

MILTON MEADOWS - ULLADULLA

Flora and Fauna Assessment

Milton Meadows

20 September 2019

Final



Report No. 16245RP3

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Executive Summary

S1 Introduction

Cumberland Ecology Pty Ltd (Cumberland Ecology) has been commissioned by ANNSCA Property Group (APG) to conduct a flora and fauna assessment to support a Development Application (DA) for 196 Windward Way, Milton (Lot 1 DP 780801 and Lot 1 DP 737576) ('the subject site'). The purpose of this flora and fauna assessment is to evaluate the ecological impacts of the proposed development, specifically impacts on threatened flora, fauna or ecological communities listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and/or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) known to occur on subject site, or within the study area.

It is noted that the NSW *Biodiversity Conservation Act 2016* (BC Act) has replaced the TSC Act as of 25 August 2017. The proposed development fits the required transitional arrangement criteria for the *Biodiversity Conservation Act 2016* (BC Act), as outlined in the *Biodiversity Conservation (Savings and Transitional) Regulation 2017*, to be assessed under the now repealed TSC Act. Therefore this report has been prepared as per requirements under the former TSC Act in accordance with transitional provisions of the BC Act and refers to the TSC Act instead of the BC Act.

S2 Background

The subject site is located within the Shoalhaven Local Government Area (LGA) and is currently largely zoned as RU1 (Primary Production), with a minor portion in the north and south-east zoned as E2 (Environmental Conservation) under the *Shoalhaven Local Environment Plan 2014*. The subject site is approximately 15.68 ha in size and contains an old silo, remains of a former dwelling/garden area, exotic grassland and patches of remnant native vegetation. The 'study area' is defined as the subject site and any additional areas outside the project boundary that are likely to be impacted by the proposed development, either directly or indirectly.

The proposed development is for the clearing of vegetation on land in the RU1 (Primary Production) zone, but excludes the majority of the native vegetation areas zoned E2 (Environmental Conservation), along with a 0.16 ha area of native vegetation comprising a large *Ficus obliqua* (Small-leaved Fig) adjacent to the south eastern E2 zone.

The DA seeks consent for the construction of a senior's housing development on the subject site. The development will include construction of a two-storey residential care facility (RCF); construction of 127 independent living units in the form of duplex dwellings; a three-storey residential flat building with 133 units across seven blocks and underground car parking; a two-level clubhouse including a medical centre, gym, swimming pool, recreational area, restaurant and associated infrastructure. The development aims at retaining the existing vegetation on the northern boundary and an area within the south eastern portion of the subject site, and includes additional offset planting for any loss of vegetation necessary to support the development of the site. A dam will be provided for use as on-site water detention, as a feature for residents and as a bushfire protection measure.

S3 Methods

This report provides an analysis of flora and fauna on the subject site based upon a compilation of data collected in 2016, 2018, and 2019.

Database analysis, vegetation/flora surveys, fauna habitat assessment, and incidental fauna observations were initially undertaken in December 2016. Further targeted fauna surveys and data analyses were then completed in February 2018. These were added to in April 2018 by completion of further vegetation/flora surveys, fauna habitat assessment and incidental fauna observations within the small lot (Lot 1 DP 737576) that was proposed for addition to the subject site. In August 2019 an additional targeted threatened species search was also undertaken for the species *Rhodamnia rubescens*.

Methods used are described within the report but included:

- **Flora:** Flora surveys involved recording the presence and abundance of flora species within 20 m x 20 m quadrats, recording the presence of species using the random meander survey technique and targeted threatened flora surveys. All vascular plants observed were recorded or collected and later identified to species level where possible. As part of the additional site surveys undertaken in February 2018, a site inspection was conducted to determine the current extent of vegetation and site condition to inform amendments to this report. The inspection involved random meanders of the entire subject site over four days.
- **Fauna:** Targeted fauna surveys conducted in February 2018 included bat call detection and analysis, harp trapping, nocturnal and diurnal bird surveys, nocturnal spotlighting surveys, evening hollow/stag watches, incidental fauna observations and random meanders to count hollow bearing trees.

S4 Results

Vegetation within the subject site was found to contain ~1.11 ha of Milton Ulladulla Subtropical Rainforest, which is listed as an Endangered Ecological Community (EEC) under the TSC Act; ~1.61 ha of Clyde Gully Wet Forest, ~3.80 ha of Native Regrowth and Exotic Weeds, ~0.12 ha of Planted Natives/Exotics and Weeds and ~9.02 ha of Exotic Grasslands.

A total of 162 plant species were recorded during surveys. Native species are the most abundant (67%) with the remainder comprising a mix of exotics and non-endemic planted natives (33%).

Two individuals of the threatened species *Rhodamnia rubescens* were recorded within the subject site. One of these was in a patch of Milton Ulladulla Subtropical Rainforest which is to be retained, and the second occurs close to the southern boundary within a 0.05 ha area of Clyde Gully Wet Forest which is also to be retained, with the exception of canopy trees the project arborist requires to be removed.

No further threatened flora species were recorded within the subject site. Two threatened plant species, the Thick-lipped Spider-orchid (*Caladenia tessellata*) and Leafless Tongue-orchid (*Cryptostylis hunteriana*) have been recorded from the locality as indicated by database searches. The Austral Toadflax (*Thesium australe*) was assessed as potentially occurring by a previous preliminary FFA undertaken by BES (2005) for part of the subject site, however no records exist in the locality for this species. Detailed literature reviews, a site inspection, and subsequent re-evaluation of the vegetation presence and condition completed in 2018, determined that the potential occurrence of these three species is unlikely within the subject site. These species were not recorded within the subject site during any surveys and the proposed development is not considered to have a significant impact on any of these species.

A total of 40 vertebrate species were recorded within the subject site during surveys undertaken by Cumberland Ecology in 2016 and 2018, including the Common Wombat (*Vombatus ursinus*).

Three threatened fauna species have been recorded from the subject site. The Grey-headed Flying-fox and Eastern Bentwing-bat were previously recorded within the subject site by BES (2005), and the Eastern Freetail-bat was recorded by Cumberland Ecology during the 2018 surveys.

In addition, the desktop assessment showed that a number of threatened fauna species have been recorded from the locality and have the potential to occur within the subject site. These species are the Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Greater Broad-nosed Bat (*Scoteanax rueppellii*), Varied sittella (*Daphoenositta chrysoptera*), Pink Robin (*Petroica rodinogaster*), Square-tailed Kite (*Lophoictinia isura*) and Powerful Owl (*Ninox strenua*).

Two migratory species, Black-faced Monarch (*Monarcha melanopsis*) and Rufous Fantail (*Rhipidura rufifrons*) listed under the EPBC Act were recorded within the subject site. Two additional migratory species, the White-throated Needletail (*Hirundapus caudacutus*) and Fork Tailed Swift (*Apus pacificus*), have the potential to forage aerially above the subject site or utilise some of the vegetation as part of a wider foraging range. The known and potentially occurring fauna species are highly mobile and are expected to move between areas of remaining habitat within the immediate vicinity of the subject site and wider area. These species are therefore not considered dependent upon the habitats present on the subject site.

Under the State Environmental Planning Policy No. 44 – Koala Habitat Protection, the subject site does not constitute potential Koala habitat and no Koala feed trees were recorded therein.

S5 Impact Assessment

The proposed development will involve the clearing of vegetation along the southern portion of the subject site, consisting of a total of ~11.06 ha of vegetation. This includes ~1.52 ha of Clyde Gully Wet Forest, ~1.81 ha of Native Regrowth and Exotic Weeds, ~0.12 ha of Planted Natives/Exotics and Weeds and ~7.59 ha of Exotic Grassland. The proposed development will not affect the ~1.06 ha of the Milton Ulladulla Subtropical Rainforest (EEC) or the ~0.05 ha of the weedy Milton Ulladulla Subtropical Rainforest (EEC) and no significant impact is predicted to occur to this community.

Three threatened fauna species have been recorded within the subject site during surveys in 2016 and 2018; the Grey-headed Flying-fox, the Eastern Bentwing-bat and the Eastern Freetail-bat. The subject site does not contain a roosting camp for the Grey-headed Flying-fox and therefore does not provide breeding habitat for this species. The proposed development will result in removal of nine hollow-bearing trees which may provide some roosting habitat for the Eastern Bentwing-bat and Eastern Freetail-bat. These hollows are not considered to be important to these species as they are likely to use them as part of a larger foraging and roosting area for this highly mobile species. It is considered that each of the threatened species have the potential to occupy the subject site occasionally as part of a foraging habitat or flyover it. However, the vegetation and habitat items to be cleared across the site would not be considered to constitute a significant impact on their populations.

S6 Mitigation Measures

A number of mitigation measures are recommended for the proposed project. These include:

- Vegetation protection;

- Pre-clearing and Clearing Surveys;
- Pre-translocation and translocation of wombats;
- Erosion, sedimentation and pollution control; and
- Weed control measures.

S7 Conclusion

Despite the impacts of previous disturbance and the location of the subject site within a fragmented landscape, the proposed development will require the clearing of exotic and non-listed native vegetation across the subject site that forms suitable habitat for some threatened fauna species. The proposed development will not impact the area of Milton Ulladulla Subtropical Rainforest which is listed as an EEC under the TSC Act. It will also not impact the two individuals of *Rhodamnia rubescens* recorded.

Based upon the assessment undertaken in this report, no significant impact is expected to occur to threatened species, populations, or communities as a result of the proposed residential development of the subject site. Therefore, the preparation of a Species Impact Statement (SIS) is not warranted. A referral to the Commonwealth Department of the Environment, under the EPBC Act is also not required.

1. Introduction

1.1. Purpose

Cumberland Ecology Pty Ltd (Cumberland Ecology) has been commissioned by ANNSCA Property Group (APG) to conduct an ecological assessment to support a Development Application (DA) for land at 196 Windward Way, Milton (Lot 1 in DP 780801 and Lot 1 in DP 737576) (the 'subject site').

The purpose of this report is to describe the current biodiversity values of the subject site and to assess the potential impacts of the proposed development on flora and fauna, particularly threatened species, populations and communities that are listed under the New South Wales (NSW) *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

It is noted that the NSW *Biodiversity Conservation Act 2016* (BC Act) has replaced the TSC Act as of 25 August 2017. The proposed development fits the required transitional arrangement criteria for the *Biodiversity Conservation Act 2016* (BC Act), as outlined in the *Biodiversity Conservation (Savings and Transitional) Regulation 2017, to be assessed under the now repealed TSC Act. Therefore this report has been prepared as per requirements under the former TSC Act in accordance with transitional provisions of the BC Act and refers to the TSC Act instead of the BC Act.*

The specific objectives of this report are to:

- Describe the vegetation communities on the subject site;
- Describe fauna habitats and fauna usage of the subject site;
- Identify any threatened species, populations or ecological communities (as listed under the TSC Act and/or EPBC Act) existing on the subject site;
- Assess the likelihood of occurrence of threatened species, populations or communities (as listed under the TSC Act and/or EPBC Act) within the subject site;
- Assess the potential impact of the project on threatened species, populations or communities (as listed under the TSC Act and/or EPBC Act), including the completion of Assessments of Significance under Section 5A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act); and
- Where relevant, recommend mitigation measures to reduce the impacts of the proposed development on biodiversity values.

1.2. Background

1.2.1. Site Description

The subject site is located at 196 Windward Way, Milton in the Shoalhaven Local Government Area (LGA) (**Figure 1**) and comprises Lot 1 in DP 780801 and Lot 1 in DP 737576.

The subject site is bounded by Windward Way to the south, Princes Highway to the north and rural/residential developments to the east and west. It is approximately 15.68 ha in size. The subject site is largely open, with

some small scattered patches of trees on its south-eastern portion, a relatively dense rainforest on its north-eastern portion associated with a creek, some moderately dense remnant native vegetation on the northern portion, and small patches of native trees scattered on the northern and western areas of the subject land. Grassland is present on its central portion. An unused silo and remnants of a dwelling/garden shed are present on the southern end of the subject site and a house plus associated planted gardens is present on the small lot occupying the north eastern corner of the subject site.

i. Zoning

The subject site is currently largely zoned as RU1 (Primary Production) under the *Shoalhaven Local Environment Plan 2014* (the 'Shoalhaven LEP 2014') (**Figure 2**). The objectives of RU1 Zoning are:

- To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.
- To encourage diversity in primary industry enterprises and systems appropriate for the area.
- To minimise the fragmentation and alienation of resource lands.
- To minimise conflict between land uses within this zone and land uses within adjoining zones.
- To conserve and maintain productive prime crop and pasture land.
- To conserve and maintain the economic potential of the land within this zone for extractive industries.

A minor portion of the subject site is zoned as E2 (Environmental Conservation) under the Shoalhaven LEP 2014. The objectives of the E2 zone are:

- To protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values.
- To prevent development that could destroy, damage or otherwise have an adverse effect on those values.
- To protect water quality and the ecological integrity of water supply catchments and other catchments and natural waterways.
- To protect the scenic, ecological, educational and recreational values of wetlands, rainforests, escarpment areas and fauna habitat linkages.
- To conserve and, where appropriate, restore natural vegetation in order to protect the erosion and slippage of steep slopes.

No actions are permitted without consent in Zone E2.

Although zoned RU1 and E2, a specific clause pertains to the study area in Schedule 1 of the Shoalhaven LEP allowing uses additional to the zoning. This is reproduced below:

8 Use of certain land at Windward Way, Milton

(1) *This clause applies to land identified as "Sch 1.12" on the Clauses Map, being Lot 1, DP 780801 and Lot 1, DP 737576, Windward Way, Milton.*

(2) *Development for the purpose of seniors housing is permitted with development consent, but only if the consent authority is satisfied of the following:*

(a) *any public utility infrastructure that is essential for the development is available or that adequate arrangements have been made to make that infrastructure available when required,*

(b) *a traffic study has been prepared to assess the impact of the development on the Princes Highway and the local road network.*

1.2.2. Description of Proposed Development

Hawes and Swan Planning are acting on behalf of APG for the submission of a DA to Shoalhaven City Council for the subject site. The DA seeks consent for the construction of a senior's housing development at 196 Windward Way, Milton. The development will include construction of a two-storey residential care facility (RCF); construction of 127 independent living units in the form of duplex dwellings; a three-storey residential flat building with 133 units across seven blocks and underground car parking; a two-level clubhouse including a medical centre, gym, swimming pool, recreational area, restaurant and associated infrastructure.

The development aims at retaining the existing vegetation on the northern portion of the subject site associated with the creek line, plus a small area zoned E2 in the south eastern corner. Additional offset planting for any loss of vegetation necessary to support the development of the site is included in the proposal.

A dam will be provided for use as on-site water detention, as a feature for residents and as a bushfire protection measure.

The development layout is shown in **Figure 3**.

1.3. Relevant Legislation

1.3.1. Environmental Planning and Assessment Act 1979

The EP&A Act is the overarching planning legislation in NSW. This act provides for the creation of planning instruments that guide land use. The EP&A Act also provides for the consideration of the environment and biodiversity values, which is addressed in Section 5A (Significant effect on species, populations or ecological communities or their habitats) should a land use change be proposed. This includes threatened species, communities, habitat and processes as listed under the TSC Act and *Fisheries Management Act 1994* (FM Act).

1.3.2. Environmental Protection and Biodiversity Conservation Act 1999

The EPBC Act is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places — defined in the EPBC Act as Matters of National Environmental Significance (MNES). Under the EPBC Act, any action (which includes a development, project or activity) that is considered likely to have a significant impact on MNES (including nationally listed threatened ecological communities and species,

and listed migratory species) must be referred to the Australian Government Minister for the Environment (the Minister). The purpose of the referral is to allow a decision to be made about whether an action requires approval on a Commonwealth level. If an action is declared a “controlled action”, then Commonwealth approval is required.

1.3.3. Threatened Species Conservation Act 1995

The TSC Act is the key piece of legislation in NSW relating to the protection and management of biodiversity and threatened species. The TSC Act aims to protect and encourage the recovery of threatened species, populations and communities that are listed under the Act through threat abatement and species recovery programs.

The TSC Act requires consideration of whether a development (Part 4) or an activity (Part 5) is likely to significantly impact threatened species, populations, communities or their habitat. The potential impacts of any developments, land use changes or activities would need to undergo an “Assessment of Significance” under Section 5A of the EP&A Act.

If the results of an Assessment of Significance indicate that a development or activity is likely to significantly affect threatened species, populations or ecological communities, the DA must be accompanied by a Species Impact Statement (SIS), which is a detailed ecological study carried out in accordance with a set of assessment requirements issued by the Director-General of the National Parks and Wildlife Service.

1.3.4. Biosecurity Act 2015

As of 1 July 2017 the NSW *Noxious Weeds Act 1993* was repealed and replaced with the NSW *Biosecurity Act 2015* (Biosecurity Act). Under the Biosecurity Act all weeds are required to be controlled by all persons under a “General Biosecurity Duty”. The General Biosecurity Duty means that all public and private land owners or managers and all other people who deal with weed species (biosecurity matters) must use the most appropriate approach to prevent, eliminate, or minimise the negative impact (biosecurity risk) of those weeds (DPI 2017).

State-wide management of weeds under the new legislation is directed by the NSW Invasive Species Plan. This assigns weed responses to four categories:

- Prevention of new weeds establishing;
- Eradication of small and localised infestations where feasible;
- Containment of larger infestation to stop wider spread; and
- Protection of key assets such as threatened plants and agricultural land, to prevent their damage or degradation by weed invasion.

Under the Biosecurity Act some weed species have been prioritised for management by specific regulations and controls under the act. These are known as State Level Priority Weeds.

The state has been divided into 11 regions (each covering a number of LGAs) under the act, with each region managed by a Regional Weeds Committee. Management actions for weeds within a region are detailed within

a Regional Strategic Weed Management Plan. Within each region, additional weed species to the State Level Priority Weeds have been prioritised for management. These species are known as Regional Priority Weeds.

A further set of weeds are identified within the Regional Strategic Weed Management Plans as being “other weeds of regional concern”. The Biosecurity Act provides powers to Local Control Authorities to take action in relation to these weeds in particular circumstances, for example where a weed threatens a high value asset, and prevention, elimination or reduction of the risk is feasible and reasonable. Examples of high values assets include the Environment, Human Health, and Agriculture.

All land within the study area occurs within the South East Local Land Services region, and weed management within the region is to be undertaken under the direction of the South East Regional Strategic Weed Management Plan. Appendix 2 and 3 of the Plan outlines the State Listed Priority Weeds, Regional Priority Weeds, and other weeds of regional concern.

1.3.5. State Environmental Planning Policy No. 44 – Koala Habitat Protection

State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) applies to Shoalhaven LGA. In accordance with SEPP 44, it must be ascertained whether the subject site contains potential koala habitat or core koala habitat.

A site is considered to contain potential koala habitat if the native vegetation contains a minimum of 15% of total number of tree species listed in Schedule 2 in the upper or lower strata. A site is considered to contain core koala habitat if a resident koala population is present.

1.3.6. Shoalhaven Local Environmental Plan 2014

The subject site is located within the Shoalhaven LGA and is therefore subject to the Shoalhaven LEP 2014. A portion of the subject site is mapped as “Excluded Land” and “Biodiversity – significant vegetation” in the Terrestrial Biodiversity Map (Sheet BIO_16C). These areas are directly associated with a creek line and riparian vegetation area in the northern portion of the subject site that is excluded from the development footprint area.

2. Methodology

2.1. Database Analysis

Database analysis was conducted for the locality using the NSW Office of Environment and Heritage (OEH) Atlas of NSW Wildlife (OEH 2018a). The locality is defined as the area within a 10 km radius of the subject site. The Atlas of NSW Wildlife Database search was used to generate records of threatened flora and fauna species listed under the TSC Act and EPBC Act within the locality of the subject site. The lists generated from this database were reviewed against available knowledge of the subject site, in conjunction with the abundance, distribution, and age of records to ascertain the likelihood of occurrence of threatened species within the subject site. This analysis was first conducted in 2016, and was conducted again in April 2018 to capture any more recent records that may have been made in the intervening period.

A 'combined geographic and habitat search' was conducted for the locality using the OEH (2018c) search tool in March 2018 at the request of Shoalhaven Council (CE 2017). The combined geographic and habitat search was used to generate a list of threatened flora and fauna species associated with the vegetation class present on the subject site. The resulting species from this search were combined with the list generated by the Atlas of NSW Wildlife and assessed together to ascertain the likelihood of occurrence of threatened species within the subject site.

2.2. Literature Review

Bushfire Environmental Services (BES 2005) prepared a "*Preliminary Flora and Fauna Report and Ecological Constraints Analysis*" for the subject site. It is understood the BES (2005) report was part of a former planning application. This report was reviewed as part of this assessment.

2.3. Flora Survey

Flora surveys were undertaken within the large lot on the southern portion of the subject site by botanist Bryan Furchert and ecologist Adriana Corona Mothe on 6 December 2016 over a six-hour period.

Additional observations were undertaken within the subject site by botanist Cecilia Phu and ecologist Adriana Corona Mothe on 11 April 2017 while conducting a weed assessment for a Vegetation Management Plan to be issued separately.

Further observations were made by ecologists Heather Gosper and Eleanor Saxon during additional targeted fauna surveys conducted over four days in February 2018. This inspection included visual observations and random meanders to establish updated information on site condition and vegetation extent; and to provide details for subsequent amendments to this report.

Flora surveys were undertaken by botanist Bryan Furchert and ecologist Heather Gosper on 23 April 2018 on the small lot comprising the northern eastern portion of the subject site. Surveys included vegetation mapping, quadrat sampling and targeted threatened flora searches. Further details of each of the survey methods are provided below.

In 2019 an additional flora survey was undertaken by botanist Bryan Furchert and ecologist Michael Davis on 27 August. The purpose of this survey was undertake targeted searches for *Rhodamnia rubescens*, which was

recorded during random meander surveys within the subject site in 2016, prior to its recent listing as critically endangered.

All vascular plants recorded or collected were identified using keys and nomenclature provided in Harden (Harden 1990, 1991, 1992, 1993). Where known, taxonomic and nomenclatural changes have been incorporated into the results, as derived from PlantNET.

2.3.1. Vegetation Mapping

Previous broad-scale mapping conducted by the Southeast NSW Native Vegetation Classification and Mapping (SCIVI) as described in Tozer *et. al.* (2010) was utilised to determine potential vegetation communities likely to occur within the subject site. Cumberland Ecology conducted additional vegetation surveys in 2016 and 2018 to revise and update the vegetation mapping prepared by Tozer *et. al.* (2010). The vegetation within the subject site was ground-truthed to examine and verify the mapping of the condition and extent of the different vegetation communities. Where vegetation community boundaries were found to differ from the OEH mapping, records were made of proposed new boundaries using a hand-held Global Positioning System (GPS) and mark-up of aerial photographs.

The resultant information was synthesised using a Geographic Information System (GIS) to create a spatial database that was used to interpret and interpolate the data to produce a vegetation map of the subject site.

2.3.2. Quadrat Sampling

Quadrat sampling was undertaken within the subject site to obtain information on species composition and community structure. A total of six quadrats were sampled within the subject site, within 20 m x 20 m plots. The locations of flora quadrats were recorded using a handheld GPS unit and are shown in **Figure 4**. The locations of the quadrats were selected so that sampling was conducted in areas most representative of the condition and composition of vegetation within the subject site. The process of quadrat sampling included the following:

- Identifying and recording all vascular flora species present within the quadrat or directly adjacent to the quadrat;
- The stratum in which each species occurred;
- Assigning a cover-abundance value to each species recorded within the plot, using a modified Braun-Blanquet scoring system (Braun-Blanquet 1927), to reflect their relative cover and abundance in the quadrat;
- Recording details about vegetation structure such as percentage foliage cover and height of each strata; and
- Taking photographs of the quadrat to provide a record of vegetation condition and appearance.

2.3.3. Random Meander Transects

Random meander surveys were undertaken to detect additional flora species not recorded during quadrat sampling. These surveys were undertaken within all vegetation communities in 2016 and 2018. **Figure 4** shows the location of all random meander transects conducted in the subject site in 2016 and 2018.

2.3.4. Targeted Threatened Flora Surveys

Targeted threatened flora searches via random meanders were undertaken within suitable habitat of threatened flora species known from the locality in 2016 and 2018 (**Figure 4**).

The location of targeted searches for *Rhodamnia rubescens* undertaken in 2019 are shown in **Figure 5**. This survey consisted of parallel field traverses spaced 5-10 m in the most intact areas of Clyde Gully Wet Forest representing the best habitat areas in the impact area. Broader searches consisting of cross sections of habitat were undertaken in low quality vegetation elsewhere within the impact area and within areas of vegetation to be retained.

2.4. Fauna Survey

Several fauna surveys have been undertaken within the subject site by Cumberland Ecology between December 2016 and April 2018. These surveys included fauna habitat assessments and fauna observations.

Detailed fauna surveys were undertaken within the study area between 27 February and 2 March 2018. These surveys included bat call detection and analysis, harp trapping, nocturnal and diurnal bird surveys, nocturnal spotlighting surveys, evening hollow/stag watches, and random meanders to count hollow bearing trees.

Further details of each of the survey methods are provided below.

2.4.1. Habitat Assessment

A fauna habitat assessment was undertaken in December 2016 over a six-hour period on the large lot occupying the southern portion of the subject site, and in April 2018 over a three-hour period on the north eastern smaller lot of the subject site. The assessments included consideration of important indicators of habitat condition and complexity including the occurrence of microhabitats such as tree hollows, fallen logs, bush rock and wetland areas such as creeks and soaks. Structural features considered included the nature and extent of the understorey and ground stratum and extent of canopy. The survey also included an assessment of the presence of habitat features suitable for use by threatened fauna species known from the locality.

2.4.2. Microchiropteran Bat Surveys

Surveys for microchiropteran bats were undertaken in February - March 2018 using harps traps, three "Songmeter" call detection units, and one "Anabat" unit. The Songmeter and Anabat units were positioned in suitable habitat along tracks or around areas which would be most likely used as flyways by bat species and within close range of identified hollow bearing trees. One of the Songmeter units was placed directly adjacent to the silo located on the southern edge of the subject site to record any bats that may utilise the silo as roosting habitat. The call detection units were set to activate before dusk each evening and switch off after

dawn. Each location was surveyed for three consecutive nights (see **Figure 5**). Ultrasonic calls collected from the units were sent to Greg Ford of Balance Environmental for identification.

Harp trapping was conducted using two harp traps each set out for a period of three consecutive nights from 27 February until 2 March 2018. Each harp trap was placed at a location targeting potential microchiropteran bat flying routes. One of the traps was relocated following the first night of trapping as a more suitable location was identified and remained in place for the following two nights. The traps were set at dusk and checked the following morning for any bats trapped, which were identified and subsequently released.

2.4.3. Diurnal Bird Surveys

Visual observation and call identification of diurnal birds was carried out within the subject site in 2016 using incidental observation, and in 2018 through area search methods based around six defined transects.

Six transects were established and surveyed for at least one person hour by traversing the length of each transect and surrounding area at dawn, then again at dusk. Transect locations were chosen based on tree coverage and with consideration of spatial and vegetation diversity within the subject site to cover areas most likely to be inhabited by birds. Any further opportunistic sightings observed throughout the duration of all surveys were also recorded. The location of the diurnal bird transects is shown in **Figure 5**.

2.4.4. Nocturnal Bird Surveys

Visual observation and call identification of nocturnal birds was carried out within the subject site on three consecutive nights between 27 February and 1 March 2018. Surveys involved traversing the same six transects and areas established for the diurnal bird surveys, for at least one person hour and utilising both spotlighting and call playback techniques.

Call playback involved playing the Powerful Owl (*Ninox strenua*) call for five minutes, followed by a listening period of five minutes, at each transect. Spotlighting of each transect occurred directly afterwards.

2.4.5. Nocturnal Mammal Surveys

Nocturnal mammal and arboreal fauna surveys occurred over several nights between 27 February and 1 March 2018. Surveys were conducted by traversing the six transects and areas utilised for the bird surveys while spotlighting with a high-powered hand-held torch. Surveys took place for at least one person hour per transect. A combination of spotlighting and call recognition methods was employed to detect species presence.

2.4.6. Hollow/Stag Watches

Hollow and stag watches were undertaken at several sites between 27 February and 1 March 2018. Each of the three sites was surveyed for 30 minutes prior to sunset and for 60 minutes following sunset. Site selection was based on the visibility and vicinity of hollow bearing trees and the locality of potential fauna refuges such as the silo.

2.4.7. Reptile Surveys

Reptile searches were undertaken within the subject site in December 2016 and April 2018 during the general habitat assessment. Further nocturnal and diurnal reptile searches were undertaken as opportunistic sightings

during completion of the additional fauna surveys undertaken in February 2018. Searches of suitable reptile habitat involved lifting of bark, fallen logs, bushrock and scraping of top soil.

2.4.8. Hollow Bearing Tree Count

A hollow bearing tree count was initially conducted as part of vegetation surveys in December 2016 by Cumberland Ecology.

A second, more comprehensive survey of the subject site to identify hollow bearing trees was conducted in February 2018 by undertaking random meanders over the entirety of the accessible areas of the subject site. Each identified hollow bearing tree was marked up with flagging tape, numbered and GPS location point taken.

2.4.9. Incidental Observations

Any incidental fauna species that were observed, heard calling, or otherwise detected on the basis of tracks or signs, were recorded and listed in the total species list for the subject site.

2.4.10. Fauna Survey Effort

The fauna survey effort utilised in the subject site by Cumberland Ecology between 2016 and 2018 is summarised in **Table 1**, below.

Table 1 - Fauna survey effort

Survey Method	Dates	Effort
General habitat assessment (as part of vegetation and flora surveys)	06/12/2016, 11/04/2017, 23/04/2018	30 person hours
Microchiropteran bat surveys	27/02/2018 – 02/03/2018	4 Sites, 3 nights
Harp trapping	27/02/2018 – 02/03/2018	3 Sites, (1 site for 3 nights, 1 site for 1 night, 1 site for 2 nights)
Diurnal bird surveys	27/02/2018 – 02/03/2018, throughout fauna survey period	6 transects, one person hour per transect minimum
Nocturnal bird surveys	27/02/2018 – 01/03/2018	6 transects, one person hour per transect minimum
Nocturnal mammal surveys	27/02/2018 – 01/03/2018	6 transects, one person hour per transect minimum
Hollow/Stag watches	27/02/2018 – 01/03/2018	3 sites, 90 minutes per site by 2 people
Hollow bearing tree count	06/12/2016, 27/02/2018 – 02/03/2018	20 person hours
Reptile surveys	Throughout fauna survey period	n/a
Incidental observations	Throughout fauna survey period	n/a

2.5. Limitations

Vertebrate fauna and vascular flora of the locality are well known based upon a sizeable database of past records and various published reports. The surveys by Cumberland Ecology conducted between 2016 and 2018 added to the existing database and helped to provide a clear indication of the likelihood that various species occur, or are likely to occur within the subject site. The data obtained from database assessment and surveys of the subject site furnished an appropriate level of information to support this assessment.

The weather conditions at the time of the flora surveys were generally favourable for plant growth and production of features required for identification of most species. Shrubs, grasses, herbs and creepers were readily identifiable in most instances. It is expected that not all flora species present would have been recorded during surveys, due to a combination of accessibility restrictions and the heavily overgrown condition of the site. Despite this, it is considered that sufficient information has been collected to assess issues including conservation significance of the flora, condition and viability of bushland and likely impact on native vegetation. An assessment of the likelihood of occurrence of threatened flora species recorded within the locality of the subject site in the database searches was undertaken to supplement the flora survey, and a detailed literature review relevant to the potentially occurring threatened flora was conducted to ascertain the suitability of the subject site as habitat for the species.

It is considered that the level of flora survey undertaken, with the addition of the detailed literature review and secondary site inspections in 2018, is adequate to assess the potential occurrence of threatened flora within the subject site.

Weather conditions and seasonal timing of the fauna surveys were generally favourable for the identification of fauna species presence based on calling period. However, opportunistic observations of fauna provide a “snapshot” of some of the fauna present on a site that were active during time of the surveys. Further, some areas of the subject site contained vegetation so dense that traversing the area without alerting and ‘scaring off’ the inhabitant species was unfeasible. For this reason, one of the transects was established within the study area but outside the boundary of the subject site as it provided the most practical way of surveying the adjacent subject site area. Therefore, the data produced by the surveys is intended to be indicative of the types of species that could occur and not an absolute census of all vertebrate fauna species occurring within the subject site. Accordingly, not all fauna utilising the subject site are likely to have been recorded during surveys.

An assessment of the likelihood of occurrence of threatened and migratory fauna species listed for the locality in the database searches was undertaken to supplement the fauna surveys. The combination of these techniques is considered appropriate for assessing the habitat values of the site for threatened fauna within the subject site.

3. Results

3.1. Vegetation Communities

Two native vegetation communities have previously been mapped as occurring on the subject site by Tozer *et al.* (2010). These communities are Clyde Gully Wet Forest which has been mapped as occurring along the creek line in the north, and Southern Lowland Wet Forest which has been mapped patchily across the remainder of the site.

Cumberland Ecology identified an additional community, Subtropical Complex Rainforest, which occurs in the creek line area mapped by Tozer *et al.* (2010) as Clyde Gully Wet Forest. A small patch was also identified in the ~0.16 ha area containing the sizeable Small-leaved Fig (*Ficus obliqua*) present in the south eastern portion of the subject site. Where this community occurs along the creek its boundary is approximately delineated by the top bank of the creek, though extends slightly further upslope in some areas. This community was delineated on site during the survey by the presence of a closed canopy of rainforest species. This community meets the final determination description of the EEC Milton Ulladulla Subtropical Rainforest in the Sydney Basin Bioregion listed under the TSC Act.

Vegetation across the site to varying extents shows evidence of being in a regrowth state following former clearing events, though old mature trees are present scattered throughout. The most intact areas (canopy, understorey and ground layer present) in the south of the subject site are considered to comprise Clyde Gully Wet Forest due to the vegetation having a greater number of positive diagnostic species for the community than for Southern Lowland Wet Forest.

Native dominated vegetation elsewhere has been mapped as Native Regrowth and Exotic Weeds to reflect that the vegetation is heavily degraded and not representative of an intact occurrence of any native vegetation community described for the locality. The remainder of the site consists of open areas of a dense ground cover of exotic grasses, which have been mapped as Exotic Grassland, the area of planted gardens associated with the house on the northern boundary, mapped as Planted Natives/Exotics and Weeds, and the area covered by the house and related structures, mapped as Cleared.

A total of six vegetation communities have been mapped across the subject site (**Figure 6**). These are described below.

3.1.1. Subtropical Complex Rainforest

TSC Act Status: Endangered Ecological Community (EEC) – Milton Ulladulla Subtropical Rainforest in the Sydney Basin Bioregion

EPBC Act Status: Not listed

The Milton Ulladulla Subtropical Rainforest (MUSR) community is associated directly with a creek line running along part of the northern boundary of the site, and occurs as a second small separate patch associated with the large *Ficus obliqua* located in the south eastern portion of the subject site. The north eastern-most extent of the community is generally intact (**Photograph 1**) with very few occurrences of exotic species. Higher abundances of exotic species are present further west along the creek line, particularly in the shrub and ground layers. The creek line associated part of the community is present from the creek line generally to the top of

the creek bank, and further upslope in some areas. The area of this community that is associated with the *Ficus obliqua* encompasses the 0.16 ha covered by the spread of the tree canopy (**Photograph 2**).

Where the community is associated with the creek, a tall and dense closed canopy is present, with trees up to 30 m in height. Canopy species present include *Acmena smithii* (Lilly Pilly), *Ceratopetalum apetalum* (Coachwood), *Alphitonia excelsa* (Red Ash), *Doryphora sassafras* (Sassafras), *Ficus obliqua* (Small-leaved Fig), and *Pittosporum undulatum* (Sweet Pittosporum). A sub canopy is also present which comprises younger individuals of the canopy species and *Synoum glandulosum* (Scentless Rosewood).

The shrub layer is comprised of juvenile individuals of the canopy species occurring along with *Pittosporum multiflorum* (Orange Thorn), the tree fern *Cyathea australis*, and *Melicytus dentatus* (Tree Violet). Exotic species such as *Ligustrum sinense* (Small-leaved Privet), *Senna pendula*, and *Solanum mauritianum* (Wild Tobacco Bush) are also present, sparsely occurring in the east and more commonly in the west. In the north east there are abundant occurrences of the native forb *Pseuderanthemum variabile* (Pastel Flower) in the ground layer, and the forb *Viola hederacea* occurs less frequently, along with other species such as *Gahnia sieberiana* (Red-fruit Saw-sedge), *Carex longebrachiata*, and *Aneilema acuminatum*. The layer is somewhat sparse, and is dominated by fern species with *Doodia aspera* (Rasp Fern) the most abundant, and other species present including *Adiantum hispidulum* (Rough Maidenhair), *Adiantum formosum* (Giant Maidenhair), and *Calochlaena dubia* (Rainbow Fern). The native grass *Oplismenus imbecillis* is also common in the layer.

In the western-most occurrences of the community, though native species are present on the creek banks and higher, the lower areas within the creek line are almost entirely dominated by the exotic species *Tradescantia fluminensis* (Wandering Trad), and other species such as *Zantedeschia aethiopicum* (Arum Lily).

Climbers are common within the community and common species include the fern *Microsorium scandens* (Fragrant Fern), along with species such as *Aphanopetalum resinosum* (Gum Vine), *Marsdenia rostrata* (Milk Vine), *Morinda jasminoides* (Sweet Morinda), and *Parsonsia straminea* (Common Silkpod).

Species establishing underneath the single large *Ficus obliqua* in the south eastern corner include *Acmena smithii*, *Livistona australis* (Cabbage Tree Palm), *Acronychia oblongifolia* (White Aspen), *Pennantia cunninghamii* (Brown Beech), *Notelaea longifolia* (Large Mock-olive), *Streblus brunonianus* (Whalebone Tree), *Brachychiton acerifolius* (Illawarra Flame Tree), and *Synoum glandulosum*.

The ground layer underneath the *Ficus obliqua* is sparse due to shading. Species present include *Pseuderanthemum variabile*, *Pellaea falcata*, *Gymnostachys anceps* (Settlers Twine), and *Carex longebrachiata*. Climbers are also present, and species include *Morinda jasminoides*, *Stephania japonica*, and *Pandorea pandorana* (Wonga Wonga Vine).

Photograph 1- Subtropical Complex Rainforest within the north-east of the subject site



Photograph 2 - Subtropical Complex Rainforest associated with the *Ficus obliqua*



3.1.2. Clyde Gully Wet Forest

TSC Act Status: Not listed

EPBC Act Status: Not listed

This community occurs in two patches along the southern boundary of the site, and as a third small patch towards the north eastern corner of the subject site. The canopy has gaps throughout, due to former clearing, and the understorey is in various states of regrowth, however the community is dominated in all strata by native species consistent with the community as described by Tozer *et al.* (Tozer et al. 2010). The eastern patch is dominated by *Eucalyptus pilularis* (Blackbutt), with sparse occurrences of *Eucalyptus botryoides* (Bangalay) and *Syncarpia glomulifera* (Turpentine) (**Photograph 3**). The western patch has a canopy of *Eucalyptus botryoides* and is more generally degraded than the occurrence in the east (**Photograph 4**), while the north eastern patch is associated with two large *Syncarpia glomulifera* as the canopy species (**Photograph 5**).

The sub-canopy contains *Eucalyptus pilularis*, *Syncarpia glomulifera*, and *Eucalyptus botryoides*, as well as *Acacia* spp. and *Alphitonia excelsa*. *Acacia maidenii* (Maiden's Wattle) and *Acacia mearnsii* (Black Wattle) occur in the eastern patch, while *Acacia mabellae* (Mabel's Wattle) dominates the sub-canopy of the western patch. The north eastern patch lacks a sub-canopy.

Native species present in the shrub layer include juveniles of the canopy and sub-canopy species along with species such as *Melicytus dentatus*, *Clerodendrum tomentosum* (Hairy Clerodendrum), *Myrsine howittiana*

(Brush Muttonwood), *Breynia oblongifolia* (Coffee Bush), *Pittosporum undulatum* and *Pittosporum revolutum* (Rough Fruit Pittosporum). Exotic species such as *Lantana camara* and *Ligustrum sinense* occur in the shrub layer, though sparsely.

The ground layer is dominated by the native grass *Microlaena stipoides* (Weeping Grass) in the eastern patch, with few exotic species present, though large occurrences of the exotic grass *Cenchrus clandestinus* (Kikuyu) are present in the western patch, along with other weed species. The north eastern patch contains a mix of native ground layer species and exotics. Other native grasses present include *Oplismenus aemulus* (Basket Grass), *Oplismenus imbecillis* (Creeping Beard Grass), and *Entolasia marginata* (Bordered Panic). Native forbs present in the layer include *Dichondra repens* (Kidney Weed), *Geranium solanderi* (Native Geranium), and *Hydrocotyle laxiflora* (Stinking Pennywort). The fern species *Pellaea falcata* (Sickle Fern), *Pteridium esculentum* (Bracken Fern), and *Calochlaena dubia* also occur.

Climbers are common and species present include *Rubus parviflorus* (Native Raspberry), *Hibbertia scandens* (Climbing Guinea Flower), *Stephania japonica* (Snake Vine), *Geitonoplesium cymosum* (Scrambling Lily), and *Glycine microphylla* (Small-leaf Glycine).

Photograph 3- Clyde Gully Wet Forest in the south-east of the subject site



Photograph 4 - Clyde Gully Wet Forest in the south-west of the subject site



Photograph 5 - Clyde Gully Wet Forest in the north east of the subject site



3.1.3. Native Regrowth and Exotic Weeds

This community consists of a number of patches of native regrowth, of species indicative of Clyde Gully Wet Forest, which suggests that the majority of the site historically was vegetated with Clyde Gully Wet Forest. Some remnant trees are present in the community and recorded species include *Ficus obliqua* and *Syncarpia glomulifera*, and a number of small trees of the latter species are present growing in association with remnant trees. The majority of these patches consist variously of a canopy of regrowth individuals of the colonising species *Acacia maidenii*, *Acacia mearnsii*, and *Acacia maidenii* ranging 15-20 m in height. The large patch in the north/north-west corner of the site also contains numerous occurrences of *Pittosporum undulatum* in the canopy.

Patches of this community on the subject site range in condition. Some areas contain a low diversity though native dominated ground layer of *Microlaena stipoides* and *Carex longibrachiata* and scattered native herbs and climbers (**Photograph 6**). Other areas are dominated in the ground layer by exotic species such as *Cenchrus clandestinus* and *Lonicera japonica* (**Photograph 7**).

The largest patch of this community within the subject site, in the north-west, consists of a sparse to dense canopy of *Pittosporum undulatum* and *Acacia* spp., and has an extremely dense understorey with numerous occurrences of both native and exotic shrub species (**Photograph 8**). Commonly occurring native shrubs include *Melicytus dentatus* and *Pittosporum undulatum*. Some native shrub species not recorded elsewhere on the site occur in this area, though sporadically. These include *Olearia viscidula* (Sticky Daisy Bush) and *Santalum*

obtusifolium (Sandalwood). Common exotic shrubs include *Solanum mauritianum*, *Ligustrum sinense*, and *Lantana camara*.

At the time of the site survey in December 2016, much of the *Acacia* regrowth in the centre of the subject site was in the process of being cleared (**Photograph 9**). Surveys completed in February 2018 showed this area is now heavily vegetated with a dense growth of primarily exotic ground layer species (**Photograph 10**).

Photograph 6- Native Regrowth with *Microlaena stipoides* dominated ground layer in the centre of the subject site (2016)



Photograph 7 - Native Regrowth with exotic dominated ground layer in the centre of the subject site (2016)



Photograph 8 - Native Regrowth with dense native/exotic understorey on the north-western portion of the subject site



Photograph 9 - Cleared areas of Acacia spp. in the centre of the subject site (2016)



Photograph 10 - Previously cleared areas of Acacia spp. In the centre of the subject site (2018)



3.1.4. Planted Natives/Exotics and Weeds

Planted natives and exotics occur in the far northern corner of the subject site surrounding the residential dwelling. Planted natives include *Callistemon viminalis* (Bottlebrush) and *Hakea salicifolia* (Willow-leaved Hakea), which is planted along the fence boundary facing Princes Highway and to the front of the house on Garrad's Lane. Neither of these species is endemic to the site (**Photograph 11**).

The planted natives are interspersed with a fragmented canopy consisting of *Ulmus parvifolia* (Chinese Elm) and *Cupressus sp.* (Cypress) and a sub canopy of scattered planted *Callistemon viminalis* and *Harpephyllum caffrum* (Kaffir Plum).

The ground layer is predominantly comprised of the exotic grass *Cenchrus clandestinus* (Kikuyu), with others such as *Ehrharta erecta* (Panic Veldtgrass) and *Tradescantia fluminensis* (Wandering Jew) present. A number of vines and climbers cover structures such as fences, sections of the building and adjacent trees, including *Jasminum polyanthum* (White Jasmine). *Wisteria sinensis* (Chinese Wisteria), *Rubus fruticosus agg.* (Blackberry), and *Hedera helix* (English Ivy).

Photograph 11 - Planted Natives/Exotics and Weeds adjacent to Princes Highway on the northern boundary of the subject site.



3.1.5. Exotic Grassland

Open grassland areas throughout the subject site are dominated by the exotic grass *Cenchrus clandestinus* (Kikuyu). Other exotic grasses occurring less frequently include *Dactylis glomerata* (Orchard Grass) and

Stenotaphrum secundatum (Buffalo Grass) (**Photograph 12**). Exotic forbs such as *Anagallis arvensis* (Scarlet Pimpernel), *Verbena rigida* (Veined Verbena), and *Taraxacum officinale* (Dandelion) are common in these areas.

Native ground layer species are relatively uncommon in these areas, consisting of scattered individuals of common species such as *Microlaena stipoides*, *Centella asiatica*, and *Glycine tabacina*.

A number of scattered trees and shrubs of species such as *Syncarpia glomulifera*, and *Acacia* spp. are present in these areas growing over exotic grasses, however they are not occurring densely enough to be mapped as a vegetation community.

The Exotic Grassland community had extended to areas where the *Acacia* regrowth was cleared in December 2016. An example is shown in **Photograph 13** where the fern Bracken (*Pteridium esculentum*) and the exotic grass *Cenchrus clandestinus* are co-dominant.

Photograph 12- Exotic Grassland within the centre of the subject site.



Photograph 13 - 3.13 Overgrown Exotic Grassland within the centre of the subject site after disturbance due to clearing (April 2017)



3.1.6. Cleared

The area occupied by the house on the northern western boundary of the small lot within the subject site is mapped as cleared. This area has been previously cleared for the residential dwelling, and no vegetation is present where the footprint of the house exists.

3.2. Flora Species

3.2.1. General Species

A total of 162 flora species have been recorded by Cumberland Ecology throughout the subject site during surveys. The dominant plant families encountered within the subject site have consistently been represented by the Poaceae, Fabaceae, Myrtaceae and Asteraceae. Species present within the subject site consists of a mix of exotics and non-endemic planted natives (33%) and locally indigenous species (67%). Quadrat and transect data for the subject site are provided in **Appendix A**.

Four additional species were recorded by BES (2005). The full list of flora species recorded within the subject site is provided in **Appendix A**.

3.2.2. Threatened Species

3.2.2.1. *Rhodamnia rubescens* (Scrub Turpentine)

Two individuals of *Rhodamnia rubescens*, which is listed as critically endangered under the TSC Act, but is not listed under the EPBC Act, were located within the subject site (**Figure 8**). One individual was located just within the subject site (1-2m from the existing fence) along the southern boundary of the site, parallel with Windward Way (**Photograph 14**), within the Clyde Gully Wet Forest community. The other individual was located within the Milton Ulladulla Subtropical Rainforest community, occurring within the site as a large *Ficus obliqua* individual and associated regrowth understorey (**Photograph 15**).

Rhodamnia rubescens is a shrub to small tree size species which occurs along the east coast of Australia, from as far south as Batemans Bay, to inland of Bundaberg in Queensland to the north. The species typically occurs in coastal areas, occasionally extending inland onto escarpments up to 600 m above sea level in areas with 1000 to 1600 mm of rainfall (OEH 2019). The species occupies soils derived from volcanic and sedimentary sources and is associated generally with rainforests and wet sclerophyll forests, although can occur in adjacent areas of dry sclerophyll forest as a pioneer (NSW Scientific Committee 2019).

The species was common and has a large geographic range, with an extent of occurrence within NSW of 123 459km². However, the species has been listed as critically endangered due to its extreme susceptibility to the introduced pathogen Myrtle Rust (*Austropuccinia psidii*). Myrtle Rust was introduced in Australia in 2010 and has since established throughout ecosystems in coastal areas of eastern Australia. All parts of *Rhodamnia rubescens* are affected by the rust, including stems, leaves, and flowers. The rust is known to kill flowers, and infect fruit preventing the fruit maturing. Mortality of the species has been recorded at over 50% in studied populations and it is estimated that within three generations over 80% of plants across its range will be deceased. As a rainforest species, seed dormancy is not expected to be long lived and the soil seed bank is therefore readily extinguished over a short period of time. Seedlings are also highly susceptible to infection by the rust which is widespread and persistent in the environment due to many host species in the Myrtaceae family (NSW Scientific Committee 2019).

The two individuals of the species within the subject site are young, about 40cm in height, and visibly infected with myrtle rust. Both individuals will be retained within the subject site. An Assessment of Significance has been prepared for the species (**Appendix E**) which indicates that as both individuals within the site are to be retained along with suitable areas of habitat within the subject site and locality a significant impact is not expected to occur to the local population of the species.

Despite efforts to retain the individuals of the species within the subject site, in the mid to long term, there is a high likelihood they will succumb to the Myrtle Rust infection.

Photograph 14 *Rhodamnia rubescens* in south of subject site within Clyde Gully Wet Forest



Photograph 15 *Rhodamnia rubescens* within Milton Ulladulla Subtropical Rainforest under large *Ficus obliqua*



3.2.2.2. Additional Threatened Species

No other threatened plant species have been recorded on the subject site during surveys undertaken by Cumberland Ecology or by BES (2005).

An additional four threatened flora species have been recorded from the locality, as indicated by database analysis. Although not recorded from the database analysis, BES (2005) considered that Austral Toadflax (*Thesium australe*) listed as vulnerable under the TSC Act had potential to occur in the subject site.

An assessment on the likelihood of occurrence of threatened plant species recorded or predicted to occur within the locality was undertaken based on surveys and habitat assessment undertaken between 2016 and 2018, and is presented in **Appendix B**.

This assessment indicated that it is unlikely that any of these additional threatened flora species occur in the subject site, however two species of orchids (*Caladenia tessellata* and *Cryptostylis hunteriana*) listed as threatened flora species under the TSC Act are considered as having some limited potential to occur. A discussion of these two orchids and the Austral Toadflax is presented below.

i. Thick-lipped Spider-orchid

The Thick-lipped Spider-orchid or Daddy Long-leg (*Caladenia tessellata*) is listed as endangered under the TSC Act and as vulnerable under the EPBC Act. The species is known from the Sydney area, Wyong, Ulladulla and Braidwood in NSW. Populations in Kiama and Queanbeyan are presumed extinct. It was also recorded in the Huskisson area in the 1930s. The species occurs on the coast in Victoria from east of Melbourne to almost the NSW border (OEH 2017j).

This orchid is generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil (DSE 2010). The plant's single leaf can regrow each year. The species flowers appear between September and November, generally in late September or early October in extant southern populations (OEH 2017j).

Very limited potential habitat for this orchid is present, and it is unlikely the species would occur within the subject site. The Thick-lipped Spider-orchid inhabits the vegetation formation Grassy Woodland, and no Grassy Woodland vegetation formations occur within the subject site. Clyde Gully Wet Forest is of the vegetation formation Wet Sclerophyll Forests and Subtropical Rainforest is of the vegetation formation Rainforest (Tozer et al. 2010). The Thick-lipped Spider-orchid is not associated with Wet Sclerophyll Forest or Rainforest vegetation formations.

Recent site inspections revealed the site is highly degraded and overgrown with primarily exotic species resulting from a long history of agricultural and land clearing activities. The National Recovery Plan for the Thick-lipped Spider-orchids (DSE 2010) indicates the species is highly susceptible to the key threats of disturbance/destruction of plants and habitat, altered fire regimes, grazing/predation, and weed invasion. Given the heavily agricultural historic land use of the site and the vegetation formations present, potential occurrence of the Thick-lipped Spider-orchid in such a highly degraded site is considered unlikely.

The species has only one previous record in the locality dating from 20 years ago (OEH 2018b) and has not been recorded in previous surveys by BES (2005) or during previous and recent surveys undertaken by Cumberland Ecology.

ii. Leafless Tongue-orchid

The Leafless Tongue-orchid (*Cryptostylis hunteriana*) is listed as vulnerable under both the TSC Act and the EPBC Act. This orchid has been recorded near the east coast of Australia, from as far north as Gibraltar Range National Park to Victoria around the coast at Orbest. It is known historically from a number of localities on the NSW south coast and has been observed in recent years sporadically at sites between Batemans Bay and Nowra, though it is uncommon. It has been recorded at Munmorah State Conservation Area, Nelson Bay, Wyee, Washpool National Park, Nowendoc State Forest, Ku-Ring-Gai Chase National Park and Ben Boyd National Park (OEH 2017f).

The species does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. Its larger populations typically occur in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black She-oak (*Allocasuarina littoralis*). It appears to prefer open areas in the understorey of

this community and is often found in association with the Large Tongue Orchid (*C. subulata*) and the Tartan Tongue Orchid (*C. erecta*) (OEH 2017f).

The Leafless Tongue-orchid has only one previous recording within a 5km radius of the subject site dating from 2014 (OEH 2018b). Very limited potential habitat for this orchid is present, and it is unlikely the species would occur within the subject site. None of the above-listed species of trees that this orchid is associated with have been recorded within the subject site and it cannot reliably be predicted to occur within a habitat type based on the broad diversity of vegetation types in which species records appear.

Neither the Large Tongue Orchid or the Tartan Tongue Orchid that the Leafless Tongue-orchid is associated with have been recorded within the subject site during surveys undertaken by Cumberland in 2016, 2017 and 2018, or by BES in 2005. Both the Large Tongue Orchid and the Tartan Tongue Orchid have few records within the locality (five and nine respectively), none of which occur as far inland as the subject site (OEH 2018b).

Recent site inspections revealed the site is highly degraded and overgrown with primarily exotic species resulting from a long history of agricultural and land clearing activities. The key threats identified for this orchid include disruption or loss of natural habitat, earthworks, site fragmentation, changes in drainage, altered fire regimes, and weed invasion (DEWHA 2008). Given the lengthy agricultural historic land use and fragmented setting of the subject site, potential occurrence of the Leafless Tongue-orchid in such a highly degraded site is considered unlikely.

iii. Austral Toadflax

The Austral Toadflax (*Thesium australe*) is listed as vulnerable under the TSC Act. This orchid is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It is also found in Tasmania and Queensland and in eastern Asia (OEH 2017a).

The species occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. It is often found in association with Kangaroo Grass (*Themeda australis*). This species is a root parasite that takes water and some nutrients from other plants, especially Kangaroo Grass (OEH 2017a).

The species has not been recorded from the subject site in previous surveys (BES 2005) or recent surveys by Cumberland Ecology, nor are there any records of the species occurring in the locality (OEH 2018b). This species was assessed by BES (2005) as having potential to occur in the locality, however very limited habitat for this species is present, and it is unlikely the species would occur within the subject site.

The Austral Toadflax inhabits grassland and grassy woodland, no grassy woodland vegetation formations occur within the subject site. Clyde Gully Wet Forest is of the vegetation formation Wet Sclerophyll Forests and Subtropical Rainforest is of the vegetation formation Rainforest (Tozer et al. 2010). The Austral Toadflax is not associated with Wet Sclerophyll Forest or Rainforest vegetation formations. Some grassland occurs on the subject site as Exotic Grassland; however this vegetation community is primarily dominated by exotic species, none of which the Austral Toadflax is associated with. The native Kangaroo Grass with which the species is associated has not been recorded within the subject site by any of the Cumberland Ecology or BES surveys. Additionally, it is considered that the majority of the subject site was formerly occupied by Clyde Gully Wet Forest, which would not represent a suitable vegetation formation or habitat for this species.

Recent site inspections revealed the site is highly degraded and overgrown with primarily exotic species resulting from a long history of agricultural and land clearing activities. The key threats identified for this species include grazing by livestock, lack of fire/disturbance, agricultural development, and weed invasion (DoE 2013). Given the heavily agricultural historic land use of the site and the extensive prevalence of exotic weeds throughout the grassland vegetation, potential occurrence of the Austral Toadflax in such a highly degraded site is unlikely.

3.2.3. Priority Weeds

Four of the exotic plant species recorded on the subject site are listed as State Priority Weeds under the NSW *Biosecurity Act 2015* in the Shoalhaven LGA. These species are; *Lantana camara* (Lantana), *Senecio madagascariensis* (Fireweed), *Rubus fruticosus* (Blackberry) and *Asparagus aethiopicus* (Ground Asparagus or Asparagus 'Fern'). Two further species, *Ipomoea spp.* (Morning Glory) and *Araujia sericifera* (Moth Vine) are species subject to local management programs. Additionally, *Lantana camara*, *A. Aethiopicus*, *R. fruticosus* and *S. madagascariensis* are also listed as Weeds of National Significance (WoNS).

3.3. Fauna

3.3.1. Fauna Habitat

The vegetation within the subject site provides some potential habitat for fauna. There is some habitat potential for tree hollow-dependent fauna as 14 trees present contain hollows in the subject site (see **Figure 7** for habitat tree locations). The rainforest located along the creek on the north-eastern portion of the site provides habitat for frogs and rainforest birds. The disused silo contains water in the base and currently provides habitat for the Striped Marsh Frog (*Limnodynastes peronii*). One inactive stick nest was sighted during surveys along with several fallen logs which may provide microhabitat for reptiles. Scattered wombat burrows occur throughout the subject site.

Although there are many exotic flora species within the subject site, these can provide potential foraging resources for nectivorous mammals and birds that may use the subject site from time to time as part of a larger foraging range.

i. Koala habitat

No koala feed tree species, as listed under SEPP44 are present within the subject site. The vegetation on the subject site is therefore not considered to comprise potential Koala habitat as defined under SEPP 44. No koala scats or individuals were recorded during the survey. As no evidence of a breeding population of Koala is present, the subject site is not considered to be Core Koala Habitat under SEPP 44.

The Koala is considered unlikely to occur on the subject site owing to the existing degraded nature of the vegetation. Therefore the proposed development will not have any impacts (direct and indirect) on the Koala and no site-specific Koala Management Plan is required.

ii. Watercourses

A second order creek is present on the north-eastern portion of the subject site and is associated with the EEC Subtropical Complex Rainforest (Milton Ulladulla Subtropical Rainforest).

Assessment of water quality within the creek was outside the scope of works for this ecological assessment. During surveys, it was noted that the water was clear and lacked odours, suggesting its condition is likely to be good.

The water level within the creek was noted to be low. It appears that weeds present upstream might be affecting the movement of water along the creek.

The topography of the subject site suggests that the land slopes down towards the MUSR. As the creek is located in a gully at the base of the MUSR, there is potential for surface water to run off into the creek (**Photograph 1**).

3.3.2. General Species

Forty-eight vertebrate fauna species were recorded from the subject site during Cumberland Ecology surveys between 2016 and 2018, including 29 birds, 16 mammals, and three amphibians.

A number of wombat burrows in varying conditions were observed across the subject site, including in the area to be occupied by the development footprint.

A complete species list of fauna recorded on the subject site by Cumberland Ecology and BES (2005) is provided in **Appendix C**. Additional bird, mammal, and reptile species are likely to utilise the subject site and surrounds as part of a larger foraging habitat and so this list is not exhaustive. The disturbed nature of the subject site is likely to have an impact on the types and abundance of fauna species occurring.

3.3.3. Threatened and Migratory Species

Three threatened fauna species have been recorded from the subject site. The Grey-headed Flying-fox and Eastern Bentwing-bat were previously recorded within the subject site by BES (2005), and the Eastern Freetail-bat was recorded by Cumberland Ecology during the 2018 surveys.

In addition, the desktop assessment showed that a number of threatened fauna species have been recorded from the locality and have the potential to occur within the subject site. These species are the Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Greater Broad-nosed Bat (*Scoteanax rueppellii*), Varied sittella (*Daphoenositta chrysoptera*), Pink Robin (*Petroica rodinogaster*), Square-tailed Kite (*Lophoictinia isura*) and Powerful Owl (*Ninox strenua*).

Appendix D presents the results of an analysis of the likelihood of occurrence within the subject site for each threatened fauna species recorded or predicted to occur within the locality. A total of nine threatened fauna species have either been recorded or are considered as having potential to occur within the subject site. A discussion of the potentially occurring threatened and migratory fauna species is provided below.

i. Grey-headed Flying-fox

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is listed as Vulnerable under the TSC Act and the EPBC Act. The Grey-headed Flying-fox is the largest Australian bat, with a head and body length of 23 - 29 cm (OEH 2016). The species is generally found within 200 km of the eastern coast of Australia (OEH 2016).

The species occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy (OEH 2016). Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young. Site fidelity to camps is high and the species can travel up to 50 km from the camp to forage; commuting distances are more often <20 km. It feeds on the nectar and pollen of native trees, in particular *Eucalyptus*, *Melaleuca* and *Banksia*, and fruits of rainforest trees and vines, but also forage in cultivated gardens and fruit crops (OEH 2016).

The Grey-headed Flying-fox has been recorded from the subject site by Cumberland Ecology and by previous surveys in 2005 (BES 2005), and potential foraging habitat for this species occurs. The species was observed foraging on the large *Ficus obliqua* during each night of the February 2018 surveys by Cumberland Ecology, and could potentially forage on Eucalyptus trees found within the subject site. The subject site does not constitute a breeding or camp site for the species, but is most likely part of a broader foraging range of the highly mobile species. The subject site is not considered to be core habitat for the species.

ii. Eastern Bentwing-bat

The Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) is listed as Vulnerable under the TSC Act. The Eastern Bentwing-bat occurs along the east and north-west coasts of Australia OEH (2017b). The species roosts mainly in caves, but also use derelict mines, storm-water tunnels, buildings and other man-made structures (OEH 2017b). The species forms discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young (OEH 2017b). At other times of the year, populations disperse within about 300 km range of maternity caves (OEH 2017b). Cold caves are used for hibernation in southern Australia (OEH 2017b). Breeding or roosting colonies can number from 100 to 150,000 individuals (OEH 2017b). The Eastern Bentwing-bat hunts in forested areas, catching moths and other flying insects above the tree tops (OEH 2017b).

The Eastern Bentwing-bat was recorded within the subject site in previous surveys by BES in 2005, and by Cumberland Ecology in the 2018 surveys. Potential foraging habitat for this species occurs within the subject site. The species could forage above the canopy of trees found across the subject site. The subject site does not contain caves suitable for roosting for the species, but the subject site is within the foraging range of the species.

iii. Eastern Freetail-bat

The Eastern Freetail-bat (*Mormopterus norfolkensis*) is listed as a vulnerable species under the TSC Act. The Eastern Freetail-bat is found along the east coast from the southern regions of QLD to southern NSW, where it occurs only to the east of the Great Dividing Range. The species inhabits a diversity of forest ecosystems including dry and wet sclerophyll forests, woodlands, swamp forests and mangrove forests (OEH 2017d).

This species is mainly solitary in nature; however it is occasionally observed roosting in communal groups. The Eastern Freetail-bat forages nocturnally for insects within the treed forest areas and roosts in suitable tree hollows, under bark, or in man-made structures (OEH 2017d).

The Eastern Freetail-bat was recorded using the subject site during the February 2018 Cumberland Ecology surveys. Limited roosting habitat for this species occurs in the form of hollow bearing trees and loose bark within the subject site, however no microbat species were observed utilising the tree hollows or man-made structures on site during the stag and hollow watches undertaken over several evenings. Therefore it is considered unlikely the site constitutes significant roosting habitat for the species. The subject site does contain potential foraging habitat for this species, and is most likely only used as part of a broader foraging area for this highly mobile species.

iv. Square-tailed Kite

The Square-tailed Kite (*Lophoictinia isura*) is listed as vulnerable under the TSC Act. The Square-tailed Kite ranges along coastal and sub-coastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems (OEH 2017i). It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March.

The species is found in a variety of timbered habitats including dry woodlands and open forests and shows a particular preference for timbered watercourses. In arid north-western NSW, it has been observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland. The Square-tailed Kite appears to occupy large hunting ranges of more than 100km² (OEH 2017i).

The Square-tailed Kite was not recorded from the subject site, however some potential foraging habitat for this species occurs. The species might utilize the subject site occasionally as part of a much larger foraging range. The subject site is not considered to provide suitable roosting or breeding site for the Square-tailed Kite.

v. Varied Sittella

The Varied Sittella (*Daphoenositta chrysoptera*) is listed as a vulnerable species under the TSC Act. The species is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands (OEH 2017k). The species inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland (OEH 2017k). It feeds on arthropods gleaned from crevices in rough or decorticated bark, dead branches, standing dead trees and small branches and twigs in the tree canopy and roots high in the living tree canopy, often re-using the same fork or tree in successive years (OEH 2017k).

The species has not been recorded in previous surveys (BES 2005) or recent surveys by Cumberland Ecology, however, the species is highly mobile and it might utilize the subject site occasionally as part of a much larger foraging range. Due to the disturbed nature of vegetation, the subject site is not considered to provide suitable breeding habitat for the Varied Sittella.

vi. Pink Robin

The Pink Robin (*Petroica rodinogaster*) is listed as a vulnerable species under the TSC Act. The species is found in Tasmania and the uplands of eastern Victoria and far south-eastern NSW, almost as far north as Bombala.

On the mainland, the species disperses north and west and into more open habitats in winter, regularly as far north as the ACT area, and is sometimes found as far north as the central coast of NSW (OEH 2017g).

The species inhabits rainforest and tall, open eucalypt forest, particularly in densely vegetated gullies. The species forages on the ground and nests in tree forks located 30cm to 6m above the ground, in deep undergrowth (OEH 2017g).

The Pink Robin has not been recorded in previous surveys (BES 2005) or recent surveys by Cumberland Ecology, however it is a mobile bird and it might utilize the subject site occasionally as part of a much larger foraging range. Due to the disturbed condition of vegetation, it is considered the subject site would represent limited roosting habitat but not suitable breeding habitat for the Pink Robin.

vii. Powerful Owl

The Powerful Owl (*Ninox strenua*) is listed as a vulnerable species under the TSC Act. This large bird of prey is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands. There are scattered records on the western slopes and plains and this species is currently found at low densities throughout most of its eastern range (OEH 2017h).

The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. It 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 (*Exocarpos cupressiformis*) and a number of eucalypt species (OEH 2017h). Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old.

The species has not been recorded in previous surveys (BES 2005) or recent surveys by Cumberland Ecology, however some potential foraging habitat for the Powerful Owl occurs within the forest vegetation within the subject site. Therefore, it is considered that the species might utilize the subject site occasionally as part of a much larger foraging range. The subject site is not considered to constitute suitable roosting or breeding habitat for this species as it does not contain large hollows or vegetation at sufficient density for roosting.

viii. Eastern False Pipistrelle

The Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) is listed as a vulnerable species under the TSC Act. The species is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania. The species prefers moist habitats, with trees taller than 20 m (OEH 2017c). The species generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. This microbat forages above or just below the tree canopy and hibernates in winter (OEH 2017c).

The Eastern False Pipistrelle was not recorded within the subject during the surveys, or in previous surveys undertaken by BES in 2005. Limited roosting habitat for this species occurs in the hollow bearing trees and

loose bark within the subject site. The species could forage among and above the canopy of trees found in the moist forest.

ix. Greater Broad-nosed Bat

The Greater Broad-nosed Bat (*Scoteanax rueppellii*) is listed as a vulnerable species under the TSC Act. The Greater Broad-nosed Bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New England Tablelands, however it does not occur at altitudes above 500 m (OEH 2017e).

This microbat species utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest (OEH 2017e). Although this species usually roosts in tree hollows, it has also been found in buildings. The species forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m. Breeding generally occurs within maternity sites located in suitable trees (OEH 2017e).

This species was not recorded within the subject during the surveys, or in previous surveys in 2005 (BES 2005). Limited potential roosting or breeding habitat for the Greater Broad-nosed Bat occurs in the hollow bearing trees within the subject site. The species could forage among and above the canopy of trees found in the moist forest.

x. Migratory species

Two migratory species, the Black-faced Monarch (*Monarcha melanopsis*) and Rufous Fantail (*Rhipidura rufifrons*) listed as migratory under the EPBC Act, were observed utilising the subject site during surveys. Two additional species may potentially pass through the locality. These are the Fork-tailed Swift (*Apus pacificus*) and the White-throated Needletail (*Hirundapus caudacutus*) which is an aerial species that may forage aerially above the subject site on occasion. All of these species are highly mobile, and it is expected the subject site constitutes only a small foraging area of part of a much broader foraging range.

4. Impact Assessment

The impacts of this development on threatened species have been assessed using the OEH Threatened Species Assessment Guidelines (DECC 2007). The Assessments of Significance (7-part test) are provided in **Appendix E**.

4.1. Impacts to Vegetation Communities and Habitat

4.1.1. Vegetation Removal

The primary impact resulting from the proposed development is the clearing of vegetation and associated habitat within the subject site for the purpose of the proposed development which will include a residential aged care facility, 127 independent living units, a three storey residential flat building with 133 units across seven blocks and underground car parking, a two-level clubhouse including a medical centre, gym, swimming pool, recreational area, restaurant and associated infrastructure.

The subject site is ~15.68 ha in size, of which ~1.06 ha comprises the native vegetation Subtropical Complex Rainforest (Milton Ulladulla Subtropical Rainforest EEC), ~0.05 ha Subtropical Complex Rainforest (Milton Ulladulla Subtropical Rainforest) with Exotic Understorey and ~1.61 ha of Clyde Gully Wet Forest. The remaining area consists of Native Regrowth and Exotic Weeds (~3.80 ha), Planted Natives/Exotics and Weeds (~0.12 ha), Cleared (~0.02 ha) and Exotic Grassland (~9.02 ha).

The vegetation community areas and impact areas are provided in **Table 2** below and shown in **Figure 8**. Note that the proposed development footprint areas exclude the Subtropical Complex Rainforest (Milton Ulladulla Subtropical Rainforest – EEC) vegetation associated with the small creek on the northern portion of the subject site and the area associated with the *Ficus obliqua* in the south east of the subject site. The proposed development also excludes the northern areas zoned E2 (Environmental Conservation), with the exception of the access road.

Table 2 Impact areas within the subject site

Vegetation Community	Area (ha)			
	Subject Site	APZ	Cleared	Total Impact
Subtropical Complex Rainforest (Milton Ulladulla Subtropical Rainforest EEC)	1.06	0	0	0
Subtropical Complex Rainforest (Milton Ulladulla Subtropical Rainforest EEC) (weedy understorey)	0.05	0	0	0
Clyde Gully Wet Forest	1.61	0.08	1.52	1.6
Native Regrowth and Exotic Weeds	3.8	1.37	1.81	3.28
Planted Natives/Exotics and Weeds	0.12	0	0.12	0.12
Exotic Grassland	9.02	1.34	7.59	8.93
Cleared	0.02	0	0.02	0.02
TOTAL	15.68	2.8	11.06	13.86

Past and current use of the subject site and surrounding areas have entailed clearing and modification of the majority of native vegetation across the subject site, with the exception of the Subtropical Rainforest Complex on the north-eastern portion and the Clyde Gully Wet Forest on the south-eastern portion of the subject site. As noted before, the Subtropical Rainforest Complex corresponds to the listed Endangered Ecological Community (EEC) known as Milton Ulladulla Subtropical Rainforest. The Clyde Gully Wet Forest is not listed as protected native vegetation. The proposed development will result in the removal of areas of the Clyde Gully Wet Forest, the native Regrowth and Exotic Weeds, Planted Native/Exotics and Weeds, and Exotic Grasslands. However, it will not impact on the EEC MUSR community. An assessment of significance of the impacts to this community is provided in **Appendix E**.

This assessment concluded that the proposed development is not likely to result in a significant impact to the EEC listed MUSR community. A suite of mitigation measures are proposed which are relevant to minimising indirect impacts to the MUSR community (see **Chapter 5**).

4.1.2. Asset Protection Zone

The proposed development will require compliance with bushfire protection, including creation of an Asset Protection Zone (APZ).

The APZ will be set back from the Milton Ulladulla Subtropical Rainforest (MUSR) in the northern portion of the subject site. It will cover areas mapped as Clyde Gully Wet Forest, Native Regrowth and Exotic Weeds, and Exotic Grassland as shown in **Figure 8**. Generally, a reduction in canopy and small tree cover and removal of mid-storey layers is required within the APZ to meet fuel reduction requirements.

4.1.3. Loss of Specific Habitat Features

In addition to the clearance of broad habitats within the subject site, a number of specific habitat features will be removed, including turpentine trees, fallen logs and nine hollow-bearing trees. Other features including the rainforest area will not be impacted by the proposed development. The loss of these habitat features is unlikely to significantly impact on the flora and fauna of the study area as they represent only a small number of such features in a degraded habitat. The preservation of the MUSR and the remaining habitat features, along with the mitigation measures outlined in **Chapter 5** is deemed appropriate to offset the minor losses that will occur as a result of the proposal.

4.1.4. Impact on Remaining Vegetation and Habitats

The proposed development has the potential to indirectly impact remaining vegetation and habitats within the study area. These impacts include:

- Habitat fragmentation - affects biodiversity by reducing the amount of available habitat for some species to occupy due to increased distances between habitat patches;
- Edge effects – affects biodiversity through microclimatic changes in light, temperature, humidity and wind, which can favour a suite of different species and therefore cause significant changes to the ecology of the patch (Lindenmayer and Fischer 2006);

- Alteration to hydrological regimes – affects biodiversity through modification of hydrology necessary for vegetation and habitat survival, such as surface water drainage patterns; and
- Increased sedimentation and erosion – affects biodiversity through the smothering of vegetation, increasing turbidity of waterways and transportation of weed matter and nutrients.

4.2. Impacts to Flora Species

The proposed development has the potential to result in a number of direct and indirect impacts to flora species within the study area. In addition to the direct removal and modification of vegetation within the subject site, potential indirect impacts to flora species include:

- Weed invasion;
- Run-off, erosion and sedimentation; and
- Modification of microhabitat features resulting from long and short-term edge effects (e.g. changes in light filtration).

A number of mitigation measures are proposed to minimise these impacts. These are discussed further in **Chapter 5**.

4.2.1. Threatened Species

One threatened flora species listed under the TSC Act was recorded within the subject site. This species is *Rhodamnia rubescens* which is listed as critically endangered under the TSC Act, but is not listed under the EPBC Act. Two individuals of this species were recorded within the subject site and both are to be retained. One individual is to be retained as part of a patch of Milton Ulladulla Subtropical Rainforest consisting of a large *Ficus obliqua* individual and a number of regenerating individuals of rainforest species including the *Rhodamnia rubescens* individual. The second individual will be retained in a Threatened Species Retention Zone in the south of the Subject Site.

No other threatened flora species listed under the TSC Act or EPBC Act were located within the subject site.

The proposed development, therefore, is determined not to have a significant impact upon threatened flora species.

4.3. Impacts to Fauna Species

The proposed development has the potential to result in a number of direct and indirect impacts to fauna species within the study area. In addition to the direct removal and modification of vegetation within the subject site, potential indirect impacts to fauna species include:

- Habitat disturbance during the construction phase of the project (e.g. changes in noise);
- Runoff, erosion and sedimentation;
- Increased pollution;

- Hydrological changes resulting in altered fauna habitats; and
- Modification of microhabitat features resulting from long and short-term edge effects (e.g. changes in light filtration).

4.3.1. Threatened Species

A total of nine threatened fauna species and two migratory species have either been recorded or are considered to have the potential to occur within the subject site (see **Section 3.3.3**). Assessments of significance for the nine threatened species are provided in **Appendix E**. These assessments concluded the project is not considered to significantly impact upon these species.

The potential impacts of the proposed development on each threatened species is discussed in sub-sections below.

i. Woodland Birds: Varied Sittella and Pink Robin

Vegetation within the subject site has the potential to be used for foraging by Varied Sittella and Pink Robin. No roosting or breeding habitat for these two species is present within the subject site.

The proposed development will result in the removal of up to ~11.06 ha of potential foraging habitat for these two woodland bird species and ~1.52 ha of potential roosting habitat. A total of ~1.06 ha of MUSR, ~0.05 ha of MUSR – Exotic Understorey, and up to ~1.99 ha of Native Regrowth and Exotic Weeds vegetation habitat will be retained onsite and improved through weed management and revegetation.

These bird species are highly mobile and are likely to utilize the subject site occasionally as part of a larger foraging range. It is worth noting that none of these species have been recorded in previous surveys by BES (2005) or in recent surveys by Cumberland Ecology. The proposed development is therefore not considered to have a significant impact upon these three species.

ii. Raptor Birds: Square-tailed Kite and Powerful Owl

The Powerful Owl and the Square-tailed Kite have not been recorded from the subject site in previous surveys (BES 2005) or recent surveys by Cumberland Ecology, however some foraging habitat is present. No roosting or breeding habitat for these species is present within the subject site due to the lack of large hollows.

The Powerful Owl could potentially use the subject site for foraging within the forest vegetation. This predatory species has a large foraging range and the subject site is not considered to represent a core foraging habitat due to its degraded condition. The subject site has very limited roosting or breeding habitat value for the Powerful Owl, the species requires large tree hollows in dense vegetation for roosting and breeding. Only one large sized tree hollow was recorded in the centre of the subject site. The hollow is in an exposed position with little surrounding forest vegetation, and is unlikely to be a suitable roosting choice for the Powerful Owl. No species were observed using it during the hollow/stag watches recently undertaken, nor was there a response to the targeted Powerful Owl call-playback.

The proposed development will result in the removal of ~11.06 ha of potential foraging habitat for these two raptor species. However, a total of ~1.06 ha of Milton Ulladulla Subtropical Rainforest, 0.05 ha of Milton Ulladulla Subtropical Rainforest – Exotic Understorey and up to 1.99 ha of Native Regrowth and Exotic Weeds

vegetation habitat will be retained onsite and improved through weed management and revegetation. The retained vegetation will be managed to enhance the value as foraging ground for these raptor threatened species.

Vegetation to be cleared within the subject site will likely represent in loss of sub-optimal foraging habitat for the Powerful Owl and Square-tailed Kite. However, it is considered that these species are likely to only utilize the subject site occasionally as part of a much larger foraging range and therefore, the proposed development will not result in significant impact on the Square-tailed Kite and Powerful Owl.

iii. Grey-headed Flying-fox

The Grey-headed Flying-fox was recorded within the subject site in recent surveys by Cumberland Ecology and during previous surveys in 2005 (BES 2005). The species has the potential to forage on the large *Ficus obliqua* and the flowering Eucalyptus trees within the subject site.

The Grey-headed Flying-fox is a social animal that roost and breeds in camps with hundreds of other individuals. The subject site does not constitute a roosting camp for the species, and it is considered that the species is only likely to forage in the subject site as part of a larger foraging range. The species was observed in February 2018 foraging only on the *Ficus obliqua* on the subject site, and this tree will be retained in the proposed development. Removal of vegetation for the proposed development will not result in a significant impact on this species.

iv. Microbats: Eastern Bentwing-bat, Eastern False Pipistrelle, Greater Broad-nosed Bat and Eastern Freetail-bat

The Eastern Bentwing-bat and Eastern Freetail-bat were recorded within the subject site.

The Eastern Bentwing-bat roosts in caves, which are not available within the subject site. Therefore, it is considered that the species only uses the subject site for foraging as part of a larger foraging range.

The Eastern Freetail-bat roosts in hollow bearing trees, under bark, and in man-made structures. Targeted hollow/stag watches were undertaken over several consecutive nights and no species were observed entering/exiting tree hollows or the open-roofed silo. This species is also primarily solitary and highly mobile, and it is therefore considered the species only uses the subject site for foraging as part of a larger foraging range.

The Eastern False Pipistrelle and the Greater Broad-nosed Bat can use loose bark and tree hollows for roosting. The tree hollows recorded within the subject site represent some potential roosting habitats for these species, although no species were observed entering/exiting tree hollows or the open-roofed silo during recent targeted surveys. It is considered that these microbats might use the subject site occasionally for foraging and as part of a larger foraging range.

The vegetation to be cleared as part of the proposed development is not considered to be core habitat for these microbats and large areas of similar vegetation will remain in the locality. Therefore the proposed vegetation clearing is not considered likely to have a significant effect on these species.

v. Migratory Species

Two migratory species, the Black-faced Monarch (*Monarcha melanopsis*) and Rufous Fantail (*Rhipidura rufifrons*) listed as migratory under the EPBC Act, were observed utilising the subject site during surveys. Two additional species may potentially pass through the locality. These are the Fork-tailed Swift (*Apus pacificus*) and the White-throated Needletail (*Hirundapus caudacutus*) which is an aerial species that may forage aerially above the subject site on occasion. All of these species are highly mobile, and it is expected the subject site constitutes only a small foraging area of part of a much broader foraging range

The subject site does not constitute core foraging, breeding or roosting habitat for these migratory species. Therefore, the proposed development is not considered likely to result in a significant effect on these migratory species.

5. Mitigation Measures

A number of mitigation measures are recommended for the proposed project. These measures should be implemented to minimise impacts to biodiversity impacts to adjoining habitats.

5.1. Vegetation Protection

5.1.1. Clearing Limits

To avoid unnecessary removal or damage to the EEC Milton Ulladulla Subtropical Rainforest vegetation located on the northern and south eastern parts of the subject site and adjacent to the proposed development area, the clearing area should be clearly demarcated and signed, where appropriate, to ensure no vegetation beyond these boundaries is removed. Clearing works and equipment should be excluded from areas outside the clearing area. Site inductions are to be given by the civil contractor to ensure all site workers and visitors are aware of any no-access areas.

Where possible, native canopy species should be retained when considering building envelopes as these trees will help maintain connectivity of habitat. These large trees provide foraging resources for a range of native fauna. Within the development footprint, the future resident housing and building envelopes will endeavour to retain existing native vegetation where possible.

5.1.2. Buffer Zones

A 20m buffer zone will surround the northern patch of Milton Ulladulla Subtropical Rainforest to protect the MUSR from encroaching weeds, or any indirect impacts resulting from the construction and operation of the proposed development. The buffer zone will consist of planted Clyde Gully Wet Forest species, and will be further surrounded by an outer APZ zone on all sides (see **Section 5.1.3** below) with the exception of the north eastern boundary abutting the access road.

The MUSR in the south east of the subject site associated with the *Ficus obliqua* will not be subject to the 20m buffer zone. The details of the management and buffer zones relevant to the project are addressed in the Vegetation Management Plan (VMP) prepared by Cumberland Ecology and issued separately to this document.

5.1.3. Threatened Species Retention Zone

An area of 0.05 ha of native will be retained in the south-east of the subject site surrounding and including an individual of the critically endangered *Rhodamnia rubescens*. Within this area impacts to vegetation will be limited to tree removal only where required by the project arborist for safety reasons. The *Rhodamnia rubescens* individual, along with other native understorey and ground layer species of the Clyde Gully Wet Forest community will be retained, and canopy trees where possible. Exotic weed species will be removed from the area.

5.1.4. Asset Protection Zone

As mentioned previously in **Section 4.1.2**, an Asset Protection Zone (APZ) will be required to meet the bushfire protection requirements of the project. Generally, a reduction in canopy and small tree cover and removal of mid-storey layers is required within the APZ to meet fuel reduction requirements.

The outer APZ will act as a secondary barrier to protect the MUSR and will be less heavily mown and managed than the inner APZ, and will have mass plantings of shrubs up to a density of 30%. The extent of the proposed outer and inner APZs is shown within the APZ zones on **Figure 8**.

5.2. Revegetation

In addition to plantings in the buffer zones (see **Section 5.1.2**), it is also recommended that native species characteristic of Clyde Gully Wet Forest are planted in available areas outside the EEC buffer zone where practicable. Planting Clyde Gully Wet Forest plants aims at facilitating a degree of connectivity to similar vegetation towards the EEC and in the locality as well as facilitating movement of native fauna. If large growing native canopy species (*Eucalyptus* or *Syncarpia*) are not able to be planted, then native shrub and groundcover species should be planted as these provide potential nesting and foraging habitat for a range of native fauna species.

Further details of the revegetation that is proposed are presented in the VMP that has been prepared for this project.

5.3. Erosion, Sedimentation and Pollution Control

Potential impacts to flora, fauna and their habitats occurring in the construction phase that can be managed include: run-off, sedimentation, erosion and pollution. To reduce sedimentation on the construction site, erosion control measures should be implemented. This includes minimising the amount of exposed soils on the site at any given time. All soil stockpiles should be adequately covered when not in use to prevent erosion from heavy rainfall. Sediment fences should be established around the perimeter of the development area to prevent the impacts of sedimentation on the adjoining vegetation. During development, precautions should be taken to ensure that no pollution, such as petrochemical substances or water containing suspended solids, escapes the construction site. Pollution traps and efficient removal of pollution to an off-site location would help to minimise pollution impacts.

5.4. Pre-clearing and Clearing Surveys

Pre-clearing surveys are to be undertaken by a suitably qualified ecologist. Pre-clearing surveys will include:

- Demarcation of key habitat features as hollow-bearing trees, fallen logs, bushrock and wombat burrows; and
- Provision of a report following the completion of a pre-clearing survey, detailing the location and type of each habitat feature.

To minimise impacts to native fauna species, clearing should be undertaken in the following two-stage process under the supervision of a suitably qualified ecologist:

- The initial phase of clearing will involve clearing around identified habitat features and leaving the features overnight; and
- The second stage will involve clearing of the habitat features left overnight followed by an inspection.

An ecologist should be present while clearing to rescue animals injured during the clearance operation. Provisions will be made to protect any native fauna during clearing activities by the following means:

- All persons working on the vegetation clearing will be briefed about the possible fauna present and should avoid injuring any present;
- Animals disturbed or dislodged during the clearance but not injured should be assisted to move to the adjacent bushland; and
- If animals are injured during the vegetation clearance, appropriate steps will be taken to humanely treat the animal (either taken to the nearest veterinary clinic for treatment, or if the animal is unlikely to survive, it will be humanely euthanized).

5.4. Nest Box Installation

It is recommended nest boxes be installed in the retained trees at a ratio of two nest boxes for each hollow bearing tree removed. This would equate to approximately eighteen nest boxes being installed to replace the nine hollow trees proposed to be removed. The size of the nest boxes will need to reflect the size of the hollows removed. Multiple nest boxes can be installed in a single tree if required. Supervision of nest box installation must be carried out by a person experienced in nest box installation, and the nest boxes must be installed at a height of at least 4 m from the ground.

5.5. Weed Control Measures

Priority weed species occurring within the subject site should be managed in order to prevent further spread. Prior to any vegetation clearance, priority weeds in the canopy and shrub layers should be demarcated in order for these to be disposed of separately from native material. All groundcover should be disposed of as exotic as the majority is exotic grass with scattered priority weeds such as *Lantana camara*, *Rubus fruticosus* sp. agg., *Senecio madagascariensis* and *Asparagus aethiopicus*. A VMP, including a weed management section, has been prepared for the subject site which contains more details on the weed control measures that will be implemented.

6. Conclusion

Past and current use of the subject site has entailed clearing and modification of the majority of pre-existing native vegetation. However, despite the impacts of previous disturbance and location of the subject site within a fragmented landscape, the proposed development will require the clearing of native vegetation that forms suitable habitat for some threatened fauna species.

Approximately ~11.04 ha of vegetation will be cleared for the proposed development, consisting of up to ~1.52 ha of Clyde Gully Wet Forest, ~1.81 ha of Native Regrowth and Exotic Weeds, ~0.12 ha of Planted Natives/Exotics and Weeds and ~7.59 ha of Exotic Grassland.

A total of ~1.11 ha of the EEC listed Milton Ulladulla Subtropical Rainforest is present within the subject site; however this community will not be removed or impacted by the proposed development.

The vegetation present on the site is not consistent with the definition of Potential or Core Koala Habitat, and no Koalas were recorded on the subject site. Therefore, no Koala Management Plan is required.

A total of 162 flora species were recorded within the subject site. The flora species consist of a mix of exotics and non-endemic planted natives (33%) and locally indigenous species (67%). Three threatened flora species (Thick-lipped Spider-orchid (*Caladenia tessellata*), Leafless Tongue-orchid (*Cryptostylis hunteriana*) and Austral Toadflax (*Thesium australe*)) have some potential habitat within the subject site. However, based on the assessment of significance for these species combined with literature review and recent site inspections, it is concluded unlikely the species would occur on the subject site due to the degree of degradation of the subject site. Accordingly, it is considered that the proposed development would not have a significant impact on these threatened plant species.

Two individuals of one threatened flora species, *Rhodamnia rubescens* have been recorded within the subject site. Both of these individuals are to be retained and habitat surrounding the individuals improved. As such a significant impact is not expected to occur to the species.

Three threatened fauna species, the Grey-headed Flying-fox (*Pteropus poliocephalus*), Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) and the Eastern Freetail-bat (*Mormopterus norfolkensis*) were recorded foraging within the subject site during surveys, and others have the potential to occur due to the presence of suitable habitat.

The following nine threatened fauna species have either been recorded or are considered as having the potential to occur within the subject site: Squared-tailed Kite (*Lophoictinia isura*), Varied Sittella (*Daphoenositta chrysoptera*), Pink robin (*Petroica rodinogaster*), Powerful Owl (*Ninox strenua*), Grey-headed Flying-fox (*Pteropus poliocephalus*), Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*), Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Eastern Freetail-bat (*Mormopterus norfolkensis*), and the Greater Broad-nosed Bat (*Scoteanax rueppellii*).

These animals are all highly mobile and access resources from a wide area. It is likely that most are using the subject site as an occasional foraging ground and the subject site is not considered to represent core habitat critical for the survival of these species. An assessment of significance has been conducted for these species which indicates that it is unlikely the proposed development will have a significant impact on these fauna species.

A range of mitigation measures are recommended to be implemented for the project, including:

- Vegetation protection;
- Erosion, sedimentation and pollution control
- Pre-clearing and clearing surveys;
- Implementation of vegetation buffer zones;
- Revegetation; and
- Weed control measures.

No significant impact is predicted to occur to threatened species, populations or communities as a result of the proposed development. Therefore, the preparation of a Species Impact Statement (SIS) is not warranted. A referral to the Commonwealth Department of the Environment, under the EPBC Act is also not required.

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APPENDIX A :

Flora Species List



Table 3 –Flora Species List

Family	Species	Common name	Q1		Q2		Q3		Q4		Q5		Q6		A	B	C	D
			C	A	C	A	C	A	C	A	C	A	C	A				
Trees																		
Altingiaceae	* <i>Liquidambar styraciflua</i>	Sweetgum														1		1
Cunoniaceae	<i>Ceratopetalum apetalum</i>	Coachwood					3	4										
							0											
Cupressaceae	* <i>Cypress sp.</i>	Cypress													1			1
Fabaceae (Faboideae)	* <i>Erythrina x sykesii</i>	Coral Tree															1	1
Fabaceae (Mimosoideae)	<i>Acacia mabellae</i>	Mabel's Wattle														1		1
Fabaceae (Mimosoideae)	<i>Acacia maidenii</i>	Maiden's Wattle			3	1	3	1							1	1		1
Fabaceae (Mimosoideae)	<i>Acacia mearnsii</i>	Black Wattle							3	10					1	1		1
									5									
Monimiaceae	<i>Doryphora sassafras</i>	Sassafras					5	2										1
Moraceae	<i>Ficus obliqua</i>	Small-leaved Fig			3	1											1	1
					0													
Myrtaceae	<i>Acmena smithii</i>	Lilly Pilly					1	3										
							5											
Myrtaceae	<i>Eucalyptus botryoides</i>	Bangalay															1	1
Myrtaceae	<i>Eucalyptus pilularis</i>	Blackbutt	40	3													1	

Family	Species	Common name	Q1	Q2	Q3	Q4	Q5	Q6	A	B	C	D
Myrtaceae	<i>Eucalyptus piperita</i>	Sydney Peppermint									1	
Myrtaceae	<i>Syncarpia glomulifera</i>	Turpentine							1	1	1	1
Pittosporaceae	<i>Pittosporum undulatum</i>	Sweet Pittosporum			2 0	2					1	1
Rhamnaceae	<i>Alphitonia excelsa</i>	Red Ash		1 0	3	1 0	3		1			
Salicaceae	* <i>Populus alba</i>	White Poplar						1	1		1	
Ulmaceae	* <i>Ulmus parviflora</i>	Chinese Elm							1	1		
Sub-canopy												
Altingiaceae	* <i>Liquidambar styraciflua</i>	Sweetgum									1	
Anacardiaceae	* <i>Harpephyllum caffrum</i>	Kaffir Plum									1	
Fabaceae (Mimosoideae)	<i>Acacia longifolia</i>	Sydney Golden Wattle										1
Fabaceae (Mimosoideae)	<i>Acacia mabellae</i>	Mabel's Wattle									1	1
Fabaceae (Mimosoideae)	<i>Acacia maidenii</i>	Maiden's Wattle	7	5	5	2		5	2			1
Fabaceae (Mimosoideae)	<i>Acacia mearnsii</i>	Black Wattle					5	5			1	1
Malvaceae	<i>Brachychiton acerifolius</i>	Flame Tree							< 1	1		1
Meliaceae	<i>Melia azedarach</i>	White Cedar									1	1

Family	Species	Common name	Q1	Q2	Q3	Q4	Q5	Q6	A	B	C	D
Monimiaceae	<i>Doryphora sassafras</i>	Sassafras			1 0	4						1
Myrtaceae	<i>Acmena smithii</i>	Lilly Pilly		1 0	2	1 0	5				1	1
Myrtaceae	<i>Callistemon viminalis</i>	Bottlebrush								1		
Myrtaceae	* <i>Corymbia citriodora</i>	Lemon-scented Gum								1		
Myrtaceae	<i>Eucalyptus botryoides</i>	Bangalay							1			1
Myrtaceae	<i>Eucalyptus pilularis</i>	Blackbutt	5	3								1
Myrtaceae	<i>Rhodamnia rubescens</i>	Scrub Turpentine									1	
Myrtaceae	<i>Syncarpia glomulifera</i>	Turpentine	15	2		3	1					1
Oleaceae	* <i>Ligustrum sinense</i>	Small-leaved Privet				5	3				1	1
Pittosporaceae	<i>Pittosporum multiflorum</i>	Orange Thorn								1		
Pittosporaceae	<i>Pittosporum undulatum</i>	Sweet Pittosporum		1 5	3	1 0	3		1 0	4	1	1
Proteaceae	<i>Hakea salicifolia</i>	Willow Hakea (planted)									1	
Rhamnaceae	<i>Alphitonia excelsa</i>	Red Ash	5	4	1 0	5					1	1
Solanaceae	<i>Solanum aviculare</i>	Kangaroo Apple										1
Solanaceae	<i>Solanum mauritianum</i>	Wild Tobacco Bush								1	1	
Ulmaceae	* <i>Ulmus glabra</i>	Scotch Elm									1	

Family	Species	Common name	Q1	Q2	Q3	Q4	Q5	Q6	A	B	C	D
Shrubs												
Altingiaceae	* <i>Liquidambar styraciflua</i>	Sweetgum								1		
Asteraceae	<i>Olearia viscidula</i>	Sticky Daisy Bush										1
Arecaceae	<i>Livistona australis</i>	Cabbage-tree Palm		2	5							1
Asteraceae	<i>Cassinia longifolia</i>	Shiny Cassinia									1	1
Bignoniaceae	* <i>Tecoma capensis</i>	Cape Honeysuckle								1	1	
Cunoniaceae	<i>Ceratopetalum apetalum</i>	Coachwood				4	6					
Fabaceae (Caesalpinioideae)	<i>Senna pendula</i>											1
Fabaceae (Caesalpinioideae)	* <i>Senna septemtrionalis</i>	Arsenic Bush				< 1	2				1	1
Fabaceae (Faboideae)	<i>Indigofera australis</i>	Austral Indigo										1
Fabaceae (Mimosoideae)	<i>Acacia maidenii</i>	Maiden's Wattle	10	20			1	5			1	
Lamiaceae	<i>Clerodendrum tomentosum</i>	Hairy Clerodendrum	1	2	3	10						1
Malvaceae	<i>Brachychiton acerifolius</i>	Flame Tree	1	2	1	2						1
Malvaceae	<i>Brachychiton populneus</i>	Kurrajong									1	
Malvaceae	<i>Howittia trilocularis</i>	-									1	
Meliaceae	<i>Synoum glandulosum</i>	Scentless Rosewood	1	3	< 1	2						1

Family	Species	Common name	Q1	Q2	Q3	Q4	Q5	Q6	A	B	C	D
Monimiaceae	<i>Doryphora sassafras</i>	Sassafras			1 0	20						1
Moraceae	<i>Ficus coronata</i>	Sandpaper Fig									1	1
Moraceae	<i>Streblus brunonianus</i>	Whalebone Tree		1	4							1
Myrsinaceae	<i>Myrsine howittiana</i>	Brush Muttonwood	4	10	5	20						1
Myrtaceae	<i>Acmena smithii</i>	Lilly Pilly		2 0	50	3	4					1
Ochnaceae	<i>Ochna serrulata</i>	Mickey Mouse Plant		< 1	5							1
Oleaceae	* <i>Ligustrum lucidum</i>	Broad-leaved Privet										1
Oleaceae	* <i>Ligustrum sinense</i>	Small-leaved Privet	1	2		3	5			1		1
Oleaceae	<i>Notelaea longifolia</i>	Large Mock Olive	5	20	5	20					1	1
Pennantiaceae	<i>Pennantia cunninghamii</i>	Brown Beech		< 1	1							1
Phyllanthaceae	<i>Breynia oblongifolia</i>	Coffee Bush	15	50	< 1	2					1	1
Pittosporaceae	<i>Bursaria spinosa</i>	Blackthorn										1
Pittosporaceae	<i>Pittosporum multiflorum</i>	Orange Thorn		1	5	1	5				1	1
Pittosporaceae	<i>Pittosporum revolutum</i>	Wild Yellow Jasmine	4	1								1

Family	Species	Common name	Q1		Q2		Q3	Q4		Q5	Q6		A	B	C	D
Pittosporaceae	<i>Pittosporum undulatum</i>	Sweet Pittosporum	15	20	5	10		5	20		< 1	3		1		1
Proteaceae	<i>Hakea salicifolia</i>	Willow Hakea (planted)									1	5		1		1
Rhamnaceae	<i>Alphitonia excelsa</i>	Red Ash	2	5				< 1	1					1		1
Rubiaceae	<i>Opercularia aspera</i>	Common Stinkweed														1
Rutaceae	<i>Acronychia oblongifolia</i>	White Aspen			1	3										1
Salicaceae	* <i>Populus alba</i>	White Poplar									< 1	4		1		
Santalaceae	<i>Santalum obtusifolium</i>	Sandalwood													1	1
Solanaceae	<i>Solanum mauritianum</i>	Wild Tobacco Bush					< 1	1	1	3	< 1	1	1	1		1
Verbenaceae	* <i>Lantana camara</i>	Lantana	1	1												1
Violaceae	<i>Melicytus dentatus</i>		1	10	5	20		3	20						1	1
Fens and Allies																
Blechnaceae	<i>Blechnum cartilagineum</i>	Gristle Fern													1	1
Blechnaceae	<i>Doodia aspera</i>	Prickly Rasp Fern					1 0	100 0							1	1
Cyatheaceae	<i>Cyathea australis</i>	Black Tree-fern					1	3							1	1
Dennstaedtiaceae	<i>Pteridium esculentum</i>	Common Bracken	5	20-50				5	100	2	20			1	1	1

Family	Species	Common name	Q1		Q2		Q3		Q4	Q5	Q6	A	B	C	D
Dicksoniaceae	<i>Calochlaena dubia</i>	Rainbow Fern	1	5	1	5	< 1	2							
Polypodiaceae	<i>Microsorium scandens</i>	Fragrant Fern					1	100						1	1
Pteridaceae	<i>Adiantum formosum</i>	Black Stem Maidenhair					1	10							1
Pteridaceae	<i>Adiantum hispidulum</i>	Rough Maidenhair Fern					1	20							1
Pteridaceae	<i>Pellaea falcata</i>	Sickle Fern	15	500	2	100									1
Pteridaceae	<i>Pteris umbrosa</i>													1	1
Herbs (Dicots)															
Acanthaceae	<i>Pseuderanthemum variable</i>	Pastel Flower			1	100	1	200				1		1	1
Apiaceae	<i>Centella asiatica</i>	Indian Pennywort							< 1	100	< 1	50			1
Apiaceae	<i>Hydrocotyle laxiflora</i>	Sinking Pennywort	<1	3											1
Asteraceae	* <i>Cirsium vulgare</i>	Nodding Thistle									< 1	1		1	1
Asteraceae	* <i>Conyza sumatrensis</i>	Tall Fleabane							< 1	5		< 1	100	1	1
Asteraceae	* <i>Hypochaeris radicata</i>	Catsear							< 1	50	< 1	50	< 1	200	1
Asteraceae	* <i>Senecio madagascariensis</i>	Fireweed							< 1	5		< 1	10	1	1

Family	Species	Common name	Q1	Q2	Q3	Q4	Q5	Q6	A	B	C	D
Asteraceae	<i>Sigesbeckia orientalis</i>		<1	1								1
Asteraceae	* <i>Taraxacum officinale</i>	Dandelion					1	100			1	1
Boraginaceae	* <i>Echium plantagineum</i>	Patterson's Curse *									1	
Chenopodiaceae	<i>Einadia hastata</i>	Berry Saltbush			< 1	5					1	1
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed	<1	100	< 1	20	< 1	100	< 1	20	1	1
Fabaceae (Faboideae)	* <i>Trifolium repens</i>	White Clover						< 1	100	< 1	20	1
Fabaceae (Faboideae)	* <i>Vicia sativa</i>							< 1	50			1
Geraniaceae	<i>Geranium solanderi</i>	Native Geranium	<1	2							1	1
Goodeniaceae	<i>Goodenia ovata</i>	Hop Goodenia									1	
Lobeliaceae	<i>Pratia purpurascens</i>	Whiteroot					< 1	100		1	1	1
Lobeliaceae	<i>Viola hederacea</i>	Native Violet				< 1	1				1	
Malvaceae	* <i>Sida rhombifolia</i>	Paddy's Lucerne	1	100			< 1	50			1	1
Myrsinaceae	* <i>Anagallis arvensis</i>	Scarlet Pimpernel						< 1	50			1
Oleaceae	* <i>Ligustrum sinense</i>	Small-leaved Privet				1	200	< 1	20		1	1

Family	Species	Common name	Q1	Q2	Q3	Q4	Q5	Q6	A	B	C	D
Oxalidaceae	<i>Oxalis perennans</i>					< 1 1		< 1 1		1		1
Oxalidaceae	* <i>Oxalis purpurea</i>	Large-flower Wood Sorrel								1		
Plantaginaceae	* <i>Plantago lanceolata</i>	Lamb's Tongues				< 5 1	< 50 1	1 100		1	1	1
Plantaginaceae	* <i>Veronica hederifolia</i>	Ivy-leaved Speedwell			< 1 1							1
Polygonaceae	* <i>Acetosa sagittata</i>	Sorrel								1		
Polygonaceae	* <i>Rumex crispus</i>	Curled Dock									1	
Solanaceae	* <i>Solanum album</i>	Potato Vine								1		
Verbenaceae	* <i>Verbena bonariensis</i>	Purpletop									1	
Verbenaceae	* <i>Verbena rigida</i>	Veined Verbena				< 20 1	1 50	< 20 1	1	1		1
Grasses												
Poaceae	* <i>Holcus lanatus</i>	Yorkshire Fog	<1 1			< 20 1	< 10 1				1	1
Poaceae	<i>Austrostipa</i> sp.	A spear grass									1	
Poaceae	* <i>Axonopus fissifolius</i>	Common Carpetgrass						1 200		1		
Poaceae	* <i>Briza maxima</i>	Quaking Grass									1	
Poaceae	* <i>Bromus catharticus</i>	Prairie Grass									1	

Family	Species	Common name	Q1	Q2	Q3	Q4	Q5	Q6	A	B	C	D
Poaceae	* <i>Cenchrus clandestinus</i>	Kikuyu Grass				< 1	20	6 5	600 0	8 0	700 0	1 1 1 1
Poaceae	* <i>Dactylis glomerata</i>	Cocksfoot				1	100	1	50	1	100	1 1 1
Poaceae	<i>Echinopogon caespitosus</i>	Tufted Hedgehog Grass										1
Poaceae	<i>Ehrharta erecta</i>	Panic Veldtgrass								1	1 1 1	1
Poaceae	<i>Entolasia marginata</i>	Bordered Panic	<1	20							1 1	
Poaceae	<i>Entolasia stricta</i>	Wiry Panic									1	
Poaceae	<i>Imperata cylindrica</i>	Blady Grass									1 1	
Poaceae	<i>Microlaena stipoides</i>	Weeping Grass	20	200	1	100	2 0	2000	5	500		1 1 1
Poaceae	<i>Oplismenus aemulus</i>	Australian Basket Grass	2	200		< 1	20	< 1	100			1 1 1
Poaceae	<i>Oplismenus imbecillis</i>	Creeping Beard Grass	1	100		5	500					1
Poaceae	* <i>Paspalum dilatatum</i>	Paspalum						2	200		1 1 1	
Poaceae	<i>Poa sp.</i>	A tussock grass									1	
Poaceae	* <i>Sporobolus sp.</i>	A Parramatta grass									1	
Poaceae	* <i>Stenotaphrum secundatum</i>	Buffalo Grass					5	500	2 0	200 0		1
Monocots (Other)												
Araceae	<i>Gymnostachys anceps</i>	Settler's Twine		< 1	3							1

Family	Species	Common name	Q1	Q2	Q3	Q4	Q5	Q6	A	B	C	D		
Araceae	<i>Zantedeschia aethiopica</i>	Arum-lily										1		
Asparagaceae	* <i>Asparagus aethiopicus</i>	Asparagus 'Fern'		< 1	1							1		
Commelinaceae	<i>Aneilema acuminatum</i>				< 1	20						1		
Commelinaceae	<i>Commelina cyanea</i>		1	50							1	1		
Commelinaceae	* <i>Tradescantia fluminensis</i>	Wandering Jew			< 1	20						1		
Cyperaceae	<i>Carex longebrachiata</i>	Bergalia Tussock	5	200	2 0	100 0	3	20	1 5	1500 0	< 1	2	1	1
Cyperaceae	<i>Cyperus tetraphyllus</i>			< 1	10								1	
Cyperaceae	<i>Gahnia sieberiana</i>	Red-fruit sedge				1	4						1	
Iridaceae	* <i>Gladiolus undulatum</i>											1		
Iridaceae	* <i>Watsonia meriana</i>	Bulbil Bugle-lily										1		
Juncaceae	<i>Juncus usitatus</i>		<1	10								1	1	
Liliaceae	* <i>Lilium formosanum</i>	Formosan Lily					< 1	4				1		
Lomandraceae	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush								1		1	1	
Phormiaceae	<i>Dianella caerulea</i> var. <i>caerulea</i>	Paroo Lily										1		

Family	Species	Common name	Q1	Q2	Q3	Q4	Q5	Q6	A	B	C	D
Phormiaceae	<i>Dianella caerulea</i> var. <i>producta</i>		<1	2								1
Climbers / Vines												
Aphanopetalaceae	<i>Aphanopetalum resinosum</i>	Gum Vine				2	20				1	1
Apocynaceae	* <i>Araujia sericifera</i>	Moth Vine						< 1	20		1	1
Apocynaceae	<i>Marsdenia rostrata</i>	Milk Vine	1	20	1	5	1	10	2	50		1
Apocynaceae	<i>Parsonsia straminea</i>	Monkey Rope	<1	1			1	3			1	1
Araliaceae	* <i>Hedera helix</i>	English Ivy									1	1
Bignoniaceae	<i>Pandorea pandorana</i>	Wonga-Wonga Vine	1	5	1	10	< 1	10	< 1	20		1
Caprifoliaceae	* <i>Lonicera japonica</i>	Japanese Honeysuckle			< 1			4	2000		1	1
Convolvulaceae	* <i>Ipomoea cairica</i>	Cairo Morning Glory								4	100	1
Convolvulaceae	* <i>Ipomoea indica</i>	Blue Morning Glory										1
Convolvulaceae	* <i>Ipomoea purpurea</i>	Morning Glory										1
Dilleniaceae	<i>Hibbertia scandens</i>	Climbing Flower	1	5	< 1	2					1	1
Fabaceae (Faboideae)	<i>Desmodium gunnii</i>	Slender Tick Trefoil	<1	10								1

Family	Species	Common name	Q1	Q2	Q3	Q4	Q5	Q6	A	B	C	D
Fabaceae (Faboideae)	<i>Desmodium varians</i>	Variable Tick-trefoil					< 3 1				1	1
Fabaceae (Faboideae)	<i>Glycine clandestina</i>		<1	10		< 1	10				1	1
Fabaceae (Faboideae)	<i>Glycine microphylla</i>	Small-leaf Glycine	1	100				< 20 1		1	1	1
Fabaceae (Faboideae)	<i>Glycine tabacina</i>						< 1 1	< 5 1		1		1
Fabaceae (Faboideae)	<i>Hardenbergia violacea</i>	Twining Pea									1	
Fabaceae (Faboideae)	* <i>Wisteria sinensis</i>	Wisteria								1		
Luzuriagaceae	<i>Eustrephus latifolius</i>	Wombat Berry	<1	3	< 1	1	< 1				1	1
Luzuriagaceae	<i>Geitonoplesium cymosum</i>	Scrambling Lily	1	20	< 1	3					1	1
Menispermaceae	<i>Stephania japonica</i>	Snake Vine	2	20	1	4	< 1	3			1	1
Oleaceae	* <i>Jasminum polyanthum</i>	White Jasmine								1		
Passifloraceae	<i>Passiflora edulis</i>	Common Passionfruit				< 1	2					1
Passifloraceae	<i>Passiflora herbertiana</i>	Native Passionfruit								1		1
Passifloraceae	* <i>Passiflora</i> sp.										1	
Ranunculaceae	<i>Clematis aristata</i>	Old Man's Beard					< 2 1				1	1

Family	Species	Common name	Q1	Q2	Q3	Q4	Q5	Q6	A	B	C	D
Rosaceae	* <i>Rubus fruticosus</i> complex	Blackberry						2	20	1	1	1
Rosaceae	<i>Rubus nebulosus</i>											
Rosaceae	<i>Rubus parvifolius</i>	Native Raspberry	<1	10				<1	1		1	1
Rosaceae	<i>Rubus rosifolius</i>	Native Bramble									1	1
Rubiaceae	<i>Morinda jasminoides</i>	Sweet Morinda	1	5	1	10	2	20				1
Smilacaceae	<i>Smilax australis</i>	Lawyer Vine										1
Vitaceae	<i>Cissus antarctica</i>	Kangaroo Vine									1	
Vitaceae	<i>Cissus hypoglauca</i>	Water Vine								1		

A = RMS 1

B = RMS 2 (small lot)

C = Rainforest Extra/Additional in Cleared and Re-growth

D = BES identified presence

1 = Presence

APPENDIX B :

Assessment of the Likelihood of Occurrence of Threatened Flora Species



Table 4 - Likelihood of Occurrence of Threatened Flora

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	10km radius Count	Habitat Requirements	Likelihood of Occurrence
Haloragaceae	<i>Haloragis exalata</i> subsp. <i>exalata</i>	Square Raspwort	V	V	0	Associated with wetlands, swamps, montane bogs and wet sclerophyll forests.	Unlikely to occur. No suitable habitat elements present across the subject site.
Myrtaceae	<i>Rhodamnia rubescens</i>	Scrub Turpentine	CE		6	Formerly common species that has been heavily impacted by Myrtle Rust to which it is extremely susceptible. Occurs in littoral, warm temperate, and subtropical rainforest, and wet sclerophyll forest, usually on volcanic and sedimentary soils.	Species has been recorded on site in two location (See Figure 8).
Myrtaceae	<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	E	V	1	On south coast of NSW occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest.	Unlikely to occur. No suitable habitat elements present across the subject site.
Orchidaceae	<i>Caladenia tessellata</i>	Thick-lipped Spider-orchid, Daddy Long-legs	E	V	1	Found in low, dry sclerophyll woodlands on clay loams or sandy soils, with a healthy or grassy understorey.	Unlikely to occur. No suitable habitat elements present across the subject site

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	10km radius Count	Habitat Requirements	Likelihood of Occurrence
Orchidaceae	<i>Cryptostylis hunteriana</i>	Leafless Tongue-orchid	V	V	26	Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp heath and woodland.	Unlikely to occur. No suitable habitat elements present across the subject site
Orchidaceae	<i>Pterostylis ventricosa</i>		CE		1	Occurs in open areas of tall coastal eucalypt forest, such as along powerline easements and on road verges. Grows in a range of groundcover types, including low heath, open sedges, grasses, leaf litter, and mosses on outcropping rock.	Unlikely to occur. No suitable habitat elements present across the subject site.
Santalaceae	<i>Thesium australe</i>	Austral Toadflax	V	V	0	Found in very small populations scattered across eastern NSW. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (<i>Themeda australis</i>).	Unlikely to occur. No suitable habitat elements present across the subject site, and no recordings from the locality.

Notes: TSC Act = NSW Threatened Species Conservation Act 1995; EPBC Act = Commonwealth Environmental Protection and Biodiversity Conservation Act 1999; E = Endangered; V = Vulnerable.

APPENDIX C :

Fauna Species List

Table 5 –Fauna Species List

Family	Scientific Name	Common Name	CE (2016)	CE (2018)	BES (2005)
Birds					
Acanthizidae	<i>Acanthiza nana</i>	Yellow Thornbill		DO	
Acanthizidae	<i>Acanthiza pusilla</i>	Brown Thornbill	CR	DO	CR
Acanthizidae	<i>Gerygone mouki</i>	Brown Gerygone	CR, DO		
Acanthizidae	<i>Sericornis frontalis</i>	White-browed Scrubwren	CR		
Alcedinidae	<i>Dacelo novaeguineae</i>	Laughing Kookaburra	CR	DO	CR
Anatidae	<i>Anas superciliosa</i>	Pacific Black Duck			DO
Artamidae	<i>Cracticus torquatus</i>	Grey Butcherbird			DO
Artamidae	<i>Gymnorhina tibicen</i>	Australian Magpie		DO	CR
Cacatuidae	<i>Calyptorhynchus funereus</i>	Yellow-tailed Black Cockatoo	CR	CR, DO	
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike			DO
Climacteridae	<i>Cormobates leucophaea</i>	White-throated Treecreeper	CR		
Columbidae	<i>Macropygia phasianella</i>	Brown Cuckoo-dove		DO	
Columbidae	<i>Columba leucomela</i>	White-headed Pigeon		DO	
Columbidae	<i>Ocyphaps lophotes</i>	Crested Pigeon		DO	CR
Columbidae	<i>Phaps sp.</i>	Feral Pigeon			DO
Coraciidae	<i>Eurystomus orientalis</i>	Dollarbird	CR		DO
Cuculidae	<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo	CR		
Cuculidae	<i>Eudynamys scolopacea</i>	Common Koel			CR
Cuculidae	<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo			CR
Dicruridae	<i>Dicrurus bracteatus</i>	Spangled Drongo		DO	
Estrildidae	<i>Neochmia temporalis</i>	Red-browed Finch		DO	DO
Maluridae	<i>Malurus cyaneus</i>	Superb Fairy-wren		DO	DO
Meliphagidae	<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill			CR
Meliphagidae	<i>Anthochaera lunulata</i>	Red Wattlebird			DO
Meliphagidae	<i>Meliphaga lewinii</i>	Lewin's Honeyeater	CR	CR, DO	

Family	Scientific Name	Common Name	CE (2016)	CE (2018)	BES (2005)
Monarchidae	<i>Grallina cyanoleuca</i>	Magpie-lark		DO	DO
Monarchidae	<i>Monarcha melanopsis</i>	Black-faced Monarch		DO	
Oriolidae	<i>Sphecotheres vieilloti</i>	Australasian Figbird		DO	
Pachycephalidae	<i>Pachycephala pectoralis</i>	Golden Whistler	CR		
Petroicidae	<i>Microeca fascinans</i>	Jacky Winter		DO	
Psittaculidae	<i>Platycercus elegans</i>	Crimson Rosella		DO	DO
Psittaculidae	<i>Trichoglossus moluccanus</i>	Rainbow Lorikeet		DO	
Psophodidae	<i>Psophodes olivaceus</i>	Eastern Whipbird	CR	CR, DO	CR
Ptilonorhynchidae	<i>Ptilonorhynchus violaceus</i>	Satin Bowerbird		DO	
Rhipiduridae	<i>Rhipidura albiscapa</i>	Grey Fantail	CR	DO	CR
Rhipiduridae	<i>Rhipidura leucophrys</i>	Willie Wagtail			DO
Rhipiduridae	<i>Rhipidura rufifrons</i>	Rufous Fantail		DO	
Zosteropidae	<i>Zosterops lateralis</i>	Silvereye	CR	DO	
Mammals					
Bovidae	<i>Bos taurus</i>	Cattle *			DO
Bovidae	-	Sheep *			DO
Petauridae	<i>Petaurus breviceps</i>	Sugar Glider		DO	
Pseudocheiridae	<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum		DO	
Pteropodidae	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox		DO	DO
Macropodidae	<i>Macropus giganteus</i>	Eastern Grey Kangaroo		DO	
Miniopteridae	<i>Miniopterus schreibersii</i>	Eastern Bentwing-bat		ANABAT	ANABAT
Molossidae	<i>Austronomus australis</i>	White-striped Free-tailed Bat		ANABAT	
Molossidae	<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat		ANABAT	
Molossidae	<i>Mormopterus ridei</i>	Ride's Freetail-bat		ANABAT	
Muridae	<i>Rattus lutreolus</i>	Swamp Rat		DO	
Muridae	<i>Rattus rattus</i>	European Rat		DO	DO

Family	Scientific Name	Common Name	CE (2016)	CE (2018)	BES (2005)
Rhinolophidae	<i>Rhinolophus megaphyllus</i>	Eastern Horseshoe Bat		ANABAT	
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat		ANABAT	ANABAT
Vespertilionidae	<i>Chalinolobus morio</i>	Chocolate Wattled Bat		ANABAT	
Vespertilionidae	<i>Nyctophilus sp.</i>	A long-eared bat			ANABAT
Vespertilionidae	<i>Scotorepens orion</i>	Eastern Broad-nosed Bat			ANABAT
Vespertilionidae	<i>Vespadelus darlingtoni</i>	Large Forest Bat		ANABAT	ANABAT
Vespertilionidae	<i>Vespadelus vulturnus</i>	Little Forest Bat		ANABAT	
Vombatidae	<i>Vombatus ursinus</i>	Common Wombat	DO	DO	HR
Amphibians					
Hylidae	-	Litoria sp	CR		
Hylidae	<i>Litoria verreauxii</i>	Whistling Tree Frog			CR
Myobatrachidae	<i>Crinia signifera</i>	Common Eastern Froglet	CR		CR
Myobatrachidae	<i>Limnodynastes peronii</i>	Striped Marsh Frog		DO, CR	

Notes: CE = Cumberland Ecology; CR = Call recognition; DO = direct observation; HR = habitat recognition.

APPENDIX D :

Assessment of the Likelihood of Occurrence of Threatened Fauna Species



Table 6 - Likelihood of Occurrence of Threatened Fauna

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Records within 10km radius	Habitat Requirements	Likelihood of Occurrence
Amphibia							
Myobatrachidae	<i>Mixophyes balbus</i>	Stuttering Frog	E	V	1	Occurs in large forest tracts of temperate, sub-tropical rainforest and wet sclerophyll forest and is generally associated with permanent streams.	Unlikely to occur. No suitable habitat and few records in the locality.
Myobatrachidae	<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V	V	4	Distribution is dependent on areas with native vegetation. Found in various vegetation communities including heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. Associated with hanging swamps and perennial creeks in the northern portion of its range, and forest communities in the southern portion. Uses wet habitats for breeding.	Unlikely to occur. No suitable habitat and few records in the locality.
Hylidae	<i>Litoria aurea</i>	Green and Golden Bell Frog	E	V	6	Inhabits a wide range of water bodies, particularly ephemeral ponds for breeding, with the	Unlikely to occur. No suitable habitat and few

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Records within 10km radius	Habitat Requirements	Likelihood of Occurrence
						exception of fast-flowing streams. Terrestrial habitat includes grassy low vegetation and diurnal shelter sites. In NSW, this species is commonly found in disturbed areas although vegetation diversity is positively associated with presence.	records in the locality.
Aves							
Accipitridae	<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	V	Ma	54	Found in coastal and terrestrial habitats along the coast of Australia characterised by large areas of open water such as large rivers, swamps and lakes used for foraging. Also known to occur near the sea or sea-shore around bays, lakes, billabongs, beaches etc. Recorded in terrestrial habitats including coastal dunes, grassland, heath land, woodland, forest and even urban areas.	Unlikely to occur. Limited suitable habitat present; however, it is not located in proximity to open water.
Accipitridae	<i>Hieraaetus morphnoides</i>	Little Eagle	V	-	7	Occurs in open eucalypt, Sheoak or Acacia forest, woodland and open woodlands. Also encountered in	Unlikely to occur. No suitable habitat present

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Records within 10km radius	Habitat Requirements	Likelihood of Occurrence
						riparian woodlands. Requires tall living trees for nesting.	within the subject site.
Accipitridae	<i>Lophoictinia isura</i>	Square-tailed Kite	V	-	6	Commonly found around timbered watercourses in dry woodlands and open forests. Forages over large distances feeding on passerines. Often encountered in habitats with open acacia scrub, low open eucalypt woodland and grassy groundcover.	Potential to occur. Some suitable foraging habitat present within the subject site. Species likely to utilise the subject site as part of a much larger foraging range.
Accipitridae	<i>Pandion haliaetus</i>	Eastern Osprey	V	Ma, Mi	8	Occurs in littoral and coastal habitats, terrestrial wetlands and offshore islands. Require extensive areas of open water for foraging. Occasionally travel inland along major rivers.	Unlikely to occur. Limited suitable habitat present; however, it is not located in proximity to open water.
Anatidae	<i>Stictonetta naevosa</i>	Freckled Duck	V	-	1	Found where there are permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree.	Unlikely to occur. No suitable habitat and few records in the locality.

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Records within 10km radius	Habitat Requirements	Likelihood of Occurrence
Apodidae	<i>Apus pacificus</i>	Fork-tailed Swift	-	Ma, Mi	5	Almost exclusively aerial, often found over inland plains, foothills or in coastal areas. Generally occur over dry or open habitats, including riparian woodland, swamps, low scrub, heathland or saltmarsh.	Potential to occur above the subject site, foraging aerially.
Apodidae	<i>Hirundapus caudacutus</i>	White-throated Needletail	-	Ma, Mi	14	Almost exclusively aerial, often found over wooded areas, including open forest, heath land and rainforest. Less frequently observed above woodland or treeless habitat.	Potential to occur above the subject site, foraging aerially.
Ardeidae	<i>Egretta sacra</i>	Eastern Reef Egret	-	Ma	2	Inhabits beaches, rocky shores, tidal rivers and inlets, mangroves, and exposed coral reefs.	Unlikely to occur. No suitable habitat and few records in the locality
Ardeidae	<i>Ixobrychus flavicollis</i>	Black Bittern	V	-	1	Found in terrestrial and estuarine wetlands, often around permanent water and dense vegetation. Also present in flooded grassland, woodland, rainforest and	Unlikely to occur. No suitable habitat and few records in the locality.

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Records within 10km radius	Habitat Requirements	Likelihood of Occurrence
						mangrove, when permanent water is present.	
Artamidae	<i>Artamus cyanopterus</i>	Dusky Woodswallow	V	-	1	Widespread from coast to inland, including the western slopes of the Great Dividing Range and farther west. Found in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. Primarily eats invertebrates, mainly insects, which are captured whilst hovering and sallying above the canopy or over water.	Unlikely to occur. No suitable habitat present within the subject site.
Cacatuidae	<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V	-	52	Occurs in tall mountain forests and woodlands in summer and drier more open eucalypt forests and woodlands in winter, and often found in urban areas. Require old growth attributes for nesting and roosting.	Unlikely to occur. No suitable habitat present within the subject site.
Cacatuidae	<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo	V	-	60	Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of She-oak species,	Unlikely to occur. No suitable habitat present

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Records within 10km radius	Habitat Requirements	Likelihood of Occurrence
						particularly <i>Allocasuarina littoralis</i> , <i>A. torulosa</i> or <i>A. verticillata</i> occur. Feeds almost exclusively on the seeds of several species of She-oak (<i>Casuarina</i> and <i>Allocasuarina</i> species). Dependent on large hollow-bearing eucalypts for nest sites.	within the subject site.
Charadriidae	<i>Thinornis rubricollis</i>	Hooded Plover	E	V	23	The species inhabits coastal areas, on or near high energy sandy beaches. They are generally found close to the shore but may visit coastal lakes.	Unlikely to occur. No suitable habitat present within the subject site.
Charadriidae	<i>Charadrius mongolus</i>	Lesser Sand Plover	V	E,Mi	1	Occurs in coastal areas	Unlikely to occur. No suitable habitat present within the subject site.
Climacteridae	<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	V	-	3	Typically found in dry open forest and eucalypt woodlands dominated by stringybarks and other rough-barked eucalypts, and an open grassy understorey. Requires fallen timber for foraging	Unlikely to occur. No suitable habitat present within the subject site.

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Records within 10km radius	Habitat Requirements	Likelihood of Occurrence
						for insect and ants. Hollows are also essential for nesting.	
Columbidae	<i>Ptilinopus superbus</i>	Superb Fruit-Dove	V	-	2	Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees. Part of the population is migratory or nomadic. Mainly found NE QLD to NE NSW.	Unlikely to occur. Limited suitable habitat present and species unlikely to occur in the area.
Dasyornithidae	<i>Dasyornis brachypterus</i>	Eastern Bristlebird	E	E	0	Habitat for central and southern populations is characterised by dense, low vegetation including heath and open woodland with a heathy understorey.	Unlikely to occur. No suitable habitat present.
Diomedeidae	<i>Diomedea exulans</i> (sensu lato)	Wandering Albatross	E	V, Ma, Mi	1	Marine and pelagic species that nests on islands near coastal or inland ridges, slopes, plateaux and plains, often on marshy ground.	Unlikely to occur. No suitable habitat present.

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Records within 10km radius	Habitat Requirements	Likelihood of Occurrence
Diomedeidae	<i>Diomedea exulans gibsoni</i>	Gibson's Albatross	V	V, Ma, Mi	1	Marine and pelagic species that nests on islands near coastal or inland ridges, slopes, plateaux and plains, often on marshy ground.	Unlikely to occur. No suitable habitat present.
Diomedeidae	<i>Thalassarche cauta</i>	Shy Albatross	V	V	5	The species is a pelagic or ocean-going bird that inhabits subantarctic and subtropical marine waters. It occurs along the eastern coast of Australia. The species is commonly recorded off southeast NSW.	Unlikely to occur. No suitable habitat present.
Diomedeidae	<i>Thalassarche melanophris</i>	Black-browed Albatross	V	V	4	This marine bird has a circumpolar range of distribution. Inhabits marine and coastal waters. Expends most of its life at sea, breeding on small isolated islands.	Unlikely to occur. No suitable habitat present.
Haematopodidae	<i>Haematopus fuliginosus</i>	Sooty Oystercatcher	V	-	30	Coastal wader found around the entire coast of Australia. Favours rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries. Forages on exposed rock or coral at low tide. Breeds almost exclusively on offshore islands.	Unlikely to occur. No suitable habitat present.

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Records within 10km radius	Habitat Requirements	Likelihood of Occurrence
Haematopodidae	<i>Haematopus longirostris</i>	Pied Oystercatcher	E	-	50	This wader is mainly distributed around the coastline. Favours intertidal flats of inlets and bays, open beaches and sandbanks.	Unlikely to occur. No suitable habitat present.
Laridae	<i>Hydroprogne caspia</i>	Caspian Tern	-	Ma, Mi	5	Found around lakes, rivers and other open wetland habitat. Prefers shallow water near margins and can be found foraging in tidal channels or mudbanks. Occasionally found in open coastal water.	Unlikely to occur. No suitable habitat present.
Laridae	<i>Sternula albifrons</i>	Little Tern	E	Ma, Mi	51	Found in sheltered coastal areas, such as lagoons, harbours and bays with exposed sandbanks or sand-spits as well as exposed ocean beaches.	Unlikely to occur. No suitable habitat present.
Meliphagidae	<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	CE	5	Generally occurs in temperate woodlands and open forests particularly Box-Ironbark woodland and River She-oak riparian forests but also known to occur in drier coastal woodlands.	Unlikely to occur. No suitable habitat present within the subject site.

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Records within 10km radius	Habitat Requirements	Likelihood of Occurrence
Meliphagidae	<i>Epthianura albifrons</i>	White-fronted Chat	V	-	1	Gregarious species found in wetland areas on bare or grassy ground.	Unlikely to occur. No suitable habitat present.
Muscicapidae	<i>Monarcha melanopsis</i>	Black-faced Monarch	-	Ma, Mi	1	Found along the coast of eastern Australia, becoming less common further south. The Black-faced Monarch is found in rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating.	Present. Identified during 2018 surveys.
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	-	9	Eucalypt forest and woodlands, especially with rough barked species, smooth-barks with dead branches, mallee and acacia. Nests in living trees and feeds off insects in dead trees	Potential to occur. Suitable habitat occurs in the form of rough-barked trees.
Petroicidae	<i>Petroica boodang</i>	Scarlet Robin	V	-	2	Occurs in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest	Unlikely to occur. No suitable habitat present.

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Records within 10km radius	Habitat Requirements	Likelihood of Occurrence
						communities, or in wetlands and Tea-tree swamps. Habitat usually contains abundant logs and fallen timber. Nests are often found in a dead branch in a live tree, or in a dead tree or shrub.	
Petroicidae	<i>Petroica rodinogaster</i>	Pink Robin	V	-	4	Found in far south-eastern NSW but can be found as far north as the central coast of NSW. Inhabits rainforest and tall, open eucalypt forest, particularly in densely vegetated gullies.	Potential to occur. Suitable habitat present in the form of rainforest vegetation and densely vegetated gullies.
Phaethontidae	<i>Phaethon lepturus</i>	White-tailed Tropicbird	-	Ma, Mi	1	Marine, pelagic	Unlikely to occur. No suitable habitat present
Procellariidae	<i>Ardenna pacificus</i> (syn. <i>Puffinus pacificus</i>)	Wedge-tailed Shearwater	-	Ma, Mi	1	Migratory bird that breeds on the east and west coasts of Australia and on off-shore islands. The species is a pelagic, marine bird.	Unlikely to occur. No suitable habitat present.
Procellariidae	<i>Ardenna tenuirostris</i> (listed as <i>Puffinus tenuirostris</i>)	Short-tailed Shearwater	-	Ma, Mi	11	Is a Marine and migratory bird. Inhabits coastal waters of the	Unlikely to occur. No suitable habitat present.

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Records within 10km radius	Habitat Requirements	Likelihood of Occurrence
						eastern coast of Australia in summer months.	
Procellariidae	<i>Macronectes giganteus</i>	Southern Giant Petrel	E	E	1	Migratory marine bird with circumpolar pelagic range. Is a common visitor off the coast of NSW.	Unlikely to occur. No suitable habitat present.
Psittacidae	<i>Glossopsitta pusilla</i>	Little Lorikeet	V	-	7	Forages primarily in the canopy of open eucalypt forest and woodland, yet also finds food in Angophoras, Melaleucas and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Also utilises isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees. Roosts in treetops, often distant from feeding areas. Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts.	Unlikely to occur. No suitable habitat present.

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Records within 10km radius	Habitat Requirements	Likelihood of Occurrence
Psittacidae	<i>Lathamus discolor</i>	Swift Parrot	E	CE, Ma	1	Semi-nomadic species foraging in dry box-ironbark forest and woodlands, but also the coastal plains forest. Widespread along the south-eastern coast of Australia, however demonstrate high site fidelity.	Unlikely to occur. No suitable habitat present.
Psittacidae	<i>Neophema pulchella</i>	Turquoise Parrot	V	-	0	Found at the edges of eucalypt woodland adjacent to clearings, timbered ridges and creeks in farmland. Associated with coastal scrubland, open forest and timbered grassland.	Unlikely to occur. No suitable habitat present.
Psittacidae	<i>Pezoporus wallicus</i>	Eastern Ground Parrot	V	-	2	Occurs in high rainfall coastal and near coastal low heathlands and sedgelands, generally below one metre in height and very dense (up to 90% projected foliage cover).	Unlikely to occur. No suitable habitat present.
Rhipiduridae	<i>Rhipidura rufifrons</i>	Rufous Fantail	-	Ma, Mi	1	Found in rainforest, dense, wet forests, swamp woodlands and mangroves, preferring deep shade, and is often seen close to the ground.	Present. Identified during 2018 surveys.

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Records within 10km radius	Habitat Requirements	Likelihood of Occurrence
Scolopacidae	<i>Actitis hypoleucos</i>	Common Sandpiper	-	Ma, Mi	1	Species occurs near coastlines utilising coastal and inland wetlands, streams, mudflats, lakes, claypans and reservoirs. Forages in shallow water and roosts on rocks or in roots or branches of vegetation.	Unlikely to occur. No suitable habitat present
Scolopacidae	<i>Arenaria interpres</i>	Ruddy Turnstone	-	Ma, Mi	1	Occurs along the coastline and only occasionally inland.	Unlikely to occur. No suitable habitat present
Scolopacidae	<i>Calidris melanotos</i>	Pectoral Sandpiper	-	Ma, Mi	1	Prefers shallow freshwater wetlands over saline. Often found in lagoons, bays, swamps and inundated grasslands by or near the coast. Occasionally found further inland.	Unlikely to occur. No suitable habitat present.
Scolopacidae	<i>Calidris ruficollis</i>	Red-necked Stint	-	Ma, Mi	1	Found in sheltered coastal areas including inlets, bays and lagoons often near spits and islets. Occasionally recorded on exposed ocean beaches near rocky shores and reefs and in inundated inland environments.	Unlikely to occur. No suitable habitat present.

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Records within 10km radius	Habitat Requirements	Likelihood of Occurrence
Scolopacidae	<i>Limosa lapponica</i>	Bar-tailed Godwit	-	Ma, Mi	3	Found in a number of coastal habitats including estuaries, harbours, bays and lagoons. Found around beds of seagrass and in nearby saltmarsh.	Unlikely to occur. No suitable habitat present.
Scolopacidae	<i>Numenius madagascariensis</i>	Eastern Curlew	-	CE, Ma, Mi	3	Generally found in sheltered coastal areas including bays, estuaries, lagoons and intertidal mudflats. Also found at coral reefs and ocean beaches that are located near estuaries.	Unlikely to occur. No suitable habitat present.
Scolopacidae	<i>Numenius phaeopus</i>	Whimbrel	-	Ma, Mi	3	Occurs in sheltered coastal areas, including intertidal mudflats, harbours, lagoons and estuaries. Occasionally occurs on sandy and rocky beaches.	Unlikely to occur. No suitable habitat present.
Stercorariidae	<i>Stercorarius parasiticus</i>	Arctic Jaeger	-	Ma, Mi	1	Migratory seabird.	Unlikely to occur. No suitable habitat present.
Strigidae	<i>Ninox connivens</i>	Barking Owl	V	-	1	Found in closed woodland or open forest, often found in tree canopies or tall midstorey trees. Also inhabits fragmented remnants,	Unlikely to occur. Limited suitable habitat present

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Records within 10km radius	Habitat Requirements	Likelihood of Occurrence
						partly cleared farmland and timbered watercourses.	and few records in the locality.
Strigidae	<i>Ninox strenua</i>	Powerful Owl	V	-	60	Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. Also occurs in fragmented habitats.	Potential to occur. Suitable foraging habitat occurs within the forest vegetation within the subject site. Breeding habitat in the form of large hollow-bearing trees is absent.
Tytonidae	<i>Tyto novaehollandiae</i>	Masked Owl	V	-	8	Found in dry eucalypt forest and woodlands. Can also be found along edges of forests and roadsides at altitudes between 0 - 1100m ASL. Breeds in moist eucalypt forest gullies utilising large tree hollows or caves.	Unlikely to occur. Limited suitable habitat present and subject site is not located within large tracks of vegetation which this species prefers.
Tytonidae	<i>Tyto tenebricosa</i>	Sooty Owl	V	-	20	Found in tall forest vegetation including rainforest, subtropical	Unlikely to occur. Limited suitable

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Records within 10km radius	Habitat Requirements	Likelihood of Occurrence
						and warm temperate rainforest and moist eucalypt forest. Nests in large tree hollows.	habitat present and subject site is not located within large tracks of vegetation which this species prefers.
Mammalia							
Balaenidae	<i>Eubalaena australis</i>	Southern Right Whale	E	E	1	Large marine mammal	Unlikely to occur. No suitable habitat present.
Burramyidae	<i>Cercartetus nanus</i>	Eastern Pygmy-possum	V	-	1	Species is found in a broad range of habitats from rainforest to wet and dry sclerophyll forests through to woodland and heath. Woodland and heath habitats are preferred. The species feeds on pollen and nectar from banksias, eucalypts, and bottlebrushes, though will eat soft fruits when flowers are unavailable, and will also eat insects throughout the year. They shelter in tree hollows, rotten stumps, holes in the ground,	Unlikely to occur. Limited suitable habitat present and few recordings from the locality.

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Records within 10km radius	Habitat Requirements	Likelihood of Occurrence
						abandoned birds' nests and Ringtail Possum dreys, and thickets of vegetation.	
Dasyuridae	<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	E	6	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	Unlikely to occur. Limited habitat present in the form of rainforest and forest vegetation; however habitat is fragmented and has limited links to previous records in the locality.
Dasyuridae	<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V	-	0	Prefers dry sclerophyll open forest with a sparse groundcover of herbs, grasses, shrubs or leaf litter. Occasionally inhabits rainforest and heath. Nests and shelters in tree hollows.	Unlikely to occur. No suitable habitat present.
Dasyuridae	<i>Sminthopsis leucopus</i>	White-footed Dunnart	V	-	1	Occurs in Tasmania and along the Victorian and southern NSW coast. The Shoalhaven area is the species'	Unlikely to occur. No suitable habitat present.

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Records within 10km radius	Habitat Requirements	Likelihood of Occurrence	
						northern-most limit. The species is found in a range of different habitats across its distribution, including coastal dune vegetation, coastal forest, tussock grassland and sedgeland, heath land, woodland and forest.		
Emballonuridae	Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	0	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 a variety of habitats across its very wide range, appears to defend an aerial territory.	Unlikely to occur. No suitable habitat present.	
Macropodidae	Petrogale penicillata	Brush-tailed wallaby	Rock-	E	V	0	Prefers rocky habitats, including loose boulder-piles, rocky outcrops, steep rocky slopes, cliffs, gorges, and isolated rock stacks. Vegetation types associated with the species include dense forest, wet sclerophyll forest, vine thicket,	Unlikely to occur. No suitable habitat present.

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Records within 10km radius	Habitat Requirements	Likelihood of Occurrence
						dry sclerophyll forest, and open forest.	
Molossidae	<i>Micronomus norfolkensis</i>	Eastern Freetail-bat	V	-	1	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.	Present. Marginal suitable habitat present, most likely to only use the site as part of a broader foraging range.
Otariidae	<i>Arctocephalus pusillus doriferus</i>	Australian Fur-seal	V	-	5	Aquatic marine mammal that prefers rocky parts of islands with flat, open terrain. The species had been recorded at Seal Rocks, near Port Stephens and Montague Island in southern NSW.	Unlikely to occur. No suitable habitat present.
Peramelidae	<i>Isoodon obesulus</i>	Southern Brown Bandicoot (eastern)	E	E	1	Generally found in heath or open forest with a heathy understorey on sandy or friable soils. Males have a home range of 5-20 ha while females have a range of 2-3 ha. Nests during the day in a shallow depression in the ground covered by leaf litter, grass, or other plant material, with nests	Unlikely to occur. Only one record in locality and species is associated with heath/heathy understorey and there are no areas

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Records within 10km radius	Habitat Requirements	Likelihood of Occurrence
						located under grass trees, blackberry bushes and other shrubs, or in rabbit burrows.	of heath within the site.
Petauridae	<i>Petaurus australis</i>	Yellow-bellied Glider	V	-	3	Occurs in high areas of rainfall in tall mature eucalypt forest where soils are nutrient rich. Dens in the hollows of large trees.	Unlikely to occur. Some sub-optimal suitable habitat present within the subject site in the form of moist forest, however habitat is fragmented and lacks an abundance of large hollow-bearing trees.
Petauridae	<i>Petaurus norfolcensis</i>	Squirrel Glider	V	-	1	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.	Unlikely to occur. No suitable habitat and few records in the locality.
Phascolarctidae	<i>Phascolarctos cinereus</i>	Koala	V	V	2	Inhabit eucalypt woodlands and forests. Feed on the foliage of	Unlikely to occur. No suitable

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Records within 10km radius	Habitat Requirements	Likelihood of Occurrence
						more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size.	habitat within the subject site.
Physeteridae	<i>Physeter macrocephalus</i>	Sperm Whale	V	-	2	Marine mammal. Concentrations of Sperm Whales tend to occur where the seabed rises steeply from a greater depth, beyond the continental shelf.	Unlikely to occur. No suitable habitat present.
Potoroidae	<i>Potorous tridactylus</i>	Long-nosed Potoroo	V	V	16	Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature.	Unlikely to occur. Some suitable habitat present in the form of moist forest; however habitat is not connected to know locations of this species and no diggings were observed during surveys.

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Records within 10km radius	Habitat Requirements	Likelihood of Occurrence
Petauridae	<i>Petauroides volans</i>	Greater Glider	-	V	25	Inhabits tall, montane, moist eucalypt forests with old growth trees. Prefers forests with a diversity of eucalypt species and large hollows for breeding and shelter.	Unlikely to occur. Some sub-optimal suitable habitat present within the subject site in the form of moist forest, however habitat is fragmented and lacks an abundance of large hollow-bearing trees.
Pseudomys	<i>Pseudomys gracilicaudatus</i>	Eastern Chestnut Mouse	V	-	0	Occurs mainly north of the Hawkesbury in dense wet heaths and swamps.	Unlikely to occur. No suitable habitat present.
Pteropodidae	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	58	Roosts in large camps located close to a regular food source, often in gullies with a dense canopy near water. Habits include temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps.	Present. Recorded within the subject site. Foraging habitat present in the vegetated portions of the subject site. No camps observed

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Records within 10km radius	Habitat Requirements	Likelihood of Occurrence
							during recent surveys.
Vespertilionidae	<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	0	The species is associated with areas dominated by sandstone escarpments; sandstone cliffs and fertile woodland valley habitat occurring in close proximity to each other is important for the species. It roosts in cliff/escarpment areas and forages in fertile forest. Roosting is predominately in arch caves with dome roofs, but has been observed in disused mines shafts, overhangs, and disused Fairy Martin nests.	Unlikely to occur. No suitable habitat present, not recorded in the locality.
Vespertilionidae	<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	-	4	Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows but has also been found under loose bark on trees or in buildings.	Potential to occur. Suitable habitat present in the form of moist forest. Roosting habitat includes hollow-bearing

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Records within 10km radius	Habitat Requirements	Likelihood of Occurrence
							trees and loose bark.
Vespertilionidae	<i>Kerivoula papuensis</i>	Golden-tipped Bat	V	-	2	Occurs in wet and dry sclerophyll forest up to 1000m. Also recorded in tall open forest, <i>Casuarina</i> -dominated riparian forest and coastal <i>Melaleuca</i> forests. Roosts in abandoned hanging Yellow-throated Scrubwren and Brown Gerygone nests modified.	Unlikely to occur. No suitable habitat present on the subject site.
Vespertilionidae	<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V	-	5	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Hunt in forested areas, catching moths and other flying insects above the tree tops.	Present. Recorded within the subject site. Foraging habitat present in the vegetated portions of the subject site.
Vespertilionidae	<i>Myotis macropus</i>	Southern Myotis	V	-	9	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by	Unlikely to occur. No suitable habitat present.

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Records within 10km radius	Habitat Requirements	Likelihood of Occurrence
						raking their feet across the water surface.	
Vespertilionidae	<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	-	3	More commonly found in tall wet forest but also occurs in dry eucalypt forest. Roosts in tree hollows and buildings. Forages along creek and river corridors.	Potential to occur. Suitable habitat present in the form of moist forest. Roosting habitat includes hollow-bearing trees.
Reptilia							
Cheloniidae	<i>Caretta caretta</i>	Loggerhead Turtle	E	E	1	The Loggerhead turtle occurs in the open ocean until it reaches maturity, and subsequently migrates to their breeding areas where they nest on open, sandy beaches. Preferred foraging habitats include various tidal and sub-tidal areas, and the species is known to keep returning to both their chosen foraging and breeding sites throughout their life cycle.	Unlikely to occur. No suitable habitat present.

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Records within 10km radius	Habitat Requirements	Likelihood of Occurrence
Cheloniidae	<i>Chelonia mydas</i>	Green Turtle	V	V	3	Marine turtle widely distributed in tropical and sub-tropical seas. Ocean-dwelling species spending most of its life at sea. Eggs laid in holes dug in beaches throughout their range. Seems to favour vegetation communities with an open understorey structure.	Unlikely to occur. No suitable habitat present.

Notes: TSC Act = NSW Threatened Species Conservation Act 1995; EPBC Act = Commonwealth Environment Protection and Biodiversity Conservation Act 1999; CE = Critically Endangered; E = Endangered; V = vulnerable; Ma = Marine; Mi = Migratory.

APPENDIX E :

Assessments of Significance (7 Part Test)

E.1. Endangered Ecological Communities

E.1.1. Milton Ulladulla Subtropical Rainforest

E.1.1.1. Background

Milton Ulladulla Subtropical Rainforest community occurs on basaltic soils (on Milton Monzonite), deep alluvium and soils of the Conjola Formation enriched by monzonite in the Milton Ulladulla area (within the Sydney Basin Bioregion) and is characterised by an assemblage of species that includes *Acmena smithii*, *Adiantum flabellifolium*, *Alectryon subcinereus*, *Aphanopetalum resinosum*, *Arthropteris tenella*, *Baloghia inophylla*, *Breynia oblongifolia*, *Cissus antarctica*, *Cissus hypoglauca*, *Citriobatus pauciflorus*, *Clayoxylon australe*, *Dendrocnide excelsa*, *Diospyros australis*, *Doodia aspera*, *Eustrephus latifolius*, *Ficus spp.*, *Geitonoplesium cymosum*, *Gymnostachys anceps*, *Legnephora moorei*, *Malaisia scandens*, *Marsdenia rostrata*, *Notelaea venosa*, *Oplismenus imbecillis*, *Pandorea pandorana*, *Pellaea falcata*, *Pittosporum undulatum*, *Plectranthus parviflorus*, *Sarcopetalum harveyanum*, *Smilax australis*, *Stephania japonica*, *Streblus brunonianus*, *Syzygium australe* and *Toona ciliata*.

The structure of Milton Ulladulla Subtropical Rainforest is dense forest up to 15 m high with an emergent tree layer to over 25 m often present. Characteristic tree species in the Milton Ulladulla Subtropical Rainforest include *Clayoxylon australe*, *Acmena smithii*, *Dendrocnide excelsa*, *Ficus species*, *Syzygium australe*, *Streblus brunonianus*, *Baloghia inophylla* and *Toona ciliata*. There is generally a sparse shrub layer and ground cover with a diverse mix of lianas, vines, and ferns, or if disturbed there are components of indigenous native species sufficient to facilitate the restoration of the characteristic habitat.

This community is listed as an Endangered Ecological Community (EEC) under the TSC Act.

The Milton Ulladulla Subtropical Rainforest community is present associated with a creek line in the north-eastern portion of the subject site and with a large *Ficus obliqua* within the south eastern portion of the subject site.

E.1.1.2. Assessment of Significance

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

Not applicable

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

Not applicable.

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

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

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

The Subtropical Complex Rainforest corresponds to the Milton Ulladulla Subtropical Rainforest in the Sydney Basin Bioregion an Endangered Ecological Community listed under the NSW *Threatened Species Conservation Act 1995*. The Milton Ulladulla Subtropical Rainforest (MUSR) located on the northern and south eastern portion of the subject site is outside of the proposed development footprint and will not be affected by the proposed development. Therefore the proposed development will not have an adverse effect on the extent of this EEC and will not put its occurrence at risk of extinction.

The MUSR will not be affected by the proposed development and this vegetation community will be preserved. Additionally, a 20m buffer zone around the boundary of the EEC located in the northern portion will be managed to ensure the protection of the EEC. The south eastern portion associated with the single *Ficus obliqua* will not have a surrounding buffer due to its current isolated location and because the community area is restricted solely to the region directly underneath the coverage of the tree. The *Ficus obliqua* and the mapped area of MUSR will not be cleared or encroached upon by the proposed development. A vegetation management plan will be prepared to manage the MUSR, its associated creek, the 20m buffer zone surrounding the northern EEC and the APZ. This will remove and prevent the presence of weeds occurring in the EEC and will enhance the biodiversity value of this EEC within the subject site. Therefore, the proposed development will not result in substantially or adversely modifying the EEC or its occurrence in the locality. The EEC will not be placed at risk of extinction as a result of the proposed development.

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

- (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
- (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
- (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Approximately 1.11 ha of Milton Ulladulla Subtropical Rainforest is present on the subject site and no area of this vegetation community will be removed or modified as a result of the proposed action.

No area of this community will become fragmented or isolated from other areas of this community as a result of the proposal.

The area of Milton Ulladulla Subtropical Rainforest in the subject site is not likely to be important to the long-term survival of this community in the locality, as it is a small area, located in a largely urban context. That notwithstanding, it will not be modified, fragmented or removed by the proposed development.

As part of the asset protection zone (APZ) that will be retained/created as part of the proposed development, the northern Milton Ulladulla Subtropical Rainforest will be adjacent to Native Regrowth vegetation, which will protect the EEC community from indirect effects such as edge effects or weed invasion.

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

There is no critical habitat for Milton Ulladulla Subtropical Rainforest currently listed by the Director-General of the OEH.

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

No recovery plan or threat abatement plan has been prepared for this community.

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

The project may result in the operation of the following key threatening processes relevant to Milton Ulladulla Subtropical Rainforest:

- Edge effects associated with grazing, light intrusion, wind and weed invasion;
- Destruction or degradation of remnants by wildfire; and
- Dumping of rubbish.

The primary key threatening process relevant to the proposed development is the edge effects due to weed invasion. As an APZ will in parts be immediately adjacent or within 5m of this community in the south eastern occurrence of the community, a vegetation management plan will be prepared to prevent edge effects.

E.1.1.3. Conclusion

The local occurrence of Milton Ulladulla Subtropical Rainforest in the subject site is comprised of a total of ~1.11 ha and none of this area will be removed for the proposed development. Therefore, the proposed development will not have a significant impact on Milton Ulladulla Subtropical Rainforest on the subject site and subsequently no Species Impact Statement is required.

E.2. Flora

E.2.1. *Rhodamnia rubescens*

E.2.1.1. Background

Rhodamnia rubescens

Rhodamnia rubescens (*Scrub Turpentine*) is listed as critically endangered under the TSC Act. This shrub/small tree species occurs along the east coast of Australia, from as far south as Batemans Bay, to inland of Bundaberg in Queensland to the north. The species typically occurs in coastal areas, occasionally extending inland onto escarpments up to 600 m above sea level in areas with 1000 to 1600 mm of rainfall (OEH 2019). The species occupies soils derived from volcanic and sedimentary sources and is associated generally with rainforests and wet sclerophyll forests, although can occur in adjacent areas of dry sclerophyll forest as a pioneer (NSW Scientific Committee 2019).

The species was common and has a large geographic range, with an extent of occurrence within NSW of 123 459km². However, the species has been listed as critically endangered due to its extreme susceptibility to the

introduced pathogen Myrtle Rust (*Austropuccinia psidii*). Myrtle Rust was introduced in Australia in 2010 and has since established throughout ecosystems in coastal areas of eastern Australia. All parts of *Rhodamnia rubescens* are affected by the rust, including stems, leaves, and flowers. The rust is known to kill flowers, and infect fruit preventing the fruit maturing. Mortality of the species has been recorded at over 50% in studied populations, and it is estimated that within three generations over 80% of plants across its range will be deceased. As a rainforest species, seed dormancy is not expected to be long lived and the soil seed bank is therefore readily extinguished over a short period of time. Seedlings are also highly susceptible to infection by the rust which is widespread and persistent in the environment due to many host species in the Myrtaceae family (NSW Scientific Committee 2019).

Two individuals of the species were recorded within areas of the subject site containing older trees than the *Acacia* regeneration occurring across large areas of the site. One individual was recorded under an old growth *Ficus obliqua*, along with an array of regenerating rainforest spp. comprising an occurrence of the Milton Ulladulla Subtropical Rainforest EEC, and the other within Clyde Gully Wet Forest very close to the southern boundary of the site (within 1-2m inside the site as delineated by an old barbed wire fence). Both of these individuals will be retained within the subject site. The *Ficus obliqua* is being retained as a pocket of the Threatened Ecological Community Milton Ulladulla Subtropical Rainforest. The other individual is being retained within an area of native vegetation to protect the species. Canopy species will be removed in this area as required by the project arborist, however understorey and ground layer vegetation will be retained along with the individual and improved. This area is situated between what will be the outer boundary fence of the development and a road/car parking.

Both individuals of the species are young, about 40 cm in height, and visibly infected with myrtle rust. Despite efforts to retain the individuals of the species within the site, in the mid to long term there is a high likelihood they will succumb to the infection.

E.2.1.2. Assessment of Significance

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

There is limited potential habitat for the species on site due generally to the degraded, regrowth nature of the vegetation which consists predominately of *Acacia* spp. and other common native species such as *Trema tomentosa*, growing along with dense occurrences of exotic woody species including *Lantana camara* and *Rubus fruticosus*.

The proposed development will remove approximately 1.52 ha of Clyde Gully Wet Forest which is likely to be the best habitat for the species within the impact area of the site. Other areas of vegetation consist of young regrowth and exotic weeds. Searches in these areas did not locate the species. All areas of the Clyde Gully Wet Forest community were searched thoroughly during targeted searches of the site for the species which is a conspicuous shrub. Only two individuals of the species were located, one in Milton Ulladulla Subtropical Rainforest, and the other in Clyde Gully Wet Forest. Both individuals are to be retained.

The proposal is not likely to place a viable local population of any of the species at risk of extinction. The species has fruit distributed by birds, and both individuals are to be retained along with suitable habitat for

future individuals to grow from seed, particularly areas of Milton Ulladulla Subtropical Rainforest. All occurrences of this community will be retained within the subject site. Both individuals were observed to be infected with Myrtle Rust however, and future fruiting is not assured regardless of the proposed development.

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

Not applicable.

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

- (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
- (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.*

Not applicable.

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

- (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
- (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
- (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.*

Approximately 1.52 ha of Clyde Gully Wet Forest and ~1.81 ha of Native Regrowth and Exotic Weeds will be cleared for the proposed development. The Native Regrowth and Exotic Weeds community is considered to be extremely poor habitat for the species as it consists predominately of young regrowth of common native species and exotic weeds. The species was not located within the Clyde Gully Wet Forest habitat to be removed, and both of the two individuals located within the subject site are being retained along with buffering areas of native vegetation. The 0.05 ha buffer area for one of the individuals is likely to be modified as trees will be required to be removed, if deemed unsafe for retention by the project arborist, in a retained area of Clyde Gully Wet Forest containing the individual.

Both areas of habitat for the individuals are likely to become fragmented from other areas as a result of the proposed development as surrounding vegetation is to be removed. However, as dispersal of the species is by fauna, particularly birds consuming fruit, the habitat is not likely to become completely isolated from other areas of habitat in the locality and the subject site, including areas of Milton Ulladulla Subtropical Rainforest to be retained.

The area of potential habitat for these species that will be cleared is not important for these species in the locality as the species was not located within these areas. As the species is thought to have seed germination which occurs within one to two months of seed being deposited into soil, it is unlikely that the habitat to be

removed contains a soil seed bank with propagules of the species. As Myrtle Rust is known to prevent fruit production in the species, and both individuals were juveniles infected with the rust, it is also unlikely the habitat to be removed would provide future habitat for the species. The most important areas of habitat for the species across its range are areas that contain individuals resistant to Myrtle Rust. As there were no mature individuals located as persisting in the site and both young individuals located were infected with rust the subject site is not likely to contain important habitat for the species which is likely to further decline in the locality regardless of habitat retention. The species was considered common and widespread prior to the introduction of Myrtle Rust and as such lack of habitat/habitat clearance is not a significant contributing factor to the species decline.

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

No critical habitat for any of the species has currently been identified by the Director- General of the OEH.

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

No specific recovery plan or threat abatement plans have been prepared for these species.

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

The following key threatening processes are relevant to the proposed development:

- Introduction and establishment of exotic rust fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae
- Clearing of re-growth native vegetation;
- Invasion and establishment of exotic vines and scramblers;
- Invasion of native plant communities by African Olive (*Olea europaea* L. subsp. *cuspidata*); and
- Invasion of native plant communities by exotic perennial grasses.

The key threatening process 'Introduction and establishment of exotic rust fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae' is highly relevant to *Rhodamnia rubescens*. The proposed development however is not likely to exacerbate the occurrence of the Myrtle Rust in the locality which is already ubiquitous within the region, is spread by wind amongst other natural factors such as fauna movement, and is unlikely to be eradicated due to the large number of less susceptible myrtaceous host species occurring throughout the range of the pathogen.

The key threatening process of 'Clearing of native vegetation', could potentially impact potential habitat for this species. However, the vegetation on the subject site is not considered to constitute significant habitat for this species. Potential habitat is likely to be widespread in the locality for the formerly common species. As potential habitat will remain in the vicinity of the subject site, the clearing of native vegetation is not likely to significantly impact habitat for the species. Habitat clearing is not in general a significant threat to the species.

Exotic species will be controlled within retained areas of vegetation, so the proposed development is likely to mitigate against the three key threatening processes related to invasion by weed species, as long as weed material cleared from the impact area is disposed of appropriately, preventing further spread of weed propagules.

E.2.1.3. Conclusion

A total of 1.82 ha of vegetation will be cleared for the proposed development comprising moderate habitat for the species, and a further 1.181 ha of sub-optimal potential habitat in which the species was not recorded. Two individuals of the species were recorded within the subject site, and the development has been designed such as to retain both individuals. Habitat suitable for future occupation by the species will be retained within the subject site. Habitat for the species is likely to be widespread within the locality, and clearing for development is not a significant threat to the formerly common species, which as listed is threatened due to its susceptibility to the introduced pathogen Myrtle Rust.

E.2.2. Other threatened Flora Species

This Assessment of Significance covers the following threatened flora species with the potential to occur:

- Thick-lipped Spider Orchid (*Caladenia tessellata*);
- Leafless Tongue-orchid (*Cryptostylis hunteriana*); and
- Austral Toadflax (*Thesium australe*).

E.2.2.1. Background

E.i. Thick-lipped Spider-orchid

The Thick-lipped Spider-orchid or Daddy Long-leg (*Caladenia tessellata*) is listed as endangered under the TSC Act and as vulnerable under the EPBC Act. The species is known from the Sydney area, Wyong, Ulladulla and Braidwood in NSW. Populations in Kiama and Queanbeyan are presumed extinct. It was also recorded in the Huskisson area in the 1930s (OEH 2017j).

This orchid is generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil (OEH 2017j). The species flowers appear between September and November, generally in late September or early October in extant southern populations (OEH 2017j).

E.ii. Leafless Tongue-orchid

The Leafless Tongue-orchid (*Cryptostylis hunteriana*) is listed as vulnerable under the TSC Act and the EPBC Act. This orchid has been recorded along the east coast of Australia, from as far north as Gibraltar Range National Park to south into Victoria as far as Orbost. It is known historically from a number of localities on the NSW south coast and has been observed in recent years at many sites between Batemans Bay and Nowra (although it is uncommon at all sites). It has been recorded at Munmorah State Conservation Area, Nelson Bay, Wyee, Washpool National Park, Nowendoc State Forest, Ku-Ring-Gai Chase National Park and Ben Boyd National Park (OEH 2017f).

The species does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. Its larger populations typically occur in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black She-oak (*Allocasuarina littoralis*). It appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (*C. subulata*) and the Tartan Tongue Orchid (*C. erecta*) (OEH 2017f).

E.iii. Austral Toadflax

The Austral Toadflax (*Thesium australe*) is listed as vulnerable under the TSC Act. This orchid is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It is also found in Tasmania and Queensland and in eastern Asia (OEH 2017a).

The species occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. It is often found in association with Kangaroo Grass (*Themeda australis*). This species is a root parasite that takes water and some nutrients from other plants, especially Kangaroo Grass (OEH 2017a).

E.2.2.2. Assessment of Significance

The following assessment of significance applies to the three threatened flora species.

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

Very limited potential habitat for the Leafless Tongue-orchid and the Thick-lipped Spider Orchid occur within the subject site. Neither of these two orchid species has been recorded from the subject site. The Thick-lipped Spider-orchid inhabits the vegetation formation Grassy Woodland, and no Grassy Woodland vegetation formations occur within the subject site. Clyde Gully Wet Forest is of the vegetation formation Wet Sclerophyll Forests and Subtropical Rainforest is of the vegetation formation Rainforest (Tozer et al. 2010). The Thick-lipped Spider-orchid is not associated with Wet Sclerophyll Forest or Rainforest vegetation formations.

Very limited potential habitat for the Leafless Tongue-orchid is present, and it is unlikely the species would occur within the subject site. None of the above-listed species of trees that this orchid is associated with have been recorded within the subject site and it cannot reliably be predicted to occur within a habitat type based on the broad diversity of vegetation types in which species records appear. Neither the Large Tongue Orchid nor the Tartan Tongue Orchid that the Leafless Tongue-orchid is associated with have been recorded within the subject site.

Very limited habitat for the Austral Toadflax is present, and it is unlikely the species would occur within the subject site. The Austral Toadflax inhabits grassland and grassy woodland, no grassy woodland vegetation formations occur within the subject site. Clyde Gully Wet Forest is of the vegetation formation Wet Sclerophyll Forests and Subtropical Rainforest is of the vegetation formation Rainforest (Tozer et al. 2010). The Austral Toadflax is not associated with Wet Sclerophyll Forest or Rainforest vegetation formations. Some grassland occurs on the subject site as Exotic Grassland; however this vegetation community is primarily dominated by exotic species, none of which the Austral Toadflax is not associated with. The native Kangaroo Grass with which the species is associated has not been recorded within the subject site. Additionally, it is considered that the

majority of the subject site was formerly occupied by Clyde Gully Wet Forest, which would not represent a suitable vegetation formation or habitat for this species. The EEC Milton Ulladulla Subtropical Rainforest vegetation community located on the north-eastern portion of the subject site is not considered a suitable habitat for the species.

The proposal is not likely to place a viable local population of any of these species at risk of extinction due to the limited amount of habitat present within the subject site.

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

Not applicable.

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

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

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

Not applicable.

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

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

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

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

Approximately 1.52 ha of Clyde Gully Wet Forest and ~1.81 ha of Native Regrowth and Exotic Weeds will be cleared for the proposed development. These vegetation types represent sub-optimal habitat for the three threatened flora species due to the historical land use of the site and the overall disturbed condition of the vegetation within the subject site. The proposed development will not clear the EEC vegetation community; therefore, it will not further fragment areas of potential habitat for these species. Although these threatened flora species were identified as having potential to occur within the subject site, they were not found during surveys undertaken within the subject site. Therefore, it is considered unlikely that the proposed development will impact on known habitat for these flora species.

The proposed action will not fragment or isolate potential habitat for these species.

The area of potential habitat for these species that will be cleared is not important for these species in the locality as it is an area of largely cleared and modified vegetation. The subject site would only likely provide minimal sub-standard habitat for the species, and is not representative of the vegetation formations and flora

species these threatened plants are associated with. Much larger areas of potential habitat occur throughout the wider locality in more heavily vegetated areas, particularly along Narrawallee Creek or Meroo National Park to the north-east and south, respectively, of the subject site. These tracts of vegetation would provide more favourable habitat for these species. It is therefore considered that the habitat provided on the subject site is not important for the long-term survival of the three threatened flora species in the wider locality.

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

No critical habitat for any of these species has currently been identified by the Director- General of the OEH.

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

No specific recovery plan or threat abatement plans have been prepared for these species.

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

The following key threatening processes are relevant to the proposed development:

- Clearing of re-growth native vegetation;
- Invasion and establishment of exotic vines and scramblers;
- Invasion of native plant communities by African Olive (*Olea europaea* L. subsp. *cuspidata*); and
- Invasion of native plant communities by exotic perennial grasses.

The key threatening process of 'Clearing of native vegetation', could potentially impact potential habitat for these species. However, the vegetation on the subject site is not considered to constitute significant habitat for these species. As potential habitat will remain in the vicinity of the subject site, the clearing of native vegetation is not likely to significantly impact habitat for potentially occurring threatened species.

E.2.2.3. Conclusion

A total of 11.04 ha of vegetation will be cleared for the proposed development comprising sub-optimal potential habitat for the three threatened flora species. The proposed development will result in the removal of modified vegetation, dominated by exotic species. No significant habitat for these orchid species will be removed within the subject site. The proposal is not likely to place a viable local population of any of these species at risk of extinction. These species were not found within the subject site during surveys and the historical landuse of land within the subject site suggests it represents sub-standard habitat within a degraded environment. The project is not likely to have a significant detrimental impact upon any of the potentially occurring threatened flora species discussed above.

E.3. Fauna

This section provides Assessments of Significance for the following threatened fauna species with the potential to occur in the subject site:

- Square-tailed Kite (*Lophoictinia isura*);
- Varied Sittella (*Daphoenositta chrysoptera*);
- Pink Robin (*Petroica rodinogaster*);
- Powerful Owl (*Ninox strenua*);
- Grey-headed Flying-fox (*Pteropus poliocephalus*);
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*);
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*);
- Greater Broad-nosed Bat (*Scoteanax rueppellii*); and
- Eastern Freetail-bat (*Mormopterus norfolkensis*).

E.3.1. Varied Sittella and Pink Robin

The following assessment of significance applies for the Varied Sittella and Pink Robin which are woodland birds with similar habitat requirements.

E.3.1.1. Background

The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Its distribution in NSW is nearly continuous from the coast to the far west. The Varied Sittella's population size in NSW is uncertain but is believed to have undergone a moderate reduction over the past several decades (OEH 2017k). The species inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland (OEH 2017k). The species feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy. It builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years (OEH 2017k). The Varied Sittella is listed as a vulnerable species under the TSC Act.

The Pink Robin is found in Tasmania and the uplands of eastern Victoria and far south-eastern NSW, almost as far north as Bombala. On the mainland, the species disperses north and west and into more open habitats in winter, regularly as far north as the ACT area, and sometimes being found as far north as the central coast of NSW (OEH 2017g). The species inhabits rainforest and tall, open eucalypt forest, particularly in densely vegetated gullies. The species is a predator and it catches prey by the perch-and-pounce method, foraging more on the ground and its diet includes insects and spiders as the main dietary items. It breeds between October and January and can produce two clutches in a season. The Pink Robin builds a nest as a deep, spherical cup made of green moss bound with cobweb and adorned with camouflaging lichen, and is lined with fur and plant down. It is situated in an upright or oblique fork, from 30cm to 6m above the ground, in deep undergrowth. Females of this species do most or all of the nest building and incubate unaided, but both adults feed the nestlings (OEH 2017g). The Pink Robin is listed as a vulnerable species under the TSC Act.

E.3.2. Assessment of Significance

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

The Varied Sittella and the Pink Robin are likely to use the subject site as foraging habitat as part of a much larger foraging range. The subject site has the potential to provide habitat within the Clyde Gully Wet Forest and in the Milton Ulladulla Subtropical Rainforest vegetation communities. These two woodland birds are highly mobile species that accesses resources from across a wide area and would not depend upon resources contained on the portion of the subject site to be developed for their survival. The proposal is not likely to place a viable local population of any of these species at risk of extinction due to the limited amount of foraging habitat present within the subject site.

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

Not applicable.

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

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

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

Not applicable.

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

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

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

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

Approximately 1.52 ha of Clyde Gully Wet Forest, ~1.81 ha of Native Regrowth and Exotic Weeds, ~0.12 ha of Planted Natives/Exotics and Weeds and ~7.59 ha of Exotic Grassland will be cleared for the proposed development. This represents a relatively small area of potential foraging habitat within the locality for these woodland bird species. However, this is not optimum foraging habitat for any of these species as they would tend to forage in more vegetated forests and woodlands, such as in Meroo National Park south or Narrawallee Creek Nature Reserve to the north-east of the subject site.

The habitat occurring within the subject site and immediate surrounds has previously been fragmented by various developments and previous land uses. Within this area, available habitat for these species exists in

fragmented patches in varying conditions. The proposed development will not fragment or isolate areas of existing habitat; however the proposed development predominantly requires clearing at the edge of treed habitat and will therefore encroach further into remaining habitat rather than creating fragmented habitat patches. Habitat on the subject site is not important for these species in the locality as it is a small area of largely cleared and modified vegetation. The subject site would only likely provide minimal foraging habitat. Much larger areas of potential habitat occur throughout the wider locality in more heavily vegetated areas, particularly along Narrawallee Creek or Meroo National Park to the north-east and south, respectively, of the subject site. These tracts of vegetation would provide more favourable roosting and foraging habitat for these species. It is therefore considered that the habitat provided on the subject site is not important for the long-term survival of the species in the wider locality.

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

No critical habitat for any of these species has currently been identified by the Director- General of the OEH.

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

No specific recovery plan or threat abatement plans have been prepared for these threatened woodland birds.

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

The following key threatening processes are relevant to the proposed development

- Clearing of re-growth native vegetation;
- Invasion and establishment of exotic vines and scramblers;
- Invasion of native plant communities by African Olive (*Olea europaea* L. subsp. *cuspidata*); and
- Invasion of native plant communities by exotic perennial grasses.

The key threatening process of 'Clearing of native vegetation' has the potential to further impact foraging habitat for these bird species. However, the vegetation on the subject site is not considered to constitute significant habitat for these species. As potential habitat will remain in the vicinity of the subject site, the clearing of native vegetation is not likely to significantly impact habitat for potentially occurring threatened species.

E.3.2.1. Conclusion

A total of ~11.04 ha of vegetation will be cleared for the proposed development comprising potential habitat for some threatened fauna species. The proposed development will result in the removal of modified vegetation, dominated by exotic species. No significant habitat for the assessed species will be removed within the subject site. The proposal is not likely to place a viable local population of any of these species at risk of extinction. These species are highly mobile and are expected to move between areas of remaining habitat

within the immediate vicinity of the subject site and wider area. The project is not likely to have a significant detrimental impact upon any of the potentially occurring threatened fauna species discussed above.

E.3.3. Square-tailed Kite and Powerful Owl

This assessment of significance applies for the Square-tailed Kite and the Powerful Owl as these two raptor birds have similar foraging habitat requirements.

E.3.3.1. Background

The Square-tailed Kite ranges along coastal and sub-coastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems (OEH 2017i). It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. The species is found in a variety of timbered habitats including dry woodlands and open forests. The species shows a particular preference for timbered watercourses. In arid north-western NSW, it has been observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland. The species is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage. The Square-tailed Kite appears to occupy large hunting ranges of more than 100km² (OEH 2017i). The Squared-tailed Kite is listed as vulnerable under the TSC Act.

The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains suggesting occupancy prior to land clearing. The species is currently found at low densities throughout most of its eastern range, rare along the Murray River and former inland populations may never recover (OEH 2017h). The species inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. It 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 (*Exocarpos cupressiformis*) and a number of eucalypt species (OEH 2017h). The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider. There may be marked regional differences in the prey taken by Powerful Owls. For example in southern NSW, Ringtail Possum make up the bulk of prey in the lowland or coastal habitat. At higher elevations, such as the tableland forests, the Greater Glider may constitute almost all of the prey for a pair of Powerful Owls. 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. 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 400 ha can support a pair; where hollow trees and prey have been depleted the owls need up to 4000 ha (OEH 2017h). The Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. While the female and young are in the nest hollow the male

Powerful Owl roosts nearby (10-200 m) guarding them, often choosing a dense "grove" of trees that provide concealment from other birds that harass him (OEH 2017h). The Powerful Owl is listed as a vulnerable species under the TSC Act.

E.3.4. Assessment of Significance

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

The Square-tailed Kite and the Powerful Owl have potential to use the subject site as foraging habitat as part of a much larger foraging range. They are all highly mobile species that accesses resources from across a wide area and would not depend upon resources contained on the portion of the subject site to be developed for their survival. The proposal is not likely to place a viable local population of any of these species at risk of extinction due to the limited amount of foraging habitat present within the subject site.

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

Not applicable.

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

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

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

Not applicable.

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

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

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

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

Approximately 1.52 ha of Clyde Gully Wet Forest, ~1.81 ha of Native Regrowth and Exotic Weeds, ~0.12 ha of Planted Natives/Exotics and Weeds and ~7.59 ha of Exotic Grassland will be cleared for the proposed development. This represents a relatively small area of potential foraging habitat within the locality for these species. Vegetation communities within the subject site represent sub-optimal foraging habitat for these threatened raptor species as they would tend to forage in more vegetated forests and woodlands, such as in Meroo National Park south or Narrawallee Creek Nature Reserve to the north-east of the subject site. The

subject site is not considered to provide suitable roosting or breeding habitat for either of these threatened raptor species.

The habitat occurring within the subject site and immediate surrounds has previously been fragmented by various developments and previous land uses. Within this area, available habitat for these species exists in fragmented patches in varying conditions. The proposed development will not fragment areas of existing habitat; however the proposed development predominantly requires clearing at the edge of treed habitat and will therefore encroach further into remaining habitat rather than creating fragmented habitat patches.

The proposed action will not remove, modify, fragment or isolate important habitat. Habitat on the subject site is not important for these species in the locality as it is a small area of largely cleared and modified vegetation. The subject site would only likely provide minimal foraging habitat. Much larger areas of potential habitat occur throughout the wider locality in more heavily vegetated areas, particularly along Narrawallee Creek or Meroo National Park to the north-east and south, respectively, of the subject site. These tracts of vegetation would provide more favourable roosting and foraging habitat for these species. It is therefore considered that the habitat provided on the subject site is not important for the long-term survival of the species in the wider locality.

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

No critical habitat for any of these species has currently been identified by the Director-General of the OEH.

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

No specific recovery plan or threat abatement plans have been prepared for these threatened raptor species.

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

The following key threatening processes are relevant to the proposed development:

- Clearing of re-growth native vegetation;
- Invasion and establishment of exotic vines and scramblers;
- Invasion of native plant communities by African Olive (*Olea europaea* L. subsp. *cuspidata*); and
- Invasion of native plant communities by exotic perennial grasses.

The key threatening process of 'Clearing of native vegetation' has the potential to further impact sub-optimal foraging habitat for these species. However, the vegetation on the subject site is not considered to constitute roosting or breeding habitat for these species. As suitable habitat will remain in the vicinity of the subject site, the clearing of native vegetation is not likely to significantly impact habitat for potentially occurring threatened species.

E.3.4.1. Conclusion

A total of ~11.04 ha of vegetation will be cleared for the proposed development comprising potential habitat for some threatened fauna species. The proposed development will result in the removal of modified vegetation, dominated by exotic species. No significant habitat for the assessed species will be removed within the subject site. The proposal is not likely to place a viable local population of these threatened raptor species at risk of extinction. These species are highly mobile and are expected to move between areas of remaining habitat within the immediate vicinity of the subject site and wider area. The project is not likely to have a significant detrimental impact upon any of the potentially occurring threatened fauna species discussed above.

E.3.5. Grey-headed Flying-fox

E.3.5.1. Background

The Grey-headed Flying-fox is distributed along the east coast from Bundaberg in Queensland to Melbourne, Victoria. It occurs as far west as the western slopes of the Great Dividing Range in northern NSW. It occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps. Grey-headed Flying-foxes migrate according to the availability of native fruits, nectar and pollen. They roost in large "camps" which are generally within 20 km of a food source (NSW Scientific Committee 2004). The Grey-headed Flying-fox is listed as Vulnerable under the TSC Act and the EPBC Act.

E.3.6. Assessment of Significance

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

The Grey-headed Flying-fox is likely to use the subject site as foraging habitat as part of a much larger foraging range. This species is highly mobile with a foraging range of up to 20 km² and would not depend upon resources contained on the portion of the subject site to be developed for their survival. The Grey-headed Flying-fox roost and breeds in 'roosting camps' of hundreds of individuals. The subject site does not constitute a 'roosting camp' for the Grey-headed Flying-fox. Therefore, the proposal is not likely to place a viable local population of the Grey-headed Flying-fox at risk of extinction due to the limited amount of foraging habitat present within the subject site.

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

Not applicable.

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

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

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

Not applicable.

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

- (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
- (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
- (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.*

Approximately 1.52 ha of Clyde Gully Wet Forest, ~1.81 ha of Native Regrowth and Exotic Weeds, ~0.12 ha of Planted Natives/Exotics and Weeds and ~7.59 ha of Exotic Grassland will be cleared for the proposed development. This represents a relatively small area of potential foraging habitat within the locality for this species. However, this is not optimum foraging habitat for the Grey-headed Flying-fox as this species would tend to forage in more vegetated forests and woodlands containing flowering gum trees, such as in Meroo National Park south or Narrawallee Creek Nature Reserve to the north-east of the subject site.

The habitat occurring within the subject site and immediate surrounds has previously been fragmented by various developments and previous land uses. Within this area, available habitat for these species exists in fragmented patches in varying conditions. The proposed development will not fragment areas of existing habitat; however the proposed development predominantly requires clearing at the edge of treed habitat and will therefore encroach further into remaining habitat rather than creating fragmented habitat patches. The Grey-headed Flying-fox is highly mobile and would be able to move across the remaining fragments.

The proposed action will not remove, modify, fragment or isolate important habitat for the Grey-headed Flying-fox. Habitat on the subject site is not important for this species in the locality as it is a small area of largely cleared and modified vegetation. The subject site would only likely provide minimal foraging habitat. Much larger areas of potential habitat occur throughout the wider locality in more heavily vegetated areas, particularly along Narrawallee Creek or Meroo National Park to the north-east and south, respectively, of the subject site. These tracts of vegetation would provide more favourable roosting and foraging habitat for these species. It is therefore considered that the habitat provided on the subject site is not important for the long-term survival of the Grey-headed Flying-fox in the wider locality.

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

No critical habitat for the Grey-headed Flying-fox has currently been identified by the Director-General of the OEH.

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

A National Draft Recovery Plan for the Grey-headed Flying-fox (DECCW 2009) has been prepared. A number of threats to this species are listed in the Plan, including the removal of critical habitat. The proposal will remove a small amount of marginal foraging habitat for this species, which is not critical habitat and is well-represented

throughout the locality. Therefore the proposal is not considered to threaten the objectives of the Recovery Plan.

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

The following key threatening processes are relevant to the proposed development:

- Clearing of re-growth native vegetation;
- Invasion and establishment of exotic vines and scramblers;
- Invasion of native plant communities by African Olive (*Olea europaea* L. subsp. *cuspidata*); and
- Invasion of native plant communities by exotic perennial grasses.

The key threatening process of 'Clearing of native vegetation', could potentially impact habitat for this species further than current conditions. However, the vegetation on the subject site is not considered to constitute significant habitat for the Grey-headed Flying-fox. As potential habitat will remain in the vicinity of the subject site, the clearing of native vegetation is not likely to significantly impact habitat for potentially occurring threatened species.

E.3.6.1. Conclusion

A total of ~11.04 ha of vegetation will be cleared for the proposed development comprising potential habitat for the Grey-headed Flying-fox. The proposed development will result in the removal of modified vegetation, dominated by exotic species. No significant habitat for the Grey-headed Flying-fox will be removed within the subject site. The proposal is not likely to place a viable local population of this species at risk of extinction. The Grey-headed Flying-fox is highly mobile and is expected to move between areas of remaining habitat within the immediate vicinity of the subject site and wider area. The project is not likely to have a significant detrimental impact upon the Grey-headed Flying-fox.

E.3.7. Microbat Species

E.3.7.1. Background

The following assessment of significance applies for the Eastern Bentwing Bat, the Eastern False Pipistrelle, the Greater Broad-nosed Bat, and the Eastern Freetail-bat as these microbat species have similar foraging habitat requirements.

The Eastern Bentwing-bat occurs throughout the east and north-west coast of Australia. They hunt in forested areas above the canopy, and roost primarily in caves, however derelict mines, storm-water tunnels, buildings and other man-made structures can be utilised (OEH 2017b). The species is listed as Vulnerable under the TSC Act.

The Eastern False Pipistrelle is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania. The species prefers moist habitats, with trees taller than 20 m (OEH 2017c). The species generally roosts in eucalypt hollows, but has also been found under loose bark on trees or

in buildings. This microbat hunts beetles, moths, weevils and other flying insects above or just below the tree canopy and hibernates in winter (OEH 2017c). The females are pregnant in late spring to early summer (OEH 2017c). The Eastern False Pipistrelle is listed as a vulnerable species under the TSC Act.

The Greater Broad-nosed Bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New England Tablelands, however does not occur at altitudes above 500 m (OEH 2017e). This microbat species utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest (OEH 2017e). The OEH (2017e) indicates that even that this species usually roosts in tree hollows, it has also been found in buildings. The species forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m. In open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species (OEH 2017e). Little is known of its reproductive cycle, however a single young is born in January; prior to birth, females congregate at maternity sites located in suitable trees, where they appear to exclude males during the birth and raising of the single young (OEH 2017e). The Greater Broad-nosed Bat is listed as a vulnerable species under the TSC Act.

The Eastern Freetail-bat is found along the east coast from the southern regions of QLD to southern NSW, where it occurs only to the east of the Great Dividing Range. The species inhabits a diversity of forests types including dry and wet sclerophyll forests, woodlands, swamp forests and mangrove forests (OEH 2017d)

This species is mainly solitary in nature; however it is occasionally observed roosting in communal groups. The Eastern Freetail-bat forages nocturnally for insects within the treed forest areas and roosts in suitable tree hollows, under bark, or in man-made structures (OEH 2017d). The Eastern Freetail-bat is listed as a vulnerable species under the TSC Act.

E.3.8. Assessment of Significance

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

The four species of microbats listed above are likely to use the subject site as foraging habitat as part of a much larger foraging range. The subject site does not represent a suitable roosting or breeding habitat for the Eastern Bentwing Bat because caves, the habitat used by the species for roosting and breeding, are not present there. This species was recorded in recent surveys and in previous surveys by BES (2005), however the lack of caves suggest the species only uses the subject site occasionally as part of its foraging range. They are all highly mobile species that accesses resources from across a wide area and would not depend upon resources contained on the portion of the subject site to be developed for their survival.

There is very limited roosting and potential breeding habitat for the Eastern False Pipistrelle, Greater Broad-nosed Bat and Eastern Freetail-bat as only 14 sub-optimal hollow bearing trees and/or decorticated bark are present within the subject site. Targeted hollow/stag watching surveys did not detect the presence of any microbat species utilising the hollows on the subject site. The proposal is not likely to place a viable local

population of any of these species at risk of extinction due to the limited amount of foraging habitat present within the subject site.

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

Not applicable.

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

- (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
- (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.*

Not applicable.

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

- (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
- (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
- (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.*

Approximately 1.52 ha of Clyde Gully Wet Forest, ~1.81 ha of Native Regrowth and Exotic Weeds, ~0.12 ha of Planted Natives/Exotics and Weeds and ~7.59 ha of Exotic Grassland will be cleared for the proposed development. This represents a relatively small area of potential foraging habitat within the locality for these species. However, this is not optimum foraging habitat for any of these threatened microbat species as they would tend to forage in more vegetated forests and woodlands, such as in Meroo National Park south or Narrawallee Creek Nature Reserve to the north-east of the subject site.

The habitat occurring within the subject site and immediate surrounds has previously been fragmented by various developments and land uses. Within this area, available habitat for these species exists in fragmented patches in varying conditions. The proposed development will not fragment areas of existing habitat; however the proposed development predominantly requires clearing at the edge of treed habitat and will therefore encroach further into remaining habitat rather than creating fragmented habitat patches. The potentially occurring microbats are highly mobile and would be able to move across the remaining fragments.

The proposed action will not remove, modify, fragment or isolate important habitat. Habitat on the subject site is not important for these species in the locality as it is a small area of largely cleared and modified vegetation. The subject site would only likely provide minimal foraging habitat. Much larger areas of potential habitat occur throughout the wider locality in more heavily vegetated areas, particularly along Narrawallee Creek or Meroo National Park to the north-east and south, respectively, of the subject site. These tracts of vegetation would

provide more favourable roosting and foraging habitat for these species. It is therefore considered that the habitat provided on the subject site is not important for the long-term survival of these four threatened microbat species in the wider locality.

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

No critical habitat for any of these species has currently been identified by the Director- General of the OEH.

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

No specific recovery plan or threat abatement plans have been prepared for the threatened microbat species assessed.

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

The following key threatening processes are relevant to the proposed development:

- Clearing of re-growth native vegetation;
- Invasion and establishment of exotic vines and scramblers;
- Invasion of native plant communities by African Olive (*Olea europaea* L. subsp. *cuspidata*); and
- Invasion of native plant communities by exotic perennial grasses.

The key threatening process of 'Clearing of native vegetation', could potentially impact habitat for these species further than current conditions. However, the vegetation on the subject site is not considered to constitute significant habitat for these microbat species. As potential habitat will remain in the vicinity of the subject site, the clearing of native vegetation is not likely to significantly impact habitat for the four potentially occurring threatened microbat species.

E.3.8.1. Conclusion

A total of ~11.04 ha of vegetation will be cleared for the proposed development comprising potential habitat for the threatened Eastern Bentwing Bat, the Eastern False Pipistrelle, the Greater Broad-nosed Bat and the Eastern Freetail-bat. The proposed development will result in the removal of modified vegetation, dominated by exotic species. No significant habitat for the four assessed microbat species will be removed within the subject site. The proposal is not likely to place a viable local population of any of these microbat species at risk of extinction. These species are highly mobile and are expected to move between areas of remaining habitat within the immediate vicinity of the subject site and wider area. The project is not likely to have a significant detrimental impact upon any of these four potentially occurring threatened microbat species.

FIGURES



Legend

 Subject Site


Coordinate System: MGA Zone 56 (GDA 94)

cumberland
ecology

0 50 100 150 200 m

Figure 1. Location of the subject site



Figure 2. Land Zoning of the Subject Site

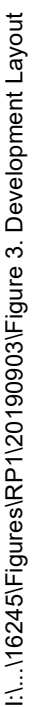


Image Source: Zenith Landscape Designs (2019). 16-3351 L02 Rev E

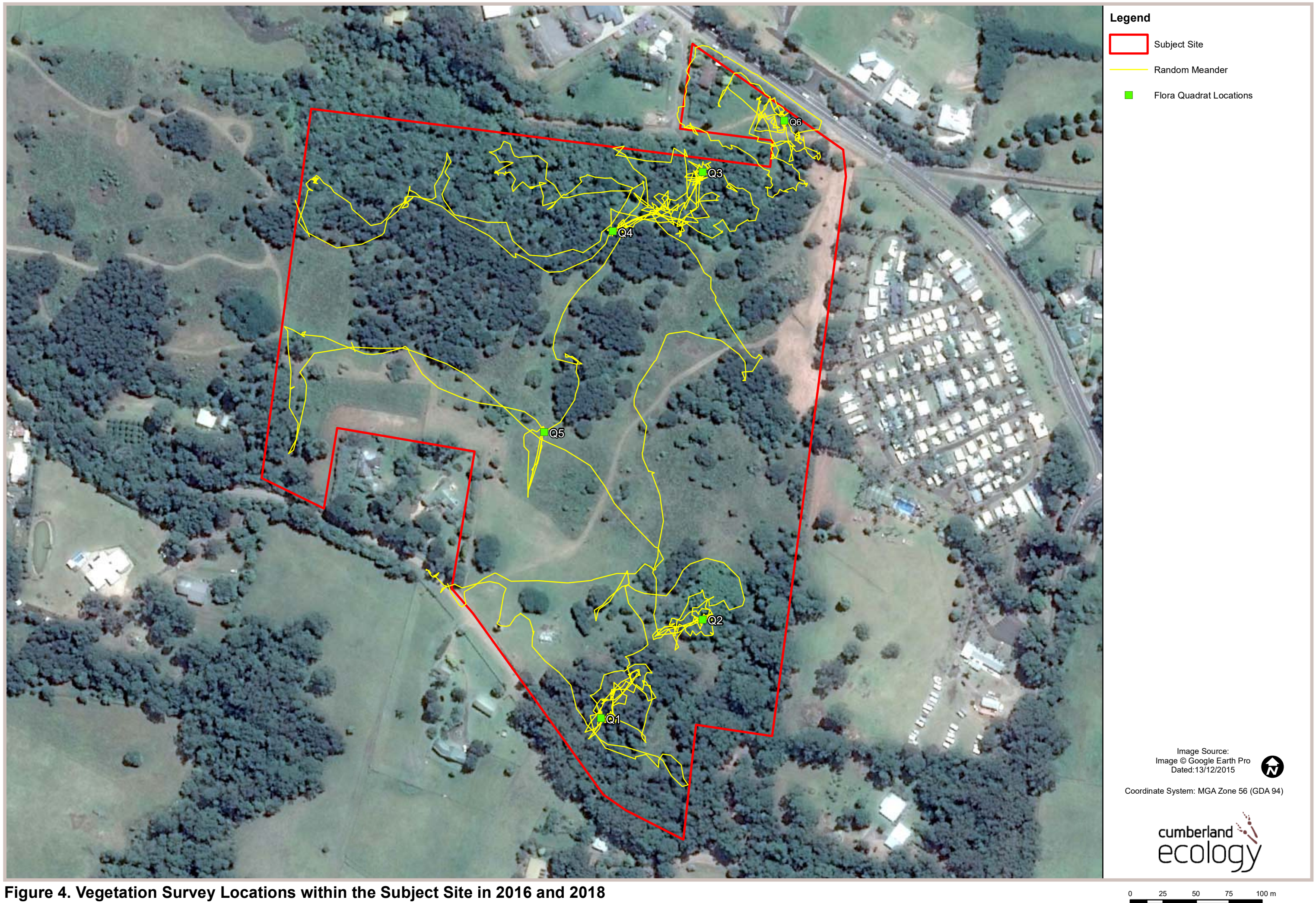
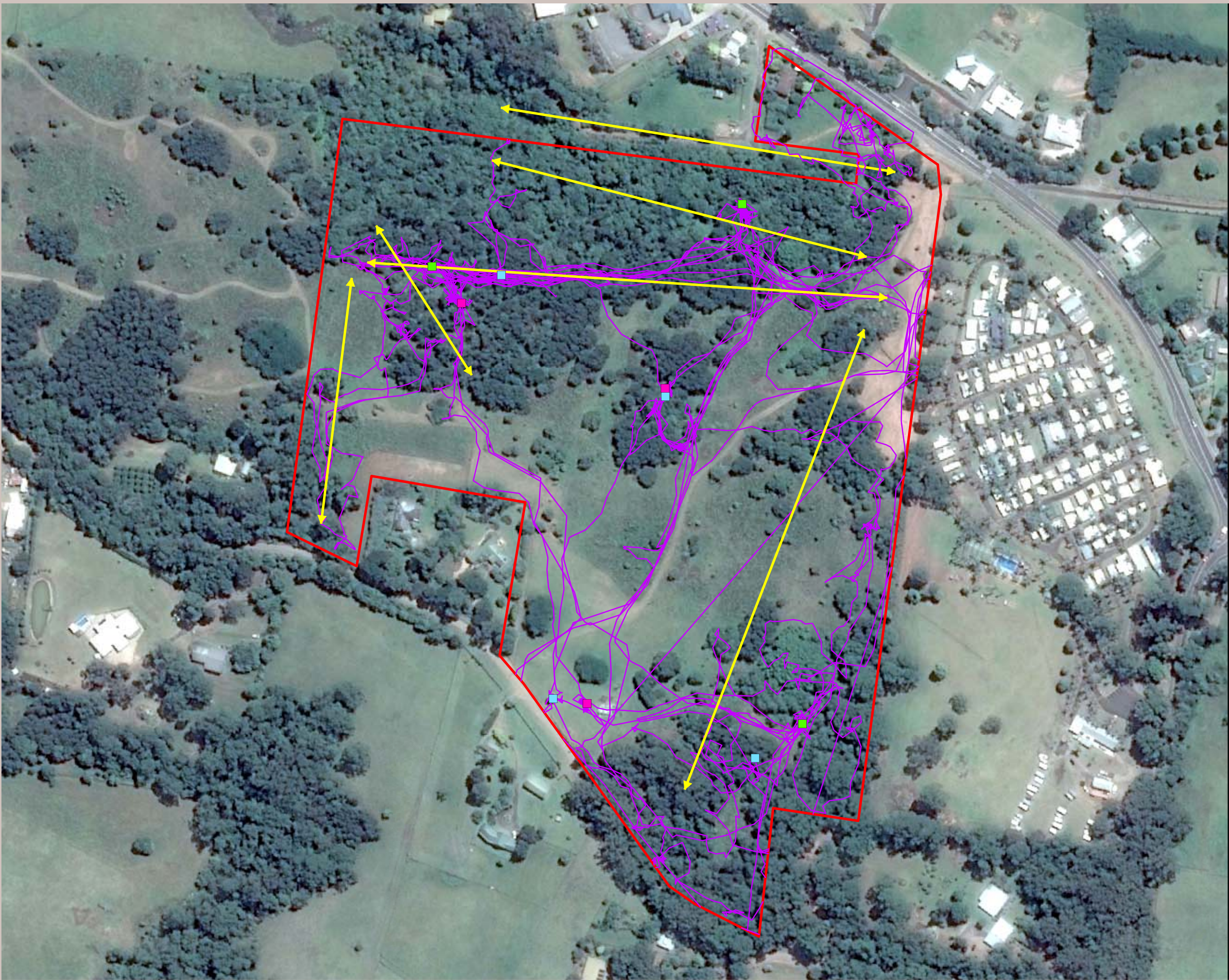


Figure 4. Vegetation Survey Locations within the Subject Site in 2016 and 2018



Figure 5. Location of Threatened Flora Searches in August 2019



Legend

- Subject Site
- Fauna Survey Locations**
- ↔ Nocturnal/Bird survey transects
- Random meander
- SM2/Anabat locations
- Harp trap locations
- Hollow/Stag watch locations

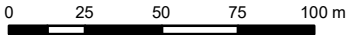
Image Source:
Image © Google Earth Pro
Dated: 13/12/2015



Coordinate System: MGA Zone 56 (GDA 94)



Figure 6. Fauna Survey Locations within the Subject Site 2018



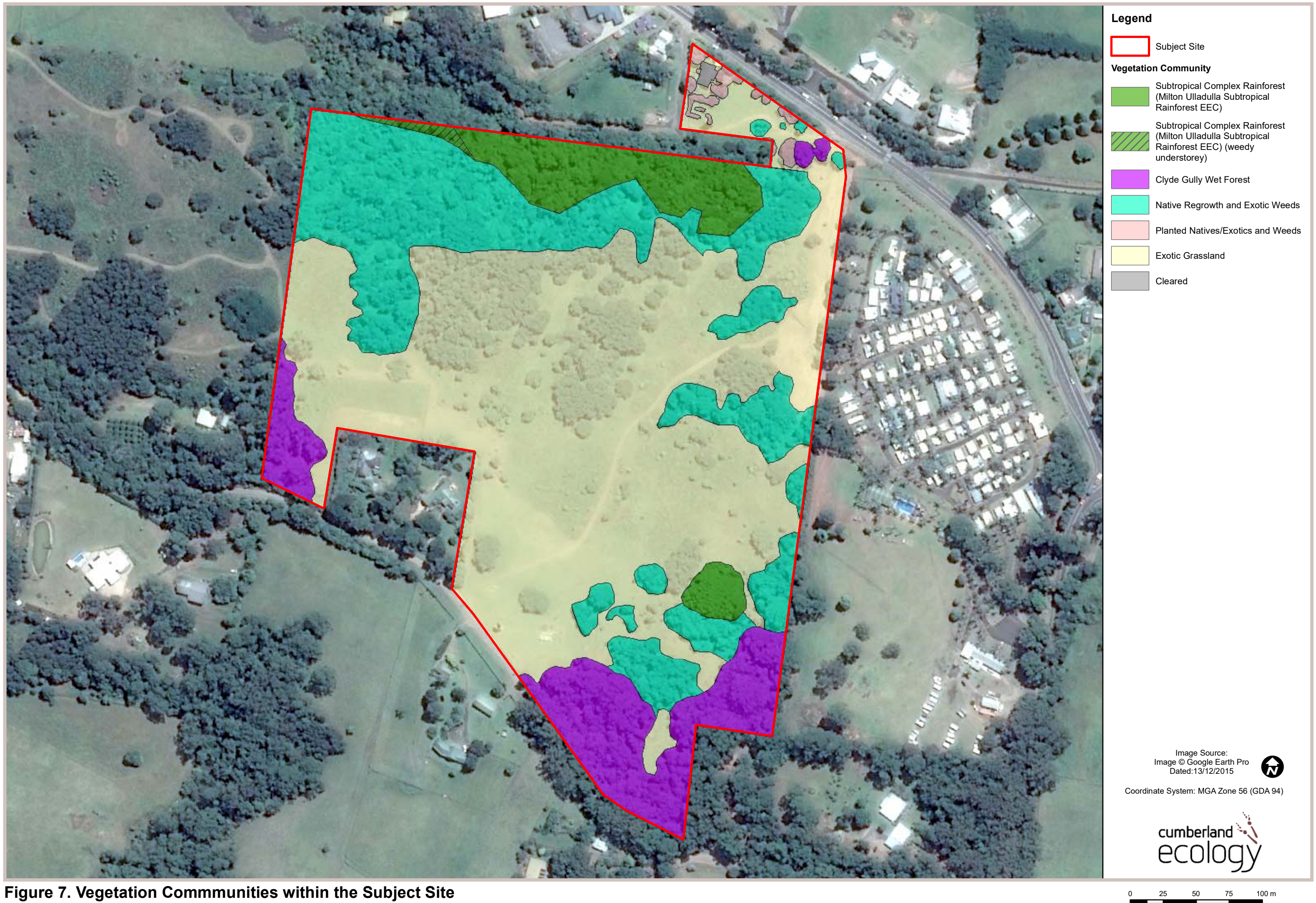


Figure 7. Vegetation Communities within the Subject Site



Legend

Subject Site

Threatened Flora

Rhodamnia rubescens

Image Source:
Image © Google Earth Pro
Dated: 13/12/2015
Coordinate System: MGA Zone 56 (GDA 94)

cumberland
ecology

0 25 50 75 100 m

Figure 8. Location of Threatened Flora Species



Legend

Subject Site

Habitat Feature

Habitat tree

Nest

Image Source:
Image © Google Earth Pro
Dated:13/12/2015

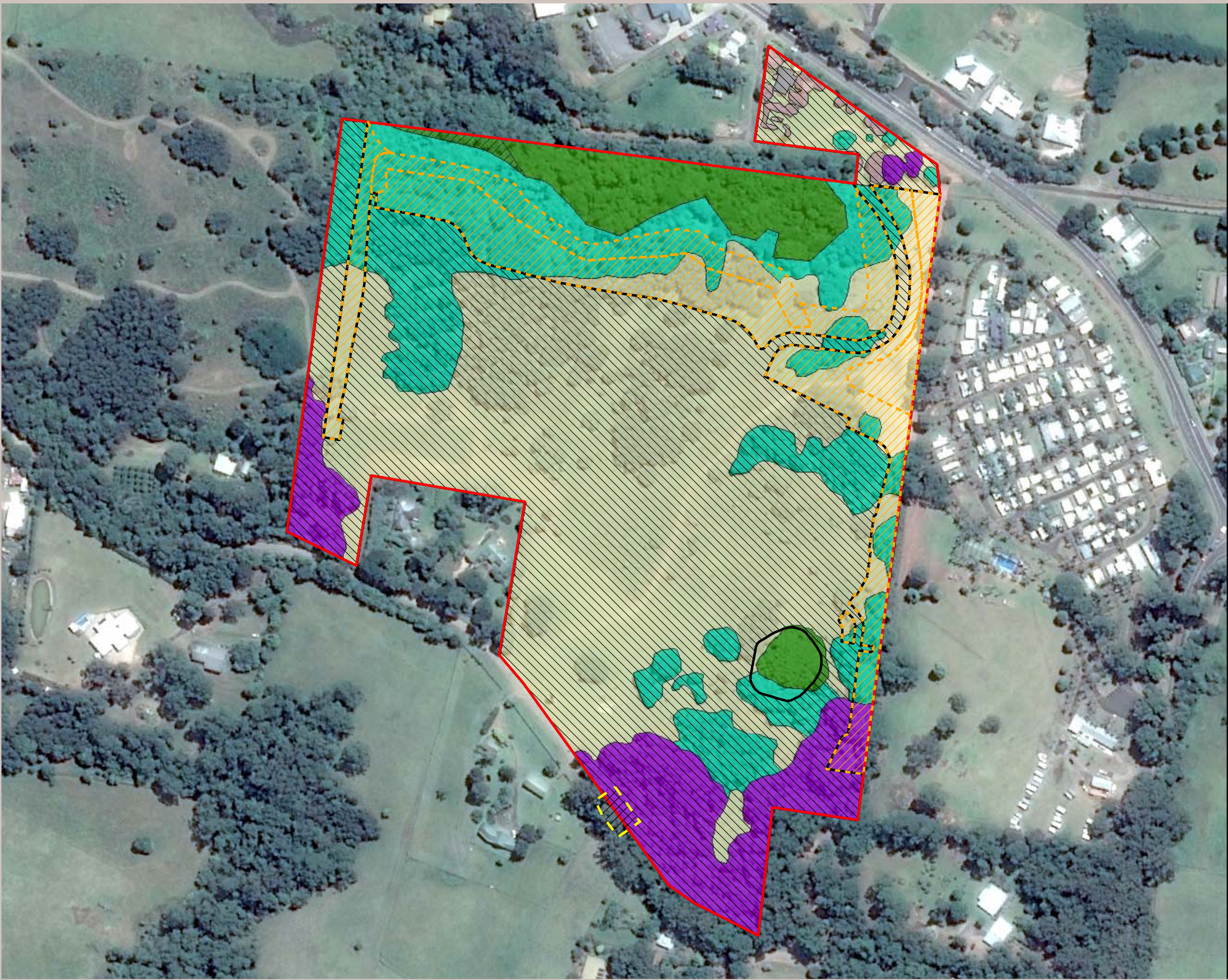
Coordinate System: MGA Zone 56 (GDA 94)





0 25 50 75 100 m

Figure 9. Habitat Features of the Subject Site



Legend

- Subject Site
- Impact Area
- APZ
- Threatened Species Retention Zone

Vegetation Community

- Subtropical Complex Rainforest (Milton Ulladulla Subtropical Rainforest EEC)
- Subtropical Complex Rainforest (Milton Ulladulla Subtropical Rainforest EEC) (weedy understorey)
- Clyde Gully Wet Forest
- Native Regrowth and Exotic Weeds
- Planted Natives/Exotics and Weeds
- Exotic Grassland
- Cleared

Image Source:
Image © Google Earth Pro
Dated:13/12/2015
Coordinate System: MGA Zone 56 (GDA 94)



0 25 50 75 100 m

Figure 10. Vegetation Impact Areas