This AoS assesses the removal of potential foraging and roosting habitat within the study area, outlined in Table 14.

***Myotis macropus* (Southern Myotis)**

The Southern Myotis is listed as vulnerable under Schedule 2 of the TSC Act. The species generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm-water channels,

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buildings, under bridges and in dense foliage. It forages over streams and pools catching insects and small fish by raking their feet across the water surface (OEH 2017b).

Small waterbodies may be used by microbats as foraging habitat (Churchill 1998). Roosting Southern Myotis require nearby waterways for foraging (Campbell 2009). Although numerous HBTs and stags with potential cracks and crevices occur within the study area and within 200 m of the riparian zone, the largest pool was 3 m by 6 m, and isolated from the creek. The entire creek line has fringing vegetation present, although sometimes marginal, with a low flow, and no fish were observed. Therefore, due to the low flow of the creek, isolated nature of the pools, and fringing vegetation, it is unlikely that Southern Myotis use HBTs or stags within the study area for roosting habitat (**Section 4.2.3.1**).

There are 15 records for the Southern Myotis within a 5 km radius of the study area (OEH 2017a). A targeted survey for Southern Myotis using two Anabats over two nights did not record this species. This AoS assesses the removal of potential foraging and roosting habitat within the study area, outlined in Table 14.

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

Factors likely to have an adverse impact on the potentially affected species include:

- loss or fragmentation in significant areas of foraging habitat
- loss of roosting habitat (HBTs).

The proposed works would remove a total of 0.89 ha of native vegetation, and under-scrub a further of 1.71 ha of native vegetation, considered potential foraging habitat for all potentially affected species (Table 14).

The proposed works would additionally remove roosting habitat for potentially affected microbat species (two stags with no obvious hollows but potential cracks and crevices), with the exception of Large-eared Pied Bat (Table 14).

The potential foraging habitat to be removed is minor compared to that available in the adjacent bushland corridor and the broader locality. The proposed works would not fragment potential foraging habitat for the potentially affected species.

The proposed works would not remove potential roosting habitat for potentially affected owl species, or potential roosting habitat within the APZ for potentially affected microbat species. The proposed works would retain seven HBTs, and there is likely to be additional HBTs in the adjacent bushland corridor.

Thus, the proposal is unlikely to adversely impact the life cycle of the potentially affected species such that a viable local population is put at risk of extinction.

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

Not applicable.

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

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

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

Not applicable.

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

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

**ii. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**

The proposed works would remove a total of 0.89 ha of native vegetation, and under-scrub a further of 1.71 ha of native vegetation, considered potential foraging habitat for all potentially affected species (**Table 14**).

The proposed works would additionally remove roosting habitat for potentially affected microbat species (two stags with no obvious hollows but potential cracks and crevices), with the exception of Large-eared Pied Bat and Southern Myotis (Table 14).

The potential foraging habitat to be removed is minor compared to that available in the adjacent bushland corridor and the broader locality. The proposed works is not likely to fragment potential foraging habitat for these highly mobile species.

The proposed works would not remove potential roosting habitat for potentially affected owl species, or potential roosting habitat within the APZ for potentially affected microbat species. The proposed works would retain seven HBTs, and there is likely to be additional HBTs in the adjacent bushland corridor.

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

Although the proposed works would remove potential foraging habitat for all potentially affected species (a total of 0.89 ha of native vegetation, and under-scrub a total of 1.71 ha of native vegetation), this vegetation is considered relatively minor compared to that available in the adjacent bushland corridor and broader locality.

Although the proposed works would remove potential roosting habitat for potentially affected microbat species (two stags with no obvious hollows; excluding of Large-eared Pied Bat), seven HBTs would be retained within the study area, and based on similar vegetation types, there is likely to be ample potential roosting habitat within the adjacent bushland corridor in the form of HBTs and stags.

Therefore the potential habitat to be removed is unlikely to be of high importance to the long-term survival of the potentially affected species.

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

No critical habitat has been declared for any of the potentially affected species.

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

A Recovery Plan has been developed for the Large-eared Pied-bat (DERM 2011). A threat abatement plan or recovery plan has not been developed for the remaining potentially affected microbats.

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Recovery plans have also been developed for the Barking Owl (NPSW 2003), as well as Large Forest Owls (DEC 2006), which includes the Powerful Owl and Masked Owl. Consistency with the objectives of the recovery plans are discussed in **Table 15.**

**Table 15**: **Objectives and assessment of the Barking Owl and Large Forest Owls recovery plans**

| Action | Assessment against proposal |
|---|---|
| **Large-eared Pied Bat (DERM 2011)** | |
| Specific Objective 1: Identify priority roost and maternity sites for protection | • Potential roosting habitat, such as caves or old mines, were not identified within the study area during the site inspection<br>• This species was not detected by microbat ecolocation devices during the site inspection (**Appendix B**) |
| Specific Objective 2: Implement conservation and management strategies for priority sites | • This species has not been recorded within the study area<br>• No known roost sites occur within the study area |
| Specific Objective 3: Educate the community and industry to understand and participate in the conservation of the large-eared pied bat | Not applicable. |
| Specific objective 4: Research the large-eared pied bat to augment biological and ecological data to enable conservation management | Not applicable. |
| Specific objective 5: Determine the meta-population dynamics throughout the distribution of the large-eared pied bat | Not applicable. |
| **Powerful Owl and Masked Owl (Large Forest Owls Recovery Plan; DEC 2006)** | |
| assess the distribution and amount of high quality habitat for each owl species across public and private lands to get an estimate of the number and proportion of occupied territories of each species that are, and are not, protected. | Not applicable. |
| monitor trends in population parameters (numbers, distribution, territory fidelity and breeding success) across the range of the three species and across different land tenures and disturbance histories. | Not applicable. |
| to assess the implementation and effectiveness of forest management prescriptions designed to mitigate the impact of timber-harvesting operations on the three owl species and, (if necessary), to use this information to refine the prescriptions so that forestry activities on state forests are not resulting in adverse changes in species abundance and breeding success. | Not applicable. |
| ensure the impacts on large forest owls and their habitats are adequately assessed during planning and environmental assessment processes | • no roosting habitat would be impacted (four medium to large HBTs within the APZ would be retained) |

| Action | Assessment against proposal |
|---|---|
| | • the potential foraging habitat is considered marginal relative to the available potential foraging habitat in the adjacent bushland corridor<br>• no areas of habitat would be fragmented or isolated for these highly mobile species |
| minimise further loss and fragmentation of habitat by protection and more informed management of significant owl habitat (including protection of individual nest sites) | • no roosting habitat would be impacted (four medium to large HBTs within the APZ would be retained)<br>• the potential foraging habitat is considered marginal relative to the available potential foraging habitat in the adjacent bushland corridor<br>• no areas of habitat would be fragmented or isolated for these highly mobile species |
| improve the recovery and management of the three large forest owls based on an improved understanding of key areas of their biology and ecology | Not applicable. |
| raise awareness of the conservation requirements of the three large forest owls amongst the broader community, to involve the community in owl conservation efforts and in so doing increase the information base about owl habitats and biology | Not applicable. |
| coordinate the implementation of the recovery plan and continually seek to integrate actions in this plan with actions in other recovery plans or conservation initiatives. | Not applicable. |
| **Barking Owl Recovery Plan (NPWS 2003)** | |
| Specific Objective 1: Increase understanding of the biology, ecology and management of the<br>Barking Owl | Not applicable. |
| Specific Objective 2: Increase education and awareness of and involvement in the conservation of the Barking Owl and its habitat in NSW. | Not applicable. |
| Specific Objective 3: Undertake threat abatement and mitigation. This includes:<br>Action 3.1 Protect known Barking Owl nest sites and surrounding habitat<br>Action 3.2 Assist with the protection of Barking Owl habitat from disturbance due to<br>developments and activities | • no roosting habitat would be impacted (four medium to large HBTs within the APZ would be retained)<br>• the potential foraging habitat is considered marginal relative to the available potential foraging habitat in the adjacent bushland corridor<br>• no areas of habitat would be fragmented or isolated for these highly mobile species |
| Specific Objective 4: Gain efficiencies through links with other conservation plans and | Not applicable. |

| Action | Assessment against proposal |
|---|---|
| conservation groups | |
| Specific Objective 5: Provide organisational support | Not applicable. |

The proposal is considered to be consistent with the objectives of the Barking Owl Recovery Plan (NPWS 2003), National recovery plan for the Large-eared Pied Bat and the Large Forest Owls Recovery Plan (DEC 2006).

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

There are two key threatening processes associated with the proposal:

- Clearing of native vegetation
- Loss of hollow bearing trees

Although the proposed works would remove native vegetation and relevant potential foraging habitat for all potentially affected species (a total of 0.89 ha of native vegetation, and under-scrub a total of 1.71 ha of native vegetation), this portion of vegetation is considered relatively minor compared to that available in the adjacent bushland corridor and the broader locality.

Although the proposed works would remove potential roosting habitat for potentially affected microbat species (two stags with no obvious hollows; excluding of Large-eared Pied Bat), seven HBTs would be retained within the study area, and there is likely to be ample potential roosting habitat within the adjacent bushland corridor in the form of HBTs and stags.

Therefore the potential habitat to be removed is unlikely to exacerbate the impacts of these key threatening processes.

**Conclusion**

The proposal is unlikely to have a significant impact on the potentially affected species given the following:

- Although the proposed works would remove a total of 0.89 ha of native vegetation, and under-scrub a total of 1.71 ha of native vegetation, considered potential foraging habitat for all potentially affected species, there is ample potential foraging habitat adjacent to the study area in a bushland corridor and broader locality, accessible to these highly mobile species
- Although the proposed works would remove roosting habitat for potentially affected microbat species (two stags with no obvious hollows but potential cracks and crevices; with the exception of Large-eared Pied Bat) the proposed works would retain seven HBTs within the study area, and there is likely to be additional potential roosting habitat (HBTs and stags) within the bushland corridor adjacent to the study area
- The proposed works would not remove existing potential roosting habitat for potentially affected owl species
- The proposed works would not fragment or isolate potential foraging habitat for the highly mobile potentially affected species

Based on the above assessment, a Species Impact Statement is not recommended with respect to the potentially affected species.

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### *Cercartetus nanus* (Eastern Pygmy Possum)

*Cercartetus nanus* (Eastern Pygmy Possum; EPP) is listed as *Vulnerable* species under the TSC Act. It is found in south-eastern Australia, from southern Queensland to eastern South Australia and in Tasmania. In NSW it extends from the coast inland as far as the Pillaga, Dubbo, Parkes and Wagga Wagga on the western slopes (OEH 2017b).

The species is found in a broad range of habitats from rainforest through sclerophyll forest and woodland to heath, but in most areas, woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest (OEH 2017b).

Eastern Pygmy Possum feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes, although soft fruits are eaten when flowers are unavailable. It is an important pollinator of heathland plants such as banksias. It also feeds on insects throughout the year and this feed source may be more important in habitats where flowers are less abundant such as wet (OEH 2017b).

Eastern Pygmy Possum shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, *Pseudocheirus peregrinus* (Ringtail Possum) dreys or thickets of vegetation, (e.g. grass-tree skirts). It appears to be mainly solitary, each individual using several nests, with males having non-exclusive home-ranges of about 0.68 hectares and females about 0.35 hectares (OEH 2017b).

Threats to EPP include loss and fragmentation of habitat, changed fire regimes that affect the abundance of flowering Proteaceous shrubs, particularly banksias, declining shrub diversity in forests and woodlands due to overgrazing by stock and rabbits, predation from cats, dogs and foxes, and loss of nest sites due to removal of firewood (OEH 2017b).

There are 77 records of EPP within 5 km of the study area, including multiple records within the vegetated corridor that the study area occurs adjacent to. No previous records of EPP occur within the study area.

Eastern Pygmy Possum was not detected within the study area during the site inspection (by nest boxes or remote cameras).

There is potential for the species to utilise the study area as roosting habitat (hollow-bearing trees; HBTs). Although there is not an abundance of high-nectar producing flora species, such as *Banksia*, the study area may provide marginal foraging habitat for EPP (for example, insects as a food source – OEH 2017b).

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

Factors likely to have an adverse effect on the life cycle of the EPP would include a substantial loss and/or fragmentation of foraging habitat and loss of suitable nesting and roosting habitat.

The proposed works involves the clearance of a total of 0.89 ha marginal foraging habitat (including canopy trees), and the potential clearance of up to 1.71 ha marginal foraging habitat (not including canopy trees; Table 16).

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**Table 16: Foraging and roosting resources likely to be impacted for EPP**

| | Foraging resources | | Roosting resources | |
|---|---|---|---|---|
| Species | Impacted | Type | Impacted | Type |
| Eastern Pygmy Possum (EPP) | Yes | 0.89 ha native vegetation cleared (development footprint), including: 0.69 ha CCEMF, 0.12 ha CCEMF (low condition), 0.04 CCEMF (exotic understorey), and 0.04 ha CWTR. 1.71 ha native vegetation under-scrubbed (APZ), which may remove some tree species with canopy in contact. This including: 0.97 ha CCEMF, 0.27 ha CCEMF (low condition), 0.18 CCEMF (exotic understorey), and 0.29 ha CWTR (a total of 2.6 ha of potential marginal foraging habitat).<br>Although vegetation to be removed does not include high nectar-producing flora species, it is likely to support insects, a food source for EPP (OEH 2017b) | No | four medium to large HBTs within the APZ will be retained |

The impact of the removal of potential marginal foraging habitat is not expected to place a local population of EPP at risk of extinction, as the study area is adjacent to a large swathe of bushland which is likely to support similar resources.

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

Not applicable. Eastern Pygmy Possum is not an endangered population.

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

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

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

Not applicable. Eastern Pygmy Possum is not an endangered ecological community.

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

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

The proposed works will result in the removal approximately 0.89 ha marginal foraging habitat (including canopy) and 1.71 ha marginal foraging habitat (excluding canopy) (Table 16). The proposed works will not remove any HBTs (potential roosting habitat) from within the study area.

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

The proposed works will not fragment or isolate any potential habitat for EPP. The study area occurs on the extremity of a corridor of bushland. Within the study area, the subject site occurs along a road, and does not disconnect any currently connected bushland.

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

The proposed works will result in the removal of a total of 2.6 ha of marginal foraging habitat for EPP (Table 16). This vegetation does not contain any high nectar-producing species, and HBTs (roosting habitat) within the subject site will be retained. Therefore although potential marginal habitat will be removed, it is not of high importance to the survival of EPP considering the study area occurs adjacent to a large corridor of likely potential foraging habitat.

**e) Whether the action proposed is likely to have an adverse effect on critical habitat.**

No critical habitat has been declared for the Eastern Pygmy Possum.

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

No recovery plan or threat abatement plan has been prepared for the Eastern Pygmy Possum.

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

The proposed works constitutes one key threatening processes of relevance to the Eastern Pygmy Possum, clearing of native vegetation, which would result in a small loss of potential habitat. However, the scale of these impacts within the study area is not considered to be significant in relation any local EPP population and the available potential habitat within the adjacent bushland corridor.

**Conclusion**

The proposed works are unlikely to significantly impact upon Eastern Pygmy Possum given that the proposed works:

- Would remove a total of 0.89 ha marginal foraging habitat (including canopy trees), and the potential clearance of up to 1.71 ha marginal foraging habitat (not including canopy trees. This potential habitat is only considered marginal as it does not contain a high density of high nectar-producing flora species
- Retain HBTs (roosting habitat) within the APZ
- Would not isolate an area of known habitat from currently interconnecting areas of potential habitat for this species.

On the basis of the above considerations, it is not likely that the proposed works will result in a significant effect on the survival of Eastern Pygmy Possum. Consequently, a Species Impact Statement is not required for the proposed works with respect to this species.

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***Phascolarctos cinereus* (Koala)**

*Phascolarctos cinereus* (Koala) is listed as *Vulnerable* under the TSC Act. The Koala is also listed as part of an endangered population within the Pittwater LGA. The Pittwater population is bound in a small restricted geographical distribution with Ingleside the western limit and includes the Barrenjoey Peninsula.

This AoS will address both assessments together for the species and the endangered population.

Koalas are solitary and territorial (particularly males) yet live in established sedentary polygynous breeding aggregates arranged in a matrix of overlapping home ranges whose size varies according to sex (males tend to be larger so that they overlap the ranges of several females) and carrying capacity of the habitat (usually measured in terms of density of primary browse species) (Phillips and Callaghan 1995).

Nationally, koalas have been observed feeding or resting in about 120 eucalypt species (66 in NSW) and 30 non-eucalypt (seven in NSW) species. Usage may also be determined by site-dependent edaphic factors e.g. soil type (Sharp and Phillips 1999), which affects the nutrient quality of forage. Forest consisting of primary browse species associations located on deep, fertile soils on floodplains, in gullies and along watercourses are generally considered preferred koala habitat. This may possibly be a reflection of the nutritional value of the foliage.

Adult koalas appear to generally avoid each other except during mating season (generally warmer months from spring but as early as July-August) when the males actively seek females with most births occurring late November-March (Martin and Lee 1984). Social cohesion is maintained in a koala population by interactions through scent marking, vocalisations and antagonistic behaviour patterns (Phillips 1997).

An established koala home range is usually occupied for several years or throughout its life (Phillips 1997, Sharp and Phillip 1999). Size of a Koala home range may vary from a hectare to hundreds of hectares (e.g. Jurskis and Potter 1997 report home ranges of 38 ha to 520 ha with an average size of 169 ha, near Eden); varying with habitat quality (e.g. if primary browse species dominate the tree component, home range size is expected to be small and carrying capacity high), sex (males have larger territories and may make forays into other areas), age of the animals (e.g. sub-adults versus adults), and location (Jurskis and Potter 1997, Phillips 1997, Sharp and Phillip 1999).

Research on koala home ranges in similar habitats in the region has found that breeding female koalas had home ranges in the order of 10 – 60 ha, and male koalas in the order of 50 – 150 ha.

Neither Koala presence, nor signs (scratches, scats, etc.) were observed during the site inspection (observation or remote camera). There are 54 records of Koala within 5 km of the study area (which includes records from the Pittwater LGA Endangered Population). The two nearest records are within 1 km to the east of the study area, and are dated 1967 and 1972. The most recent record within 5 km is dated 1 July 1987, over 30 years ago. The nearest record within the last 30 years is approximately 6 km to the north-west of the study area, in Ku-Ring-Gai Chase National Park from 1986 (25 August 2009).

The study area is located within the Central Coast Koala Management Area (KMA) as designated by the species recovery plan (DECC 2008). The recovery plan for the Koala (DECC 2008) provides a list of koala food trees categorized as primary, secondary and supplementary for each KMA.

The proposed works would remove a total of 0.89 ha of vegetation, and the potential clearance of additional canopy trees in an APZ of 1.71 ha. Vegetation within the subject area includes *Angophora costata* (Smooth-barked Apple), *Eucalyptus paniculata* (Grey Ironbark), *Eucalyptus resinifera* (Red mahogany), and *Eucalyptus umbra* (Broad-leaved White Mahogany). *Eucalyptus resinifera* is listed as a

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secondary food tree species for Koala species under the Recovery Plan (DECC 2008), while *E. paniculata* is considered an important food tree for the endangered Pittwater population (OEH 2017b). The endangered Pittwater population may also utilise other variety of other Eucalypt and Angophora species which are not listed in the Recovery Plan (OEH 2017b). Thus the study area contains potential foraging habitat for Koala. The study area also contains a high density of *Syncarpia glomulifera* (Turpentine), an important shelter tree for Koala in times of extreme weather (OEH 2017b).

The potential foraging habitat within study area is located on the fringe of a large corridor of conservation reserve (> 50 ha) and connected to Ku-ring-gah Chase National Park via a network of vegetation intersected by roads which is likely to also contain potential foraging habitat.

Habitat within the study area is not considered core or potential koala habitat under SEP 44 (**Section 2.5**).

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

The proposed works would remove a total of 0.89 ha of vegetation, and the potential clearance of additional canopy trees in an APZ of 1.71 ha. Vegetation proposed to be removed within the subject site includes *Eucalyptus resinifera*, a secondary food tree species for Koala (DECC 2008), *Syncarpia glomulifera*, an important shelter tree species (OEH 2017b), and *Angophora costata*, *Eucalyptus paniculata*, and *Eucalyptus umbra,* all potential foraging habitat (OEH 2017b).

The nearest Koala records, within 1 km to the east of the study area, are over 30 years old. The nearest record within the last 30 years is approximately 6 km to the north-west of the study area, in Ku-Ring-Gai Chase National Park in 1986 (25 August 2009). There are no recent records within the bushland corridor that the study area occurs adjacent to, and thus the Koala is unlikely to currently occur there. The Koala was not recorded by observation or by remote cameras during the site inspection.

Although the study area contains potential foraging and shelter habitat, there is likely to be equivalent habitat in the bushland corridor adjacent to the study area and broader locality. Therefore the proposed works is unlikely to place a viable local population of the Koala species or the endangered Pittwater population at risk of extinction.

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

As above. The proposed works would remove a total of 0.89 ha of vegetation, and the potential clearance of additional canopy trees in an APZ of 1.71 ha. Vegetation proposed to be removed within the subject site includes *Eucalyptus resinifera*, a secondary food tree species for Koala (DECC 2008), *Syncarpia glomulifera*, an important shelter tree species (OEH 2017b), and *Angophora costata*, *Eucalyptus paniculata*, and *Eucalyptus umbra,* all potential foraging habitat (OEH 2017b).

The nearest Koala records, within 1 km to the east of the study area, are over 30 years old. The nearest record within the last 30 years is approximately 6 km to the north-west of the study area, in Ku-Ring-Gai Chase National Park (25 August 2009). There are no recent records within the bushland corridor that the study area occurs adjacent to, and thus the Koala is unlikely to currently occur there. The Koala species or population was not recorded by observation or by remote cameras during the site inspection.

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Although the study area contains potential foraging and shelter habitat, there is likely to be equivalent habitat in the bushland corridor adjacent to the study area and broader locality. Therefore the proposed works is unlikely to place a viable local population of the Koala at risk of extinction.

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

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

This is not an endangered ecological community.

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

This is not an endangered ecological community.

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

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

The proposed works would remove a total of 0.89 ha of vegetation, and the potential clearance of additional canopy trees in an APZ of 1.71 ha. Vegetation proposed to be removed within the subject site includes *Eucalyptus resinifera*, a secondary food tree species for Koala (DECC 2008), *Syncarpia glomulifera*, an important shelter tree species (OEH 2017b), and *Angophora costata*, *Eucalyptus paniculata*, and *Eucalyptus umbra,* all potential foraging habitat (OEH 2017b).

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

The proposed works will not fragment or isolate any potential habitat for Koala. The study area occurs on the extremity of a corridor of bushland. Within the study area, the subject site occurs along a road, and does not disconnect any currently connected bushland.

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

The habitat proposed to be removed includes one secondary food tree species, one shelter tree species, and three species which are considered general foraging habitat for Koala. The study area is located on the edge of a large corridor of bushland, thus the proposed removal of potential habitat would not fragment remaining potential habitat. Koala are unlikely to currently utilize the potential habitat in the study area, as no records occur in the bushland corridor adjacent to the site, the closest record within 30 years is approximately 7 km to the south of the site and partially isolated by roads, and no Koala was recorded during the site inspection (observation or remote camera).

Thus, the vegetation proposed to be removed is unlikely to be important to long term survival of the Koala as a species or as an endangered population.

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

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The koala habitat assessment tool (EPBC Act Referral Guidelines) was used to determine if the vegetation within the study area could be classed as habitat critical to the survival of the Koala (DotE 2014). The assessment concluded that the study area did not contain vegetation critical to the survival of the Koala (score less than 5) (**Section 5.4**).

There are currently no areas of 'critical habitat' for Koala identified under the TSC Act.

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

The Approved Recovery Plan for the Koala (DECC 2008) provides a framework for localised recovery efforts throughout NSW through a number of recovery objectives. The objectives are:

- Conserving Koalas in their existing habitat, rehabilitate and restore Koala habitat and populations
- Rehabilitate and restore koala habitat and populations
- Develop a better understanding of the conservation biology of Koalas
- Ensure that the community has access to factual information about the distribution, conservation and management of koalas at a national, state and local level
- Manage captive, sick or injured Koalas and orphaned wild Koalas to ensure consistent and high standards of care
- Manage overbrowsing to prevent both koala starvation and ecosystem damage in discrete patches of habitat
- Coordinate, promote the implementation, and monitor the effectiveness of the NSW Koala Recovery Plan across New South Wales.

The habitat proposed to be removed includes one secondary food tree species, one shelter tree species, and three species which are considered general foraging habitat for Koala. The study area is located on the edge of a large corridor of bushland, the thus the proposed removal of potential habitat would not fragment remaining potential habitat. Koala are unlikely to currently utilize the potential habitat in the study area, as no records occur in the bushland corridor adjacent to the site, the closest record within 30 years is approximately 7 km to the south of the site and partially isolated by roads, and no Koala was recorded during the site inspection (observation or remote camera).

Therefore the works are unlikely to restrict the conservation of Koala habitat and populations (Objective 1).

The remainder of these objectives are not relevant to the proposed works and their implementation are the responsibility of OEH.

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

One key threatening process is relevant to the proposal: 'clearing of native vegetation' (OEH 2017b; DECC 2008).

The vegetation removal involved with the proposal is considered to represent the key threatening process: 'clearing of native vegetation'. While the proposal will cumulatively contribute to this key threatening process, the extent of this vegetation removal is not considered a significant contribution to this cumulative impact.

**Conclusion**

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The proposed works is unlikely to cause a significant impact on the Koala given that:

- The proposed works would remove a total of 0.89 ha of vegetation, and the potential clearance of additional canopy trees in an APZ of 1.71 ha. This is small relative to the adjacent bushland corridor (> 50 ha) and broader locality
- Vegetation proposed to be removed within the subject site includes *Eucalyptus resinifera*, a secondary food tree species for Koala (DECC 2008), *Syncarpia glomulifera*, an important shelter tree species (OEH 2017b), and *Angophora costata*, *Eucalyptus paniculata*, and *Eucalyptus umbra,* all potential foraging habitat (OEH 2017b). There is likely to be similar potential foraging resources located in the adjacent bushland corridor
- The proposed works would not fragment or isolate other potential habitat, as the study area is adjacent to a bushland corridor
- No signs (including scratches or scats) were observed on and around feed trees during the site inspection, and remote cameras did not detect Koala. Although there are numerous records of Koala within 5 km of the study area, no Koala records occur within the bushland corridor adjacent to the study area, and the closest record within 30 years of the study area is approximately 7 km away. Therefore it is unlikely Koala currently utilize the potential habitat within the study area.
- The koala habitat assessment tool (EPBC Act Referral Guidelines) determined that the study area does not contain habitat critical to the survival of the Koala (DotE 2014)

On the basis of the above considerations, it is not likely that the proposal would result in a significant impact to the Koala as a threatened species, or as an endangered population. Consequently, a Species Impact Statement is not required for the proposal with respect to this species or to the endangered population (Pittwater LGA).

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# Appendix E : Assessment of Significance (EPBC Act)

Significance Assessments under the EPBC Act were conducted for the following species:

*Amphibian species:*

- *Heleioporus australiacus* (Giant Burrowing Frog).

*Microbat species:*

- *Chalinolobus dwyeri* (Large-eared Pied Bat)

*Mammal species (excluding microbats)*

- *Phascolarctos cinereus* (Koala).

***Heleioporus australiacus* (Giant Burrowing Frog)**

*Heleioporus australiacus* (Giant Burrowing Frog; GBF) is listed as *Vulnerable* under the TSC

There are 17 records of GBF within 5 km of the study area. The nearest record is approximately 1 km to the south of the study area (1/1/19979).

A targeted survey did not record this species within the study area. Although, survey limitations identified that the survey was not conducted during optimal conditions for this species and therefore the survey methodology does not comply fully to the survey guidelines. Despite this, it is not considered likely that an important population occurs within or adjacent to the study area.

Approximately 0.18 ha of potential breeding habitat for this species occurs in the western portion of the study area, within the riparian area along the small creek-line. This habitat would not be impacted by the proposed works, as it is excluded from the APZ.

GBF can travel up to 300 m to forage (OEH 2017b), and thus all native vegetation within the study area is potential foraging habitat for the GBF. Approximately 2.6 ha of potential foraging habitat (ground and mid-story vegetation) would be removed by the proposed works.

**An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:**

**Criterion a: lead to a long-term decrease in the size of an important population of a species**

A targeted survey did not record this species within the study area. Thus it is unlikely that an important population occurs within or adjacent to the study area.

**Criterion b: reduce the area of occupancy of an important population**

A targeted survey did not record this species within the study area. Thus it is unlikely that an important population occurs within or adjacent to the study area.

**Criterion c: fragment an existing important population into two or more populations**

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A targeted survey did not record this species within the study area. Thus it is unlikely that an important population occurs within or adjacent to the study area.

The proposed works would not fragment or isolate habitat within the adjacent bushland corridor.

**Criterion d: adversely affect habitat critical to the survival of a species**

No critical habitat has been declared for this species. The proposed works would not fragment or isolate habitat within the adjacent bushland corridor, and thus is unlikely to impact any GBF within the vicinity of the study area.

**Criterion e: disrupt the breeding cycle of an important population**

A targeted survey did not record this species within the study area. Thus it is unlikely that an important population occurs within or adjacent to the study area.

The proposed works would not impact the potential breeding habitat within the study area (approximately 0.18 ha).

**Criterion f: modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;**

No critical habitat has been declared for this species. The proposed works would not fragment or isolate habitat within the adjacent bushland corridor, and thus is unlikely to impact any GBF within the vicinity of the study area.

**Criterion g: Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

The project will not result in the establishment of an invasive species that is harmful to the GBF.

**Criterion h: Introduce disease that may cause the species to decline;**

The project will need to take into consideration mitigation measures to take care to wash down (and, if necessary, bleach) equipment used in other aquatic environments to reduce the risk of introduction of Chytrid fungus to the site.

**Criterion i: Interfere substantially with the recovery of the species;**

Considering the above factors, the project will not interfere substantially with the recovery of the species.

**Conclusion**

The proposed works is not likely to have a significant impact on the GBF for the following reasons:

- An targeted survey did not detect GBF within the study, and thus an important population is unlikely to occur within or adjacent to the study area
- Potential breeding habitat within the study area would not be impacted by the proposed works
- The proposed works would not fragment or isolate potential habitat in the adjacent bushland corridor.

The action is not likely to have a significant impact on the GBF.

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***Chalinolobus dwyeri* (Large-eared Pied Bat)**

*Chalinolobus dwyeri* (Large-eared Pied Bat; LPB) is listed as *Vulnerable* under the EPBC Act.

In general, the proposed works would remove a total of 0.89 ha (development footprint) of native vegetation, and under-scrub a total of 1.71 ha (APZ) of native vegetation, considered potential foraging habitat

There are eight records for the Large-eared Pied Bat within a 5 km radius of the study area (OEH 2017a). The most recent record within 5 km was 26 April 2016. Only individual records occur within 5 km of the study area, suggesting no roosts have been detected within this radius, and thus it is unlikely an important population occurs in or near the study area. Microbat ultrasonic recording devices did not detect this species within the study area.

There was no roosting habitat (caves or abandoned mines) recorded within the study area. This AoS assesses the removal of potential foraging habitat within the study area.

**An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:**

**Criterion a: lead to a long-term decrease in the size of an important population of a species**

No important populations have been recorded within the study area, and it is unlikely that an important population occurs within the area.

The proposed works would remove a total of 0.89 ha of native vegetation, and under-scrub a total of 1.71 ha of native vegetation, considered potential foraging habitat for this species. This is relatively small compared to the available potential foraging habitat located adjacent to the study area in a bushland corridor. The study area does not contain any potential roosting habitat.

Thus the proposed works are to cause a long-term decrease in an important population.

**Criterion b: reduce the area of occupancy of an important population**

No important populations have been recorded within the study area, and it is unlikely that an important population occurs within the area.

The proposed works would remove a total of 0.89 ha of native vegetation, and under-scrub a total of 1.71 ha of native vegetation, considered potential foraging habitat for this species. This is relatively small compared to the available potential foraging habitat located adjacent to the study area in a bushland corridor. The study are does not contain any potential roosting habitat.

Microbat ultrasonic recording devices did not detect this species within the study area, it is unlikely that this species is currently utilizing the site. Therefore it is unlikely that the proposed works would reduce the area of occupancy of an important population.

**Criterion c: fragment an existing important population into two or more populations**

No important populations have been recorded within the study area, and it is unlikely that an important population occurs within the area.

The proposed works would remove a total of 0.89 ha of native vegetation, and under-scrub a total of 1.71 ha of native vegetation, considered potential foraging habitat for this species. This is relatively small compared to the available potential foraging habitat located adjacent to the study area in a bushland corridor. The native vegetation to be removed would not fragment or isolate further the remaining vegetation. The study are does not contain any potential roosting habitat.

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Microbat ultrasonic recording devices did not detect this species within the study area, it is unlikely that this species is currently utilizing the site. Therefore it is unlikely that the proposed works would fragment an existing population.

**Criterion d: adversely affect habitat critical to the survival of a species**

No critical habitat has been declared for this species. Habitat of high important to this species includes potential roosting habitat such as caves or old mines, which were not recorded within the study area.

**Criterion e: disrupt the breeding cycle of an important population**

No important populations have been identified in the study area, and are unlikely to occur within the immediate area.

**Criterion f: modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;**

The proposed works would remove a total of 0.89 ha of native vegetation, and under-scrub a total of 1.71 ha of native vegetation, considered potential foraging habitat for this species. This is relatively small compared to the available potential foraging habitat located adjacent to the study area in a bushland corridor. The native vegetation to be removed would not fragment or isolate further the remaining vegetation. The removal of this potential foraging habitat is unlikely to cause a decline in this highly mobile species.

**Criterion g: Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

The project will not result in the establishment of an invasive species that is harmful to the Large-eared Pied Bat.

**Criterion h: Introduce disease that may cause the species to decline;**

The proposed works is unlikely to introduce disease that may cause this species to decline.

**Criterion i: Interfere substantially with the recovery of the species;**

Considering the above factors, the project will not interfere substantially with the recovery of the Large-eared Pied Bat.

**Conclusion**

Based on the above assessment, it is concluded that the proposed works would not cause a significant impact to the Large-eared Pied Bat and thus a referral is noted required, as:

- An important population of Large-eared Pied Bat is not located within the study area, and is unlikely to occur nearby
- The proposed works would remove a total of 0.89 ha of native vegetation, and under-scrub a total of 1.71 ha of native vegetation, considered potential foraging habitat for this species. This is relatively small compared to the available potential foraging habitat located adjacent to the study area in a bushland corridor.
- Potential roosting habitat (for example caves or abandoned mines) does not occur within the study area.

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***Phascolarctos cinereus* (Koala)**

The Koala is listed as *Vulnerable* under the EPBC Act.

The Significance Assessment under the EPBC Act makes an assessment based around impacts to an important population of threatened species. Regarding Koala important populations, the Koala SPRAT profile notes '*There is a data deficiency in regards to the delineation of sub-populations throughout the listed koala's range. Therefore, it is currently difficult to specify important populations and such a proposition must be assessed on a case by case basis, using the information available for a particular location.'* (DotEE 2017a).

Neither Koala presence, nor signs (scratches, scats, etc.) were observed during the site inspection (observation or remote camera). There are 90 records of Koala within 5 km of the study area. The two nearest records are within 1 km to the east of the study area, and are dated 1967 and 1972. The nearest record within the last 30 years is approximately 6 km to the north-west of the study area, in Ku-Ring-Gai Chase National Park (25 August 2009). Other recent records within the last 30 years occur to the north-west of the study area, greater than 5 km away. No Koala records occur within the bushland corridor adjacent to the study area.

Therefore due to the lack of recent records relative to the study area, this assessment has identified that an important population of Koala is unlikely to occur within or adjacent to the study area.

Habitat within the study area is not considered core or potential koala habitat under SEP 44 (**Section 2.5**).

**Criterion a: lead to a long-term decrease in the size of an important population of a species**

The proposed works would remove a total of 0.89 ha of vegetation, and the potential clearance of additional canopy trees in an APZ of 1.71 ha. Vegetation proposed to be removed within the subject site includes *Eucalyptus resinifera*, a secondary food tree species for Koala (DECC 2008), *Syncarpia glomulifera*, an important shelter tree species (OEH 2017b), and *Angophora costata*, *Eucalyptus paniculata*, and *Eucalyptus umbra;* all potential foraging habitat (OEH 2017b). Similar potential foraging and shelter habitat is likely to occur in the relatively larger bushland corridor (> 50 ha) adjacent to the study area.

This assessment has identified that an important population of Koala is unlikely to occur within or adjacent to the study area.

In consideration of the above, the proposed works are unlikely to lead to a long-term decrease in the size of an important population of Koala.

**Criterion b: reduce the area of occupancy of an important population;**

The proposed works would remove a total of 0.89 ha of vegetation, and the potential clearance of additional canopy trees in an APZ of 1.71 ha. Vegetation proposed to be removed within the subject site includes *Eucalyptus resinifera*, a secondary food tree species for Koala (DECC 2008), *Syncarpia glomulifera*, an important shelter tree species (OEH 2017b), and *Angophora costata*, *Eucalyptus paniculata*, and *Eucalyptus umbra;* all potential foraging habitat (OEH 2017b). Similar potential foraging and shelter habitat is likely to occur in the relatively larger bushland corridor (> 50 ha) adjacent to the study area.

This assessment has identified that an important population of Koala is unlikely to occur within or adjacent to the study area.

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Therefore, the proposed works are unlikely to reduce the area of occupancy of an important population of Koalas.

**Criterion c: fragment an existing important population into two or more populations;**

The study area is located adjacent to a bushland corridor, and the proposed removal of vegetation would not fragment or isolate the remaining vegetation further.

This assessment has identified that an important population of Koala is unlikely to occur within or adjacent to the study area, and therefore the proposed works is unlikely to fragment an existing population.

**Criterion d: adversely affect habitat critical to the survival of a species;**

The koala habitat assessment tool (EPBC Act Referral Guidelines) was used to determine if the vegetation within the study area could be classed as habitat critical to the survival of the Koala (DotE 2014). The assessment concluded that the study area did not contain vegetation critical to the survival of the Koala (**Section 5.4**).

The following attributes were considered:

- Koala occurrence: Neither Koala presence, nor signs (scratches, scats, etc.) were observed during the site inspection (direct observation or remote camera). There are 90 Koala records within 5 km of the study area, recorded greater than 30 years ago. The two nearest records are within 1 km to the east of the study area, and are dated 1967 and 1972. There are no records within the bushland corridor adjacent to the study area. The nearest record within the last 30 years is approximately 6 km to the north-west of the study area, in Ku-Ring-Gai Chase National Park (25 August 2009). There is no evidence of Koalas occurring in the study area in the last five years (Score of 0)
- Vegetation composition: Has forest or woodland with only one species of known koala food tree present (Score of 1)
- Habitat connectivity: The vegetation within the study area is part of a contiguous landscape > 300 ha (Score of 1)
- Key existing threats:
    - Potential habitat within the study area is located directly adjacent to access roads for the retirement village. Therefore there is a chance of Koala mortality from vehicle strike.
    - The study area is located in a residential area (although currently zone RU2 Rural Landscape). Therefore there is a potential chance of Koala mortality from dog attack (Score of 1).
- Recovery value: It is uncertain whether the potential habitat within the study area has the potential to be important for achieving the interim recovery objectives in the context of the study area, due to the isolated nature of the bushland corridor from recent records, and the unlikely presence of recent Koalas. Relevant objectives include:
    - Protect and conserve the quality and extent of habitat refuges.
    - Maintain the quality, extent and connectivity of large areas of Koala habitat surrounding habitat refuges (Score of 1).

Based on the above assessment tool, the potential habitat within the study area has a total score of '3'. Impact areas that score less than five using the Koala habitat assessment tool do not contain habitat critical to the survival of the Koala (DotE 2014).

**Criterion e: disrupt the breeding cycle of an important population;**

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This assessment has identified that an important population of Koala is unlikely to occur within or adjacent to the study area, and therefore the proposed works is unlikely to fragment an existing population.

Therefore it is unlikely that the proposed removal of vegetation would disrupt the breeding cycle of an important population.

**Criterion f: modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;**

The proposed works would remove a total of 0.89 ha of vegetation, and the potential clearance of additional canopy trees in an APZ of 1.71 ha. Vegetation proposed to be removed within the subject site includes *Eucalyptus resinifera*, a secondary food tree species for Koala (DECC 2008), *Syncarpia glomulifera*, an important shelter tree species (OEH 2017b), and *Angophora costata*, *Eucalyptus paniculata*, and *Eucalyptus umbra;* all potential foraging habitat (OEH 2017b). Similar potential foraging and shelter habitat is likely to occur in the relatively larger bushland corridor (> 50 ha) adjacent to the study area.

Neither Koala presence, nor signs (scratches, scats, etc.) were observed during the site inspection (observation or remote camera). There are 90 records of Koala within 5 km of the study area. The two nearest records are within 1 km to the east of the study area, and are dated 1967 and 1972. The nearest record within the last 30 years is approximately 6 km to the north-west of the study area, in Ku-Ring-Gai Chase National Park (25 August 2009). Other recent records within the last 30 years occur to the north-west of the study area, greater than 5 km away. No Koala records occur within the bushland corridor adjacent to the study area.

This assessment has identified that an important population of Koala is unlikely to occur within or adjacent to the study area. It is unlikely that Koala currently utilize the potential habitat in the study area.

In consideration of the above, it is unlikely that the proposed removal of vegetation would cause a likely decline of the Koala.

**Criterion g: result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

The proposed works is unlikely to result in invasive species that would be harmful to the Koala.

**Criterion h: introduce disease that may cause the species to decline; or**

The proposed works would be unlikely to introduce a disease that may cause this species to decline.

**Criterion i: interfere substantially with the recovery of the species**

The Approved Recovery plan for the Koala (DECC 2008) provides a framework for localised recovery efforts throughout NSW through a number of recovery actions. The actions include:

- Conserving Koalas in their existing habitat, rehabilitate and restore Koala habitat and populations
- Rehabilitate and restore koala habitat and populations
- Develop a better understanding of the conservation biology of Koalas
- Ensure that the community has access to factual information about the distribution, conservation and management of koalas at a national, state and local level
- Manage captive, sick or injured Koalas and orphaned wild Koalas to ensure consistent and high standards of care

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- Manage overbrowsing to prevent both koala starvation and ecosystem damage in discrete patches of habitat
- Coordinate, promote the implementation, and monitor the effectiveness of the NSW Koala Recovery Plan across New South Wales.

Although the proposed works would remove up to a total of approximately 2.6 ha of potential foraging and shelter habitat, the proposal is unlikely to restrict the conservation of Koala habitat and populations (Objective 1), as an important population of Koalas, or Koala individuals, are unlikely to currently utilize the study area.

The remainder of these objectives are not relevant to the proposed works and their implementation are the responsibility of OEH.

**Conclusion**

Based on the above assessment, it is concluded that the proposed works would not cause a significant impact to the Koala as:

- No signs (including scratches or scats) were observed on and around feed trees during the site inspection (direct observation or remote camera). There are no records from the last 30 years that occur within 5 km of the study area. Therefore it is unlikely that an important population of Koala, or Koala individuals, currently utilize the potential habitat within the study area
- Although the proposed works would remove up to approximately 2.6 ha of potential foraging and shelter habitat, similar habitat is likely to occur in the bushland corridor adjacent to the study area
- The proposed removal of vegetation would not fragment or isolate other potential habitat, as the study area is located on the fringe of the bushland corridor
- The koala habitat assessment tool (EPBC Act Referral Guidelines) determined that the study area did not contain vegetation critical to the survival of the Koala (DotE 2014; **Section 5.4**).

Therefore a referral to the Department of Environment and Energy (DoEE) is not recommended.

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