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# Flora and Fauna Assessment

## Lot 1 // DP 949932

## Taylors Lane, Cambewarra, NSW 2540

Proposed subdivision

Prepared for: Cardno Pty Ltd

**12 March 2019**

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# Glossary and abbreviations

| Abbreviation | Description |
|---|---|
| BC Act | NSW *Biodiversity Conservation Act 2016* |
| EEC | Endangered Ecological Community |
| EP&A Act | NSW *Environmental Planning and Assessment Act 1979* |
| EPBC Act | Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* |
| GHFF | Grey-headed Flying-fox |
| HBT | Hollow Bearing Tree/s |
| LEPB | Large-eared Pied Bat |
| mm/cm/m/km | millimetres/centimetres/metres/kilometres |
| masl | Metres above sea level |
| NPWS | National Parks and Wildlife Service |
| TEC | Threatened Ecological Community, listed as vulnerable, endangered or critically endangered under either the TSC Act and/or EPBC Act |
| TSC Act | NSW *Threatened Species Conservation Act 1995* |
| SGGIW | Spotted Gum - Grey Ironbark - Woollybutt grassy open forest on coastal flats |
| SLEP | Shoalhaven Local Environmental Plan |
| WM Act | *Water Management Act 2000* |
| WoNS | Weeds of National Significance |
| * | Denotes exotic species |

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# Executive summary

This flora and fauna assessment has been undertaken to guide the preparation of a development application relating to the proposed residential subdivision of Lot 1 // DP 949932 Taylors Lane, Cambewarra, NSW. The proposal residential subdivision includes 51 residential properties, and associated roads and infrastructure (**Figure 1.2**).

The study area was subject to grazing and was dominated by exotic grasses, *Axonopus fissifolius** (Narrow-leafed Carpet Grass), *Cenchrus clandestinus** (Kikuyu Grass), *Paspalum dilatatum** (Paspalum), *Sporobolus africanus** (Parramatta Grass), and *Senecio madagascariensis** (Fireweed).

Field survey validated regional vegetation mapping conducted by ELA (2014) and Tozer et al. (2010), and collected site specific ecological data, including target survey for microbats.

Three vegetation types were identified within the study area:

- Spotted Gum - Grey Ironbark - Woollybutt grassy open forest on coastal flats
- Exotic grassland
- Native plantings

No threatened flora species were recorded within the study area. However, five threatened microbat species were recorded on site. Given the disturbed nature of the site, the site provides limited habitat for threatened and migratory species. Significance assessments in accordance with the EPBC Act and Section 5A of the NSW *Environmental Planning and Assessment Act* (EP&A Act) were applied and concluded is not likely to result in a significant impact.

The proposed development within the study area has avoided any significant impacts to native vegetation communities. Recommendations to reduce the impact on the environment include:

- development and implementation of a Vegetation Management Plan for the Vegetated Riparian Zone
- retaining a corridor of trees along Taylors Lane
- including measures to maintain water quality in the farm dam
- develop a tree clearing protocol for very large and hollow bearing trees (HBTs), including an ecologist to supervise tree clearing, so that fauna can be salvaged and relocated.

# 1 Introduction

## 1.1 Purpose of report and legislative context

This flora and fauna assessment has been undertaken to guide the development of a proposed residential subdivision at Lot 1 // DP949932 Taylors Lane, Cambewarra, NSW. The purpose of this report is to identify and assess the flora and fauna within the study area and the likely impacts of future development. This report addresses the legislative context provided in **Table** 1.1.

**Table 1.1: Legislative framework reviewed in this report**

| Instrument | Considerations | Context |
|---|---|---|
| **Commonwealth** | | |
| *Environment Protection and Biodiversity Conservation* (EPBC) *Act 1999* | Matters of National Environmental Significance | An action will require approval from the Minister if the action has, will have, or is likely to have, a significant impact on a matter of national environmental significance. |
| **State (New South Wales)** | | |
| *Environmental Planning and Assessment* (EP&A) *Act 1979* | Section 5A | Assessment of the potential for an action or activity to have a significant effect on threatened species, populations or ecological communities, or their habitats. |
| *Biosecurity Act 2015* | Priority weeds | Describes the state and regional priorities for weeds in New South Wales. |
| *Threatened Species Conservation* (TSC) *Act 1995*[1] | Schedules 1, 1A, 2 and 3 | Lists threatened species, populations, ecological communities and key threatening processes to be considered under Section 5A EP&A Act. |
| *Water Management* (WM) *Act 2000* | Section 91 | Controlled activity approval is required for activities in, on or under waterfront land. |
| **Local** | | |
| Shoalhaven Local Environmental Plan (SLEP) 2014 | Clause 7.6 – Riparian Land and watercourses | The objective of this clause is to ensure that development does not adversely impact upon riparian lands. It applies to land shown as “riparian land” on the ‘Riparian Land Map’. |
| Shoalhaven Development Control Plan (SDCP) 2009 | Chapter G5: Threatened Species Impact Assessment | This chapter provides information and assistance to applicants and decision makers who may be required to consider the effect of a proposed development, activity or action on threatened species, populations and endangered ecological communities (EECs), or their habitats. |

| Instrument | Considerations | Context |
|---|---|---|
| | Chapter G4 – Tree & Vegetation Management | The purpose of this Chapter is to prescribe trees and other vegetation under clause 5.9(2) of the Shoalhaven Local Environment Plan (SLEP) 2014. |

[1] The *Biodiversity Conservation Act 2016* (BC Act) commenced on the 25th August 2017 repealing the TSC Act. Under the *Biodiversity Conservation (Savings and Transitional) Regulation 2017*, an application for development consent under Part 4 of the EP&A Act made within 3 months of the commencement of the BC Act may be determined under the TSC Act.

## 1.2 Site description

### 1.2.1 Subject site and study area

Following the *Threatened species assessment guidelines: the assessment of significance* (DECC 2007) the subject site is defined as the area 'directly impacted upon by the proposal', and includes all vegetation proposed to be removed following approval of the subdivision. For the purposes of this report, the subject site comprises the development footprint including residential lots, access roads, parks and on site detention (OSD) basins (**Figure 1.1**).

The study area is defined as the subject site and all areas that are indirectly impacted upon by the proposal. The study area was confined to Lot 1 // DP 949932 and is currently grazed by livestock with remnant and planted trees. Pastures were dominated by exotic grass and forb species. Small areas of Spotted Gum - Grey Ironbark - Woollybutt grassy open forest (SGGIW) were present along the southern, western and northern boundaries. The eastern boundary of the study area bisects a farm dam that is situated on a first order watercourse. Native shrubs and tree species have been planted along the first order watercourse.

Within the study area the south western corner was located on the highest point with land gently sloping to the north, east and south from this high point of approximately 62 metres above sea level (masl).

## 1.3 Description of the proposal

The study area is zoned R1 – General Residential, with small areas zoned E2 - Environmental Conservation, E3 – Environmental Management and RU1 – Primary Production, under the Shoalhaven Local Environmental Plan (SLEP) 2014. The site consists of Lot 1 // DP 949932 (12.03 ha). The E2 zoned land contains riparian buffers along two unclassified watercourses, which drain to the west. The E3 zoned land is located in the north eastern corner of the site parallel with Moss Vale Rd. The proposal consists of a residential subdivision which would include approximately 100 residential properties (split over two stages, with the first stage comprising approximately 70 lots) and associated roads and infrastructure (**Figure 1.2**).


**Figure 1.1: Study area and subject site.**


**Figure 1.2: Proposed lot layout, including residential lots, access roads and OSD basin.**

# 2 Methods

## 2.1 Literature and database review

A site-specific literature and database review was undertaken prior to undertaking field survey. The review included desktop analysis of aerial photography and regional scale mapping resources from the following sources:

- NSW Planning Viewer (NSW Dept. of Planning and Environment 2017)
- BioNet Atlas of NSW Wildlife (NSW Office of Environment and Heritage 2017)
- Protected Matters Search Tool (Commonwealth Department of the Environment and Energy 2017)
- Native Vegetation of South East NSW (Tozer et al.2010)
- Biometric Vegetation Compilation for South East Local Land Services (Eco Logical Australia 2014).
- SIX Maps (LPI 2017)

Records of threatened species, populations and migratory species within 5 km of the study area were assessed using the Atlas of NSW Wildlife (OEH 2017) and the EPBC Protected Matters Search Tool (DoEE 2017). Results were consolidated and their likelihood of occurrence assessed by:

- review of location and date of recent (<5 years) and historical (>5-20 years) records
- review of available habitat within the study and surrounding areas
- review of the scientific literature pertaining to each species and population
- applying expert knowledge of each species

Pelagic and shorebird species were disregarded due to the location of the study area.

The potential for each threatened species, population and/or migratory species to occur was then considered and the necessity for targeted field surveys was determined. Following field surveys and review of available habitat within the subject site and study area, the potential for species to use the site and be affected directly or indirectly by the proposed action were considered as either:

- “Recent record” = species has been recorded in the study area within the past 5 years
- “High” = species has previously been recorded in the study area (>5 years ago) or in proximity to (for mobile species), and/or habitat is present that is likely to used by a local population
- “Moderate” = suitable habitat for a species is present onsite but no evidence of a species detected and relatively ***high*** number of recent records (5-20 years) in the locality or species is highly mobile
- “Low” = suitable habitat for a species is present onsite but limited or highly degraded, no evidence of a species detected and relatively ***low*** number of recent records in the locality
- “Not present” – suitable habitat for the species is not present onsite or adequate survey has determined species does not occur in the study area

## 2.2 Field survey

A field survey was undertaken on 10 October 2017 by Bruce Mullins (Principal Ecologist) and Kieren Northam (Ecologist) over twelve person hours. A microbat survey conducted at the time (10-12 October) failed to record any microbats despite the survey team observing microbats in the area, and it was deemed likely that there was a fault with the recording device. Therefore, another survey for microbats was conducted on 24-29 October 2017 (see Section 2.2.2).

Weather conditions on the day were mild, with 5.6 mm rain recorded in the 9 days preceding the survey (**Table 2.1**) (BOM 2017).

**Table 2.1: Daily weather observations at Nowra (13.2 km SSW)**

| Date | Temp (°C) | | Rainfall (mm)[1] | Max wind | |
|---|---|---|---|---|---|
| | Min | Max | | Direction | Speed (km/h) |
| 10/10/2017 | 14.1 | 21.0 | 0 | ENE | 22 |
| 24/10/2017 | 9.2 | 30.0 | No record (0) | WNW | 44 |
| 25/10/2017 | 14.2 | 31.6 | No record (0.2) | WSW | 57 |
| 26/10/2017 | 13.2 | 22.9 | No record (2.0) | SSW | 35 |
| 27/10/2017 | 14.9 | 21.9 | No record (14.8) | S | 44 |
| 28/10/2017 | 12.1 | 30.6 | 0 | W | 35 |
| 29/10/2017 | 17.2 | 31.6 | 0 | WNW | 46 |

Note – no rainfall data was recorded in Nowra from the 24 to 27 October. Data in the Table was recorded in Jervis Bay.

### 2.2.1 Vegetation communities and flora

Field survey involved traversing the study area, whilst recording native and exotic flora species, with a focus on identifying potential habitat for threatened flora species. Nomenclature followed PlantNET (RBGDT 2017).

Field survey was undertaken to validate regional vegetation mapping of Tozer et al (2010) and ELA (2014) to site specific accuracy. Vegetation communities were checked against described TEC listed under either the EPBC Act or the TSC Act and compared to additional vegetation mapping of the study area.

### 2.2.2 Fauna survey and habitat assessment

Fauna habitat searches were conducted for potential foraging, roosting, breeding or nesting habitat of nocturnal and diurnal species. This included inspection for tree hollows, stags, bird nests, possum dreys, decorticating bark, mature / old growth trees, food trees (winter-flowering eucalypts), culverts, dens, dams, riparian areas and refuge habitats of man-made structures.

After the initial microbat survey using a SM2 Songmeter (Wildlife Acoustics) failed, an Anabat Express (Titley Electronics) was placed on site to record the echolocation calls of microbats

from 24 to 29 October 2017. The Anabat was attached to a *Corymbia maculata* in the study area near Taylors Lane.

A frog and spotlight survey were conducted between 7:50 pm and 9:30 pm on 10 October 2017. Frogs were identified by their calls and direct observation.

Primary sources of literature accessed for species nomenclature include:

- Birds - Christidis and Boles (2008)
- Mammals - Van Dyck and Strahan (2008)
- Reptiles and amphibians - Cogger (2014)

### 2.2.3 Survey limitations

The flora survey aimed to record as many species as possible. However, it is acknowledged that this is not a definitive list of the flora within the study area. Additional species would be recorded during a longer survey over various seasons. Nevertheless, the techniques used in this investigation are considered adequate to gather the data necessary to validate the vegetation communities and vegetation condition in the study area, and detect any threatened flora.

A full fauna survey following *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC 2004) was not undertaken as sufficient detail to determine the likelihood of occurrence of threatened and migratory species for this report was achieved through habitat assessment during the field survey.

# 3 Results

## 3.1 Literature and database review

### 3.1.1 Topography, drainage, soils and biodiversity layer

Two first order watercourses flow through study area in a south-easterly and easterly direction towards the farm dam (**Figure 3.1**). The southern first order watercourse has been modified and lacks a defined channel.

Some proposed lots were within waterfront land (i.e. within 40 m of a waterway). This required that the proposal be referred to DPI Water for a Controlled Activity Approval. However, given that the southern watercourse did not functioning as a waterway, with no bed or bank observed, it may be removed with approval from DPI Water.

The WM Act also requires vegetated riparian zones (VRZ) to be established around watercourses. The width of a VRZ is predetermined and standardised for watercourses based on their Strahler order. Given the watercourses are first order streams, a 10 m buffer is required on either side of the channel (**Figure 3.1**).

Regional scale mapping of soil landscape groups by Troedson and Hashimoto (2013) indicated that the soils of the study area occur within an alluvial plain system within the quaternary unit comprising 'Quaternary alluvial and colluvial fan'. This unit consisted of fluvial sand, silt, gravel and clay.

### 3.1.2 Threatened species, populations and migratory species

A search of relevant databases and literature identified a potential 32 threatened species (pelagic and shorebirds were not included) in the locality including 11 threatened flora species and 21 threatened fauna species (12 birds (of which three are migratory), eight microbats, one megabat, two arboreal/semi-arboreal mammals, one ground-dwelling mammal and one amphibian) within 5 km of the study area (**Figure 3.2**)

The likelihood of occurrence analysis undertaken prior to the field survey reduced the primary list to ten threatened species that had recently been recorded or had a 'moderate' or 'high' potential to use the study area, and thus may have been impacted by the proposed works (**Appendix A**).


**Figure 3.1: Strahler stream order classification for the study area**

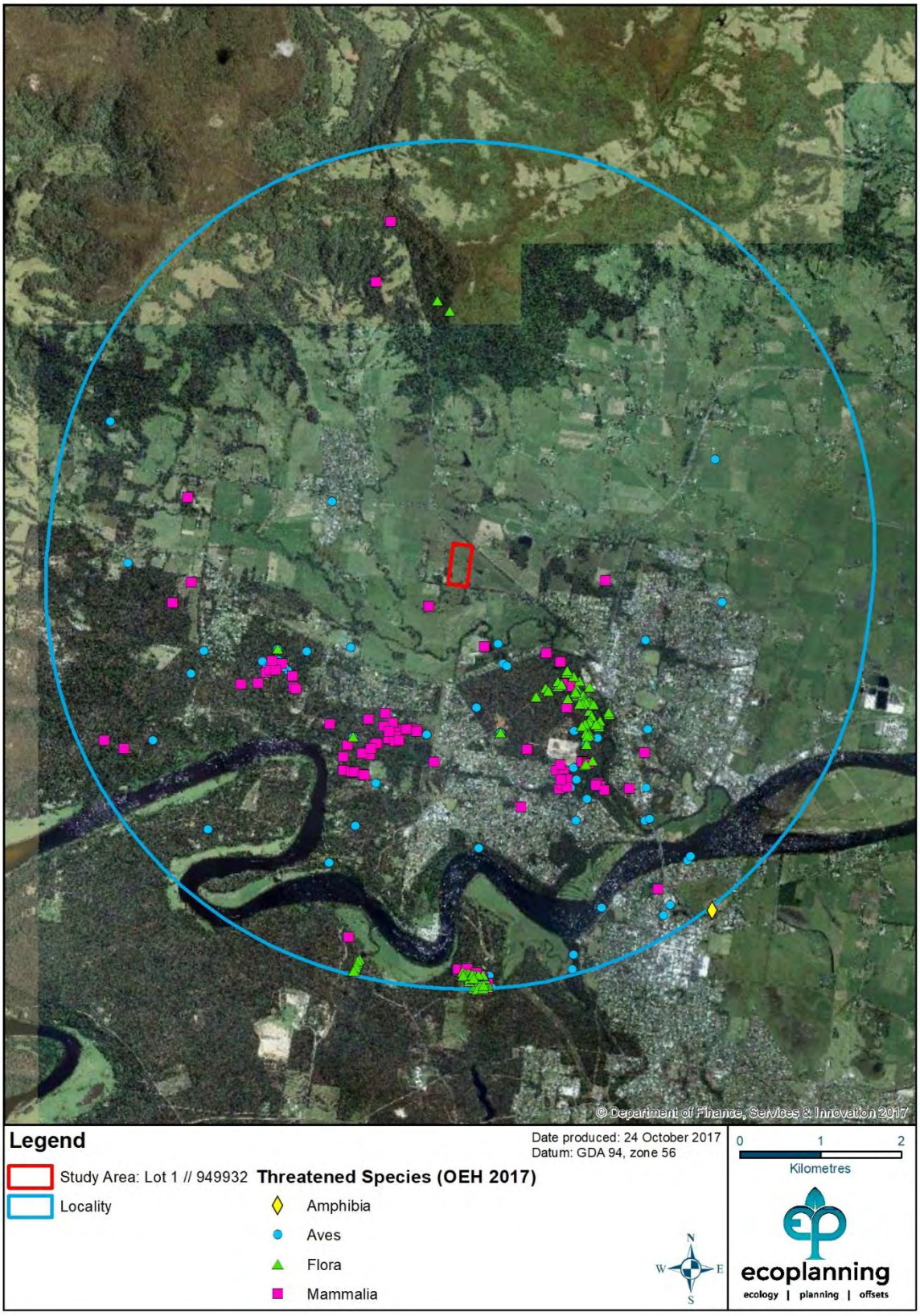


**Figure 3.2: Threatened species records within the locality (5 km).**

### 3.1.3 Vegetation and threatened ecological communities

Tozer et al (2010) mapped two vegetation types within the study area (**Figure 3.3**):

- Currambene-Batemans Lowlands Forest, p85; and
- Illawarra Gully Wet Forest, p99.

ELA (2014) mapped Plant Community Types and identified one native vegetation community within the study area (ELA 2014):

- Spotted Gum – Grey Ironbark – Woollybutt grassy open forest on coastal flats (PCT 1212)

## 3.2 Field survey

### 3.2.1 Vegetation communities and flora species

Field survey confirmed mapping by ELA (2014) and identified one native vegetation community within the study area; Spotted Gum – Grey Ironbark – Woollybutt grassy open forest on coastal flats (PCT 1212) (**Figure 3.4**). The remainder of the study area consisted of exotic pasture/grassland and planted native vegetation. The vegetation had been modified by agricultural practices (grazing and pasture improvement), reducing the structural complexity and diversity of the community.

The site contained several very large trees (particularly *C. maculata*), eight of which were hollow bearing. Hollow bearing trees (HBTs) provide habitat for a wide range of birds, mammals, amphibians and reptiles. A farm dam with an interrupted fringe of aquatic vegetation, was also in the study area.

*'Spotted Gum – Grey Ironbark – Woollybutt grassy open forest (SGGIW)'*

This community occurred in a highly modified state. A long grazing history of the site had virtually removed the cover of native shrubs and ground cover, leaving a canopy of *Corymbia maculata* (Spotted Gum) and *Eucalyptus paniculata* (Grey Ironbark) (**Figure 3.5**). Beneath the canopy the ground cover was dominated by *Microlaena stipoides* subsp. *stipoides* (Weeping Grass) and *Sporobolus* sp., with *Commelina cyanea* and *Dichondra repens* (Kidney Weed) also occurring. Species such as *Oplismenus aemulus, Cenchrus clandestinus** (Kikuyu), *Sida rhombifolia** (Paddy's Lucerne), *Hypochaeris radicata** (Flatweed), and *Senecio madagascariensis** (Fireweed) were also present. A total of 1.13 ha of SGGIW occurred on site, comprising 9.5% of the study area.

### 3.2.2 Other vegetation

#### *Farm dam*

One farm dam was present within the study area (**Figure 3.5**), although the eastern boundary of the site bisected the dam. Macrophytes including *Typha orientalis* (Typha) and *Eleocharis sphacelata* were common around the fringe of the farm dam in shallow waters, and had been planted to stabilise the bank. These plants formed a narrow band around the edge of the dam. Other aquatic plants, such as *Alisma plantago-aquatica* (Water Plantain), also occurred. A total of 0.04 ha of this vegetation type occurred on site, most of this vegetation type extended into the adjacent lot to the east.

*Exotic grassland*

Most of the vegetation in the study area consisted of pasture dominated by exotic grasses and herbaceous weeds including *Axonopus fissifolius** (Narrow-leafed Carpet Grass), *Cenchrus clandestinus** (Kikuyu), *Paspalum dilatatum** (Paspalum), *Plantago lanceolata** (Plantain), *Sporobolus africanus** (Parramatta Grass), *Sida rhombifolia** (Paddy's Lucerne), *Hypochaeris radicata** (Flatweed) *and Senecio madagascariensis** (Fireweed), (**Figure 3.6**). This vegetation community occurred over 10.39 ha, or approximately 86% of the study area.

*Native plantings*

A small area of predominately planted vegetation was present along the watercourses and centre of the site (**Figure 3.6**). This vegetation type was characterised by plantings of non-local canopy species including *Acacia* sp. and *Eucalyptus paniculata*. This vegetation type occurs over 0.46 ha.

### 3.2.3 Waterways

The waterways on site were highly modified and surrounded by grassland/pasture and planted trees. The vegetation along the creek bank and surrounds comprises mostly exotic species, and has minor visible structural impacts from livestock. A managed vegetated riparian zone may be required to buffer streams in accordance with the Strahler order.

The southern first order watercourse lacks a defined bank and bed due to the pasture improvement and grazing history. Both watercourses were dry during the survey.

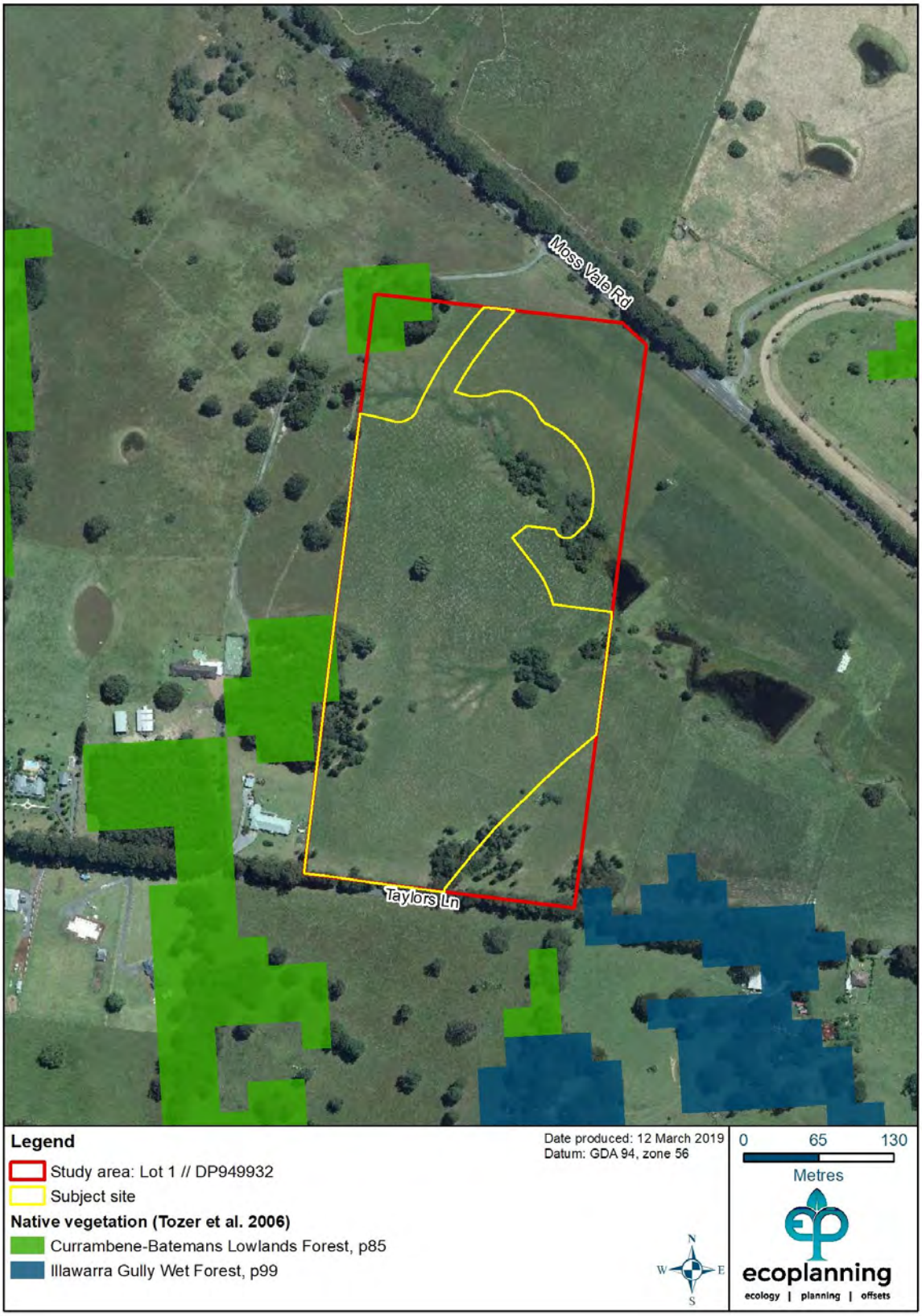


**Figure 3.3: Vegetation communities by Tozer et al (2010).**


**Figure 3.4: Field validated vegetation (from ELA 2014) in the study area.**

**Figure 3.5: Native vegetation 'Spotted Gum – Grey Ironbark – Woollybutt grassy open forest' on the western boundary of the study area.**

**Figure 3.6: Other vegetation - 'exotic grassland' and 'native plantings' - surrounding first order watercourse, with the farm dam in the distance.**

### 3.2.4 Flora species

A total of 62 flora species were identified within the study area during field investigations, of which 32 were exotic or planted species (**Appendix B**). No individuals or populations of threatened flora species were recorded or were expected to occur in the study area.

Three priority weeds listed under the NSW *Biosecurity Act 2015* for Shoalhaven were recorded in the study area, all of which were Weeds of National Significance (WoNS) (**Table 3.1**).

**Table 3.1: Priority weeds and Weeds of National Significance (WoNS)**

| Common name | Scientific name | WoNS[1] | Duty |
|---|---|---|---|
| Lantana | *Lantana camara** | Y | **Mandatory Measure**<br>*Must not be imported into the State or sold*<br>**Regional Recommended Measure**<br>*Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Exclusion zone: The plant should be eradicated from the land and the land kept free of the plant.* |
| Blackberry | *Rubus fruticosus* species aggregate | Y | **Mandatory Measure**<br>*Must not be imported into the State or sold* |
| Fireweed | *Senecio madagascariensis** | Y | **Mandatory Measure**<br>*Must not be imported into the State or sold*<br>**Regional Recommended Measure**<br>*Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Exclusion zone: The plant should be eradicated from the land and the land kept free of the plant.* |

[1] http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html

### 3.2.5 Fauna and fauna habitat

Twenty-four birds, five frogs and 13 mammals (12 microbats) were observed during the survey (**Appendix B**).

Five threatened microbats were recorded on site:

- *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat)
- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
- *Mormopterus norfolkensis* (Eastern Freetail-bat)
- *Chalinolobus dwyeri* (Large-eared Pied Bat)
- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat)

Fauna habitat features were limited throughout the site and included:

- HBTs
- Woodland
- Grassland
- An artificial wetland (farm dam) and creek lines

The SGGIW and planted native trees provided potential foraging, roosting and nesting habitat for bird and mammal species and the farm dam provided potential habitat for reptiles, birds and amphibians (**Table 3.2**). Eight HBTs were located within the study area in the SGGIW (**Figure 3.4**).

**Table 3.2: Key fauna habitat features of relevance to fauna in the study area**

| Habitat features | Fauna species |
|---|---|
| Hollow bearing trees | Birds, arboreal and flying mammals, reptiles and frogs |
| Woodland | Birds, mammals, reptiles |
| Grassland | Birds, terrestrial mammals, reptiles, frogs |
| Artificial wetland and creeks | Amphibians; birds, reptiles, terrestrial and flying mammals |

# 4 Impact assessment

This section outlines the potential direct and indirect impacts of the development on the ecological values of the study area.

## 4.1 Direct impacts

### 4.1.1 Vegetation clearing

The subject site (i.e. the area of direct impact) comprises a total of 8.02 ha, which equals approximately 67% of land within the study area. The proposal will remove 0.34 ha of native vegetation and the upper section of one first order watercourse (if approved) (**Figure 4.1** and **Table 4.1**). A majority of the vegetation to be impacted by the proposed development consists of exotic grassland (7.30 ha or 91%). The farm dam in the study area will not be removed under the current proposal.

**Table 4.1: Area of impact on vegetation in the subject site.**

| Vegetation type | Vegetation zone (condition class) | Study area (ha) | Development footprint (ha) |
|---|---|---|---|
| Native vegetation | Spotted Gum – Grey Ironbark – Woollybutt grassy open forest | 1.13 | 0.34 |
| Other vegetation | Native plantings | 0.46 | 0.38 |
| | Exotic grassland | 10.39 | 7.30 |
| | Artificial wetland | 0.04 | 0 |
| | ***Total vegetation*** | ***12.03*** | ***8.02*** |

### 4.1.2 Loss of fauna habitat

The proposal will remove potential foraging, roosting and nesting habitat. This consists of woodland, HBTs and grassland. Grassland and woodland provides potential foraging habitat for bird species common to rural environments.

Field surveys identified eight HBTs within the study area, with one located within proposed residential lots or roads. An additional two are located within the proposed parkland on the western boundary. HBTs are a limited resource across the landscape, and take over 100 years to develop. Four HBTs are concentrated within the north-western corner of the study area, another near the southern boundary and another in open space will not be impacted (**Figure 4.1**). A further two HBTs on the western boundary will be retained within a park. A tree removal protocol must be prepared to remove the HBT. This requires that a qualified ecologist be engaged to supervise tree clearing on site to provide advice and salvage and relocate displaced fauna.

Approximately 70% of the SGGIW on site will be retained in the study area. Given the already degraded, under-scrubbed nature of SGGIW, this vegetation type does not represent an area of high ecological value. As a result, impacts on threatened species due to loss of habitat are reduced.

Five threatened microbats have been recorded in the study area, including three that roost in tree hollows. Therefore, the HBTs are of high ecological value.

The degree of clearing proposed along Taylors Lane is not clear. However, a corridor of trees should be maintained along the road to retain connectivity between vegetation to the east and west.

## 4.2 Indirect impacts

It is difficult to quantify indirect impacts of the proposed development, but these may include impacts such as erosion and reduced water quality in the farm dam that may be associated with the construction phase of the project and urbanisation of the area.

Urbanisation is unlikely to further degrade the ground cover in retained patches of native vegetation. There is an opportunity for development to include landscape plantings consistent with the original vegetation community. This includes revegetation and management of the riparian zone along the northern watercourse.


**Figure 4.1: Direct impacts of the proposal.**

## 4.3 Impacts to listed species and ecological communities

### 4.3.1 Commonwealth considerations

The significant impact criteria were applied to *Chalinolobus dwyeri* (Large-eared Pied Bat (LEPB)) and *Pteropus poliocephalus* (Grey-headed Flying-fox (GHFF)), as these species were either recorded on site or were likely to occur (**Appendix D**). The proposal is not likely to have a significant impact on LEPB and GHFF given that no roosting habitat would be impacted, only a small area of potential foraging habitat is to be removed, that potential habitat will remain within the study area and in adjacent areas, and that these species are highly mobile.

### 4.3.2 State considerations

*Environmental Planning and Assessment (EP&A) Act 1979*

The Assessment of Significance (AoS) was applied to:

- *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat)
- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
- *Mormopterus norfolkensis* (Eastern Freetail-bat)
- *Chalinolobus dwyeri* (Large-eared Pied Bat)
- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat)
- *Myotis macropus* (Southern Myotis)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)
- *Pteropus poliocephalus* (Grey-headed Flying-fox).

The AoS concluded that the proposal is unlikely to significantly impact these threatened species given that a small area of potential foraging habitat is to be removed, that potential habitat will remain within the study area and in adjacent areas, and that these species are highly mobile (**Appendix C**).

*Water Management Act 2000*

In accordance with the *Water Management Act 2000* (WM Act), activities carried out in or on waterfront land are regulated. Several proposed lots appear to be within waterfront land (i.e. within 40 m of a waterway), which would require that the proposal be referred to DPI Water for a Controlled Activity Approval. The southern first order stream does not appear to be functioning as a water way, with no bed or bank observed. Consequently, it may be possible to remove this watercourse with approval from DPI Water.

The WM Act requires vegetated riparian zones (VRZ) to be established and maintained through a VMP. The width of a VRZ is predetermined and standardised for watercourses based on their Strahler order. Retained first order streams on site will require a 10 m on either side of the channel.

# 5 Conclusion and recommendations

The proposed development will subdivide the subject site into approximately 51 residential lots (split over three stages). It will directly impact on 7.30 ha of land, which consists of both native and exotic vegetation communities. A degraded form of SGGIW was mapped within the study area, however, it has been underscrubbed and subject to years of grazing which has simplified the community, removing the mid story. Most of the vegetation in the study area comprises exotic grassland, while a farm dam (which will not be impacted) is located on the eastern boundary of the study area.

Following field survey, no threatened flora species were considered likely to occur in the study area. Five threatened microbats were recorded on site, three of which roost and breed in tree hollows.

Recommended measures to reduce or mitigate the potential impact of the proposal on the environment include:

- Include measures to maintain water quality and habitat values around the farm dam.
- Retain a corridor of trees along Taylors Lane
- Prepare and implement a Vegetation Management Plan for the Vegetated Riparian Zone around retained first order streams.
- Use species consistent with the Spotted Gum – Grey Ironbark – Woollybutt grassy open forest on coastal flats native vegetation community in landscape plantings.
- Develop a tree clearing protocol for very large and HBTs, including an ecologist to supervise tree clearing, so that fauna can be salvaged and relocated.

Based on the current assessment and recommended mitigation measures no significant impact on any threatened species or vegetation communities are likely and no further assessment under the EPBC Act nor EP&A Act / TSC Act is necessary.

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# Appendix A: Species likelihood of occurrence

The potential for each threatened species, population and/or migratory species to occur was then considered and the necessity for targeted field surveys was determined. Following field surveys and review of available habitat within the subject site and study area, the potential for species to use the site and be affected directly or indirectly by the proposed action were considered as either:

- "Recent record" = species has been recorded in the study area within the past 5 years
- "High" = species has previously been recorded in the study area (>5 years ago) or in proximity to (for mobile species), and/or habitat is present that is likely to used by a local population
- "Moderate" = suitable habitat for a species is present onsite but no evidence of a species detected and relatively high number of recent records (5-20 years) in the locality or species is highly mobile
- "Low" = suitable habitat for a species is present onsite but limited or highly degraded, no evidence of a species detected and relatively low number of recent records in the locality
- "Not present" – suitable habitat for the species is not present onsite or adequate survey has determined species does not occur in the study area

| *Scientific Name* Common Name | Legal status | Number of records | Closest record and date | Most recent and proximity | Likelihood of occurrence | | Need for an Assessment of Significance |
|---|---|---|---|---|---|---|---|
| | | | | | Prior to field assessment | Post field assessment | |
| **KINGDOM: Animalia; CLASS: Amphibia** | | | | | | | |
| *Litoria aurea* Green and Golden Bell Frog | TSC Act: E EPBC Act: V | 1 | 5.0 km (1/11/2010) | 1/11/2010 (5.0 km) | Low | Low | No |
| **KINGDOM: Animalia; CLASS: Aves** | | | | | | | |
| *Burhinus grallarius* Bush Stone-curlew | TSC Act: E | 1 | 4.35 km (24/01/2007) | 24/01/2007 (4.35 km) | Low | Low | No |
| *Callocephalon fimbriatum* Gang-gang Cockatoo | TSC Act: V | 13 | 1.06 km (15/03/2005) | 5/03/2015 (1.51 km) | Low | Low | No |
| *Calyptorhynchus lathami* Glossy Black-Cockatoo | TSC Act: V | 156 | 0.81 km (22/05/1998) | 3/03/2017 (2.87 km) | Low | Low | No |
| *Daphoenositta chrysoptera* Varied Sittella | TSC Act: V | 6 | 1.88 km (05/07/2004) | 4/04/2016 (3.43 km) | Low | Low | No |
| *Haliaeetus leucogaster* White-bellied Sea-Eagle | TSC Act: V EPBC Act: C | 4 | 1.88 km (1/05/2004) | 12/08/2012 (4.76 km) | Low | Low | No |
| *Hydroprogne caspia* Caspian Tern | EPBC Act: C, J | 1 | 4.76 km (12/08/2012) | 12/08/2012 (4.76 km) | Low | Low | No |
| *Ixobrychus flavicollis* Black Bittern | TSC Act: V | 1 | 4.93 km (8/02/2009) | 8/02/2009 (4.93km) | Low | Low | No |
| *Lophoictinia isura* Square-tailed Kite | TSC Act: V | 7 | 1.59 km (6/01/2002) | 12/07/2013 (4.37 km) | Low | Low | No |
| *Ninox strenua* Powerful Owl | TSC Act: V | 19 | 2.30 km (10/03/2002) | 4/04/2016 (3.43 km) | Low | Low | No |

| *Scientific Name* Common Name | Legal status | Number of records | Closest record and date | Most recent and proximity | Likelihood of occurrence | | Need for an Assessment of Significance |
|---|---|---|---|---|---|---|---|
| | | | | | Prior to field assessment | Post field assessment | |
| *Pandion cristatus* Eastern Osprey | TSC Act: V | 2 | 4.33 km (17/06/2010) | 17/06/2010 (4.33 km) | Low | Low | No |
| *Tyto tenebricosa* Sooty Owl | TSC Act: V | 4 | 2.67 km (1/10/2003) | 1/07/2004 (2.67 km) | Low | Low | No |
| **KINGDOM: Animalia; CLASS: Mammalia** | | | | | | | |
| *Cercartetus nanus* Eastern Pygmy-possum | TSC Act: V | 4 | 2.25 km (15/03/2005) | 15/03/2005 (2.25 km) | Low | Low | No |
| *Chalinolobus dwyeri* Large-eared Pied Bat | TSC Act: V EPBC Act: V | 4 | 1.88 km (15/03/2005) | 4/04/2016 (3.43 km) | Medium | Present | Yes |
| *Dasyurus maculatus* Spotted-tailed Quoll | TSC Act: V EPBC Act: E | 3 | 3.35 km (12/12/2002) | 1/07/2004 (3.35 km) | Low | Low | No |
| *Falsistrellus tasmaniensis* Eastern False Pipistrelle | TSC Act: V | 2 | 3.02 km (15/12/2015) | 4/04/2016 (3.43 km) | Medium | Present | Yes |
| *Miniopterus australis* Little Bentwing-bat | TSC Act: V | 1 | 3.43 km (4/04/2016) | 4/04/2016 (3.43 km) | Medium | Low | No |
| *Miniopterus schreibersii oceanensis* Eastern Bentwing-bat | TSC Act: V | 5 | 1.88 km (24/09/2008) | 4/04/2016 (3.43 km) | Medium | Present | Yes |
| *Micronomus (Mormopterus) norfolkensis* East-coast Freetail Bat | TSC Act: V | 4 | 0.78 km (1/04/2005) | 4/04/2016 (3.43 km) | Medium | Present | Yes |
| *Myotis macropus* Southern Myotis | TSC Act: V | 11 | 1.80 km (12/04/2010) | 4/04/2016 (3.43 km) | Medium | Medium | Yes |
| *Petaurus australis* Yellow-bellied Glider | TSC Act: V | 117 | 1.29 km (30/06/2002) | 12/04/2010 (1.88 km) | Medium | Low | No |

| *Scientific Name* Common Name | Legal status | Number of records | Closest record and date | Most recent and proximity | Likelihood of occurrence | | Need for an Assessment of Significance |
|---|---|---|---|---|---|---|---|
| | | | | | Prior to field assessment | Post field assessment | |
| *Pteropus poliocephalus* Grey-headed Flying-fox | TSC Act: V EPBC Act: V | 98667 | 0.37 km (1/10/2003) | 4/04/2016 (3.43 km) | Medium | Medium | Yes |
| *Saccolaimus flaviventris* Yellow-bellied Sheathtail-bat | TSC Act: V | 2 | 1.70 km (19/02/2007) | 4/04/2016 (3.43 km) | Medium | Present | Yes |
| *Scoteanax rueppellii* Greater Broad-nosed Bat | TSC Act: V | 4 | 1.88 km (1/10/2003) | 4/04/2016 (3.43 km) | Medium | Medium | Yes |
| **KINGDOM: Plantae** | | | | | | | |
| *Cryptostylis hunteriana* Leafless Tongue Orchid | TSC Act: V EPBC Act: V | 3 | 2.27 km (5/07/2004) | 5/07/2004 (2.27 km) | Low | Not present | No |
| *Eucalyptus langleyi* Albatross Mallee | TSC Act: E2 EPBC Act: V | 56 | 1.83 km (27/08/2004) | 1/01/2010 (1.83 km) | Low | Not present | No |
| *Eucalyptus langleyi* population north of the Shoalhaven River in the Shoalhaven local government area | TSC Act: E2 EPBC Act: V | 28 | 1.83 km (27/08/2004) | 31/10/2010 (1.83 km) | Low | Not present | No |
| *Genoplesium baueri* Bauer's Midge Orchid | TSC Act: E EPBC Act: E | 26 | 1.87 km (24/08/2005) | 8/0/2010 (1.87 km) | Low | Not present | No |
| *Hibbertia stricta* subsp. *furcatula* | TSC Act: E | 46 | 1.63 km (1/01/2010) | 1/08/2011 (1.86 km) | Low | Not present | No |
| *Triplarina nowraensis* Nowra Heath Myrtle | TSC Act: E EPBC Act: E | 93 | 4.78 km (1/11/1998) | 7/04/2014 (4.96 km) | Low | Not present | No |
| *Zieria baeuerlenii* Bomaderry Zieria | TSC Act: E EPBC Act: E | 1849 | 1.63 km (15/04/2004) | 1/05/2014 (1.63 km) | Low | Not present | No |

| *Scientific Name* Common Name | Legal status | Number of records | Closest record and date | Most recent and proximity | Likelihood of occurrence | | Need for an Assessment of Significance |
|---|---|---|---|---|---|---|---|
| | | | | | Prior to field assessment | Post field assessment | |
| *Zieria tuberculata* Warty Zieria | TSC Act: V EPBC Act: V | 102 | 2.88 km (24/10/2012) | 24/10/2012 (2.880 km) | Low | Not present | No |
| Coastal Upland Swamps in the Sydney Basin Bioregion | TSC Act: E EPBC Act: E | | | | | Not present | No |
| Illawarra and south coast lowland forest and woodland ecological community | TSC Act: E EPBC Act: CE | | | | | Not present | No |
| Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion | TSC Act: E EPBC Act: E | | | | | Not present | No |

Unless other stated, text is taken from the OEH Threatened Species (http://www.environment.nsw.gov.au/threatenedspecies/); Legal Status codes from the Atlas of NSW Wildlife: V = Vulnerable, E = Endangered, E2 = Endangered Population, CE = Critically Endangered, C = China and Australia Migratory Bird Agreement (CAMBA), J = Japan and Australia Migratory Bird Agreement (JAMBA), K = Republic of Korea and Australia Migratory Bird Agreement (ROKAMBA); TSC Act = NSW *Threatened Species Conservation Act 1995,* EPBC Act = Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*

# Appendix B: Flora and fauna species inventory

## Flora

| Species | Common Name | SGGIW | Grassland | Dam and drainage line |
|---|---|---|---|---|
| **Ageratina adenophora* | Crofton Weed | | | X |
| **Andropogon virginicus* | Whisky Grass | | X | |
| **Axonopus fissifolius* | Carpet grass | | X | X |
| **Bidens pilosa* | Cobblers Pegs | X | | |
| **Briza maxima* | Quaking Grass | | X | |
| **Briza minor* | Shivery Grass | | X | X |
| **Briza subaristata* | | | | X |
| **Cenchrus clandestinus* | Kikuyu Grass | X | X | X |
| **Centaurium erythraea* | Common Centaury | | X | |
| **Cerastium glomeratum* | Mouse-ear Chickweed | X | X | X |
| **Cyperus* sp. | | | X | |
| **Eragrostis* sp. | Lovegrass | | X | |
| **Gamochaeta* sp. | | | X | X |
| **Holcus lanatus* | Yorkshire Fog | | | X |
| **Hypochaeris radicata* | Catsear | X | X | X |
| **Lantana camara* | Lantana | X | | |
| **Paspalum dilatatum* | Paspalum | | X | X |
| **Plantago lanceolata* | Lamb's Tongues | | X | X |
| **Romulea rosea* | Onion grass | | | |
| **Rubus fruticosus* (complex) | Blackberry | | | X |
| **Senecio madagascariensis* | Fireweed | X | X | X |
| **Setaria parviflora* | Pigeon Grass | X | | |
| **Sida rhombifolia* | Paddy's Lucerne | X | | X |
| **Sisyrinchium micranthum* | Blue Pigroot | | X | |
| **Solanum mauritianum* | Wild Tobacco Bush | X | | |
| **Solanum pseudocapsicum* | Madeira Winter | X | | |
| **Sporobolus africanus* | Parramatta Grass | | X | |
| **Sporobolus* sp. | | X | | |
| **Trifolium dubium* | Yellow Suckling Clover | | X | |
| **Trifolium repens* | White Clover | | X | |
| **Trifolium* sp. | | | X | X |
| **Vulpia* sp. | | | X | X |
| *Acacia* sp. | | X | | |
| *Acacia binervia* | | | | X |
| *Carex* sp. | | | X | |
| *Centella asiatica* | Indian Pennywort | | X | |
| *Commelina cyanea* | | X | | |

| Species | Common Name | SGGIW | Grassland | Dam and drainage line |
|---|---|---|---|---|
| *Corymbia maculata* | Spotted Gum | X | | |
| *Dichondra repens* | Kidney Weed | X | | |
| *Dichopogon fimbriatus* | Nodding Chocolate Lily | | X | |
| *Einadia hastata* | Berry Saltbush | X | | |
| *Einadia* sp. *(c)* | | X | | |
| *Eleocharis sphacelata* | | | | X |
| *Entolasia stricta* | | X | | |
| *Eucalyptus paniculata* | Grey Ironbark | X | | X |
| *Euchiton sphaericus* | | | X | |
| *Glycine tabacina* | | X | | |
| *Hardenbergia violacea* | False Sarsaparilla | X | | |
| *Juncus* sp. | | | X | X |
| *Lomandra filiformis* | | | | X |
| *Lomandra multiflora* | | | | X |
| *Marsdenia* sp. | | X | | |
| *Microlaena stipoides* | Weeping Grass | X | X | |
| *Oplismenus aemulus* | Australian Basket Grass | X | | |
| *Oxalis* sp. | | X | | |
| *Parsonsia straminea* | Common Silkpod | | | X |
| *Persicaria decipiens* | Slender Knotweed | | | X |
| *Pittosporum undulatum* | Sweet Pittosporum | X | | X |
| *Pteridium esculentum* | Bracken | | | X |
| *Syncarpia glomulifera* | Turpentine | X | | X |
| *Typha orientalis* | Cumbungi | | | X |
| *Zornia dyctiocarpa* | Zornia | | X | |

An '*' or '#' preceding the species name denotes an exotic species or planted specimen, respectively

# Fauna

| Species Name | Common Name |
|---|---|
| **Birds** | |
| *Acanthiza nana* | Yellow Thornbill |
| *Acrocephalus australis* | Australian Reed Warbler |
| *Alisterus scapularis* | King Parrot |
| *Anthochaera carunculata* | Red Wattlebird |
| *Bubulucus (Ardea) ibis* | Cattle Egret |
| *Cacatua sanguinea* | Little Corella |
| *Calyptorhynchus funereus* | Yellow-tailed Black Cockatoo |
| *Corvus coronoides* | Australian Raven |
| *Cracticus tibicen* | Australian Magpie |
| *Dacelo novaeguineae* | Laughing Kookaburra |

| Species Name | Common Name |
|---|---|
| *Egretta novaehollandiae* | White-faced Heron |
| *Eolophus rosiecapilla* | Galah |
| *Eurystomus orientalis* | Dollarbird |
| *Grallina cyanoleuca* | Magpie-lark |
| *Malurus cyaneus* | Superb Fairy-wren |
| *Manorina melanocephala* | Noisy Miner |
| *Neochmia temporalis* | Red-browed Finch |
| *Platycercus eximius* | Eastern Rosella |
| *Porphyrio porphyrio* | Purple Swamphen |
| *Rhipidura leucophrys* | Willie Wagtail |
| *Scythrops novaehollandiae* | Channel-billed Cuckoo |
| *Todiramphus sanctus* | Sacred Kingfisher |
| *Trichoglossus moluccanus* | Rainbow Lorikeet |
| *Zosterops lateralis* | Silvereye |
| **Frogs** | |
| *Crinia signifera* | Common Eastern Froglet |
| *Limnodynastes peronii* | Striped Marsh Frog |
| *Litoria fallax* | Dwarf Tree Frog |
| *Litoria peronii* | Peron's Tree Frog |
| *Litoria verreauxii* | Verreaux's Tree Frog |
| **Mammals** | |
| *Austronomus australis* | White-striped Freetail Bat |
| *Chalinolobus dwyeri* | Large-eared Pied Bat |
| *Chalinolobus gouldii* | Gould's Wattled Bat |
| *Chalinolobus morio* | Chocolate Wattled Bat |
| *Falsistrellus tasmaniensis* | Eastern False Pipistrelle |
| *Micronomus norfolkensis* | East-coast Freetail Bat |
| *Miniopterus (schreibersii) orianae oceansis* | Eastern Bentwing Bat |
| *Pseudocheirus peregrinus* | Common Ringtail Possum |
| *Rhinolophus megaphyllus* | Eastern Horseshoe Bat |
| *Scotorepens orion* | Eastern Broadnosed Bat |
| *Vespadelus darlingtoni* | Large Forest Bat |
| *Vespadelus vulturnus* | Little Forest Bat |

# Appendix C: State listings under the TSC Act

For the purposes of s5A of EP&A Act and, in particular, the administration of sections 78A, 79B, 79C, 111 and 112, the following factors and any assessment guidelines must be taken into account in deciding whether there is likely to be a significant impact on threatened species, populations or ecological communities, or their habitats. The below s5A assessments have been prepared in accordance with the appropriate guidelines (DECC 2007).

*Microchiropteran Bats*

***Hollow roosting***

Eastern False Pipistrelle (*Falsistrellus tasmaniensis)*
Eastern False Pipistrelle is found on the south-east coast and ranges from Queensland to Tasmania. It prefers moist habitats with large trees (>20 m) and generally roosts in eucalypt hollows but has been found under loose bark and in buildings (OEH 2017). It typically forages for insects above or just below the tree canopy.

Eastern Freetail-bat (*Mormopterus norfolkensis*)
Eastern Freetail Bat is found along the east coast of NSW. It inhabits dry woodlands and forests, and swamp forests throughout its range. It is often a solitary roosting species, where it will mostly roost in tree hollows, but will also use man-made structures (OEH 2017b).

Great Broad-nosed Bat *(Scoteanax rueppellii*)
Greater Board-nosed bat is found in gullies and river systems that drain the Great Diving Range extending to the coastline. It uses various habitats including woodlands, rainforest and dry eucalypt but most common in tall wet forest. It typically roosts in tree hollows but has been found in man-made structures. Open woodland habitat suits the foraging patterns of this species (OEH 2017).

Southern Myotis *(Myotis macropus)*
Southern Myotis is found along the coastal band from western Victoria to north-west Australia. It is rarely found more than 100 km inland and lives close to water. It generally roosts in caves, tree hollows, dense foliage and man made structures (OEH 2017)

Yellow-bellied Sheathtail-bat *(Saccolaimus flaviventris)*
Yellow-bellied Sheathtail-bat is found over much of NSW and extends into most of Victoria and adjacent South Australia. It roosts both singly or in groups in tree hollows, man-made structures and mammal burrows. Foraging habitat is wide ranging with and without trees (OEH 2017)

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 these microbat species would include a substantial loss and/or fragmentation of foraging habitat and pesticide/herbicide usage.

The proposal will remove 0.34 ha of SGGIW in which one large HBT occurs on the western boundary in the impact area. HBTs provide foraging, roosting and breeding habitat for these species. There were a total of eight HBTs on site and an additional two observed outside the study area along Taylors Lane and adjoining property. Seven HBTs will be retained in the study area, therefore, it is unlikely that the small area of habitat to be removed would place the local population of these 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, these threatened species are not endangered populations.

*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, none of these threatened bat species form a threatened 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;*

The proposal will remove 0.34 ha of SGGIW and potentially several HBTs, representing foraging and roosting habitat for these species. This area includes potential foraging and roosting habitat. Seven HBTs will be retained in the study area.

*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 vegetation being removed occurs on the edge of a small patch of remnant vegetation, and, therefore, will not be fragmented. All bat species are mobile, therefore, the proposal should not fragment or isolate their habitat.

*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 small area of foraging to be removed by the proposal is unlikely to be important to these microbat species. Seven HBTs will be retained in the study area.

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

These species are not eligible for declaration of critical habitat as they are not listed as endangered under Schedule 1 of the TSC Act (1995) (DEC 2006). Therefore, there are no areas of 'critical habitat' identified under the TSC Act for these microbats.

*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 these species.

*g) Whether the action proposed constitutes or is part of a Key Threatening Process (KTP) or is likely to result in the operation of, or increase the impact of, a KTP.*

The Key Threatening Processes (KTP) relevant to this proposal is clearing of native vegetation.

*Conclusion*

The proposed development will not result in a significant impact on Eastern False Pipistrelle, Eastern Freetail-bat, Greater Broad-nosed Bat, Southern Myotis and Yellow-bellied Sheathtail-bat given that:

- the proposed works will only remove a small area of foraging habitat
- the works will not isolate an area of known habitat from other interconnecting areas of potential habitat for these highly mobile species
- much larger areas of more suitable foraging habitat are present nearby.

HBTs represent important roosting and breeding habitat for these species. Removal of HBTs requires a tree clearance protocol, which must be adhered. In the event of HBT removal, a significant impact is considered unlikely due to the single HBT to be removed and the disturbed nature of the vegetation. Seven HBTs will be retained outside residential lots.

Therefore, a Species Impact Statement (SIS) is not required for the proposed development with respect to these species.

***Cave Roosting***

Eastern Bentwing-bat *(Miniopterus schreibersii)*

Eastern Bentwing-bat is generally associated rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland (Churchill 2008). It forages above and below the tree canopy on small insects (Hoye and Hall 2008). This species is known to use caves, old mines, and stormwater channels, under bridges and occasionally buildings for shelter (Hoye and Hall 2008).

Large-eared Pied Bat (*Chalinolobus dwyeri*)

Large-eared Pied Bat is found in areas with extensive cliffs and caves and has a patchy distribution within NSW. It ranges from Rockhampton in Queensland to the NSW Southern Highlands. It roosts in caves, crevices, old mines and Fairy Martin Nests. It frequents low to mid elevation forests close to these features and remains loyal to the same roost over several years (OEH 2017).

*b) 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 these microbat species would include a substantial loss and/or fragmentation of foraging habitat and pesticide/herbicide usage.

The proposal will remove 0.34 ha of SGGIW and may impact several trees representing foraging habitat for these species. These species typically roost within caves and old mines which are not present within the study area. Given the small area of habitat to be removed, that potential habitat will be retained within the study area and in adjacent areas, and that these species are highly mobile, it is unlikely that the proposal would place the local population of these 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, these threatened species are not endangered populations.

*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, none of these threatened bat species form a threatened 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;*

The proposal will remove 0.34 ha of SGGIW, representing foraging habitat for these species. No roosting habitat will be impacted by the proposal.

*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 vegetation being removed occurs on the edge of a small patch of remnant vegetation, and, therefore, will not be fragmented.

*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 small area of vegetation to be affected by the proposal is unlikely to be important to these microbat species. There are no roosting or maternal sites present and the study area represents already disturbed habitat.

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

These species are not eligible for declaration of critical habitat as they are not listed as endangered under Schedule 1 of the TSC Act (1995) (DEC2006). Therefore, there are no areas of 'critical habitat' identified under the TSC Act for these microbats.

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

A National Recovery Plan has been prepared for LEPB (DERM 2011). The proposal does not conflict with the recovery plan.

No recovery plan or threat abatement plan has been prepared for *Miniopterus schreibersii oceanensis*.

*g) Whether the action proposed constitutes or is part of a Key Threatening Process (KTP) or is likely to result in the operation of, or increase the impact of, a KTP.*

The Key Threatening Processes (KTP) relevant to this proposal is clearing of native vegetation.

*Conclusion*

The proposed development will not result in a significant impact on Eastern Bentwing-bat or Large-eared Pied Bat given that:

- the proposed works will only remove a small area of foraging habitat
- the works will not isolate an area of known habitat from other interconnecting areas of potential habitat for these highly mobile species
- much larger areas of more suitable foraging habitat are present nearby.

Therefore, a Species Impact Statement (SIS) is not required for the proposed development with respect to these species.

### Grey-headed Flying-fox *(Pteropus poliocephalus)*

The Grey-headed Flying-Fox (GHFF) is listed as vulnerable under the TSC Act. It is endemic to Australia and occurs along the east coast from Bundaberg in Queensland to Melbourne, Victoria. The Grey-headed Flying-fox occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps with urban gardens and cultivated fruit crops also providing habitat for this species.

The species roosts in large aggregations, known as camps, which are used as refuge and resting habitat as well as breeding habitat. Camps are used as day refuges by animals that forage in surrounding areas over several weeks, as maternity camps, and as short-term stopover sites by migrating animals. GHFF breed in January and give birth to young in October. Mothers late in their pregnancy and newborn young can be susceptible to disturbance at roost sites. The nearest known camps for this species include Bomaderry Creek and Bugong Creek, with the nearest known occupied camp located at Bomaderry Creek (DoEE 2017) approximately 2.5 km to the south of the site.

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

The proposal will remove 0.34 ha of SGGIW foraging habitat for this species. There is not a GHFF camp on site, and the nearest known occupied camp is at Bomaderry Creek approximately 2.5 km away. The proposal will remove *Corymbia maculata* (Spotted Gum), which is an important food resource for the species. However ,the area to be removed is small and there are large areas of similar habitat within the range of the local population. Therefore, the removal of a small amount of vegetation will not place a viable local 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.

*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;*

The proposal will remove 0.34 ha of SGGIW representing foraging habitat for this species.

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

The proposal will not fragment vegetation. The vegetation being removed occurs in a fragmented landscape within grazed pastures.

*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.*

Important habitat for GHFF are camps, maternity sites and large areas of highly productive foraging resources. The study area only represents a very small area of potential foraging habitat for the species.

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

There are no areas of 'critical habitat' identified under the TSC Act for this species.

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

The proposal is unlikely to interfere substantially with the recovery of the species (DECCW 2010). The impact area is small and there are large amounts of similar habitat conserved in the locality.

*g) Whether the action proposed constitutes or is part of a Key Threatening Process (KTP) or is likely to result in the operation of, or increase the impact of, a KTP.*

The Key Threatening Processes (KTP) relevant to this proposal is clearing of native vegetation.

*Conclusion*

The proposed development will not result in a significant impact on GHFF given that:

- the proposed works will only remove a small area of foraging habitat
- the works will not isolate an area of known habitat from other interconnecting areas of potential habitat for these species
- the works will not impact a known camp.

Therefore, a SIS is not required for the proposed development with respect to this species.

# Appendix D: Federal listings under the EPBC Act

The EPBC Act Matters of National Environmental Significance Significant Impact Guidelines (EPBC Act Significant Impact Guidelines) (DotE 2013) set out 'Significant Impact Criteria' which identify the steps to determine if a proposed action is likely to have a significant impact on Matters of Environmental Significance (MNES). If the following assessments identify a potential impact on an MNES, a referral is required.

The MNES addressed below has also been assessed above for the state listing under the TSC Act. Their ecology including distribution and habitat is presented in the state assessment.

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

- **Lead to a long-term decrease in the size of an important population of a species**

An important population is considered a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are key source populations either for breeding or dispersal; populations that are necessary for maintaining genetic diversity; and/or populations that are near the limit of the species range.

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

The Large-eared Pied Bat (LEPB) is considered to consist of small populations throughout its range, in which colonies rarely contain more than 50 individuals. The largest know populations occur in areas dominated by sandstone escarpments.

The proposed action is unlikely to lead to a long-term decrease in the size of an important population. There is no typical roosting habitat within the study area as this species typically roosts within sandstone cliffs. The proposed action does not directly or indirectly cause mortality of individuals. The removal of 0.34 ha of SGGIW does not cause foraging stress in the locality such that the population size would decrease.

- **Reduce the area of occupancy of an important population**

The LEPB occupies most areas in their distribution in an irregular pattern due to seasonal and geographic variation in foraging resources. The proposed action would reduce the area available to forage for this species by clearing of 0.34 ha of SGGIW, but would not reduce the area the species could occupy at a given time. The species would be able to continue foraging in the study area in retained habitat.

- **Fragment an existing important population into two or more populations**

As the LEPB requires very specific roosting habitats, which are not in the study area. Consequently, the proposed action would not fragment the existing population into two or more populations.

- **Adversely affect habitat critical to the survival of a species**

Habitat critical to the survival of the LEPB is outlined in the Draft National Recovery Plan (DERM 2011).

  - Maternity roosts consisting of sandstone caves or disused mine shafts;
  - Roosts are very specific, comprising arch caves with dome roofs, which are uncommon in the landscape;
  - Sandstone cliffs near fertile wooded habitat which are important for foraging.

The subject site would not meet the definition of critical habitat for this species. It does not contain maternity roosts and while the site occurs within 4 km on the escarpment, the SGGIW has been extensively grazed and is in a disturbed condition. Further, the development will not impact a large area (0.34 ha) of wooded habitat.

- **Disrupt the breeding cycle of an important population**

The small extent of habitat that would be removed by the proposed development is unlikely to disrupt a breeding cycle.

- **Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The removal of 0.34 ha of SGGIW representing potential foraging habitat is not likely to cause a species decline due to the small scale of the clearing. The additional fragmentation of habitat is not considered to isolate habitat patches as the LEPB roosts in caves and cliff faces utilising nearby fertile wooded habitat.

- **Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**

The proposed action would not result in an invasive species becoming established in the habitat. It is likely that there are invasive species that already occur in the study area, but the proposed action would not cause new species to become established.

- **Introduce disease that may cause the species to decline, or**

It is unlikely that the proposed action would introduce disease that may cause the species to decline. The proposed works would not cause a new disease to be introduced into the population.

- **Interfere substantially with the recovery of the species.**

The proposed action is unlikely to interfere substantially with the recovery of the species. The retention of habitat in the study area provides ongoing foraging habitat.

**Conclusion**

A referral is not recommended for LEPB. The habitat in the study area classifies as critical to the survival of this species, the small scale of clearing leads to a conclusion that the habitat is not adversely affected.

*Pteropus poliocephalus (Grey-headed Flying-fox) – Vulnerable*

The Grey-headed Flying-fox (GHFF) is considered to consist of one national population due to the constant genetic exchange and movement between camps throughout the geographic distribution. Hence the individuals in the locality are part of an important population.

The proposed action is unlikely to lead to a long-term decrease in the size of an important population. There are no camps in the study area and no camps would be indirectly impacted by the proposed action. The proposed action would not directly or indirectly cause mortality of individuals. The removal of 0.34 ha of SGGIW would not cause foraging stress in the locality such that the population size would decrease.

- **Reduce the area of occupancy of an important population**

The GHFF occupies most areas in their distribution in an irregular pattern due to seasonal and geographic variation in foraging resources. The proposed action would reduce the area available to forage for this species by clearing of 0.34 ha of SGGIW, but would not reduce the

area the species could occupy at a given time. The species would be able to continue foraging in the study area in retained habitat.

- **Fragment an existing important population into two or more populations**

As the GHFF is highly dispersive and mobile, the proposed action would not fragment the existing population into two or more populations.

- **Adversely affect habitat critical to the survival of a species**

Habitat critical to the survival of the GHFF is outlined in the Draft National Recovery Plan (DECCW 2009). Foraging habitat must meet at least one of the following criteria:

  - Productive during winter and spring, when food bottlenecks have been identified
  - Known to support populations of >30,000 individuals within an area of 50 km radius (the maximum foraging distance of an adult)
  - Productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (September to May)
  - Productive during the final stages of fruit development and ripening in commercial crops affected by GHFF (months vary between regions)
  - Known to support a continuously occupied camp

*Corymbia maculata* (Spotted Gum) is an important foraging resource for GHFF in late winter and spring when food can be scarce, and the recovery plan indicates that clearing significant foraging habitat will have an adverse impact on the species. However, the area to be impacted is small (0.34 ha), and larger areas of similar habitat occur in the range of the local population, that the habitat to be removed is unlikely to adversely affect the survival of this species.

- **Disrupt the breeding cycle of an important population**

There are no camps in the study area and hence the proposed action would not disrupt the breeding cycle of an important population. The removal of habitat critical to the survival of an important population would include clearing which reduces the availability of foraging resources that would be used during the breeding cycle. However, the small extent of habitat that would be removed by the proposed development is unlikely to disrupt a breeding cycle.

- **Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The removal of 0.34 ha of SGGIW representing potential foraging habitat is not likely to cause a species decline due to the small scale of the clearing. The additional fragmentation of habitat is not considered to isolate habitat patches as the GHFF is highly mobile.

- **Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**

The proposed action would not result in an invasive species becoming established in the habitat. It is likely that there are invasive species that already occur in the study area but the proposed action would not cause new species to become established.

- **Introduce disease that may cause the species to decline, or**

It is unlikely that the proposed action would introduce disease that may cause the species to decline. Due to the highly mobile nature of the species, the transportation of disease may occur through a population by individuals moving through a large geographic range. However, the proposed works would not cause a new disease to be introduced into the population.

- **Interfere substantially with the recovery of the species.**

The proposed action is unlikely to interfere substantially with the recovery of the species. The retention of habitat in the study area provides ongoing foraging habitat.

**Conclusion**

A referral is not recommended for GHFF. Although the habitat in the study area classifies as critical to the survival of this species, the small scale of clearing leads to a conclusion that the habitat for the local population is not adversely affected.