ACS Environmental Pty Ltd

FLORA AND FAUNA SURVEYS

AND BIODIVERSITY IMPACT ASSESSMENT

FOR

PROPOSED DEVELOPMENT

AT THE RESOURCE RECOVERY LEARNING CENTRE

AT 20 FLATROCK ROAD, MUNDAMIA,

WEST NOWRA

PREPARED FOR:
Isabella Buddee
Terroir
Level 2 / 79 Myrtle St
Chippendale 2008

28th AUGUST 2023

ACS Environmental Pty Ltd

Flora and Fauna Surveys, Biodiversity and Ecological Impact Assessment and Bushland Plans of Management Services

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The principal of 'ACS Environmental P/L has worked in the area of floristic and faunal impact assessment services for a period of greater than 20 years. He also has over 30 years of experience in scientific research (ecological) and teaching in biological science.

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EXECUTIVE SUMMARY

In October 2022, ACS Environmental was commissioned by Terroir Architects to survey for flora and fauna and undertake a biodiversity impact assessment for the development of a Resource Recovery Learning Centre on part of Lot 1 in DP 1018193, at Flatrock Road, Mundamia, West Nowra

The total area of the subject land proposed for development is estimated at about 2,210m^2. The crown canopy area of existing trees occurring within this subject land is estimated at about 500m^2.

The current canopy stratum is comprised mainly of moderately tall individuals of remnant trees, with no shrub stratum, in a managed ground cover of exotic grasses and herbaceous weeds.

The proposal is to build a series of buildings comprising the Resource Recovery Learning Centre at the subject area.

Architectural plans submitted with this application should be consulted for detail (Terroir Architects - 2022).

Ground-truthing confirms that the vegetation of the subject land appears to contain remnant trees of a former woodland distribution which still occurs in natural condition to the east and south-east of the subject development site

The vegetation occurring on the subject land and surrounds has been mapped and confirmed as Shoalhaven Lowland Bloodwood Shrub Forest (PCT 3654) (DPE 2022), a tall to very tall dry shrubby sclerophyll open forest with a ground cover of grasses, graminoids and ferns mainly situated on Nowra sandstone lowlands and foothills in the Shoalhaven region between Kangaroo Valley, Nowra and Bawley Point.

A total of 7 individual trees, including Narrow-leaved Scribbly Gum, Grey Gum and Red Bloodwood, occur on the subject site (Figures 5 & 6), and most of these mature trees are proposed for removal for the building footprint (Figure 3). The trees occur in an exotic grassland ground stratum with few native forbs and no shrub layer.

Shoalhaven Lowland Bloodwood Shrub Forest is common in the locality and is not associated with any threatened ecological communities (DPE 2022).

A large mature individual of Narrow-leaved Scribbly Gum has numerous fauna habitat hollow structures where many species of common birds were observed roosting in the

hollows. It is confirmed that this individual will be retained *in situ* as part of the development plan (J. Lynch *pers.comm.*).

Bionet Atlas of NSW Wildlife data records for an area of 5km radius around the subject site indicate that 11 flora species of conservation significance have been recorded within the last 20 years (Bionet Atlas 2023).

Habitat at the managed exotic grassland subject site does not appear to be suitable for most of these species.

All threatened species where habitat may be suitable for their occurrence were targeted in searches throughout the subject land, but none were located. There is no lower shrub canopy (Figures 5 & 6) and targeted searches were not limited by dense vegetation.

The DPE Bionet Atlas of NSW Wildlife database (2023) recorded thirty two (32) species of terrestrial and avifauna listed as threatened under the BC Act within a 5 km radius of the site. None of these threatened fauna species have been recorded at the subject site but threatened species such as the Grey-headed Flying Fox, Yellow-bellied Glider, Large-eared Pied Bat, Large Bentwing Bat and Powerful Owl are considered to have potential to occasionally forage or roost at the site.

All of these mobile species have very large foraging ranges and the proposal to clear a small area of trees from the lower slope of the subject land would not be considered to compromise these species' life cycles or viability in relation to foraging, roosting and breeding behaviours, particularly as the mature individual of Narrow-leaved Scribbly Gum with many suitable fauna habitat hollows (Figure 6) is to be retained *in situ*.

In regard to threatened species legislation, the proposed development is considered to comply with the desired criteria in relation to The Shoalhaven City Council LEP (2014) and Shoalhaven City Council DCP (2014).

It is considered that the development would be highly unlikely to have an adverse effect on the life cycle of any individual threatened flora or fauna species or their respective habitat. It is considered that for potential impacts to any threatened ecological communities or threatened flora or fauna, concurrence from the Director General of the Department of Planning, Industry and Environment is not required, nor is a Species Impact Statement necessary for the proposed development.

Environmental criteria in relation to requirement for biodiversity offsets is assessed as follows:

- The area of property and area proposed for development is less than 1ha and less than 0.25ha respectively, areas too small to trigger offsets;

- The subject land was previously marked on the Biodiversity Values Map as containing significant biodiversity value resulting from known distributions of the Greenhood orchid *Pterostylis vernalis*, and so potentially triggering biodiversity offsets, but after a long period of review, this biodiversity value was rescinded due the extensive authorised clearing of bushland to the south of the subject site which was known to provide habitat for this orchid (Figure 16);
- It is assessed and considered that no threatened species (of either flora and fauna) would be significantly impacted by the small area of the proposed development at the subject land; and
- The scale of potential loss of habitat is small (estimated at about 500m^2).

GLOSSARY AND ACRONYMS

APZ - Asset Protection Zone

BAM - Biodiversity Assessment Method (2017) - supports the BC Act (2016).

BC Act - *Biodiversity Conservation Act (2016)* - legislation enacted in August 2017

CEEC - Critically Endangered Ecological Community

DCCEEW - Commonwealth Department of Climate Change, Environment, Energy and Water

DPE - Department of Planning and Environment

E (threatened species status) - Endangered species

EEC - Endangered Ecological Community as listed by the BC Act and EPBC Act

EPBC Act - Environmental Protection & Biodiversity Conservation Act (1999). Enacted to protect and manage nationally and internationally (migratory) flora, fauna and ecological communities, defined in the Act as matters of national environmental significance (NES)

Habitat - areas occupied, either territorially, periodically or occasionally, by a species, population or ecological community

IPA - Inner Protection Area

KTP - Key threatening process, a process that threatens the survival, life cycle, abundance or potential evolutionary development of native species, populations or ecological communities (Dept of Environment and Conservation 2004). KTP's are listed under the BC Act and the EPBC Act.

Migratory species - listed under the EPBC Act and relating to international agreements to which Australia is a signatory. Includes the Japan-Australia Migratory Bird Agreement (JAMBA), Chine-Australia Migratory Bird Agreement (CAMBA) Republic of Korea Migratory Bird Agreement (ROKAMBA)

OEH - State Office of Environment and Heritage

PCT - Plant Community Type identified as such using the Bionet Vegetation Classification system (OEH 2018)

RoTAP - Rare or Threatened Australian Plants

RRP - Resource and Recovery Park

SMCMA - Sydney Metropolitan Catchment Management Authority

TEC - Threatened Ecological Community

Threatened species, populations or ecological communities - Entities listed by the BC Act and EPBC Act as 'Vulnerable to decreasing population growth in time', Endangered as population growth decreasing rapidly leading to eventual extinction' or 'Critically Endangered, a more extreme rate of population decrease than the former'.

V (threatened species status) - Vulnerable

INTRODUCTION

1.1 Proposed development

In October 2022, ACS Environmental was commissioned by Terroir Architects to survey for flora and fauna and undertake a biodiversity impact assessment for the development of a Resource Recovery Learning Centre on part of Lot 1 in DP 1018193, at Flatrock Road, Mundamia, West Nowra.

The total area of the subject land proposed for development of buildings is estimated at about 2,210m^2.

The subject land occurs on a relatively level area at the base of gentle sloping land to the north.

The current canopy stratum is comprised mainly of moderately tall individuals of remnant trees, with no shrub stratum, in a managed ground cover of exotic grasses and herbaceous weeds.

The proposal is to build a series of buildings comprising the Resource Recovery Learning Centre at the subject area.

Figure 1 is an aerial image showing the subject land indicating adjoining properties.

Figure 2 is an aerial image of the subject land where the buildings of the Resource Recovery Centre are proposed to be located.

Figure 3 is a schematic ground floor site plan of the proposed buildings comprising the Resource Recovery Learning Centre.

Figure 4 is an aerial depiction of the subject site showing the land in relation to established development in the local area.

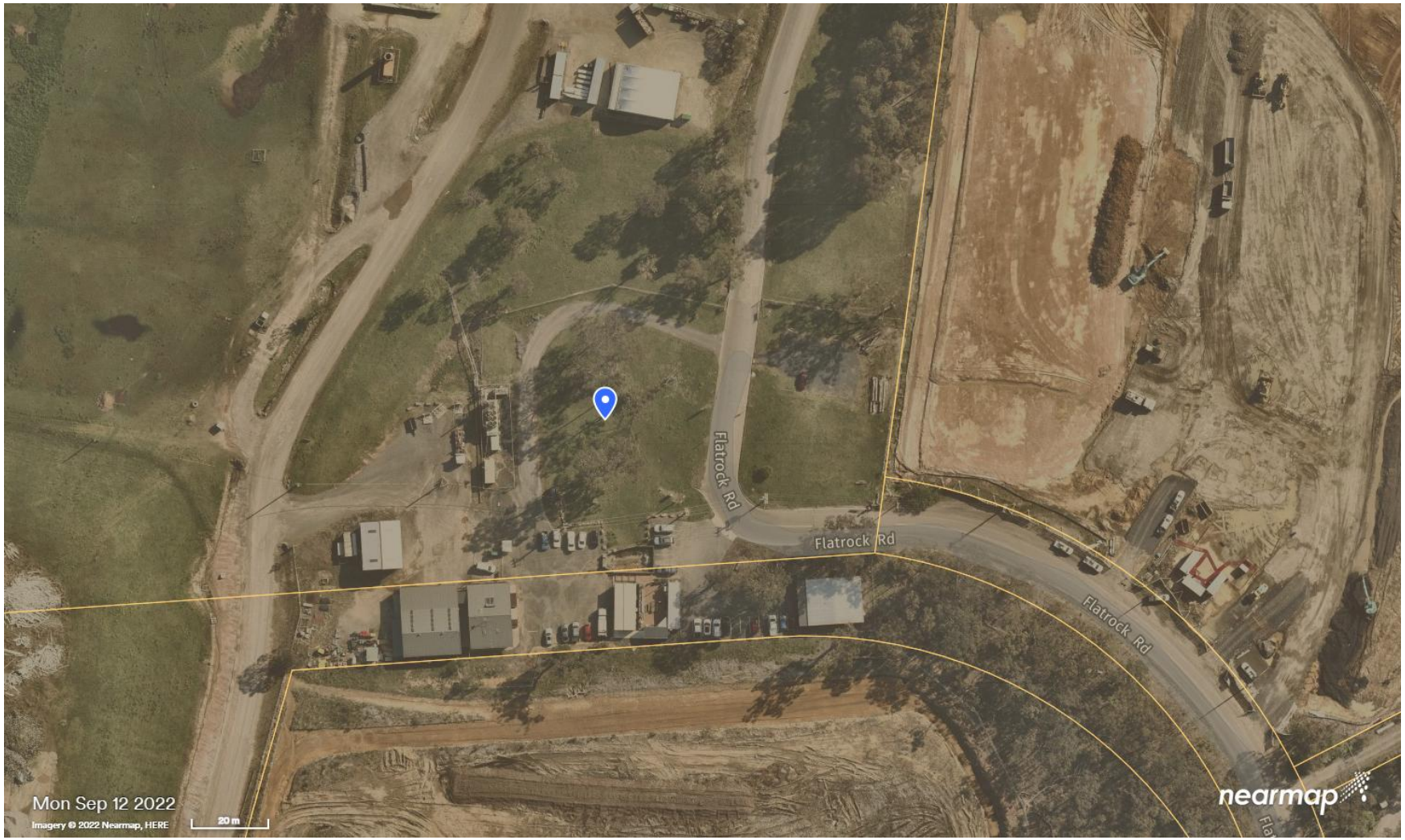


Figure 1 - Aerial image of subject land at 20 Flatrock Road, Mundamia (blue pointer) indicating surrounding open woodlands and developed areas including administrative buildings within the West Nowra Recycling and Waste Depot. Current development occurring at Lot 342 DP 257515 to the east (Nearmap 2022).

Figure 2 - Aerial image of surveyed subject land (blue shaded polygon) showing location of canopy trees, (most of which are proposed for removal), in relation to adjacent access roads, administrative buildings and other infrastructure (Nearmap 2022)

Figure 3 - Schematic Ground Floor Site Plan of proposed buildings and associated infrastructure comprising the Resource Recovery Learning Centre at Flatrock Road, Mundamia with trees to be retained and those to be removed as well as landscaped tree plantings indicated at the site and surrounds (Terroir Architects 2023)

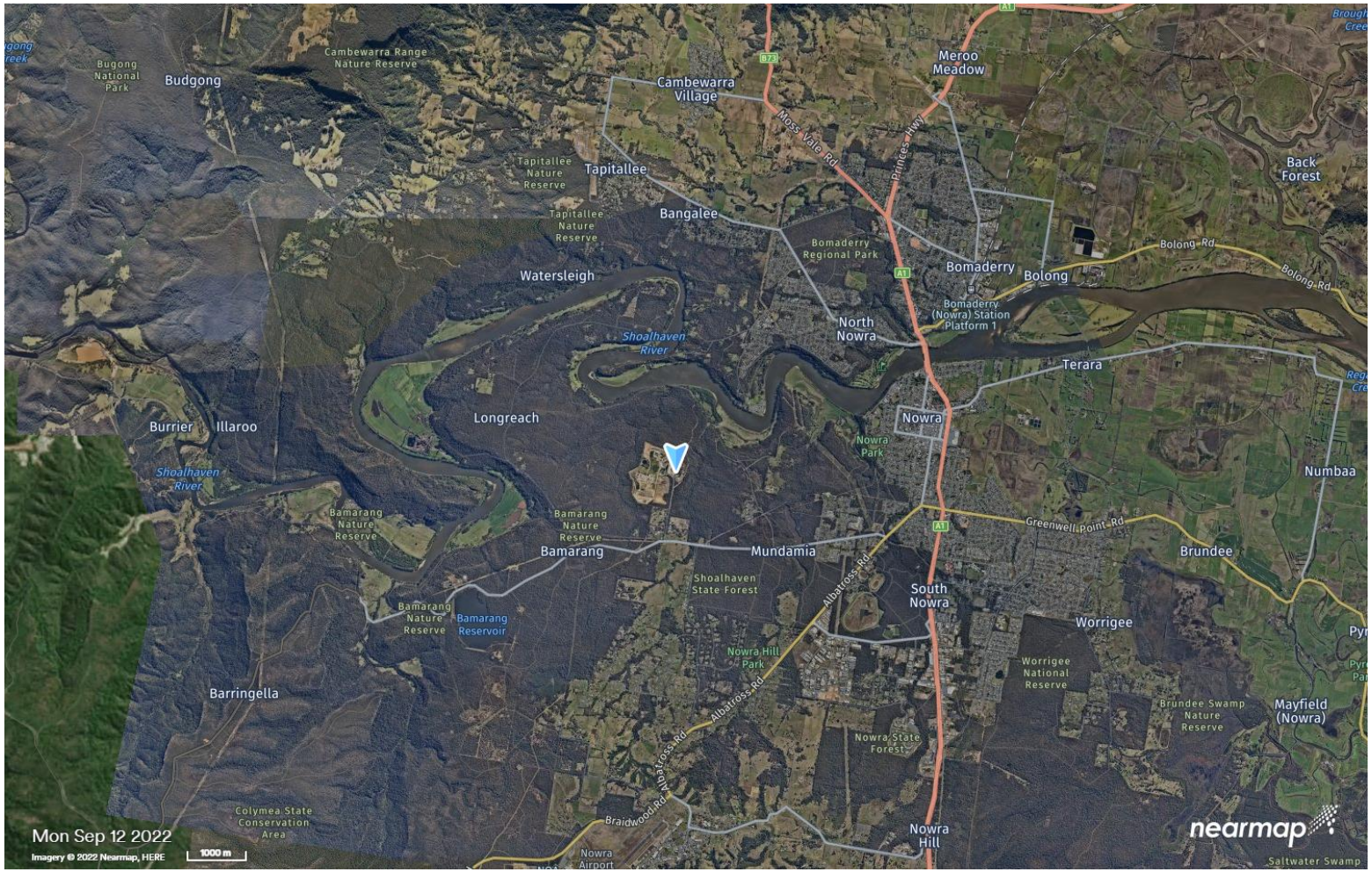


Figure 4 - Aerial view of the subject land (blue pointer) in relation to development in locality including roads, residential development, natural bushland and waterways (Nearmap 2022)

1.2 Purpose of biodiversity impact assessment report

The purpose of flora and fauna surveys and ecological impact assessment is to document existing and expected biota and to ensure all necessary safeguards are described and complied with in relation to the proposal as required by Shoalhaven City Council.

1.3 Statutory and legislative requirements

Planning controls provided by State and Commonwealth Legislation include the following:

- Environmental Planning and Assessment Act (EP & A Act) (1979),
- Commonwealth Environment Protection and Biodiversity Conservation Act (EPBC Act) (1999),
- Biodiversity Conservation Act (BC Act) (2016). The BC Act (2016) includes Preliminary Determinations of the NSW Scientific Committee (to November 2022) as well as Provisional Listings of Endangered Species on an emergency basis (to November 2022),

  The objectives of this Act are:

  - to provide for the conservation of threatened species, populations and ecological communities of animals and plants. The Act sets out a number of specific objects relating to the conservation of biological diversity and the promotion of ecologically sustainable development.
- Planning for Bushfire Protection (2019).
- Biosecurity Weeds Act 2015 (NSW)

  The objectives of this Act are:
  - to reduce the negative impact of weeds on the economy, community and environment of this State by establishing control mechanisms to:
  - prevent the establishment in this State of significant new weeds, and
  - restrict the spread in this State of existing significant weeds, and
  - reduce the area in this State of existing significant weeds,
  - to provide for the monitoring of and reporting on the effectiveness of the management of weeds in this State

Local Council planning controls include the:

- Shoalhaven Local Environment Plan (2014) and Shoalhaven Development Control Plan (2014)

This flora and fauna assessment report includes an account of:

- Threatened flora and fauna species, populations, endangered ecological communities and their habitats, as listed under the Biodiversity Conservation Act (BC Act), 2016;

- Nationally significant flora species, as listed under the Environment Protection and Biodiversity Conservation Act (EPBC Act), 1999;
- Rare or threatened Australian plants (RoTAP) as listed in Briggs and Leigh (1996); and
- Any regionally or locally significant species in the Shoalhaven City Council LGA.

1.4 Documents provided

- Terroir Architects (2022) Various site plans of the proposed development;
- Harry Diversi (Tree Management Officer) (2022) – Tree Management Strategy
- Tree Management Strategies (2022) – Tree Management Strategy at West Nowra Recycling and Waste Depot, Mundamia

1.5 Objectives of the study

- To carry out detailed flora and fauna surveys on the subject land;
- To prepare a comprehensive report qualifying potential impacts and describing mitigation measures in relation to the above assessments.

1.6 Scope of the study

The survey work was undertaken to provide Terroir Architects with current and detailed information on the following:

- Identification of the flora and fauna that occur at the subject sites including documentation of species lists and mapping of identifiable plant communities;
- Identification of Threatened (Endangered and Vulnerable) species, populations, communities and habitats as listed in Schedules 1 & 2 of the Biodiversity Conservation Act 2016 (BC Act) including Preliminary Determinations of the NSW Scientific Committee, and the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), ROTAP species (Briggs & Leigh 1996) and regionally and locally significant species that could potentially be impacted upon by the proposed development;
- Identify listed migratory species (as listed in international treaties referred to in the EPBC Act);
- Identification of fauna species, including species of amphibians, reptiles, birds or mammals, not directly recorded during surveys but that could potentially occur in the study area as indicated by the presence of associated habitat;
- Preparation of a report describing vegetation communities on the subject land indicating their current condition and level of degradation;
- Recording of the area and extent of Biosecurity (and other significant High Threat Exotic) weed species in the study area;
- Assessment of potential impacts of the proposal on existing flora and fauna within the study area;
- Submission of draft report;

- Incorporation of relevant review comments and amendment of draft report to final.

2 EXISTING ENVIRONMENT

2.1 Topography, geology and soils

The surveyed site is a roughly circular polygon of land of area about 2,210m^2 (Figures 1 & 2).

The site lies at the base of two gently sloping hillsides to the north and west (Figures 1 & 3)

The local substrate geology of the land at the subject area at Flatrock Road is landfill (RFT Excerpt document of potentially contaminated land - Shoalhaven Council 1995).

The natural soil prior to land-filling was used as a source of road gravel by Shoalhaven Council. Landfill since 1975 included waste types including residential waste, commercial and industrial waste, both in solid and liquid form. The landfill was covered by excavated material or when this was insufficient in supply, ash from the paper mill was used (RFT Excerpt document of potentially contaminated land - Shoalhaven Council 1995).

2.2 Existing vegetation

The subject surveyed land shown in Figure 2 contains 7 mature trees, including 4 individuals of Narrow-leaved Scribbly Gum (*Eucalyptus racemosa*), two individuals of Grey Gum (*Eucalyptus punctata*) and one individual of Red Bloodwood (*Corymbia gummifera*). The ground stratum is managed exotic grassland dominated by Prairie Grass and Common Couch (Figures 5 & 6).

The trees have been planted on landfill apparently some 50 years previously (local Council officers *pers. comm).*

Surrounding areas containing trees were also surveyed floristically and these areas are described in Chapter 3 of this report.

2.3 Current and surrounding land use

The aerial view of the subject land at Lot 1 DP 1018193 indicates that much of the landscape immediately surrounding the subject site has been established as landfill, this area in turn surrounded by Bamarang Nature Reserve and Shoalhaven State Forest.

Closer to the coast, the landscape includes established rural allotments and residential development close to Nowra (Figure 4; from Nearmap 2022).

Figure 5 - Image of woodland on surveyed subject site dominated by trees of Narrow-leaved Scribbly Gum, Grey Gum and Red Bloodwood (courtesy of H Diversi - Tree Management Officer Shoalhaven Council 2022)

Figure 6 - Image of Narrow-leaved Scribbly Gum to 20m tall with several active fauna hollows

3 FLORA AND FAUNA SURVEY AND ASSESSMENT

3.1 Methods

3.1.1 Literature review

Existing information on 'Threatened Flora of the Locality', defined as an area of 5km radius around the site, was accessed from the DPE Atlas of NSW Wildlife (online BioNet), Commonwealth DCCEEW Environmental Reporting Tool (November 2022) and RoTAP (Briggs and Leigh 1996) databases. Other literature detailing regionally and locally threatened and significant flora and fauna, as well as plant communities of the study area, included NSW Scientific Committee Final Determinations (1996-2022), and DPE Mapping (2022).

3.1.2 Site survey

The subject site included 5 separate areas where woodland vegetation has established in and around the Resource Recovery Centre, this wider sampling area indicated in Figure 7. The vegetation and local fauna was surveyed on 9th November 2022.

3.1.3 Flora survey

Currently existing information on 'Threatened Flora of the Locality', defined as a 10km x 10km area centred around the site, was accessed from the DPE Atlas of NSW Wildlife (November 2022), the Department of Climate Change, Environment, energy and Water (DCCEEW) Environmental Reporting Tool (November 2022), and RoTAP (Briggs & Leigh, 1996) databases.

Other literature detailing regionally and locally threatened and significant flora, as well as endangered populations and plant communities of the study area, including NSW Scientific Committee Final Determinations (1996 - 2022) were accessed and reviewed.

Comprehensive surveys were undertaken on foot (Diversity Search method of Cropper 1993, and Threatened Biodiversity Surveys and Assessment - Guidelines for Developments and Activities - DEC 2004) to identify the existence of extant flora populations present on the subject area.

As the subject land was in large part, relatively uniform in vegetation structure and floristics, a comprehensive flora survey methodology was undertaken for assessment of cover and species assemblage, resulting in five (5) separate areas being surveyed and species recorded.

The survey included a complete floristic inventory of indigenous and exotic species and an assessment of the presence, or likelihood of occurrence, of any threatened, rare, regionally or locally significant species or plant community occurring at the surveyed site.

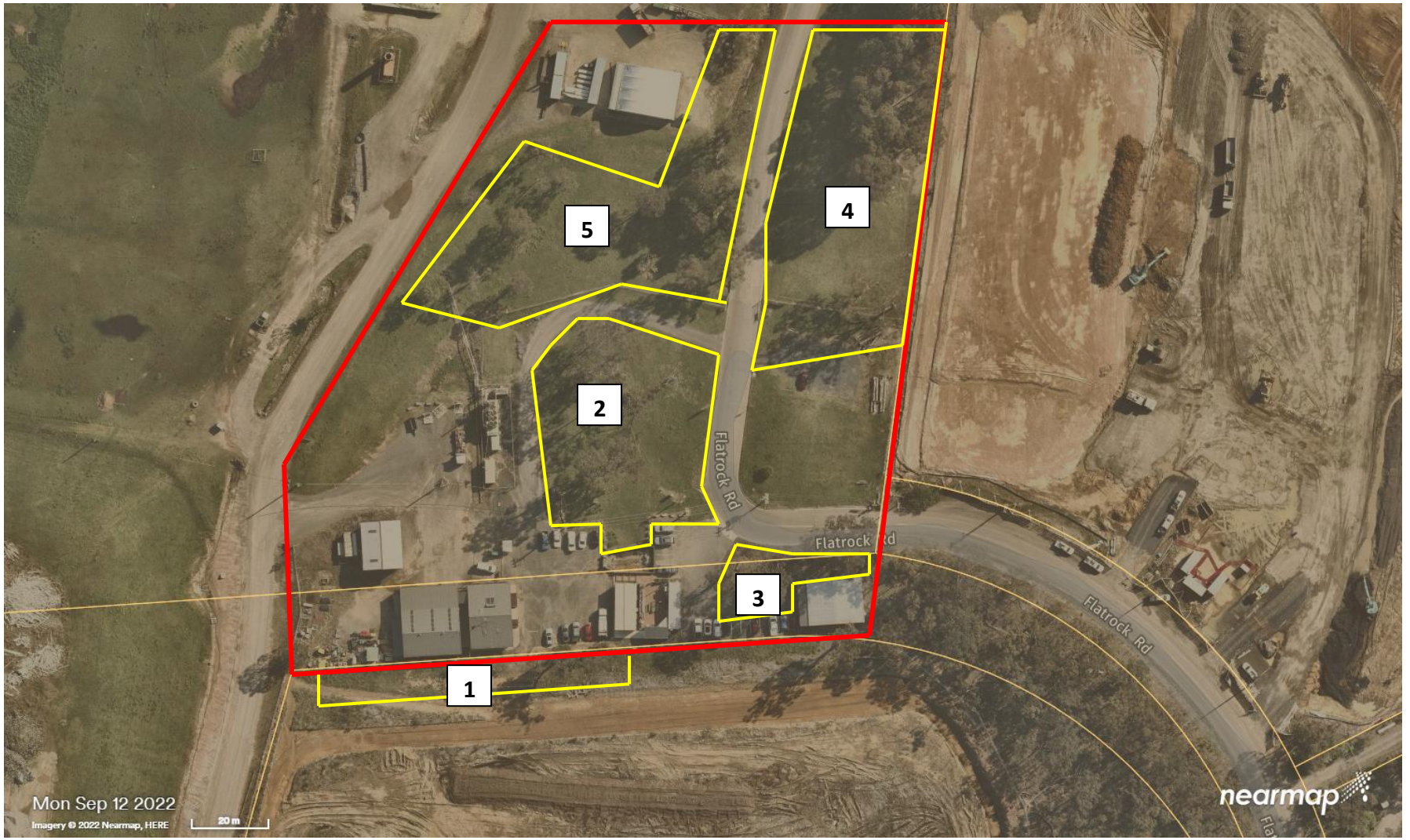


Figure 7 - Five separate survey areas were recorded for flora within an area capturing the existing perimeter fence, boundary of Lot 342 DP 257515 to the east, existing buildings and carparks, and existing road and levels; discrete areas numbered as above (from Nearmap 2022)

3.1.4 Fauna Survey

The survey effort complies with the survey effort recommended by the Draft Guidelines for Threatened Species Assessment under Part 3A (DEC and DPI, 2004) for the study area size, habitat types available on the site and seasonal factors.

A dedicated ground search was under taken as was a census of extant birds. The survey involved different search strategies and protocols and all extant fauna or evidence of fauna was recorded. Threatened fauna species not recorded in the surveys but with the potential to be present as indicated by habitat are considered in the final assessment.

Strategies employed for the field investigation of the Study Area:

Assessment of the value of habitat suitable for native fauna species and specific habitat structures/resources considered important in life cycles. These structures or resources include:

- Mature trees with hollows for breeding, roosting and/or nesting;
- Particular foraging resources such as certain tree or shrub species;
- Dispersal, migratory or foraging corridors for fauna;
- Leaf litter and ground search for reptiles, frogs and threatened invertebrates;
- Identification of scats and other indirect evidence to suggest fauna utilisation such as tracks, scratch marks or diggings;

3.1.5 Limitations of the study

Limitations of the study may arise where certain cryptic species of plants may occur as soil-stored seed or as subterranean vegetative structures. Some species are identifiable above-ground only after particular environmental circumstances related to factors such as periodic fire frequency, intensity or seasonality, soil moisture regime, grazing pressure, biological life-cycle patterns as in the case of small geophytic taxa such as species of orchids etc.

Diurnal surveys at one time of the year cannot be expected to detect the presence of all species occurring, or likely to occur, in the study area. This is because some species may (a) occur seasonally, (b) utilise different areas periodically (as a component of a more extensive home range), or (c) become dormant during specific periods of the year. Rather, the survey provides the opportunity to sample the area, search specifically for species likely to be encountered within the available time frame, and assess the suitability of habitat for particular species.

The criteria used to assess the likelihood of threatened species occurring in the Study Area included the specificity of habitat features such as tree canopy cover, relative soil moisture regime, relative soil nutrient regimes, extent of historical disturbance and degradation of vegetation and known occurrences of threatened species in the immediate locality.

If all or most of these collective criteria deemed optimal for the occurrence of a particular threatened species occur in relation to the habitat of the Study Area, then the likelihood of its potential occurrence in the habitat of the Study Area could be assessed as being relatively high. If only some of these collective criteria deemed suitable for the occurrence of a particular threatened species occur in the habitat of the Study Area, then its potential occurrence in the area of study may be deemed moderate at best. If few of these collective criteria deemed suitable for the occurrence of a particular threatened species occur in the habitat of the Study Area, then the likelihood of its occurrence would be assessed as being low to very unlikely.

These criteria are qualified in respect of threatened flora species in Appendix 2 of this report and in relation to threatened species of fauna in Appendix 4 of this report.

3.2 Results - Flora

3.2.1 Landscape features

The subject site occurs within the Ettrema IBRA subregion of the Sydney Basin IBRA Region.

The Mitchell Soil Landscape appears to be defined as the Nowra-Durras Coastal Slopes of the Jervis Meso Group of landforms.

3.2.2 Indigenous and exotic plant species

Table 1 lists the 5 various areas and dominant tree species where flora was surveyed and recorded.

AREA (Figure 7)	1	2	3	4	5
Location	South of perimeter fence (Fig 7)	Proposed site of construction of RRLC (Fig 2)	Area to east adjacent to admin buildings	Area to north-east adjacent to Lot 342 (Fig 7)	Open woodland north of proposed RRLC
Main tree species	Grey Gum	Narrow-leaved Scribbly Gum; Grey Gum; Red Bloodwood	Grey Gum; Brown Barrel; White Stringybark	Narrow -leaved Scribbly Gum; Spotted Gum	Grey Gum; Brown Barrel; Narrow-leaved Scribbly Gum; Blackbutt; Yellow Bloodwood
To height (m)	15	20	20	22	20
No. locally - occurring indigenous spp	7	8	5	5	8

Appendix 1 lists the various plant species found to occur within the 5 separate sampling areas depicted in Figure 7.

Species nomenclature follows that of Harden (1990 – 2002; 2023 online).

A total of 22 native species were recorded across the entire subject site, with many apparently having been planted across the various landfill sites. The main canopy species are listed in Table 1 and Appendix 1.

Many exotic weed species were recorded over this section of the subject land, though none are declared Biosecurity Weeds. Most common weed species, which occur sparsely within many of the surveyed sections of the subject area, are not listed in the appendix (Appendix 1).

3.2.3 Plant community

Previous mapping

The local ecological plant community that occurs at the Study Area has been mapped by DPE (2022) compiling data from API and environmental attributes of geology, average annual rainfall, topography, elevation, Soil Landscape Series type and extent of disturbance (condition), and including some ground-truthing (Figure 8) (DPE 2022).

Patches of the PCT 3654, Shoalhaven Lowland Bloodwood Forest (DPE 2022), occur among wider areas of disturbed terrain with no identifiable plant community types (Figure 8).

It appears that the patch of woodland within the area proposed to be cleared for the RRLC either contains remnant trees from a former distribution of Shoalhaven Lowland Bloodwood Forest, or has been planted with representative canopy species associated with this plant community.

Figure 8 - DPE (2023) mapping of ecological community occurring on areas of landfill at the subject site at the West Nowra Landfill Waste Depot (PCT 3654: Shoalhaven Lowland Bloodwood Shrub Forest) indicated by the numbered polygon.

3.2.4 Description and conservation status of Shoalhaven Lowland Bloodwood Shrub Forest

Description of ecological community

Shoalhaven Lowland Bloodwood Shrub Forest is a tall to very tall dry shrubby sclerophyll open forest with a ground cover of grasses, graminoids and ferns mainly situated on Nowra sandstone lowlands and foothills in the Shoalhaven region between Kangaroo Valley, Nowra and Bawley Point.

The tree canopy almost always includes *Corymbia gummifera*, commonly with *Syncarpia glomulifera* and may also include a wide variety of other eucalypt species. These may be associated with one or more of *Eucalyptus pilularis*, *Eucalyptus punctata*, *Eucalyptus racemosa*,

Corymbia maculata or one or more species from the stringybark eucalypt group, of which *Eucalyptus globoidea* is most frequent.

The natural mid-stratum very frequently includes several layers with a sparse taller canopy of *Syncarpia glomulifera* and *Allocasuarina littoralis*. A mid-dense shrub layer almost always includes *Banksia spinulosa* with *Lomatia silaifolia* with *Persoonia linearis* less frequent. Other common species include *Hakea sericea, Acacia terminalis* and occasional individuals of *Leptospermum trinervium*, *Persoonia levis* and *Lambertia formosa*.

The natural ground layer is characterised by combinations of grasses and graminoid species, almost always including *Entolasia stricta*, and very frequently other grasses such as *Microlaena stipoides* and occasionally *Themeda triandra*. The graminoids *Dianella caerulea, Lepidosperma laterale* and *Lomandra multiflora* are also common along with ferns *Pteridium esculentum* and *Lindsaea linearis* (DPE 2022).

Distribution of ecological community

Shoalhaven Lowland Bloodwood Shrub Forest is found on a range of aspects however mostly on low relief Permian sediments, less frequently on foothills. This PCT is common west of Nowra and around St Georges Basin, however becomes patchy and discontinuous on Wandrawandian sediments north of Jervis Bay, where it is replaced by dry open grassy forest PCT 3273. This may be distinguished by a sparser shrub layer, greater diversity of grasses and an absence of *Syncarpia glomulifera*. It grades into dry shrub forest PCT 3267 with increasing elevation (greater than 100 metres asl) on the Shoalhaven foothills or heathy forest PCT 3588 on shallow sandy soils (DPE 2022).

Status of ecological community occurring at subject site and mitigation measures

Shoalhaven Lowland Bloodwood Shrub Forest is not listed on registers of the NSW BC Act or Commonwealth EPBC Act. There are no TEC's associated with this PCT (DPE 2022).

About 20% of the natural area of Shoalhaven Lowland Bloodwood Shrub Forest has been cleared and it is estimated that 16,253ha of the community is retained.

3.2.5 Impacts and mitigation measures to patch of Shoalhaven Lowland Bloodwood Shrub Forest

The potential impacts to the small patch of mapped structurally deficient Shoalhaven Lowland Bloodwood Shrub Forest vegetation as a result of the proposal to construct the RRLC at Flatrock Road, Mundamia, over a relatively small area estimated at about 2,210m^2 (0.22ha) with a large expanse of natural vegetation remaining to the west, east and south-east of the subject site (Figure 9), would not be considered to significantly impact on the biodiversity of the local ecological community.

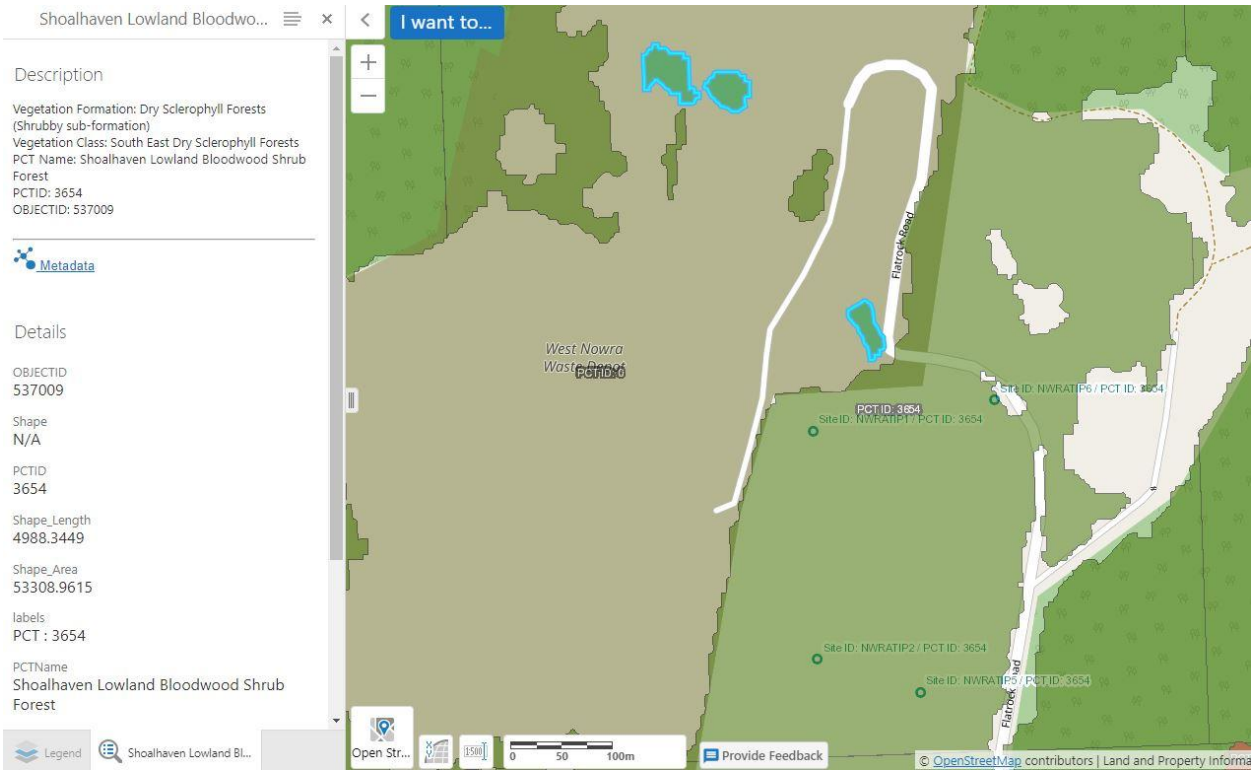


Figure 9 - Vegetation mapping of locality showing extensive areas of PCT 3654 to the west, east and south-east of the subject site (bounded by aqua border adjacent to Flatrock Road (DPE 2023)

<u>Status of individual trees occurring at subject site and mitigation measures</u>

One particular individual tree of Scribbly Gum contains numerous hollows (Figure 6) and appears to contain many scratch and incision marks on the trunk (Figure 10). Though highly unlikely due to the open exposed location of the scattered trees shown in Figure 5, this individual may contain habitat for a Vulnerable fauna species, the Yellow-bellied Glider, which has been recorded in the vicinity as depicted in Figure 11.

Discussion with representatives of Terrior (J. Lynch *pers.comm.*) confirm that this individual of Narrow-leaved Scribbly Gum (Figure 6) will be retained *in situ* as part of the proposed construction plan to conserve the fauna habitat hollows and living tree as incorporated into the development.

It would also be recommended to utilise up to 80% of components of the Shoalhaven Lowland Bloodwood Shrub Forest assemblage in any landscaping plans for the development.

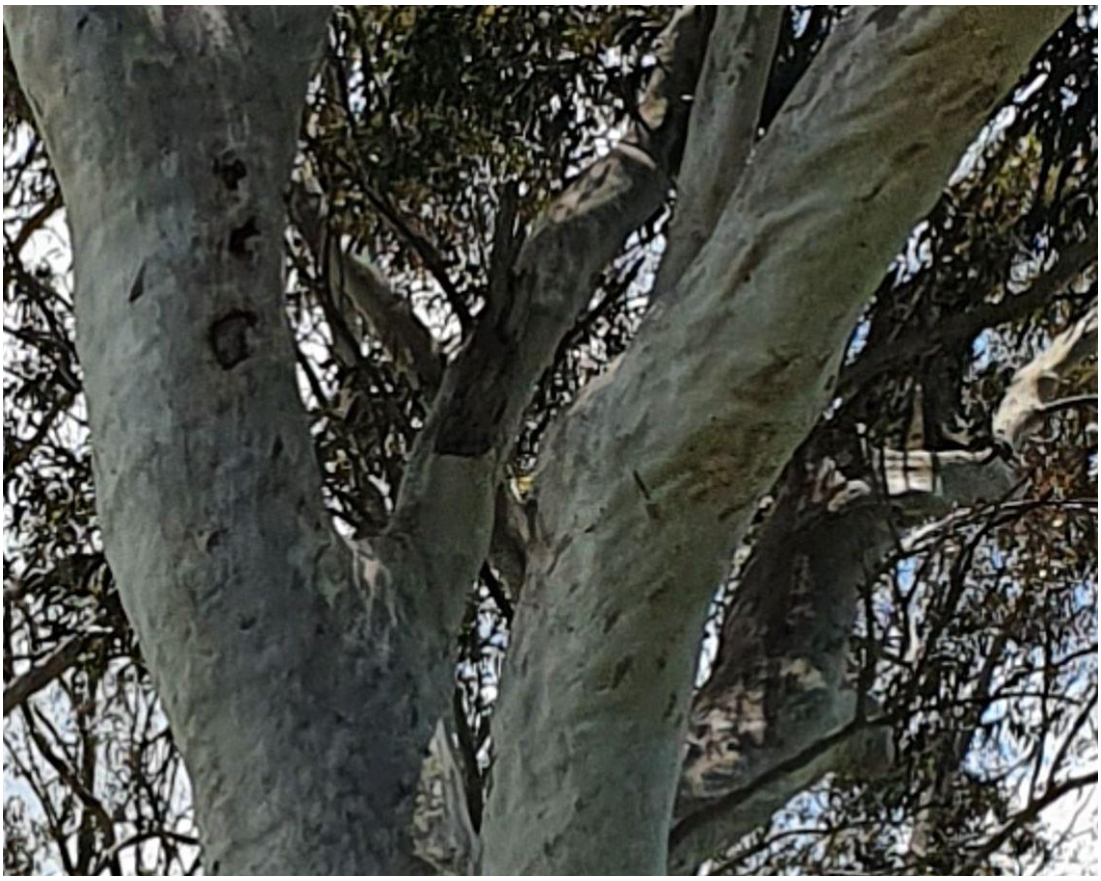
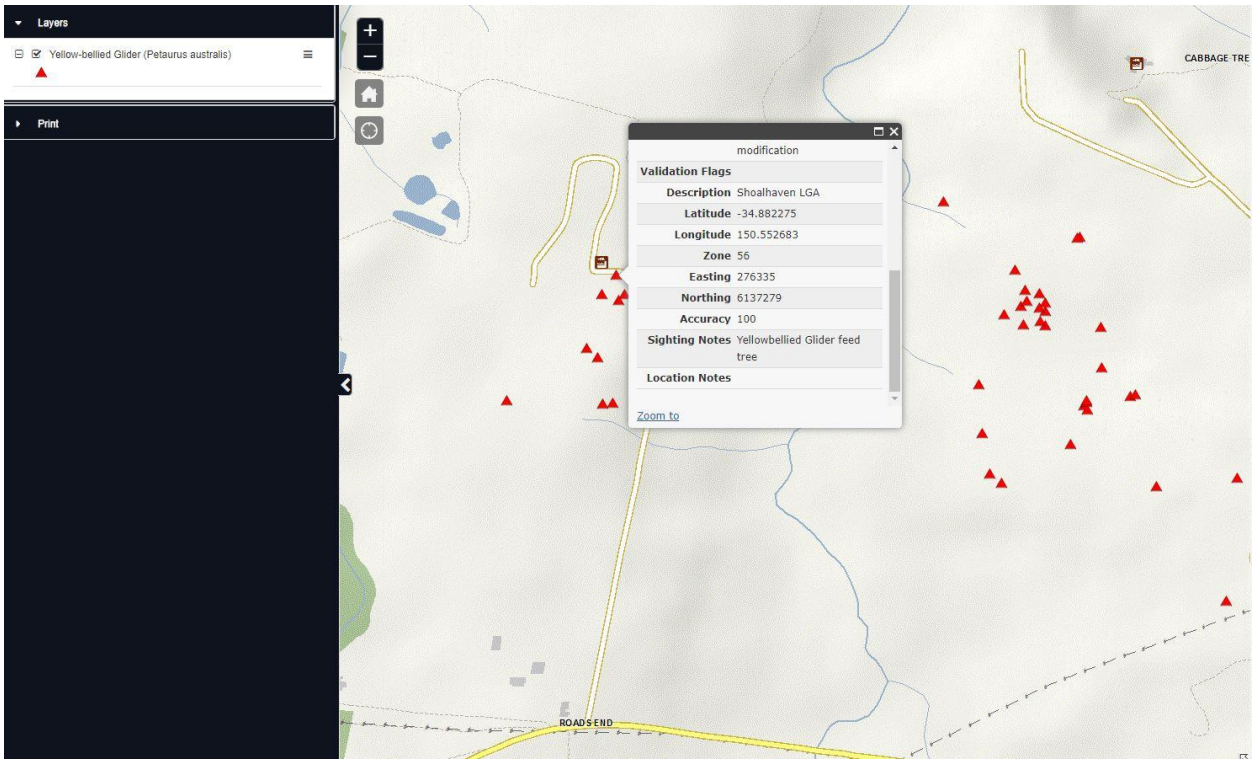


Figure 10 - The individual of Narrow-leaved Scribbly Gum indicated in Figure 6 with numerous hollows also contains numerous scratch and incision marks on the trunk which may reflect possum or Glider activity.



Dataset Name	DPIE Data from Scientific Licences dataset
User Key	SDMPI0222179
Species Code	1136
Scientific Name	Petaurus australis
Common Name	Yellow-bellied Glider
First Date	22/6/2003
Last Date	22/6/2003
Observation Type	Tracks, scratchings
Status	Valid and accepted without modification

Validation Flags	
Description	Shoalhaven LGA
Latitude	-34.882275
Longitude	150.552683
Zone	56
Easting	276335
Northing	6137279
Accuracy	100
Sighting Notes	Yellowbellied Glider feed tree
Location Notes	

Figure 11 - Records of Yellow-bellied Glider in the immediate locality of the subject land at Flatrock Road, Mundamia, a feed tree located some 100m from the proposed development site.

3.2.6 Flora species of conservation significance

Threatened species

The DPE Atlas of NSW Wildlife (2023) records for an area of 5km radius around the subject site indicate that 12 species of conservation significance have been recorded within a radius of 5km of the site within the last 20 years (Table 2).

Nine (9) of these species are listed as Endangered on the BC Act with three listed as Vulnerable, with 3 species listed as Endangered, 2 listed as Critically Endangered and 4 listed as Vulnerable on the Commonwealth EPBC Act.

Appendix 2 lists these species with an account of their threatened status, geographical range, physiognomic attributes, habitat features and likelihood of occurrence at the subject site.

Family	Common name	Scientific name	NSW status	Comm. status	No. of records
Dilleniaceae		*Hibbertia puberula*	E1		2
		Hibbertia stricta subsp. furcatula	E1		21
Fabaceae (Mimosoideae)	Downy Wattle	*Acacia pubescens*	V	V	3
Myrtaceae	Albatross Mallee	*Eucalyptus langleyi*	V	V	33
	Scrub Turpentine	*Rhodamnia rubescens*	E4A	CE	3
	Nowra Heath Myrtle	*Triplarina nowraensis*	E1	E	268
Orchidaceae	Leafless Tongue Orchid	*^Cryptostylis hunteriana*	V	V	3
	Bauer's Midge Orchid	*^Genoplesium baueri*	E1	E	22
		^Pterostylis ventricosa	E4A		1
		^Pterostylis vernalis	E4A	CE	28
Rutaceae	Bomaderry Zieria	*Zieria baeuerlenii*	E1	E	102

Table 2 - Eleven (11) species of threatened flora that have been recorded within a 10km area centred around the subject site within the last 20 years (DPE 2023)

For all of these species, the cleared habitat of the subject site, with little structure in the vegetation, sparse shrub layer and no natural ground cover (Figures 5 & 6), appears unsuitable for their occurrence (Appendix 2). Most records of threatened species occur in natural bushland areas to the west, east and south-east (Figure 12).

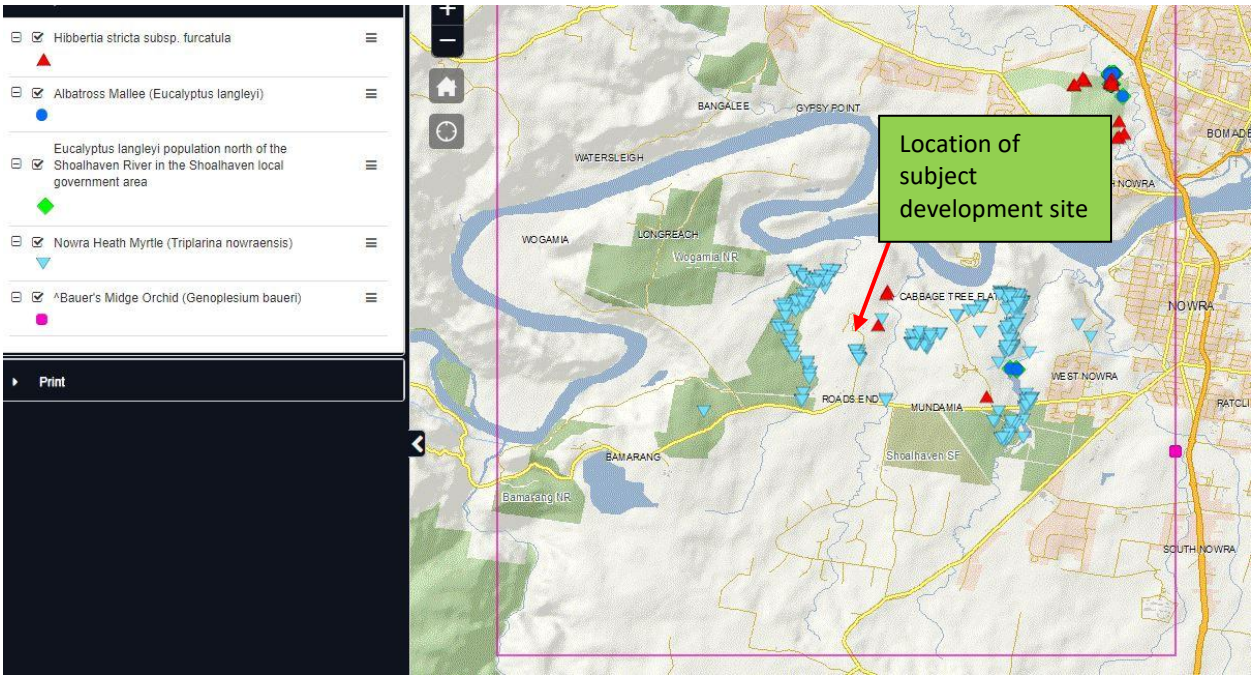


Figure 12 - Indicates the recorded sightings of five flora species of conservation significance, where recordings in the locality have been the most numerous.

Threatened flora species, where habitat may be considered suitable for their occurrence, were targeted in searches throughout the relatively small area of the subject land, but none were located. The lower canopy was very open (Figures 5 & 6) and targeted searches were not limited by dense vegetation.

3.3 Results - Fauna and habitat potential assessment

The following fauna assessment has been prepared with particular regard to the BC Act, Section 5A of the current EP&A Act and the EPBC Act.

3.3.1 Location and weather conditions of subject surveyed site

Grid co-ordinates of centre of subject land;
latitude: -34.882470^{o} ;
longitude: 150.554200^{o}

Weather conditions
Warm and relatively humid weather conditions with light winds, no rain

9th November 2022	9am	3pm
Temp	19.1^{0}	22.3^{0}
Wind	N 9km/hr	ENE 28km/hr

A dedicated ground search was undertaken as well as a census of extant birds. The survey involved different search strategies and protocols and all extant fauna or evidence of fauna was recorded.

3.3.2 Habitats present

The habitat of the proposed building envelope (Figures 1, 2, 3, 5, 6 & 7) is a uniform managed woodland patch of Shoalhaven Lowland Bloodwood Shrub Forest occurring on a level area at the base of gently sloping land to the north and west (Figure 3).

Only 7 mature trees occur at the subject site including 4 individuals of Narrow-leaved Scribbly Gum, 2 individuals of Grey Gum and one individual of Red Bloodwood. A dead stag also occurs at the site but contains no hollows.

There is no understory and no natural ground cover (Figures 5 & 6).

One mature individual of Scribbly Gum contains numerous hollows and spouts (Figures 6 & 10) and all hollows were occupied by a suite of birds such as Rainbow Lorikeets, Galahs, Little Corellas, Noisy Minors and an individual Nankeen Kestrel, with microbats highly likely also to find shelter in the hollows.

This individual will be retained *in situ* and incorporated into the proposed RRLC development and so preserving the fauna habitat features of this individual.

The canopy trees presently provide sheltering and seasonal food resources for avifauna such as parrots. Large hollows for owl species were not recorded within the study area. No arboreal nests were recorded during this survey.

No habitat occurs within the managed exotic grassland ground cover for sheltering for reptiles or small mammals (Figures 5 & 6).

3.3.3 Wildlife corridor potential

The presence of similar small patches of adjacent managed woodland/forest vegetation within the immediate subject site (Figure 7), and larger expanses of natural Shoalhaven Lowland Bloodwood Shrub Forest to the west, north, east and south-east affords effective connectivity for avian, microchiropteran and arboreal species in the locality (Figure 4).

3.3.4 Fauna recorded

The conditions of mild, warm temperatures and light winds, though with a lack of flowering trees, shrubs and ground covers, were suitable for fauna occurrence. Proximity to the relatively busy Flatrock Road traversing through the location may provide a deterrent for midday activity of fauna.

Table 3 indicates the fauna recorded or expected to occur on occasion when flowering resources are available within the relatively small area of survey at Flatrock Road, Mundamia

Class/Family	Common name	Scientific name	Patches of woodland in Operational Areas
REPTILIA Scincidae	Dark-flecked Garden Sunskink	*Lampropholis delicata*	x
Elapidae	Red-bellied Black Snake Sunskink	*Pseudochis porphyriacus*	e
AVES Alcedinidae	Laughing Kookaburra	*Dacelo novaeguineae*	x
Artamidae	Grey Butcherbird	*Cracticus torquatus*	e
Cacatuidae	Sulphur-crested Cockatoo	*Cacatua galerita*	x
	Little Corella	*Cacatua sanguinea*	x
	Galah	*Eolophus roseicapilla*	x
Psittacidae	Crimson Rosella	*Platycercus elegans*	e
	Rainbow Lorikeet	*Trichoglossus haematodus*	x
	Eastern Rosella	*Platycercus adscitus eximius*	e
	Australian King Parrot	*Allisterus scapularis*	e
Meliphagidae	Noisy Miner	*Manorina flavigula*	x
	Little Wattle Bird	*Anthochaera chrysoptera*	x
Corvidae	Australian Raven	*Corvus coronoides*	x
Falconidae	Nankeen Kestrel	*Falco cenchroides*	x
Hirundinidae	Welcome Swallow	*Hirundo neoxena*	x
Charadriidae	Masked Lapwing	*Vanellus miles*	x
MAMMALIA Macropodidae	Eastern Grey Kangaroo	*Macropus giganteus*	x (scat)
Pseudocheiridae	Common Ringtail possum	*Pseudocheirus peregrinus*	e
Phalangeridae	Common Brushtail Possum	*Trichosurus vulpecula*	e
Pteropodidae	Grey-headed Flying-fox	*Pteropus poliocephalus*	e
Vespertilionidae	Gould's Wattled Bat	*Chalinolobus gouldii*	e
Vespertilionidae	Little Forest Bat	*Vespadelus vulturnus*	e
Muridae	Black Rat*	*Rattus rattus*	e

Legend:
x - observed either onsite, observed overhead or heard in vicinity; e - expected to occur onsite (previous surveys in similar habitat) and in vicinity on occasion

The Powerful Owl (*Ninox strenua*) may occasionally forage within the area if prey species are in abundance. However during the survey, prey for this large owl did not appear sufficient in number to attract it to the area at the present time. No breeding hollows observed onsite and no whitewash was observed beneath any individuals of mature trees at the subject site.

The Common Brushtail Possum (*Trichosurus vulpecula*) and Ringtail Possum (*Pseudocheirus peregrinus*) are expected to occur within the low woodland/forest habitat.

The common Little Forest Bat (*Vespadelus vulturnus*), and Gould's Wattled Bat (*Chalinolobus gouldii*) may be expected to occur occasionally for foraging. The Little Forest Bat roosts in hollows in old trees, buildings and timber stacks. These bat species are common insectivorous microbat species in the region.

The larger megabat, Grey-headed Flying Fox (*Pteropus poliocephalus)* was not sighted during the survey, which occurred during mid-morning when the bats would be roosting in camps, but may be attracted to nearby flowering Eucalyptus trees on occasion during the warmer months.

Reptilian habitat was rated as poor for foraging and sheltering as little leaf litter was developed or retained in the ground strata (Figures 5 & 6).

Habitat for amphibian species was rated as poor as no drainage lines or ponds occur at the subject site.

The pest species Black Rat and House Mouse may be expected to occur occasionally at and in the vicinity of the subject site as a Waste landfill area provides an ideal habitat for these feral species.

3.3.5 Fauna species of conservation significance

3.3.5.1 Threatened species

The criteria used to assess the likelihood of threatened species occurring in the Study Area include the specificity of habitat features such as tree canopy cover, relative soil moisture regime, relative soil nutrient regimes, historical disturbance and degradation of vegetation and known occurrences of threatened species in the immediate locality.

If all or most of these collective criteria deemed optimal for the occurrence of a particular threatened species occur in relation to the habitat of the Study Area, then the likelihood of its potential occurrence in the habitat of the Study Area could be assessed as being relatively high. If only some of these collective criteria deemed suitable for the occurrence of a particular threatened species occur in the habitat of the Study Area, then its potential occurrence in the area of study may be deemed moderate at best. If few of these collective criteria deemed suitable for the occurrence of a particular threatened species occur in the habitat of the Study Area, then the likelihood of its occurrence would be assessed as being low to very unlikely.

The DPE Bionet Atlas of NSW Wildlife database 2023 (Dept Planning and Environment) listed thirty-two (32) species of terrestrial and avifauna considered threatened under the BC Act within a 5 km radius of the site (Table 4). Five of these species are designated as endangered by

the NSW Scientific Committee with the remainder designated as vulnerable. Under the Commonwealth EPBC Act 1999, four are listed as endangered and seven species are listed as vulnerable.

Family	Common name	Scientific name	NSW status	Comm. status	No. of records
Amphibia **Hylidae**	Green and Golden Bell Frog	*Litoria aurea*	E1,P	V	2
Reptilia **Elapidae**	Broad-headed Snake	*^Hoplocephalus bungaroides*	E1,P,2	V	1
Aves **Anatidae**	Freckled Duck	*Stictonetta naevosa*	V,P		2
Ardeidae	Black Bittern	*Ixobrychus flavicollis*	V,P		1
Accipitridae	White-bellied Sea-Eagle	*Haliaeetus leucogaster*	V,P		4
	Square-tailed Kite	*^^Lophoictinia isura*	V,P,3		9
Burhinidae	Bush Stone-curlew	*Burhinus grallarius*	E1,P		1
Cacatuidae	Gang-gang Cockatoo	*^^Callocephalon fimbriatum*	V,P,3	E	16
	Glossy Black-Cockatoo	*^Calyptorhynchus lathami*	V,P,2	V	228
Psittacidae	Little Lorikeet	*Glossopsitta pusilla*	V,P		5
Strigidae	Powerful Owl	*^^Ninox strenua*	V,P,3		23
Tytonidae	Masked Owl	*^^Tyto novaehollandiae*	V,P,3		1
	Sooty Owl	*^^Tyto tenebricosa*	V,P,3		2
Dasyornithidae	Pilotbird	*Pycnoptilus floccosus*	P	V	1
Neosittidae	Varied Sittella	*Daphoenositta chrysoptera*	V,P		10
Artamidae	Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	V,P		2
Petroicidae	Scarlet Robin	*Petroica boodang*	V,P		1
Mammalia **Dasyuridae**	Spotted-tailed Quoll	*Dasyurus maculatus*	V,P	E	2
Phascolarctidae	Koala	*Phascolarctos cinereus*	E1,P	E	1
Burramyidae	Eastern Pygmy-possum	*Cercartetus nanus*	V,P		13
Petauridae	Yellow-bellied Glider	*Petaurus australis*	V,P	V	250
	Squirrel Glider	*Petaurus norfolcensis*	V,P		2
Pseudocheiridae	Greater Glider	*Petauroides volans*	E1,P	E	1
Pteropodidae	Grey-headed Flying-fox	*Pteropus poliocephalus*	V,P	V	1,736
Emballonuridae	Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V,P		2
Molossidae	Eastern Coastal Free-tailed Bat	*Micronomus norfolkensis*	V,P		6
Vespertilionidae	Large-eared Pied Bat	*Chalinolobus dwyeri*	V,P	V	10
	Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V,P		6
	Southern Myotis	*Myotis macropus*	V,P		8

Family	Common name	Scientific name	NSW status	Comm. status	No. of records
Vespertilionidae	Greater Broad-nosed Bat	*Scoteanax rueppellii*	V,P		9
Miniopteridae	Little Bent-winged Bat	*Miniopterus australis*	V,P		1
	Large Bent-winged Bat	*Miniopterus orianae oceanensis*	V,P		11

Legend to Table 4- BC Act, EPBC Act, Migratory Bird Agreements

Key	
Environmental Protection and Biodiversity Conservation Act (EPBC Act) 1999	Biodiversity Conservation Act (BC Act) 2016
	E1 - Endangered
CE - Critically Endangered	E4 - critically endangered
E - Endangered	V - Vulnerable
V - Vulnerable	C CAMBA Migratory bird agreement between Australia and China

Table 4 - 32 species of threatened fauna recorded within 5km radius of the subject site within the previous 20 years (DPE Bionet Atlas 2022).

3.3.5.2 Threatened species with potential to occur at the subject land

All threatened species listed require specific habitat for foraging, nesting or roosting. The subject land was assessed for these habitat requirements (refer to Appendix 3).

Due to the open woodland habitat of the subject site with few trees, no understorey or natural ground cover and high cover of exotic grassland, few threatened fauna species are considered likely to regularly occur as indicated by the recorded sightings of threatened fauna species in the locality. Figure 13 indicates the most recorded threatened fauna species.

Many of the threatened species listed in Table 4 occur in habitats differing from that indicated for the managed, structurally compromised condition of the subject site.

The Yellow-bellied Glider occurs in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Figures 11 and 12 indicate a high number of observations of this species in forested areas of Shoalhaven Lowland Bloodwood Shrub Forest in the vicinity of the subject site.

This species feeds primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein. The animal extracts sap by incising (or biting into) the trunks and branches of favoured food trees, often leaving a distinctive 'V'-shaped scar.

The individual of Scribbly Gum with the numerous fauna-habitat hollows indicated in Figure 6 has extensive pock-marks, scratch marks and incisions on the trunk, but not the characteristic deep 'V-shaped' incisions of the Yellow-bellied Glider (Figure 10).

Figure 12 also indicates the numerous sightings of the Grey-headed Flying Fox, concentrated around the settlement of Nowra. This could reflect the greater reporting by personnel from urbanised areas as much as the presence of foraging resources in the locality. The Grey-headed Flying Fox has a wide range across the locality.

A total of 228 sightings of the Glossy Black Cockatoo appears to be concentrated in only two disparate areas, at South Nowra and to the west of Bamarang Nature Reserve (Figure 12).

Figure 13 indicates the locations of sightings and calls of the Powerful Owl across a small area of the locality mostly between Cabbage Tree Flat and Mundamia, its range documented as records on a 1km grid pattern.

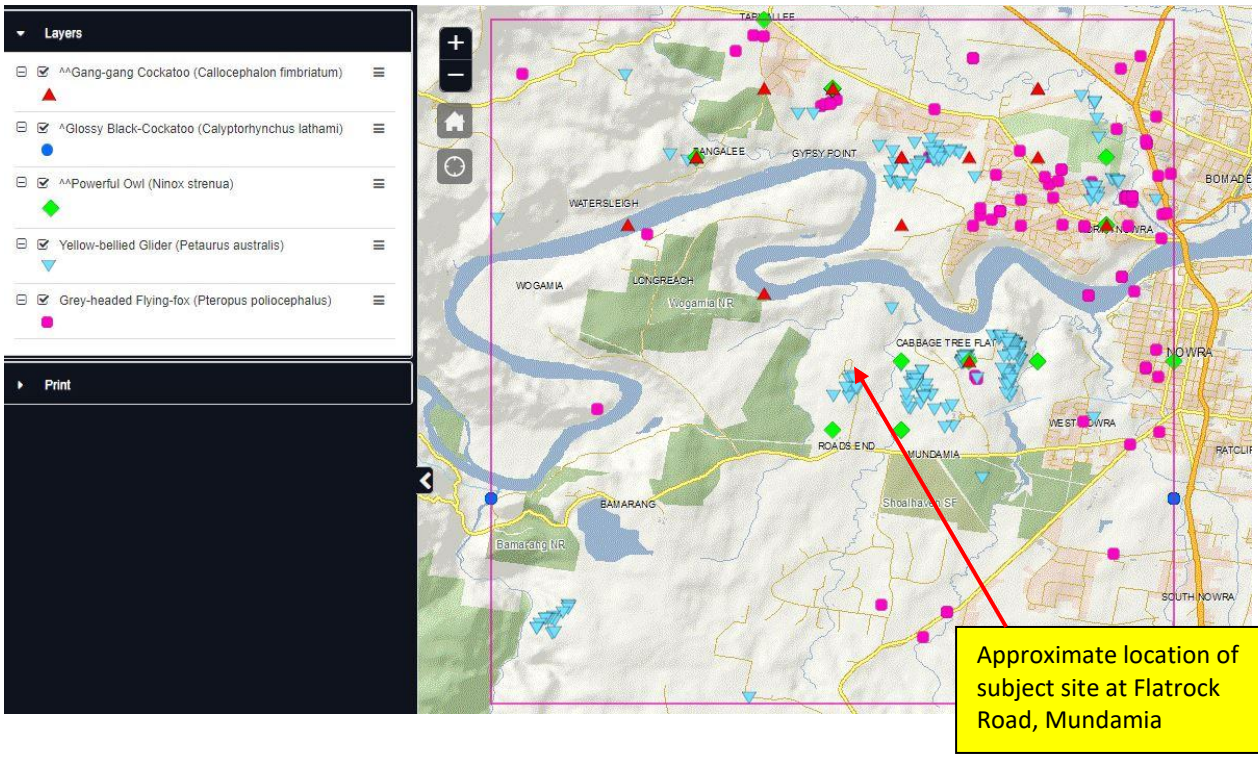


Figure 13 - Indicates recorded sightings of 5 threatened fauna species in the locality of the subject site, including for the Yellow-bellied Glider, Grey-headed Flying Fox, Glossy Black Cockatoo and Powerful Owl.

Five threatened species occurring closest to, or in the vicinity of the site, include the following (See Appendix 3 for habitat assessment):

1. Yellow-bellied Glider (*Petaurus australis*) occurs in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. This species is highly mobile and occupies large home ranges between 20 to 85 ha to encompass dispersed and seasonally variable food resources (DPE 2022). Figures 11 and 13 indicate a high number

of observations of this species in forested areas of Shoalhaven Lowland Bloodwood Shrub Forest in the vicinity of the subject site.

This species feeds primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein. The animal extracts sap by incising (or biting into) the trunks and branches of favoured food trees, often leaving a distinctive 'V'-shaped scar (DPE 2022).

The over-mature individual of Narrow-leaved Scribbly Gum indicated in Figures 6 and 10 is a Yellow-bellied Glider food tree (DEC 2004) this individual will be retained to preserve the hollows and potential feed resource *in situ.*

2. Powerful Owl (*Ninox strenua*). The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest.

The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine *Syncarpia glomulifera*, Black She-oak *Allocasuarina littoralis*, Blackwood *Acacia melanoxylon*, Rough-barked Apple *Angophora floribunda*, Cherry Ballart *Exocarpus cupressiformis* and a number of eucalypt species (DPE 2023).

The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider. Flying foxes are important prey in some areas; birds comprise about 10-50% of the diet depending on the availability of preferred mammals. As most prey species require hollows and a shrub layer, these are important habitat components for the owl (DPE 2023).

Pairs of Powerful Owls demonstrate high fidelity to a large territory, the size of which varies with habitat quality and thus prey densities. In good habitats a mere 400ha can support a pair; where hollow trees and prey have been depleted the owls need up to 4000 ha (DPE 2023).

The Powerful Owl may forage in the area of the subject land from time to time and be an infrequent visitor to the subject area. However, as much of the surrounding forest will be retained and occurs in reserve areas, it is considered that the proposal is not expected to affect the life-cycle or viability of populations of the Powerful Owl in the locality.

3. Glossy Black Cockatoo (*Miniopterus orianae oceanensis*). Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m with She-oak species, particularly Black She-oak (*Allocasuarina littoralis*), Forest She-oak (*A. torulosa*) or Drooping She-oak (*A. verticillata*). The relatively small area of vegetation that will be

impacted by the proposal does not contain any Sheoak species, and nor do the surrounding patches of vegetation within the Waste Operations landform, and as such, the proposal is not considered to result in a significant adverse impact on the life-cycle or population dynamics of the Glossy Black Cockatoo (DPE 2023).

4. Grey-headed Flying Fox (*Pteropus poliocephalus*). This species congregates in large camps and is found in a variety of habitats including rainforest, mangroves, Melaleuca swamps, wet and dry sclerophyll forests and also cultivated areas. The species feeds on the blossoms of more than 80 plant species, especially eucalyptus blossom and the fruits of a number of palm species. Flowering species of eucalypts such as Swamp Mahogany (*Eucalyptus robusta*) and Forest Red Gum (*Eucalyptus tereticornis)* and Paperbarks (*Melaleuca quinquenervia*), are particularly important. Distances of up to 30km from the camp are often travelled, with 60-70km sometimes covered per night to reach a particular food source.

   The Grey-headed Flying Fox (*Pteropus poliocephalus)* was not sighted during the survey, which occurred during mid-morning when the bats would be roosting in camps, but may be attracted to flowering Eucalyptus trees on occasion during the warmer months.

   It is considered that, as the area that is proposed to be impacted is not optimal habitat and is very small compared to its large foraging range in the locality, this species will not be compromised by the development proposed for the subject site (DPE 2023).

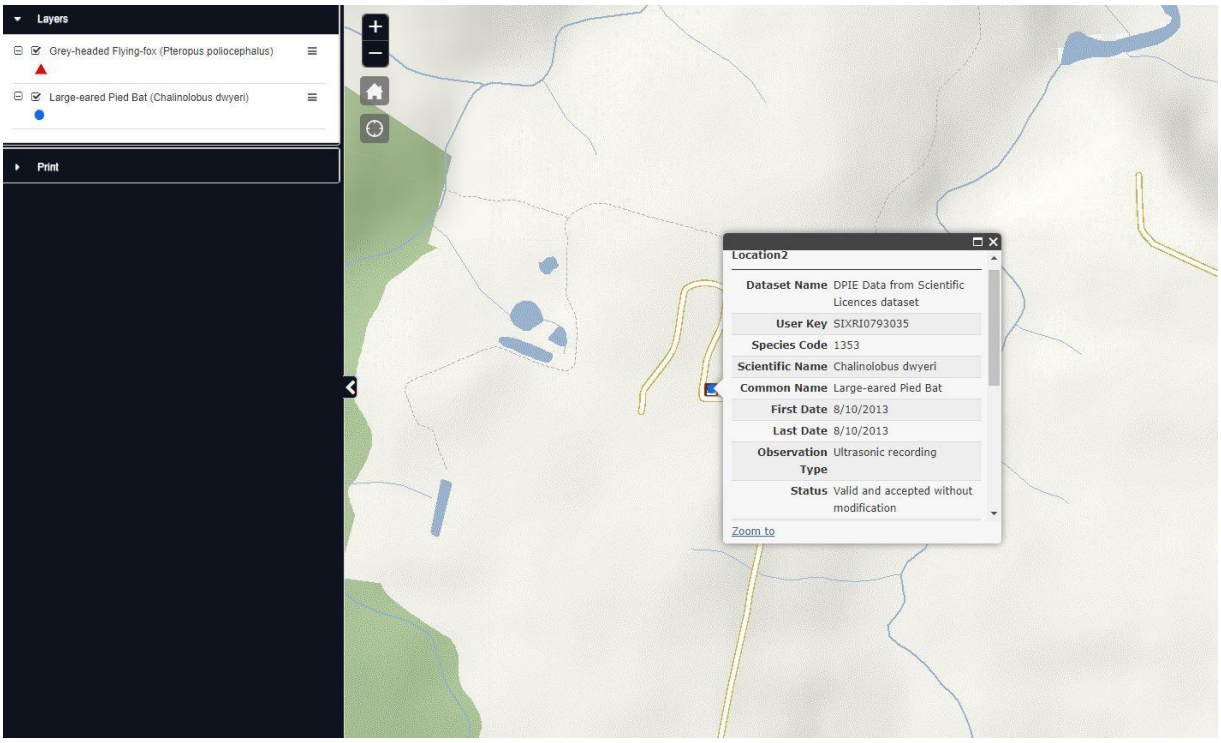
5. Large-eared Pied Bat (*Chalinobus dwyeri*). A small to medium-sized bat with long, prominent ears and glossy black fur. It is generally rare with a very patchy distribution in NSW. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features (DPE 2022).

   Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. Found in well-timbered areas containing gullies (DPE 2022).

   Found in well-timbered areas containing gullies.

   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 (DPE 2023).

   There is a digital recording of an individual (population) taken in 2013 about 75m to the east of the subject development site (Figure 14). The habitat of the subject development site does not appear optimal however for this species, likely preferring the natural wooded areas of bushland to the east and south-east of the subject site.



Dataset Name	DPIE Data from Scientific Licences dataset
User Key	SIXRI0793035
Species Code	1353
Scientific Name	Chalinolobus dwyeri
Common Name	Large-eared Pied Bat
First Date	8/10/2013
Last Date	8/10/2013
Observation Type	Ultrasonic recording
Status	Valid and accepted without modification

Validation Flags	
Description	West Nowra RRP, directly east of West Nowra landfill site off Flatrock Road, West Nowra
Latitude	-34.881972
Longitude	150.552391
Zone	56
Easting	276308
Northing	6137312
Accuracy	10
Sighting Notes	
Location Notes	

Figure 14 - Recording of Large-eared Pied Bat some 75m east of the subject RRLC site at West Nowra Resource Recovery Park, Flatrock Road, Mundamia

4 POTENTIAL IMPACTS AND COMPLIANCE WITH DEVELOPMENT IN SHOALHAVEN COUNCIL LGA

4.1 Introduction

Residential development must comply with Shoalhaven Council LEP (2014) and Shoalhaven Council DCP (2014). This plan applies to all land within the Shoalhaven Council LGA to which LEP 2014 applies.

4.2 Shoalhaven Council LEP (2014)

The aims of the Plan include the following:

(a) to encourage the proper management, development and conservation of natural and man-made resources,
(b) to ensure that suitable land for beneficial and appropriate uses is made available as required,
(c) to manage appropriate and essential public services, infrastructure and amenities for Shoalhaven,
(d) to minimise the risk of harm to the community through the appropriate management of development and land use.

Comment: The proposal is to remove a total of 6 individuals of trees from a small area of land to provide appropriate space to construct a series of buildings incorporating a Resource Recovery Learning Centre (RRLC).

One individual Narrow-leaved Scribbly Gum appears as a suitable habitat tree for fauna, containing a number of medium sized hollows where different species of birds were observed occupying the hollows (Figures 6 & 10). Fortunately, this individual (Figure 6 & 10) with hollows and feed resource potential for ongoing fauna habitat function will be retained *in situ* and be incorporated into the proposed development (J. Lynch *pers.comm.*).

4.3 Shoalhaven City Council DCP (2014)

The Shoalhaven Development Control Plan (DCP) 2014 provides detailed guidance and provisions for the use of land including the criteria for the assessment of development applications.

4.4 Proposed impacts to floristic biodiversity

The small patch of woodland that is proposed to be removed contains a small number of canopy species such as Narrow-leaved Scribbly Gum, Grey Gum and Red Bloodwood that are common to surrounding areas of Shoalhaven Lowland Bloodwood Shrub Forest (Figure 5).

Local patches of woodland surveyed within the wider subject area contained these species as well as other canopy species such as Spotted Gum, Blackbutt, Yellow Bloodwood and Brown Barrel (Table 1).

As such, the removal of some individuals of trees in an area where these species are common in the immediate and extended locality, would not be considered to substantially alter the floristics, structure or functionality of the local ecological community of Shoalhaven Lowland Bloodwood Shrub Forest. It is, however, recommended to replace these species to be planted in suitable sections of the subject land.

The section of land where some trees are proposed to be removed is not included in the Shoalhaven Council Biodiversity Mapping either as containing significant biodiversity or as part of a habitat corridor (Figure 15).

Figure 15 – Mapping of biodiversity at the Waste Operations area at Flatrock Road, Mundamia (Shoalhaven City Mapping Dept 2022)

4.5 Compliance with Threatened Species Legislation

4.5.1 Threatened species

No individuals of threatened flora or fauna were recorded at the subject site.

Occasional visitors to the site when food resources become available may include the Yellow-bellied Glider, Powerful Owl and Grey-headed Flying Fox. These are highly mobile species and the limited development on the small area of the subject site shown in Figures 1, 2 & 3 is not considered to have any significant impact on these species behavior or life-cycles.

An individual of Narrow-leaved Scribbly Gum contains numerous hollows (Figure 6 & 10) that could also provide habitat for the Yellow-bellied Glider of which there are extensive sightings of in the locality (Figure 11 & 12). This individual will be retained and incorporated into the proposed development plan (J. Lynch *pers.comm.*) and so retaining the fauna habitat value of several hollows in various sections of the tree.

4.5.2 Threatened Ecological Community

A typical patch of canopy tree species representative of Shoalhaven Lowland Bloodwood Shrub Forest occurs at the subject site of the proposed RRLC (Figure 3).

This ecological community is not listed as an EEC on either registers of the BC Act (2016) or the EPBC Act (1999) with a total of 16,253ha of this community retained with 20% cleared (DPE 2022).

4.6 Compliance with Effluent and Stormwater Disposal

The site would be serviced by existing sewage and storm water infrastructure that occurs in the locality.

4.7 Conclusions

With appropriate management of potential environmental constraints, the retention of a fauna habitat tree and the undertaking of effective mitigation measures as outlined in this report, the proposed development is considered to comply with the desired criteria in relation to Shoalhaven City Council DCP (2014).

5 ADDRESSING THE PROPOSED DEVELOPMENT IN RELATION TO THE BAM (BIODIVERSITY ASSESSMENT METHOD) AS REQUIRED BY THE BC ACT (2016)

5.1 Offset Scheme Thresholds

5.1.1 Area criteria

The threshold for clearing above which the BAM and offsets apply is 0.4ha (BAM 2016). Of this 0.4ha area, if the area to be developed is >0.25ha then offsets may apply (BAM 2016). If the area of the property is >1ha, then up to 0.5ha of vegetation can be cleared before offsets apply (BC Act 2016).

The section of land at the subject site to be cleared comprises an area of about 0.22ha within a total area of the West Nowra Landfill site of greater than 50ha (Figure 2) (Nearmap 2022).

The development does not meet the offset criteria in relation to potential area to be impacted.

5.1.2 Biodiversity Values Map

The Biodiversity Values Map (BV Map) identifies land with high biodiversity value, as defined by the *Biodiversity Conservation Regulation 2017*. The Biodiversity Offsets Scheme applies to all local developments, major projects or the clearing of native vegetation where the *State* Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017 applies. Any of these will require entry into the Biodiversity Offsets Scheme if they occur on land mapped on the Biodiversity Values Map (DPE 2022).

The location of the subject property on a reviewed and updated Biodiversity Values Map is indicated in Figure 16.

The subject development site of the West Nowra Recycling Plant property is indicated as no longer containing significant Biodiversity Value that may be impacted either directly or indirectly by the proposed development (Figure 16).

An area of bushland, at the eastern edge of the Landfill site, contiguous with the western alignment of Flatrock Road, has retained mapping as having Biodiversity Value (Figure 16).

Shoalhaven Lowland Bloodwood Shrub Forest is not listed on registers of the NSW BC Act or Commonwealth EPBC Act. There are no TEC's associated with this PCT (DPE 2023).

About 20% of the natural area of Shoalhaven Lowland Bloodwood Shrub Forest has been cleared and it is estimated that 16,253ha of the community is retained (DPE 2023).

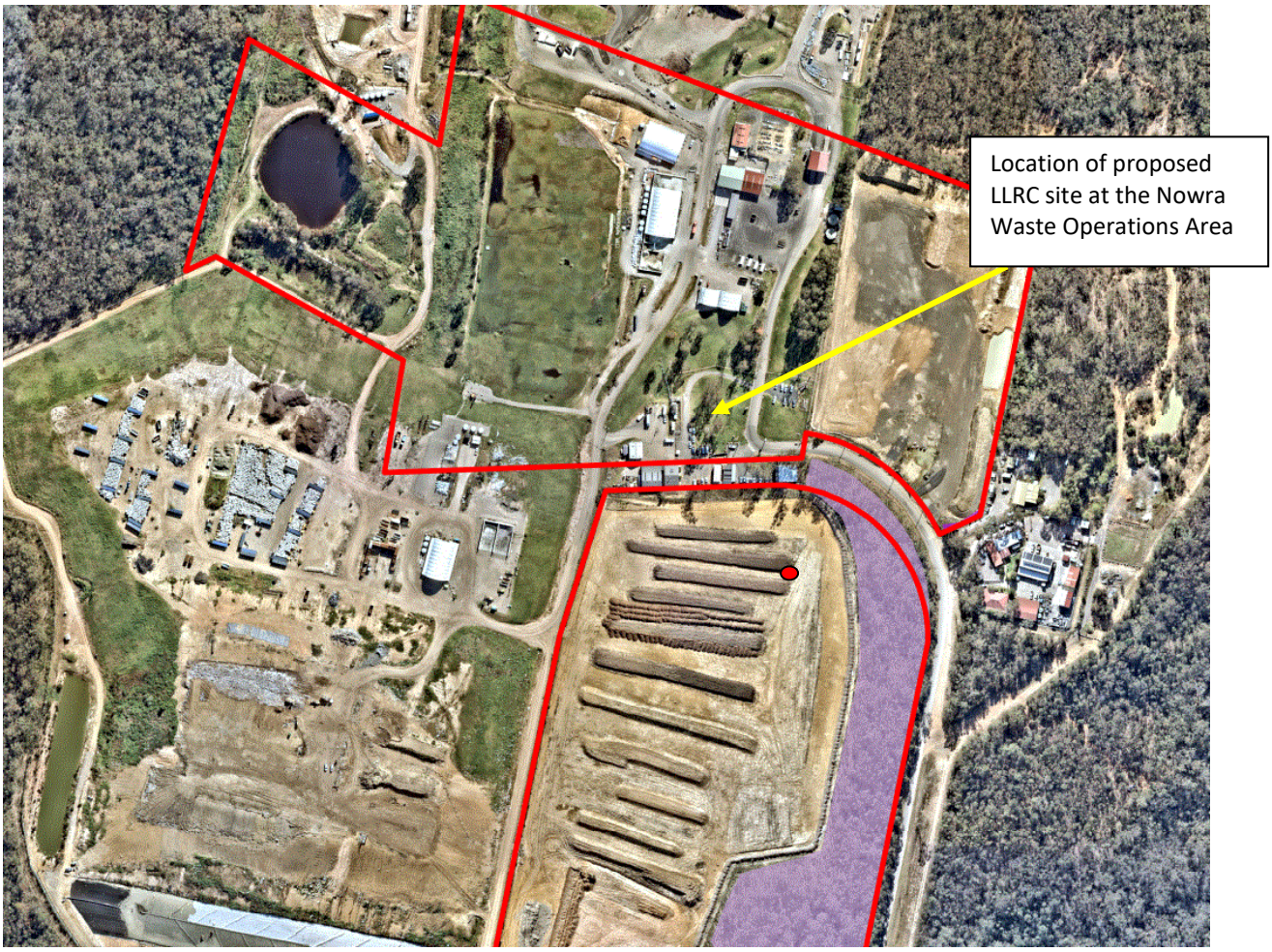


Figure 16 - Revised Biodiversity Values Mapping of subject site at the Nowra Waste Landfill site (after review), showing biodiversity values mapped for the subject site only along the eastern edge of bushland aligned with the western edge of Flatrock Road, Mundamia (Biodiversity value marked as shaded in purple shading) (DPE 2023).

5.1.3 Threatened species, populations and/or ecological communities.

No threatened species of flora or fauna or ecological community will be impacted by the development proposal.

No threatened ecological community would be impacted by the development proposal.

As such, it is considered that no significant impacts would occur to the extent of or viability of any threatened species or ecological community either at the subject land or in the locality.

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Appendix 1: Floristic species assemblages recorded at the Nowra Waste Operations Area

KEY

Status
***** - Exotic

Vegetation
Elements of Shoalhaven Lowland Bloodwood Shrub Forest (For numbered 'Areas' see Figure 7)

Relative cover or number of individuals of canopy species value (% cover or number of individuals with estimates of height)

STATUS	SCIENTIFIC NAME	COMMON NAME	AREA 1	AREA 2	AREA 3	AREA 4	AREA 5
	MAGNOLIOPSIDA: MAGNOLIDAE						
	Altingiaceae						
*pl	*Liquidambar styraciflua*	Sweet Gum					1
	Fabaceae: Faboideae						
	Dillwynia retorta	Heathy Parrot Pea	*				
	Hardenbergia violacea	False Sarsaparilla	*				
*pl	*Robinia pseudoacacia*	Black Locust					4%
	Geraniaceae						
	Geranium solanderi			*			
	Malvaceae						
*	*Pavonia hastata*				1%		
	Mimosaceae						
	Acacia elongata	Swamp Wattle	*		5%		
	Acacia implexa	Hickory Wattle			2%		To 10m (3%)
	Acacia longifolia subsp. *longifolia*	Sydney Golden Wattle					To 10m (3%)
	Acacia parramattensis	Parramatta Green Wattle	*	10%		3%	
	Myrtaceae						
	Callistemon sieberi	River Bottlebrush					2%
	Corymbia gummifera	Red Bloodwood		1 x 20m			
	Corymbia maculata	Spotted Gum				To 22m (70%)	8%
	Eucalyptus eximia	Yellow Bloodwood					8%

STATUS	SCIENTIFIC NAME	COMMON NAME	AREA 1	AREA 2	AREA 3	AREA 4	AREA 5
	Myrtaceae						
	Eucalyptus fastigiata	Brown Barrel			1 (10%)		10%
	Eucalyptus haemastoma	Broad-leaved Scribbly Gum					
	Eucalyptus globoidea	White Stringy Bark			1 x 20m (10%)		
	Eucalyptus pilularis	Blackbutt					3 x 13m (7%)
	Eucalyptus punctata	Grey Gum	1 x 15m	2	1 x 18m (30%)		8%
	Eucalyptus racemosa	Narrow-leaved Scribbly Gum		4 x to 20m		2 x 18m	To 20m (10%)
	Leptospermum trinervium	Paperbark Teatree	*				
	Passifloraceae						
*	*Passiflora caerulea*	Blue Passionflower				3%	
	Polygonaceae						
	Rumex brownii	Swamp Dock		*			
	Proteaceae						
	Petrophile pulchella	Conesticks	*				
	MAGNOLOPSIDA: LILIDAE						
	Asparagaceae						
	Lomandra longifolia	Spiky-headed Mat-rush				10%	
	Commelinaceae						
	Commelina cyanea	Scurvy Weed		*		3%	
	Juncaceae						
	Juncus usitatus	Common Rush		*			

Appendix 2: Plant species of conservation significance recorded within a 5km radius of the surveyed area since 2002 where potential habitat may occur (DPE Bionet Atlas of NSW Wildlife 2022[α]) or where potential habitat is deemed to potentially occur (Commonwealth Environmental Reporting Tool 2022[β])

Scientific Name	Status (EPBC Act 1999)	Status (BC Act 2016)	Nos of records	RoTAP	Habit/potential habitat/general geographic location	Likelihood of occurrence in surveyed areas	Reference material derived from 'Final Determinations' (Scientific Committee) and others listed below:
Hibbertia purebula **Hibbertia purebula**		V	2		Sparsely branched shrublet to 30cm tall with weak stems. Occurs in sandy soils or clay in woodland and shrubland from Wollemi National Park to south coast near Nowra.	**Highly unlikely** -nearest record about 1.2km to the south on Roads End. No shrubs in small patch of managed woodland **No further assessment required**.	DPE Bionet Atlas of NSW Wildlife (2023); Harden (2000)
Hibbertia stricta **subsp** ***furcatula***		E1	21		Small upright shrub to 1.3m tall. *Hibbertia stricta* subsp. *furcatula* (*Hibbertia* sp. nov. 'Menai') is known to occur in two populations, one in the southern outskirts of Sydney, and one near Nowra on the mid-South Coast of NSW. The southern population is mainly in the vicinity of Nowra. Habitat of the Southern Sydney population is broadly dry eucalypt forest and woodland. This population appears to occur mainly on upper slopes and above the Woronora River gorge escarpment, at or near the interface between the Lucas Heights soil landscape and Hawkesbury sandstone. Toelken & Miller (2012) note that the species usually grows in 'gravelly loam or clay soil in heath under open	**Highly unlikely** -nearest record occurs about 440m to the east. No shrubs in small patch of managed woodland **No further assessment required**.	DPE Bionet Atlas of NSW Wildlife (2023)

					woodland'. Habitat of the South Coast population is poorly recorded, but appears to be dry sclerophyll forest or woodland associations in sandy soils over sandstone		
Scientific Name	**Status (EPBC Act 1999)**	**Status (BC Act 2016)**	**Nos of records**	**RoTAP**	**Habit/potential habitat/general geographic location**	**Likelihood of occurrence in surveyed areas**	**Reference material derived from 'Final Determinations' (Scientific Committee) and others listed below:**
Acacia pubescens **Downy Wattle**	V	V	3		Spreading shrub to 5m tall. Dry sclerophyll woodland/forest on clay soils, from Bilpin to the Georges River.	**Highly unlikely:** Nearest record about 4.7km to the SE at South Nowra. No shrubs in small patch of managed woodland. **No further assessment required**.	DPE Bionet Atlas of NSW Wildlife (2023), Robinson (1994), Fairley (2004).
Eucalyptus langleyi **Albatross Mallee**	V	V	33		The main occurrence of the Albatross Mallee is to the south-west of Nowra as far as Yarramunmun Creek. A very small population is found to the north of the Shoalhaven River in the Bomaderry Creek Regional Park. Found in mallee shrubland on poorly-drained, shallow, sandy soils on sandstone.	**Unlikely** - Habitat unsuitable. Nearest record about 2.3km to the south-east at west Nowra. Absence of conspicuous large-life form individuals indicate non-occurrence. **No further assessment required**.	DPE Bionet Atlas of NSW Wildlife (2023)
Triplarina nowraensis [α]	E	E1	268		A small, erect shrub to 5 m tall. There are five known populations of Nowra Heath Myrtle. Three of these form a cluster to the immediate west of Nowra. A fourth, much smaller population is found 18km south-west of Nowra in the Boolijong Creek Valley. The fifth population is located north of	**Highly unlikely** – Habitat unsuitable. Nearest record 280m to south in natural woodland. No shrub component in subject site. Absence of conspicuous large-life form individuals indicate non-occurrence. **No further assessment required**.	DPE Bionet Atlas of NSW Wildlife (2023); Robinson (2000); Fairley (2004)

					the Shoalhaven River on the plateau above Bundanoon. Nowra Heath Myrtle occurs on poorly drained, gently sloping sandstone shelves or along creek lines underlain by Nowra Sandstone. The sites are often either treeless or have a very open tree canopy due to the impeded drainage. Individuals have been observed to resprout from lignotubers and they are also expected to reproduce from seed though this needs to be confirmed.		
Scientific Name	**Status (EPBC Act 1999)**	**Status (BC Act 2016)**	**Nos of records**	**RoTAP**	**Habit/potential habitat/general geographic location**	**Likelihood of occurrence in surveyed areas**	**Reference material derived from 'Final Determinations' (Scientific Committee) and others listed below:**
Genoplesium baueri $^{\alpha}$ **Bauer's Midge Orchid**	E*	E1	22		Terrestrial orchid to 15cm tall, occurs in sparse sandy dry sclerophyll forest habitat and moss outcrops over sandstone.	**Highly unlikely** – Habitat unsuitable. Record from about 5.1km to the south-east at South Nowra. **No further assessment required**.	Bionet Atlas of NSW Wildlife (2023)
Pterostylis ventricosa $^{\alpha}$		E4A	1		Pterostylis ventricosa is a perennial terrestrial orchid. The 8-30 cm tall flowering stem emerges from an underground tuber and produces 1 to 6 flowers at the top each year. *Pterostylis ventricosa* is known from populations at St Georges Basin, Sussex Inlet and west of Nowra in the Shoalhaven and also near Tallong and Mittagong in the Southern Highlands.	Unlikely - Habitat not suitable in managed patch of subject open woodland. No records in locality. Most populations nearer to coast, Flowering times March - May. No further assessment required.	Bionet Atlas of NSW Wildlife (2023)

					Surveys carried out at various times between 2007 to 2010 estimate a total population of about 1,200 plants. The two largest populations, one at St Georges Basin and one at Sussex Inlet, are located on estates of private land. Two smaller populations, comprising a total of less than 10% of the known plants, are within Conjola National Park. Predominantly in more open areas of tall coastal eucalypt forest often dominated by one or more of the following tree species:- Turpentine, Spotted Gum, Grey Ironbark, Blackbutt, White Stringybark, Scribbly Gum and Sydney Peppermint. Often favours more open areas such as along powerline easements and on road verges where the tree overstorey has been removed or thinned. Grows in a range of groundcover types, including moderately dense low heath, open sedges and grasses, leaf litter, and mosses on outcropping rock. Small moss gardens are a commonly associated micro-habitat feature in most habitats.		

Scientific Name	Status (EPBC Act 1999)	Status (BC Act 2016)	Nos of records	RoTAP	Habit/potential habitat/general geographic location	Likelihood of occurrence in surveyed areas	Reference material derived from 'Final Determinations' (Scientific Committee) and others listed below:
Pterostylis vernalis [α]	CE	E4A	28		Perennial terrestrial orchid with flowering stems 10-20 cm tall. *Pterostylis vernalis* is only known from the Nowra area on the NSW south coast. There are five known populations located to the west and south-west of Nowra. Four are within a few kilometres of each other, and one is located approximately 18 km to the south-west. The total population is approximately 450-500 known individuals. The four northern populations may have once been considered as one population covering an area of approximately 3 km^2 Most known Pterostylis vernalis plants are located on land not reserved for conservation purposes. The exceptions are the southern-most population which is located in Jerrawangala National Park, and a part of one of the northern populations, which is located in Triplarina Nature Reserve Pterostylis vernalis grows in open sites around moss gardens in shallow soil over sandstone sheets or moss gardens on heavy laterite associated soils, in heath and dry heathy forest/woodland.	**Unlikely –** Habitat unsuitable in . Nearest records about 5.1km to south-east at South Nowra **No further assessment required**	DPE Atlas Of NSW Wildlife (2023);

					The distribution of the plants throughout its range is naturally patchy as the species is often restricted to sections of rock shelf where there is only a thin layer of soil over the rock shelf and where these sites are subject to particular hydrological conditions. Habitat generally contains moss gardens on various substrates Pterostylis vernalis is distinguished from other species of Pterostylis by the emergence of the rosettes before the development of the inflorescence (Jones 2006). Pterostylis vernalis is a seasonal perennial which is present above ground in the cooler months between late autumn until it sets seed in late spring. The above ground parts then wither and the plants persist as a dormant tuber underground over summer. Pterostylis vernalis is the only Pterostylis species in the vicinity of Nowra that flowers in spring (Jones 2006).		
Zieria baeuerlenii $^{\alpha}$ **Bomaderry Zieria**	E*	E1	102		Bomaderry Zieria is an 80 cm tall shrub, with clover-like (trifoliate) leaves that are covered in velvety hairs The species occurs in only one location north-west of Nowra. The population occurs in a total of 43 colonies in six discrete clusters. These clusters are	**Unlikely** – Habitat unsuitable. Records about 5km to the north-east at Bomaderry on ridgetop topography **No further assessment required**	DPE Bionet Atlas of NSW Wildlife (2023);

					confined within a 0.5 km x 1.0 km area of the bushland, and are found on both sides of Bomaderry Creek. Bomaderry Zieria occurs on skeletal sandy loam overlaying sandstone, on a rocky plateau amongst sandstone boulders in either shrubby open forest, shrubby woodland or closed scrub. Seed production has never been observed in the Bomaderry Zieria and all evidence collected to date suggests that the species has lost its capacity to reproduce sexually.		
Scientific Name	**Status (EPBC Act 1999)**	**Status (BC Act 2016)**	**Nos of records**	**RoTAP**	**Habit/potential habitat/general geographic location**	**Likelihood of occurrence in surveyed areas**	**Reference material derived from 'Final Determinations' (Scientific Committee) and others listed below:**
Rhodamnia rubescens $^{\alpha}$ **Scrub Turpentine**	CE	E4A	3		Shrub or small tree to 25 m high with reddish/brown, fissured bark (DPE 2022). Occurs in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils (DPE 2022).	**Unlikely** –Habitat unsuitable. Nearest records occur to the north-east about 1.8km of the subject site on the opposite side o the Shoalhaven River (DPE 2022). The habitat of the subject site is open and managed, however, the survey targeted this species of conservation significance but no individuals were found to occur in the surveyed area. **No further assessment required**	DPE Bionet Atlas of NSW Wildlife (2023)
Cryptostylis hunteriana $^{\alpha}$ **Leafless Tongue Orchid**	V*	V	3	3VC-	No leaf, flowers only in Dec-Feb, saprophytic. Known from a range of swamp-heath and woodland communities	**Unlikely:** Habitat unsuitable. No records in locality **No further assessment required**	DPE Bionet Atlas of NSW Wildlife (2023); Robinson (2000)

Key to Conservation Status:

Commonwealth legislation

Environmental Protection and Biodiversity Conservation Act, 1999
EX – Presumed extinct
E* - Endangered
V* - Vulnerable

NSW legislation

Biodiversity Conservation Act, 2016

E4A – Schedule 1 Part 1 – Presumed extinct, recently recorded
E1 Schedule 1 Part 1 – Endangered
V Schedule 2 - Vulnerable

RoTAP

Conservation code
2 - geographic range <100km
3 - geographic range >100km

Conservation status
E - endangered to point of extinction if current land use and other threats continue to operate
V - vulnerable, at risk of depletion over 20-50- years if land use that threatens survival is maintained
C - at least one population conserved in a national park or proclaimed conservation area

Size class of reserved populations

a - >1000 plants in conservation reserve
i - < 1000 plants in conservation reserve
- reserved population size not accurately known

Appendix 3 - Likelihood of occurrence of fauna species of conservation significance recorded within a 5km radius of the Study Area at the West Nowra Waste Operations Area (DPE Bionet Atlas of NSW Wildlife 2023) or where potential habitat is deemed to potentially occur (DCCEEW 2023).

Amphibians	**BC Act**	**EPBC Act**	**Habitat**	**Record (source)**	**Likelihood of Occurrence**	**Assessment of Significance required**
Green and Golden Bellfrog *Litoria aurea*	E1	V	**Distribution**: Formerly distributed from the NSW north coast near Brunswick Heads, southwards along the NSW coast to Victoria where it extends into east Gippsland. Records from west to Bathurst, Tumut and the ACT region. Since 1990 there have been approximately 50 recorded locations in NSW, most of which are small. Large populations in NSW are located around the metropolitan areas of Sydney, Shoalhaven and mid north coast. **Habitat**: Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spike-rushes *(Eleocharis* spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*) Suitable habitat in the form of ephemeral ponds with emergent reeds, are not present on the subject land for the Green and Golden Bell Frog. No impact is expected to this species as a result of the proposed development.	2 DPE Bionet Atlas (2023)	**Highly unlikely -** no suitable habitat on the subject land. Nearest record some 5.8km to south-east at South Nowra	No
Reptiles	**BC Act**	**EPBC Act**	**Habitat**	**No sighted (source)**	**Likelihood of Occurrence**	**Assessment of Significance required**
Broad-headed Snake *Hoplocephalus bungaroides*	E1	V	**Description;** The Broad-headed Snake is generally black above with yellow spots forming narrow, irregular cross-bands. **Habitat;** Usually located in exposed sandstone outcrops in woodland, open woodland and heath. The snake prefers sandstone outcrops that occurs in vegetation that include Corymbia gummifera (Red Bloodwood) and Eucalyptus sieberi	1 DPE Bionet Atlas (2023)	**Highly unlikely -** no suitable habitat on the subject land.	No

			(Silver-top Ash).			
Birds	**BC Act**	**EPBC Act**	**Habitat**	**No sighted (source)**	**Likelihood of Occurrence**	**Assessment of Significance required**
Freckled Duck *Stictonetta naevosa*	V		A dark, greyish-brown bird with a large head that is peaked at the rear, and a distinctive narrow, slightly up-turned bill. Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds. Generally rest in dense cover during the day, usually in deep water. Feed at dawn and dusk and at night on algae, seeds and vegetative parts of aquatic grasses and sedges and small invertebrates. Nesting usually occurs between October and December but can take place at other times when conditions are favourable.	2 DPE Bionet Atlas (2023)	**Highly unlikely -** no suitable habitat on the subject land	No
Black Bittern *Ixobrychus flavicolis*	V		Black Bitterns roost and nest in trees, and are found in tree-lined wetlands and in mangroves. They forage in both daylight and darkness, mainly from shady trees over water, but may be seen during the day in open areas of short marshy vegetation and along creeks.	1 DPE Bionet Atlas (2023)	**Unlikely -** habitat unsuitable.	No
White-bellied Sea-Eagle *Haliaeetus leucogaster*	V		Occurs in wooded areas near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest. May overfly site on occasion.	4 DPE Bionet Atlas (2023)	**Low -** May overfly the area as part of a wider foraging range. May perch on low trees in study area. all records close to Shoalhaven River	No
Square-tailed Kite *Lophoictinia isura*	V		In NSW the Square-tailed Kite is often associated with ridge and Gully forests dominated by Woollybutt *Eucalyptus longifolia,* Spotted Gum *Eucalyptus maculata,* or Peppermint Gum *Eucalyptus elata.* It has also been sighted in forests containing *Angophora spp*.and *Callitris spp* with a shrubby understorey and	9 DPE Bionet Atlas (2023)	**Low-** habitat unsuitable	No

			Box-Ironbark woodland. It feeds on honeyeating birds and insects in the tree canopy. They have a large foraging range and hunt prey early morning and evening. Nesting sites are along or close to watercourses in a fork or large horizontal limb of a *Eucalyptus* or *Angophora* species (Pizzey and Knight 2003).			
Birds	**BC Act**	**EPBC Act**	**Habitat**	**No sighted (source)**	**Likelihood of Occurrence**	**Assessment of Significance required**
Bush Stone-curlew *Burhinus grallarius*	E1		The Bush Stone Curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and in the south-east it is either rare or extinct throughout its former range. Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Largely nocturnal, being especially active on moonlit nights. Feed on insects and small vertebrates, such as frogs, lizards and snakes. Nest on the ground in a scrape or small bare patch.	1 DPE Bionet Atlas (2023)	**Low-**Habitat unsuitable. Open managed exotic grassland with no fallen logs etc	No
Gang-gang Cockatoo *Callocephalon fimbriatum*	V		Has a preference for wetter forests and woodlands from sea level to > 2,000m on the Great Dividing Range, timbered foothills and valleys, timbered watercourses, coastal scrubs, farmlands and suburban gardens. In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas.	16 DPE Bionet Atlas (2023)	**Low -**Habitat unsuitable. Records scattered across locality. Nearest record about 1.9km to the north-west	No
Glossy Black Cockatoo *Calyptorhynchus lathami*	V		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 Black She-oak (*Allocasuarina littoralis*), and Forest She-oak (*A. torulosa*) occur. Forest She-oak is the	228 DPE Bionet Atlas (2023)	**Low -**No She-oak onsite or in neighbouring areas. Closest record occurs	No

			preferred foraging resource. Roosts in the canopy of tall trees, occasionally in tree hollows. *The likelihood of this species being impacted by the development is unlikely*		about 5.2km to the south-east at South Nowra	
Birds	**BC Act**	**EPBC Act**	**Habitat**	**No sighted (source)**	**Likelihood of Occurrence**	**Assessment of Significance required**
Little Lorikeet *Glossopsitta pusilla*	V		Little Lorikeets mostly occur in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes. Little lorikeets are considered to be nomadic, likely in a response to food availability. These lorikeets usually forage in small flocks, feeding mainly on nectar and pollen, but also fruit of eucalypts, melaleucas and mistletoes. The little lorikeet breeds from May to September, nesting in tree hollows, with small diameter entrance holes. Most breeding records are located on the western slopes.	5 DPE Bionet Atlas of NSW Wildlife (2023)	**Low -** Records scattered across locality. The loss of a few trees compared to extensive bushland retained in study area will not impact on the foraging behaviours or life cycle of this species	No
Powerful Owl *Ninox strenua*	V		Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. It roosts by day in dense vegetation comprising species such as Turpentine *Syncarpia glomulifera*, Black She-oak *Allocasuarina littoralis*, Blackwood *Acacia melanoxylon*, Rough-barked Apple *Angophora floribunda,* Cherry Ballart *Exocarpus cupressiformis* and a number of other eucalypt species. *No evidence of this species using the subject site for roosting. The subject site is not regarded as core habitat for Powerful Owl.*	23 DPE Bionet Atlas (2023)	**Low -** Habitat unsuitable, even if occurs occasionally in surrounding bushland, then no impact on habitat of this species as its foraging range is large and no breeding habitat at the subject site	No
Masked Owl *Tyto novahollandiae*	V		Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. There is no seasonal variation in its distribution. Lives in dry eucalypt forests and woodlands from	1 DPE Bionet Atlas (2023)	**Low -** Habitat unsuitable.	No

			sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to 1000 hectares. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.			
Birds	**BC Act**	**EPBC Act**	**Habitat**	**No sighted (source)**	**Likelihood of Occurrence**	**Assessment of Significance required**
Sooty Owl *Tyto tenebricosa*	V		Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Roosts by day in the hollow of a tall forest tree or in heavy vegetation; hunts by night for small ground mammals or tree-dwelling mammals.	2 DPE Bionet Atlas (2023)	**Low -** Habitat appears unsuitable, more likely to occur within tracts of dense undisturbed bushland.	No
Pilot Bird *Pycnoptilus floccosus*		V	The pilotbird is found from the Wollemi National Park and Blue Mountains National Park in New South Wales through to the Dandenong Ranges, near Melbourne in Victoria. Its natural habitat is temperate wet sclerophyll forests and occasionally temperate rainforest, where there is dense undergrowth with abundant debris. It is sedentary	1 DPE Bionet Atlas of NSW Wildlife (2023)	**Low -** Habitat unsuitable	No
Scarlet Robin *Petroica boodang*	V		The species inhabits dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. Prefers abundant logs and fallen timber which do not occur at the subject site. *Not optimal habitat for the Scarlet Robin. The proposed development should not impact on the foraging activity of this species.*	1 DPE Atlas of NSW Wildlife (2023)	**Low -** more likely to occur where there are large areas of open, grassy forest and woodland.	No
Varied Sitella	V		Inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead	10 DPE Atlas of NSW	**Low -** Habitat appears suboptimal. Nearest	No

Daphoenositta chrysoptera			branches, mallee and *Acacia* woodland. The Varied Sittella feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy.	Wildlife (2023)	record some 2.6km to the south-east at Mundamia. Most records north of Shoalhaven River	
Birds	**BC Act**	**EPBC Act**	**Habitat**	**No sighted (source)**	**Likelihood of Occurrence**	**Assessment of Significance required**
Artamus cyanopterus cyanopterus **Dusky woodswallow**	V		The Dusky Woodswallow is found in open forests and woodlands, and may be seen along roadsides and on golf courses. The Dusky Woodswallow nests colonially in 'neighbourhoods'. The nest is a loose bowl of twigs, grass and roots, lined with fine grass, and is placed in a tree fork, behind bark, in a stump hollow or in a fence post, about 1 m - 10 m above the ground.	2 DPE Atlas of NSW Wildlife (2023)	**Low -** Habitat appears suboptimal. The loss of a few trees compared to extensive bushland retained in study area will not impact on the foraging behaviours or life cycle of this species	No
Mammals	**BC Act**	**EPBC Act**	**Habitat**	**No sighted (source)**	**Likelihood of Occurrence**	**Assessment of Significance required**
Spotted-tail Quoll *Dasyurus maculatus*	V	E	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites (Edgar & Belcher 1995).	2 Bionet Atlas of NSW Wildlife (2023)	**Unlikely -** Habitat unsuitable and nearest records in South Nowra some 3.9km to the south-east	No
Koala *Phascolarctus cinereus*	E	V	Occurs in natural eucalypt forests and woodlands. Koala feed trees listed under Schedule 2 of SEPP 44 legislation include: Forest red gum *Eucalyptus tereticornis;* Tallowwood, *Eucalyptus microcorys*; Grey Gum, *Eucalyptus punctata*; Manna Gum, *Eucalyptus viminalis*; River Red Gum, *Eucalyptus camaldulensis*; Broad leaved scribbly gum, *Eucalyptus haemastoma*; Scribbly gum, *Eucalyptus signata*; White box, *Eucalyptus albens*; Bimble box, *Eucalyptus populnea* and Swamp mahogany, *Eucalyptus robusta.*	1 DPE Atlas of NSW Wildlife (2023)	**Highly unlikely -** Open structured, managed habitat unsuitable. Record at Bangalee, north of the Shoalhaven River some 3.9km to the north-west from subject site	No

Eastern Pygmy Possum *Cercartetus nanus*	V		In most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable.	13 DPE Atlas of NSW Wildlife (2023)	**Highly unlikely -** no suitable habitat on the subject land. Old record from 2013 some 160m to the west of subject site (although this area had been cleared long before then - Nearmap 2012)	No
Mammals	**BC Act**	**EPBC Act**	**Habitat**	**No sighted (source)**	**Likelihood of Occurrence**	**Assessment of Significance required**
Yellow-bellied Glider *Petaurus australis*	V		The Yellow-bellied Glider is found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. Feed primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein. Extract sap by incising (or biting into) the trunks and branches of favoured food trees, often leaving a distinctive 'V'-shaped scar.	250 DPE Bionet Atlas (2023)	**Low -** Habitat suboptimal. No foraging activity recorded though some indentation/incision marks may occur on a mature individual of Narrow-leaved Scribbly Gum (Figure 10). Nearest record about 100m to the east in natural bushland	No
Greater Glider *Petauroides volans*	E1	E	Occurs in eucalypt forests and woodlands along the east coast of Australia from northeast Queensland to the Central Highlands of Victoria. Feeds exclusively on eucalypt leaves, buds, flowers and mistletoe. Shelter during the day in tree hollows and will use up to 18 hollows in their home range.	1 DPE Atlas of NSW Wildlife (2023)	**Highly unlikely -** habitat highly structurally and floristically modified; suboptimal habitat on the subject land.	No

			Occupy a relatively small home range with an average size of 1 to 3 ha.			
Squirrel Glider ***Petaurus norfolcensis***	V		The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. Live in family groups of a single adult male one or more adult females and offspring. Require abundant tree hollows for refuge and nest sites. Diet varies seasonally and consists of *Acacia* gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein.	2 DPE Atlas of NSW Wildlife (2023)	**Highly unlikely -** habitat highly structurally and floristically modified; suboptimal habitat on the subject land.	No
Mammals	**BC Act**	**EPBC Act**	**Habitat**	**No sighted (source)**	**Likelihood of Occurrence**	**Assessment of Significance required**
Grey-headed Flying-fox *Pteropus poliocephalus*	V	V	Grey-headed Flying Fox (*Pteropus poliocephalus*). This species congregates in large camps and is found in a variety of habitats including rainforest, mangroves, Melaleuca swamps, wet and dry sclerophyll forests and also cultivated areas. The species feeds on the blossoms of more than 80 plant species, especially eucalyptus blossom and the fruits of a number of palm species. Flowering species of eucalypts such as Swamp Mahogany (*Eucalyptus robusta*) and Forest Red Gum (*Eucalyptus.tereticornis)* and Paperbarks (*Melaleuca quinquenervia*), are particularly important. Distances of up to 30km from the camp are often travelled, with 60-70km sometimes covered per night to reach a particular food source. The Grey-headed Flying Fox (*Pteropus poliocephalus)* was not sighted during the survey, which occurred during mid-morning when the bats would be roosting in camps, but may be	1736 DPE Bionet Atlas (2023)	**Low - Moderate-** May on occasion forage in the area as part of a wider foraging range in the locality. The proposed development will not impact on populations of the Grey-headed Flying Fox. Greatest number of records at North Nowra.	No

			attracted to flowering Eucalyptus trees in the locality on occasion.			
Eastern Freetail Bat *Micronomus norfolkensis*	V		Occur in dry sclerophyll forest and woodland east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures. Insectivorous.	20 DPE Bionet Atlas (2023)	**Low -** Habitat appears suboptimal. Nearest record some 2.3km to the east at Cabbage Tree Flat. Development will not impact on this species	No
Mammals	**BC Act**	**EPBC Act**	**Habitat**	**No sighted (source)**	**Likelihood of Occurrence**	**Assessment of Significance required**
Large-eared Pied Bat *Chalinobus dwyeri*	V	V	These bats roost in shallow caves in escarpments, particularly in sandstone and forage in remnant native dry and wet open forests, woodlands and rainforests.	10 DPE Bionet Atlas (2023)	**Low -** May on occasion forage in the area as part of a wider foraging range. Close record some 75m to the east of the West Nowra RRP site (Figure 13). It is considered that the species will not be compromised by the proposed development at the subject site as extensive habitat occurs in surrounding natural bushland and reserves (DPE 2022).	No
Eastern False Pipistrelle *Falsistrellus tasmaniensis*	V		It occupies sclerophyll forests, particularly where the habitats are wet and where the tree heights are greater than 20 metres (Strahan 1995; Churchill 1998). The Eastern Falsistrelle roosts in tree hollows, and has also been recorded occupying caves in the Jenolan area (NSW). Known home ranges of 12 km have been recorded.	6 DPE Bionet Atlas (2023)	**Low- Moderate** Habitat of site currently unsuitable. Record taken in 2013 when bushland still intact to south of the	No

					RRP, about 80m to the south-west of the subject site. May on occasion forage at the subject site as part of a wider foraging range. Tree with hollows suitable for roosting for this species	
Mammals	**BC Act**	**EPBC Act**	**Habitat**	**No sighted (source)**	**Likelihood of Occurrence**	**Assessment of Significance required**
Southern Myotis *Myotis macropus*	V		Prefers permanent and/or flowing water. The Southern Myotis is commonly a cave dwelling microchiropteran, but will utilise tree hollows, mines, stormwater drains, bridges and dense vegetation (Churchill 1998). Roosting sites can be located within a wide variety of habitats, usually located in close proximity to permanent, slow flowing water. Breeding occurs between November and December, with young being weaned after three to four weeks (Churchill 1998). The Southern Myotis commonly forages over water bodies for insects and small fish (Churchill 1998).	8 DPE Bionet Atlas (2023)	**Low-**no foraging habitat on the subject land. All records north of the Shoalhaven River.	No
Greater Broadnose Bat *Scoteanax ruepellii*	V		The preferred foraging habitat of this species appears to be tree-lined creeks and the interface between forested land and cleared areas. This species usually roosts in tree hollows, with large live or dead emergent hollow bearing trees preferred. The roof spaces of old buildings are also used as roost sites. The Greater Broad-nosed Bat has been observed to travel from a forested foraging area, several kilometres to a roost tree hollow adjacent to the edge of a town. A colony of up to 80 individuals was using the roost. Large, individual paddock trees have also been found to be used by this species. This indicates that an individual tree may be extremely important, at least on a seasonal basis.	9 DPE Atlas of NSW Wildlife (2023)	**Low -- Moderate** Habitat of site currently unsuitable. Record taken in 2013 when bushland still intact to south of the RRP, about 80m to the south-west of the subject site. May on occasion forage at the subject site as part of a wider foraging range. It is not expected that	No

					the Greater Broadnose Bat will be impacted upon by the proposed development . Tree with hollows suitable for roosting for this species	
Mammals	**BC Act**	**EPBC Act**	**Habitat**	**No sighted (source)**	**Likelihood of Occurrence**	**Assessment of Significance required**
Yellow-bellied Sheathtail-Bat *Saccolaimus flaviventris*	V		The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range - most of Victoria, south-western NSW and adjacent South Australia - it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	2 DPE Bionet Atlas (2023)	**Low -** May on occasion forage in the area as part of a wider foraging range. Both records occur well to the north of the Shoalhaven River. It is considered that species will not be compromised by the proposed development at the subject site (DPE 2022).	No
Little Bentwing Bat *Miniopterus australis*	V		Habitat in moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and at night forage for small insects beneath the canopy of densely vegetated habitats.	1 DPE Bionet Atlas (2023)	**Low-** Single record 5km to the north-west. Habitat unsuitable It is considered that there would be no impact to this species by the proposed development.	No

Large Bentwing Bat *Miniopterus orianae oceanensis*	V		This sub species of Bentwing Bat occurs from Cape York to central Vic. Occurs in wet and dry sclerophyll forests and rainforests. Roost within man-made structures. Known roost sites include caves, disused mines, storm-water drains, culverts and buildings. However maternity roosts occur in sandstone or limestone cave systems. Will form scattered smaller colonies, mostly within 300km of the larger maternity cave (Churchill 1998).Active all year round, foraging mostly on moths above the tree canopy. Feeds over large areas of land and has been reported to travel up to 70 km in one night (Dwyer 1995)*The Large Bentwing Bat will not be impacted upon by the proposed development.*	11 DPE Bionet Atlas (2023)	**Moderate-** Scattered foraging habitat occurs across the locality, one record about 220m to the south-east of the subject site. Proposed development will not impact on this species as the foraging area in the locality is extensive.	No