



Biodiversity Development Assessment Report 286 Mafeking Road Goonengerry, NSW

FINAL REPORT

Prepared for Sally and Hugo Peterson

18 July 2019

Biosis offices

NEW SOUTH WALES

Albury

Phone: (02) 6069 9200
Email: albury@biosis.com.au

Newcastle

Phone: (02) 4911 4040
Email: newcastle@biosis.com.au

Sydney

Phone: (02) 9101 8700
Email: sydney@biosis.com.au

Wollongong

Phone: (02) 4201 1090
Email: wollongong@biosis.com.au

VICTORIA

Ballarat

Phone: (03) 5304 4250
Email: ballarat@biosis.com.au

Melbourne

Phone: (03) 8686 4800
Email: melbourne@biosis.com.au

Wangaratta

Phone: (03) 5718 6900
Email: wangaratta@biosis.com.au

Document information

Report to: Sally and Hugo Peterson 'the Land Owners'

Prepared by: Renae Baker

Biosis project no.: 28740

File name: 28740.Goonengerry.BDAR.FIN01.20190718

Citation: Biosis 2018. 286 Mafeking Road Goonengerry Biodiversity Development Assessment Report. Authors: R Baker Biosis Pty Ltd, Wollongong, NSW. 28624.

Document control

Version	Internal reviewer	Date issued
Draft version 01	Jane Raithby-Veall	26/11/2018
Final version 01	Rebecca Dwyer	18/07/2019

Acknowledgements

Biosis acknowledges the contribution of the following people and organisations in undertaking this study:

- Sally and Hugo Peterson.
- Department of the Environment and Energy for access to the Protected Matters Search Tool of the Australian Government.
- NSW Office of Environment and Heritage for access to the BioNet Atlas of NSW Wildlife and the Threatened Species Profile Database.
- BirdLife Australia for access to the New Atlas of Australian Birds 1998-2013.
- NSW Department of Primary Industries for access to indicative mapping of freshwater threatened species and fish populations.

Biosis staff involved in this project were:

- Renae Baker
- Anne Murray (mapping)

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Glossary

BAM	NSW Biodiversity Assessment Method
BC Act	NSW <i>Biodiversity Conservation Act 2016</i>
BDAR	Biodiversity Development Assessment Report
Biosecurity Act	NSW <i>Biosecurity Act 2015</i>
BOS	Biodiversity Offsets Scheme
CM Act	<i>Coastal Management Act 2016</i>
DA	Development Application
DBH	Diameter at Breast Height
DCDB	Digital cadastral database
DEE	Commonwealth Department of the Environment and Energy
DoIW	Directory of Important Wetlands
DPE	NSW Department of Planning and Environment
DPI	NSW Department of Primary Industries
DTDB	Digital topographic databases
Ecosystem credit species	A measurement of the value of EECs, CEECs and threatened species habitat for species that can be reliably predicted to occur with a PCT. Ecosystem credits measure the loss in biodiversity values at a development.
EP&A Act	NSW <i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
GDE	Groundwater Dependent Ecosystem
GIS	Geographic Information System
IBRA	Interim Biogeographic Regionalisation of Australia
LEP	Local Environmental Plan
LGA	Local Government Area
Locality	Area located within 10 kilometres radius from the study area
LPI	NSW Land and Property Information
Matters of NES	Matters of National Environmental Significance protected by a provision of Part 3 of the EPBC Act
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type

SALIS	NSW Soil and Land Information System
SEPP 44	NSW State Environmental Planning Policy No. 44 – Koala Habitat Protection
study area	The broader area in which the subject land is located, including all direct and indirect impacts
subject land	The area of direct impact for the proposed development
TEC	Threatened Ecological Community
VIS	NSW Vegetation Information System
WM Act	NSW <i>Water Management Act 2000</i>

Summary

Biosis Pty Ltd was commissioned by Sally and Hugo Peterson to provide a Biodiversity Development Assessment Report (BDAR) to assess the biodiversity impacts and offsetting requirements for proposed works at 286 Mafeking Road Goonengerry, NSW (Lot 3 DP601327) (hereafter referred to as the study area).

Proposed works at the study area will be assessed under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) as local development and will include:

- Extension to existing house (bedroom)
- Reconfiguration of existing carport
- Development of a studio
- Boundary readjustment

The purpose of this assessment is to apply the NSW Biodiversity Assessment Method (BAM) (Office of Environment and Heritage [OEH] 2017) to the proposed works, and provide Sally and Hugo Peterson with a BDAR, to be submitted to Byron Shire Council (Council) with the Development Application (DA).

A DA (10.2018.307.1) was submitted to Council, who has provided advice that the works will involve removal of vegetation from an area designated within the Biodiversity Values Map (OEH 2018). As such, the works require assessment in accordance with the Biodiversity Offsets Scheme (BOS) and the *Biodiversity Conservation Act 2016* (BC Act) and a BDAR is required to be submitted to Council to support the DA.

A total of 0.016 hectares of native vegetation occurring as PCT 1302 *White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion* was recorded within the subject land, representing the Lowland Subtropical Rainforest ecological community, listed as *Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions* endangered ecological community under the BC Act and *Lowland Rainforest of Subtropical Australia* Critically Endangered Ecological Community under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This community is referred to as Lowland Rainforest here forth.

Avoidance of impacts to native vegetation, threatened ecological communities and threatened species habitat has been undertaken by the proponents, to restrict proposed impacts to total removal of 0.016 hectares of Lowland Rainforest occurring as two condition types:

- Vegetation Zone 1 (0.011 hectares): PCT 1302 Good condition
- Vegetation Zone 2 (0.0055 hectares): PCT 1302 Canopy over Cleared

The vegetation integrity score of Vegetation Zone 1 was calculated as 62.6 and as such, in accordance with Section 10.3 of the BAM, offsets are required for impacts to this zone. The vegetation integrity score of Vegetation Zone 2 was calculated as 11.8. As such, offsets are not required for impacts to this zone.

One threatened flora species, Red Boppel Nut *Hicksbeachia pinnatifolia* (Vulnerable BC Act and EPBC Act), was recorded within the study area during field investigations undertaken for this proposal and in accordance with the BAM. This species does not occur within the subject land and will not be removed as a result of the proposal.

Matters of National Environmental Significance were assessed in accordance with the EPBC Act and are not likely to be significantly impacted by the proposed development and as such, a referral of the project to the Commonwealth is not required.

Stage 1 – Biodiversity assessment

1 Introduction

Biosis Pty Ltd was commissioned by Sally and Hugo Peterson to provide a Biodiversity Development Assessment Report (BDAR) to assess the biodiversity impacts and offsetting requirements for proposed works at 286 Mafeking Road Goonengerry, NSW (Lot 3 DP601327) (hereafter referred to as the study area) (Figure 1).

The purpose of this assessment is to apply the NSW Biodiversity Assessment Method (BAM) (Office of Environment and Heritage [OEH] 2017) to the proposed works, and provide Sally and Hugo Peterson with a BDAR, to be submitted to Byron Shire Council (Council) with the Development Application (DA).

The proposed works at the study area have been assessed as triggering the NSW BOS, through the removal of native vegetation from land designated within the Biodiversity Values Map. The following proposed works have triggered the BOS:

- Removal of a small area of rainforest vegetation (0.01 hectares) in good/moderate condition, for development of the studio and 2 metre buffers around the main house extension and the studio.
- Removal of a small area of vegetation (0.0055 hectares) consisting of some limited canopy over an established garden to accommodate the main house extension (bedroom).

The BC Act requires that the BAM be applied to all proposals that trigger the BOS, and a BDAR is required to be submitted to the approval authority. As the project is local development assessed under Part 4 of the EP&A Act, the approval authority in this case is Byron Shire Council.

1.1 Background

Andrew Baker of Wildsite Ecological Services (Wildsite) was engaged in 2006 by previous owners, to undertake a flora assessment of the study area for proposed vegetation clearance associated with hazard protection measures previously prescribed by the Rural Fire Service (RFS). The survey was undertaken on 12 June 2006 and involved random meanders of the study area over 3.5 hours, recording all flora species and recording the location of any threatened or regionally significant flora species. No survey of fauna was conducted by Wildsite for the assessment.

Wildsite (2006) identified Lowland Rainforest within the study area, listed as an Endangered Ecological Community under the BC Act as *Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions* and listed as critically endangered under the EPBC Act as *Lowland Rainforest of Subtropical Australia*.

Two threatened flora species listed as Vulnerable under the EPBC Act and BC Act were also recorded within the study area; Red Boppel Nut *Hicksbeachia pinnatifolia* and Durobby *Syzigium moorei* (Wildsite 2006).

The previous development consent for works at the study area included provision for vegetation management within the prescribed Asset Protection Zones (APZs), which were:

- 20 metre APZ to the north, east and south of the existing dwelling house.
- 30 metre APZ to the west of the existing dwelling house.

The proponents have received recent advice from the RFS that the current required APZs for the proposed development at the study area are:

- 8 metres to the north of the existing and proposed development footprints.
- 9 metres to the south and east of the existing and proposed development footprints.

- 25 metres to the west of the existing development footprint.

A figure comparison of previous and current APZs is provided within this report, demonstrating that no additional vegetation management is required as a result of this proposal or the current RFS requirements. The ongoing APZ management will be consistent with the previous approval (the main point being that all canopy is retained and the understorey managed to conserve the rainforest) and no additional vegetation removal from the APZs is proposed as part of this DA. Therefore, ongoing and consistent APZ management is not required to be addressed in this BDAR. Detail on management of the APZ to maintain the value of the rainforest and significant species is contained within the updated Bushfire Risk Assessment (Bushfire Risk Pty Ltd 2018). A map comparing the existing APZ and the future APZ management area is provided as Map1 in Appendix 1, for information purposes and as requested by Council.

The property also lies within the 10/50 Vegetation Clearing Scheme Area under the NSW *Rural Fires Act 1997*. This scheme gives people living near the bush an additional way of being better prepared for bush fires. The scheme allows people in a designated area to:

- Clear trees on their property within 10 metres of a home, without seeking approval.
- Clear underlying vegetation such as shrubs (but not trees) on their property within 50 metres of a home, without seeking approval.

The owners of the property have no intention of clearing under the scheme and this intention has been confirmed with Council. Therefore, the potential clearing associated with the 10/50 Vegetation Clearing Scheme will not occur at the property and does not require assessment within this BDAR. A condition of consent will be included in the development approval that will state this area will be maintained for conservation purposes, in accordance with Section 7.8 of the 10/50 Vegetation Clearing Code of Practice. A map showing the current and future 10/50 clearing entitlements at the study area is provided as Map 2 in Appendix 1, for information purposes and as requested by Council.

1.2 Purpose of this assessment

This BDAR will:

- Address the requirements of the BAM and the BOS with respect to the proposal for development of the studio and extension to the main house (bedroom).
- Identify how the proponent avoids and minimises impacts to biodiversity.
- Identify any potential impacts that could be characterised as serious and irreversible.
- Describe the offset obligations required to compensate for any unavoidable biodiversity impacts resulting from the proposal.
- Provide recommendations for the works to ensure minimal impact to the ecology of the study area and local area.

All biodiversity assessments have been undertaken in accordance with the BAM, and this BDAR has been prepared and reviewed by Accredited BAM Assessors Renae Baker and Jane Raithby-Veall.

1.3 The study area

The study area is approximately 0.3 hectares of land located at 286 Mafeking Road, Goonengerry, NSW (Lot 3 DP 601327) in the Byron Shire Local Government Area (LGA) and the North Coast Local Land Services (LLS) Region. The study area is defined as the existing building footprint with a 20 metre buffer (or to the property boundary) (see Figure 1), which was deemed a reasonable distance to assess all potential direct and indirect impacts of the proposal.

The study area is located approximately 36 kilometres to the west of the Byron Bay Central Business District (CBD) and is currently zoned 'DM – Deferred Matter'. A number of areas with environmental values throughout the Byron Shire were deferred from being zoned in the *Byron Local Environmental Plan 2014* (BLEP), pending the outcome of the Department of Planning and Environment's Northern Councils E Zone Review (the E Zone Review). As part of Council's implementation of the E Zone review, areas currently identified as a Deferred Matter under the BLEP are being assessed against clear criteria that must be met to rezone land to Environmental Conservation (E2) or Environmental Management (E3), based on the primary land use and the nature of existing vegetation. Deferred Matter areas that do not meet the criteria for an E Zone will have an alternative zone applied.

Land surrounding the study area consists of land zoned as Deferred Matter and 'RU1 - Primary Production'. Further to the west, land of the Whian Whian State Conservation Area (SCA) is zoned 'E1 – National Parks and Nature Reserves'.

The study area boundary adjustment that forms part of this proposal comes with a clearing entitlement, whereby land owners can legally clear vegetation up to 2 metres in width to allow for fence line installation. The owners of the property do not intend to clear vegetation or install a fenceline along the boundary. This intention has been confirmed with Council and will form part of the conditions of consent. Therefore the clearing entitlement does not require assessment in this BDAR.

1.3.1 The subject land

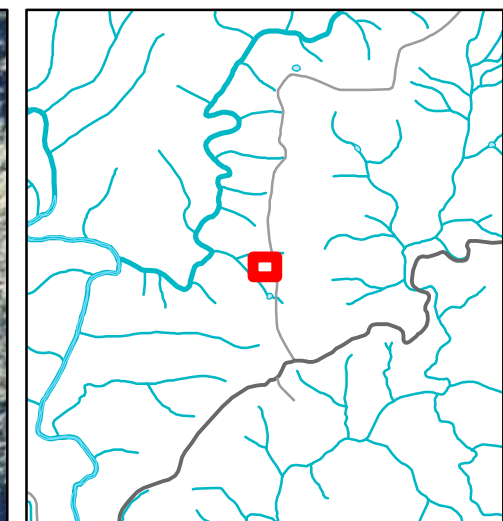
The subject land is approximately 0.017 hectares in area (measured as 0.0165 using GIS), located entirely within the study area and defined as the total area of proposed disturbance, encompassing proposed development footprints, bushfire safety clearance buffer (2 metres around new development footprints) and any areas that could be disturbed during construction. The subject land and study area are shown on Figure 1.

The proposal will result in the removal of 0.016 hectares of vegetation (measured as 0.0162 using GIS) from the subject land consisting of:

- Removal of 0.011 hectares of rainforest vegetation for:
 - Development of the proposed studio.
 - 2 metre fire protection buffer around the proposed studio.
 - 2 metre fire protection buffer around the proposed house extension (bedroom).
- Removal of 0.0055 hectares of disturbed rainforest vegetation (canopy over cleared) for:
 - Development of the proposed house extension (bedroom).

Other components of the proposal that will not require additional native vegetation clearance and are therefore not included in the subject land or vegetation removal BAM calculations include:

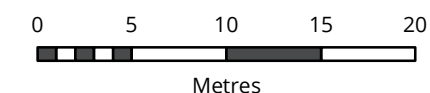
- Installation of wastewater services beneath the existing dwelling.
- Installation of a water tank for the purposes of fire fighting, agreed with Council to be located in a cleared part of the study area on the eastern boundary (roadside).
- Reconfiguration of the existing car port to include a storage shed. This will not involve vegetation removal.
- Boundary adjustment to allow for the existing car port, which was built outside of the legal boundary of the study area. The boundary adjustment will not result in construction of a fence line or vegetation clearing.
- Existing APZ maintenance requirements in accordance with RFS conditions and the updated Bushfire Risk Assessment (Bushfire Risk Pty Ltd 2018).



Legend

-  Study area
-  Subject land
-  Property boundary
-  Existing development - main dwelling
-  Existing development

Figure 1 Site map



Scale: 1:400 @ A3
Coordinate System: GDA 1994 MGA Zone 56



Albury, Ballarat, Melbourne,
Newcastle, Sydney, Wangaratta & Wollongong

Matter: 28740
Date: 17 July 2019,
Checked by: RBA, Drawn by: AEDM, Last edited by: amurray
Location: P:\30400s\30430\Mapping\30430_BDAR_F1_SiteMap

1.4 Sources of information

Sources of information used in this assessment included relevant databases, spatial data, literature and previous site reports. In order to provide a context for the study area, records of flora and fauna from within 5 kilometres (the 'locality') were collated from the following databases and reviewed:

- Commonwealth Department of the Environment and Energy (DoEE) Protected Matters Search Tool for matters protected by the EPBC Act.
- OEH BioNet Atlas of NSW Wildlife, for species, populations and ecological communities listed under the BC Act.
- PlantNET (Royal Botanic Gardens and Domain Trust).
- BirdLife Australia, the New Atlas of Australian Birds 1998-2015.

Other sources of biodiversity information relevant to the study area were sourced from:

- The NSW Plant Community Types (PCTs), as held within the BioNet Vegetation Classification database (OEH 2017c).
- *Byron Shire Council vegetation mapping* (Byron Shire Council 2017).
- Fisheries NSW Spatial Data Portal.
- BAM Calculator.

The following reports were also reviewed and relied on to provide additional information:

- *Lot 3 DP 601327 286 Mafeking Road Goonengerry Flora assessment* (Wildsite Ecological services 2006).
- *Bushfire Risk Assessment Proposed Development: Alterations & Additions to an Existing Dwelling & Detached Two-Storey Studio* (Bushfire Risk 2018).

Mapping at the study area was conducted using hand-held (uncorrected) GPS units (GDA94), mobile tablet computers running Collector for ArcGIS™ and aerial photo interpretation. The accuracy of this mapping is therefore subject to the accuracy of the GPS units (generally ± 5 metres) and dependent on the limitations of aerial photo rectification and registration.

Basemap data was obtained from NSW Land and property information (LPI) 1:25,000 digital topographic databases (DTDB), with cadastral data obtained from LPI digital cadastral database (DCDB).

The following spatial datasets were utilised during the development of this report:

- Mitchell Landscapes Version 3.0
- Interim Biogeographic Regionalisation of Australia (IBRA) Version 7
- *State Environmental Planning Policy (SEPP) Coastal Management 2018*

Mapping has been produced using a Geographic Information System (GIS). The following maps and data have been provided:

- Digital mapping with aerial photography showing 1:1000 or finer.
- Site map as described in subsection 4.2.1.1 of the BAM.
- Location map as described in subsection 4.2.1.2 of the BAM.
- Landscape map with features including 1500 metre buffer, as described in section 4.2.1.3 of the BAM.

1.5 Legislative requirements

The project has been assessed against relevant biodiversity legislation and government policy, including:

- *Environment Protection and Biodiversity Conservation Act 1999*
- *Environmental Planning and Assessment Act 1979*
- *Biodiversity Conservation Act 2016*
- *Biosecurity Act 2015*
- *State Environmental Planning Policy 44 Koala Habitat Protection*
- *Byron Local Environmental Plan 1988*
- *Rural Fires Act 1997*

2 Landscape Context

This chapter describes the landscape and site context of the study area, describing the landscape features present within the study area and within a 1500 metre buffer, as required by the BAM (OEH 2017a). Figure 2 shows the location of the study area and landscape features within the 1500 metre buffer (the assessment area).

2.1 Landscape features

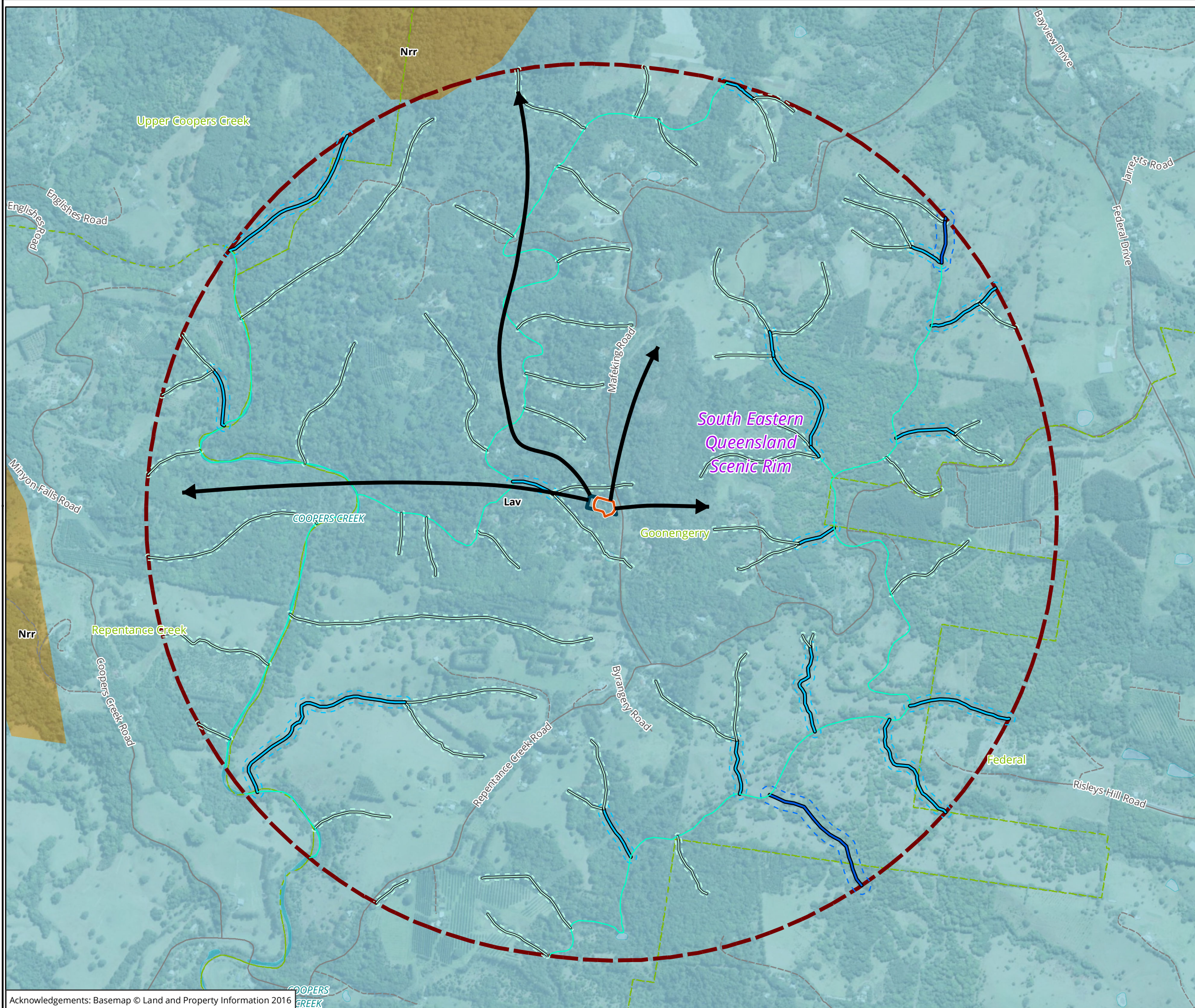
2.1.1 Bioregions

The study area occurs within the South Eastern Queensland Interim Biogeographic Regionalisation of Australia (IBRA) bioregion and the Scenic Rim IBRA subregion. The South Eastern Queensland Bioregion consists of metamorphic and acid to basic volcanic hills and ranges (Beenleigh, D'Aguilar, Gympie, Yarraman Blocks), sediments of the Moreton, Nambour and Maryborough Basins, extensive alluvial valleys and Quaternary coastal deposits including high dunes on the sand islands such as Fraser Island. The bioregion is characterised by humid *Eucalyptus-Lophostemon-Syncarpia* tall open forests, eucalypt open forests and woodlands, subtropical rainforests often with *Araucaria cunninghamii* emergents and small areas of cool temperate rainforest dominated by *Nothofagus moorei* and semi-evergreen vine thickets, *Melaleuca quinquenervia* wetlands and Banksia low woodlands, heaths and mangrove/saltmarsh communities (Environment Australia [EA] 2000).

2.1.2 NSW (Mitchell) Landscapes

The study area occurs within the Lamington Volcanic Slopes Mitchell Landscape. This landscape is characterised by extensive hills and ridges forming a broadly circular pattern 50 kilometres in diameter, with radial drainage centred on Mt Warning. Elevation ranges between 50 to 1120 metres; local relief varies considerably and is greatest in the higher landscape where it is up to 500 metres. Soils are mostly red and brown gradational structured loams with high organic content and high fertility. On lower slopes adjacent to valleys red, brown and grey-brown texture-contrast soils occur. Most of the landscape is covered in subtropical closed forest with stands of cool temperate Antarctic Beech *Nothofagus moorei* above 1000 metres (Mitchell 2002).

Typical subtropical species present within this landscape include White Booyong *Argyrodendron trifoliolatum*, Red Carabeen *Geissois benthamii*, Rose Marara *Pseudoweinmannia lanchnocarpa*, Pigeonberry Ash *Cryptocarya erythroxylon*, Myrtle Ebony *Diospyros pentamera*, Incense Cedar *Anthocarapa* species and emergent Moreton Bay Fig *Ficus macrophylla*, Strangling Fig *Ficus watkinsiana*, Giant Stinging Tree *Dendrocnide excelsa* and Yellow Carabeen *Sloanea woollsii*. Drier sites and less fertile soils support forests of Sydney Blue Gum *Eucalyptus saligna*, Brush Box *Lophostemon confertus*, Broad-Leaved Apple *Angophora subvelutina*, Flooded Gum *Eucalyptus grandis*, Turpentine *Syncarpia glomulifera*, Blackbutt *Eucalyptus pilularis* and Coachwood *Ceratopetalum apetalum*. On lower slopes there are forests of Tallowwood *Eucalyptus microcorys* Grey Gum *Eucalyptus punctata*, White Mahogany *Eucalyptus acmenoides*, Manna Gum *Eucalyptus viminalis* and Forest Oak *Allocasuarina torulosa* (Mitchell 2002).



- Legend**
- Property boundary
 - Study area
 - Study area 1500m buffer
 - IBRA Sub-region
 - Habitat connectivity
- Strahler stream order**
- Not calculated
 - 1st
 - 2nd
 - 3rd
- Strahler stream order buffers**
- 1st
 - 2nd
 - 3rd
- Mitchell landscape v3**
- Lav, Lamington Volcanic Slopes
 - Nrr, Nimbin Ridges

Figure 2 Location map

0 100 200 300 400 500
Metres

Scale: 1:12,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

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Albury, Ballarat, Melbourne,
Newcastle, Sydney, Wangaratta & Wollongong

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Location: P:\30400s\30430\Mapping\30430_BDAR_F2_LocationMap

2.1.3 Soils

The study area is within the Rosebank soil landscape of the Lismore to Ballina 1:100k soil landscape sheet (Morand 2009). Landscapes are typically rolling low hills and hills on Lismore Basalts. Relief is 70 to 100 metres with slopes of 20 to 40%. Ridges and crests are convex and moderately broad (100 to 300 metres). Ridge slopes, sideslopes and isolated hills are common. Vegetation consists of virtually completely cleared closed forest (subtropical rainforest) of the “Big Scrub”, with Camphor laurel *Cinnamomum camphora* the dominant tree species forming a closed forest community. A closed sod grassland of pasture species now occupies much of this soil landscape. Soils are shallow (less than 100 centimetres), well drained Krasnozems and brownish red Krasnozems on crest margins. Moderately deep to deep (greater than 100 centimetres) Krasnozems and brownish red well-drained Krasnozems occur on slopes. Limitations include very acid soils with high aluminium toxicity potential, steep slopes with mass movement hazard and localised rock outcrop.

2.1.4 Native vegetation extent

Native vegetation extent within the subject land, study area and within the 1500 metre buffer area was assessed and measured using aerial photographic interpretation, existing vegetation mapping (Byron Shire Council 2017, Lismore City Council 2011), local area knowledge and GIS. A total of 398.57 hectares of native vegetation was recorded within the buffer area. Table 1 lists the type, area and percent (of total) of native vegetation identified from existing vegetation mapping, as occurring within the study area, subject land and within the 1500 metre buffer. Figure 3 shows the extent of native vegetation within the study area and 1500 metre buffer.

Table 1 Native vegetation types mapped within the study area, subject land and buffer

Mapping source	Vegetation type	Study area	Subject land	Buffer (1500m) (ha, %)
Byron Shire Council 2017	PCT Class: Subtropical Rainforest (PCT community unassigned, PCT Code 0)	<ul style="list-style-type: none"> 0.29 ha 0.07% of total native vegetation in buffer area 0.1 % of this PCT type mapped within the buffer 	<ul style="list-style-type: none"> 0.017 ha 0.004% of total native vegetation in buffer area 0.007 % of this PCT type mapped within the buffer 	236.21 ha (59.3%)
	PCT Class: Camphor Laurel 51-80%, PCT Community: Derived Camphor Laurel Rainforest Wet Sclerophyll Forest (PCT Code 3)	0	0	86.09 ha (21.6%)
	PCT Class: Northern Hinterland Wet Sclerophyll Forests, PCT Community: (Blackbutt) Pink Bloodwood – Blackbutt – Grey Ironbark shrubby open forest (PCT Code 2186)	0	0	2.59 ha (0.65%)
	PCT Class: North Coast Wet Sclerophyll Forests (PCT community unassigned, PCT Code 0)	0	0	34.01 ha (8.53%)

Mapping source	Vegetation type	Study area	Subject land	Buffer (1500m) (ha, %)
	PCT Class: North Coast Wet Sclerophyll Forests, PCT Community: Tallowwood-Brush Box-Flooded Gum on sheltered lower slopes and gullies (PCT Code 9017)	0	0	1.20 ha (0.3%)
Lismore Council 2011	Keith Class, form: Closed forest, rainforest (derived), Lismore veg unit: Camphor Laurel Eucalypt-Rainforest	0	0	15.52 ha (3.89%)
	Keith Class, form: Closed forest, rainforest (derived), Lismore veg unit: Camphor Laurel – Rainforest	0	0	3.74 ha (0.94%)
	Keith Class, form: Subtropical Rainforest, Rainforest, Lismore veg unit: Rainforest	0	0	6.54 ha (1.64%)
	Keith Class, form: Subtropical Rainforest, Rainforest, Lismore veg unit: Rainforest – Camphor Laurel	0	0	8.81 ha (2.21%)
	Keith Class, form: Subtropical Rainforest, Rainforest, Lismore veg unit: Wattle- Rainforest	0	0	3.55 ha (0.89%)
TOTAL		0.29 ha	0.017 ha	398.57 ha

Within the subject land, Byron Shire Council has mapped 0.017 hectares of *PCT Class: Subtropical Rainforest (PCT community unassigned, PCT Code 0)*. This area is equal to 0.007% of this vegetation type mapped within the 1500 metre buffer area.

Non-native vegetation types (Lismore City Council 2011, Byron Shire Council 2017) not shown within the mapped native vegetation areas on Figure 2 include:

- Vines – exotic
- Camphor laurel > 80%
- Exotic
- Planted

These vegetation types were first identified using the vegetation mapping (Lismore City Council 2011, Byron Shire Council 2017) and then assessed using aerial photographic interpretation and local area knowledge. They were then excluded from the native vegetation extent mapping, as they are not representative of native vegetation as defined in the BAM.

2.1.5 Cleared areas

Cleared areas within the study area and buffer area include built structures, infrastructure, easements, rural landuse including agistments, hobby farms and orchards, roads, townships, creeks and farm dams. These areas often appear vegetated on the aerial photographs, where the rainforest canopy overhangs them.

2.1.6 Differences between mapped vegetation extent and aerial imagery

The Byron Shire Council vegetation mapping (2017) includes the entire study area and subject land as PCT Class: Subtropical Rainforest (PCT community unassigned, PCT Code 0).

However, within the study area there are cleared areas consisting of a boundary easement, driveway and car port, garden and vegetable garden, informal pathways and the residential house footprint. These areas are not obvious on aerial imagery, due to the tall overhanging tree canopy. The parts of the study area where there are existing structures beneath the canopy were tracked on the ground using a hand held tablet and mapped using GIS. The total area difference between the aerial imagery, vegetation mapping (Byron Shire Council 2017) and what exists on the ground layer at the site is approximately 0.11 hectares. **Error! Reference source not found.** shows the mapped cleared areas within the study area. Where canopy overhangs these areas, they have been mapped as 'canopy over cleared'.

The Biodiversity Values Map designates the whole study area, including the existing house, and the developed and cleared parts of the study area, presumably as a pure translation of 'rainforest' being mapped across the entire study area.

2.1.7 Rivers and streams

The study area is located within the North Coast Local Land Services Region and the Northern Rivers catchment. The Northern Rivers Catchment occupies an area of approximately 50,000 square kilometres from the Camden Haven River in the south to the Queensland border and 160 kilometres inland. Major rivers are the Tweed, Brunswick, Richmond, Clarence, Bellinger, Nambucca, Macleay and Hastings (NSW Department of Primary Industries [DPI] 2018).

Water from the study area flows westwards, downslope approximately 130 metres to an unnamed first order non-perennial watercourse. This watercourse flows west and joins a perennial tributary of Coopers Creek located 480 metres to the west of the study area. Coopers Creek is located approximately 800 metres to the west of the study area; Byrongerry Creek occurs upslope approximately 200 metres to the east. No tributaries originate within the study area (Land surrounding the study area consists of land zoned as Deferred Matter and 'RU1 - Primary Production'. Further to the west, land of the Whian Whian State Conservation Area (SCA) is zoned 'E1 - National Parks and Nature Reserves'.

The study area boundary adjustment that forms part of this proposal comes with a clearing entitlement, whereby land owners can legally clear vegetation up to 2 metres in width to allow for fence line installation. The owners of the property do not intend to clear vegetation or install a fenceline along the boundary. This intention has been confirmed with Council and will form part of the conditions of consent. Therefore the clearing entitlement does not require assessment in this BDAR.

2.1.8 The subject land

The subject land is approximately 0.017 hectares in area (measured as 0.0165 using GIS), located entirely within the study area and defined as the total area of proposed disturbance, encompassing proposed development

footprints, bushfire safety clearance buffer (2 metres around new development footprints) and any areas that could be disturbed during construction. The subject land and study area are shown on Figure 1.

The proposal will result in the removal of 0.016 hectares of vegetation (measured as 0.0162 using GIS) from the subject land consisting of:

- Removal of 0.011 hectares of rainforest vegetation for:
 - Development of the proposed studio.
 - 2 metre fire protection buffer around the proposed studio.
 - 2 metre fire protection buffer around the proposed house extension (bedroom).
- Removal of 0.0055 hectares of disturbed rainforest vegetation (canopy over cleared) for:
 - Development of the proposed house extension (bedroom).

Other components of the proposal that will not require additional native vegetation clearance and are therefore not included in the subject land or vegetation removal BAM calculations include:

- Installation of wastewater services beneath the existing dwelling.
- Installation of a water tank for the purposes of fire fighting, agreed with Council to be located in a cleared part of the study area on the eastern boundary (roadside).
- Reconfiguration of the existing car port to include a storage shed. This will not involve vegetation removal.
- Boundary adjustment to allow for the existing car port, which was built outside of the legal boundary of the study area. The boundary adjustment will not result in construction of a fence line or vegetation clearing.
- Existing APZ maintenance requirements in accordance with RFS conditions and the updated Bushfire Risk Assessment (Bushfire Risk Pty Ltd 2018).

Figure 1). Byrongerry Creek and Coopers Creek are both mapped as Key Fish Habitat (DPI 2018).

The closest major waterbody is Rocky Lake (Rocky Creek Dam), located approximately 8 kilometres to the west.

2.1.9 Wetlands

There are no listed wetlands or Ramsar wetlands within the study area or within the 1500 metre buffer area. The closest Ramsar site is located at Moreton Bay, Queensland, more than 150 kilometres to the north. Covering more than 110,000 hectares, the Moreton Bay Ramsar site varies from perched freshwater lakes and sedge swamps on the offshore sand islands, to intertidal mudflats, marshes, sandflats and mangroves next to the Bay's islands and the mainland. This variety enhances the Bay's biological diversity with an overlap of wildlife species normally considered tropical or temperate (State of Queensland [Department of Environment and Science] 2018).

The closest nationally important wetland is Tuckean Swamp, located approximately 36 kilometres to the south of Goonengerry. Tuckean Swamp is a coastal floodplain which has been significantly modified through drainage for agricultural purposes. It drains into the Richmond River via an estuarine reach known as the Tuckean Broadwater. The swamp is bordered by the Tuckurimba ridge to the west, the Blackwall range to the east and the Alstonville plateau to the north. It is situated on sedimentary deposits of an infilled lagoon which is part of the Clarence - Moreton Basin, an off-shoot of the Great Australia Basin (Directory of Important Wetlands [DoIW] [Commonwealth of Australia 2010]).

2.1.10 Connectivity features

Properties in the immediate surrounds of the study area consist largely of small acreages with areas cleared for housing, gardens, driveways and hobby farms, existing within a predominantly native forest landscape. The rainforest vegetation of the study area is well connected to other areas of rainforest and the wet sclerophyll forests of adjacent properties.

The study area is located on Mafeking Road, an unsealed local road that would not limit local connectivity of habitat or dispersal for most locally occurring mobile species. Further to the north, the vegetation of the local area is connected at a regional scale to the habitats of the Goonengerry National Park and the Whian Whian State Conservation Area (SCA). To the south and east, native habitat connectivity becomes fragmented by the agricultural landscapes of Federal and Coorabell (see Figure 3).

The closest riparian zone is more than 130 metres to the west and there are no riparian connectivity features within the study area.

2.1.11 Areas of geological significance

There are no recorded karst, caves, crevices, cliffs or other areas of geological significance within the study area or within the 1500 metre buffer surrounding the study area.

There are significant geological features consisting of caves, crevices and cliffs between 2,500 metres and 3,000 metres to the west of the study area, within the Whian Whian SCA. This includes the significant features of Condong Falls and Minyon Falls, which occur along Repentance Creek and its tributaries.

2.1.12 Biodiversity Values Map

The whole study area is designated within the Biodiversity Values Map, including the existing cleared yards, paths and built structures.

2.1.13 Soil hazard features

The soils within the study area have not been assessed for acid sulfate hazard risk (Naylor et al 1998). Given the position in the landscape and previous land use history, it is unlikely there are any soil hazards within the subject land or study area.

2.2 Site context

The site context was assessed using a site-based method undertaken October-November 2018.

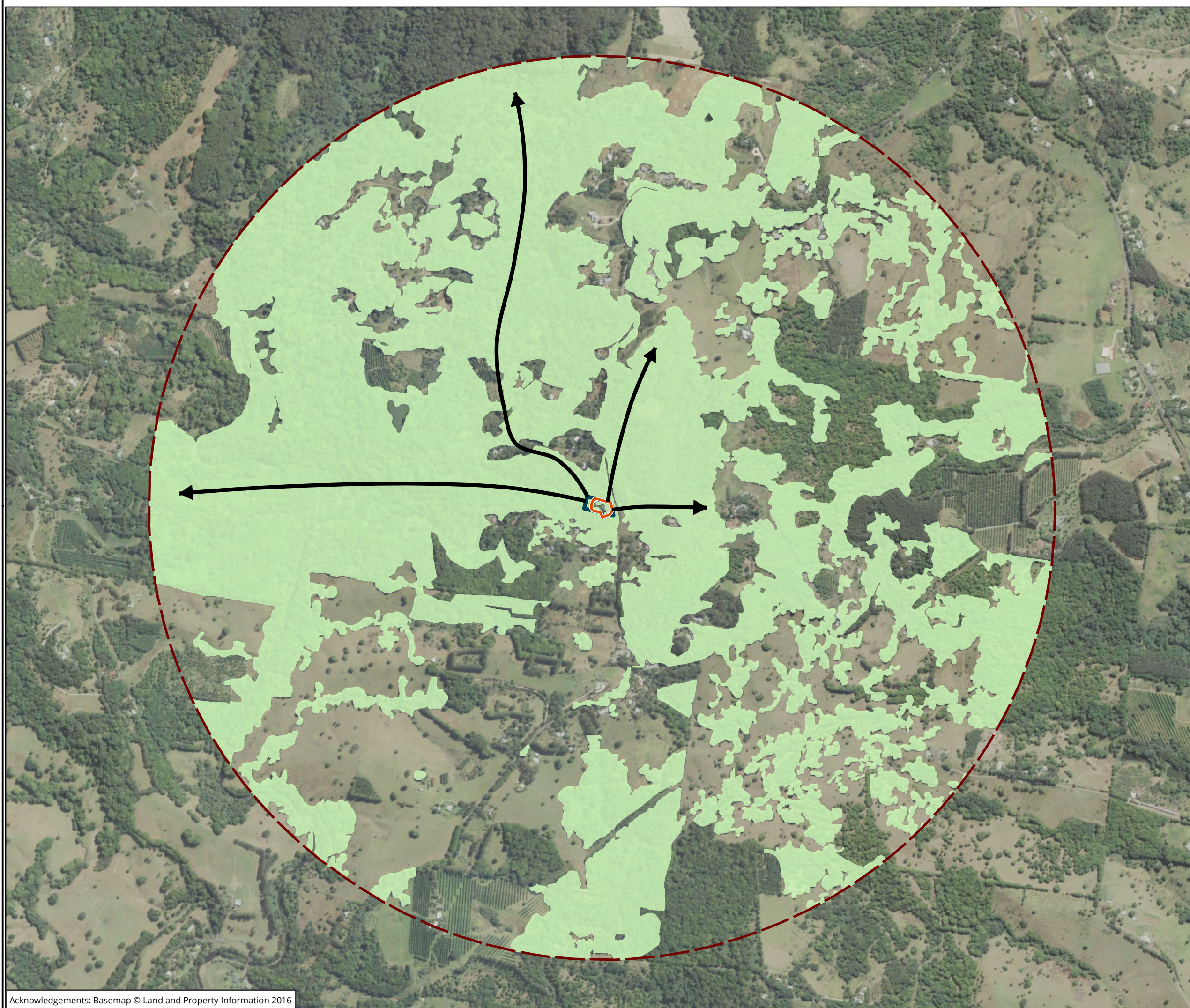
2.2.1 Native vegetation cover

Native vegetation cover was assessed using GIS based on the most suitable vegetation mapping, in this case *Byron Shire Council Vegetation mapping* (Byron Shire Council 2017).

Native vegetation cover within the study area was measured as approximately 0.29 hectares and within the 1500 metre buffer was found to be approximately 398.57 hectares (54 % of the assessment area). The native vegetation within the subject land was measured as 0.017 hectares (0.004%) (see Table 1).

2.2.2 Patch size

Patch size was assessed as per the BAM (OEH 2017) using a select process in ArcGIS. All intact woody vegetation that has a gap of less than 100 metres from the next area of moderate to good condition native vegetation is considered to be of the same patch. Vegetation within the study area meeting this criteria was mapped sequentially and it was found to form part of a relatively large patch of connecting vegetation with a patch size larger than 100 hectares.



Legend






-  Study area
-  Property boundary
-  Study area 1500m buffer
-  Native vegetation
-  Habitat connectivity

Figure 3 Native vegetation and connectivity

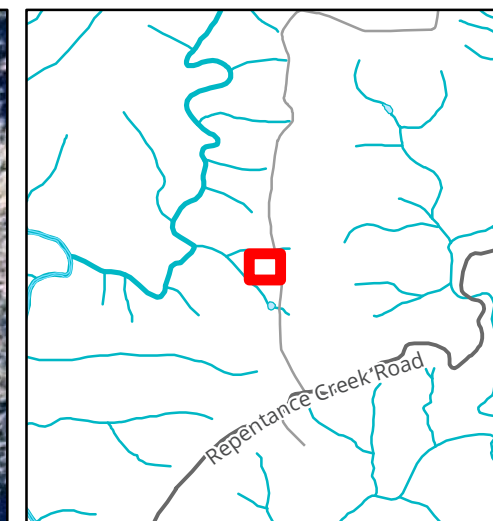
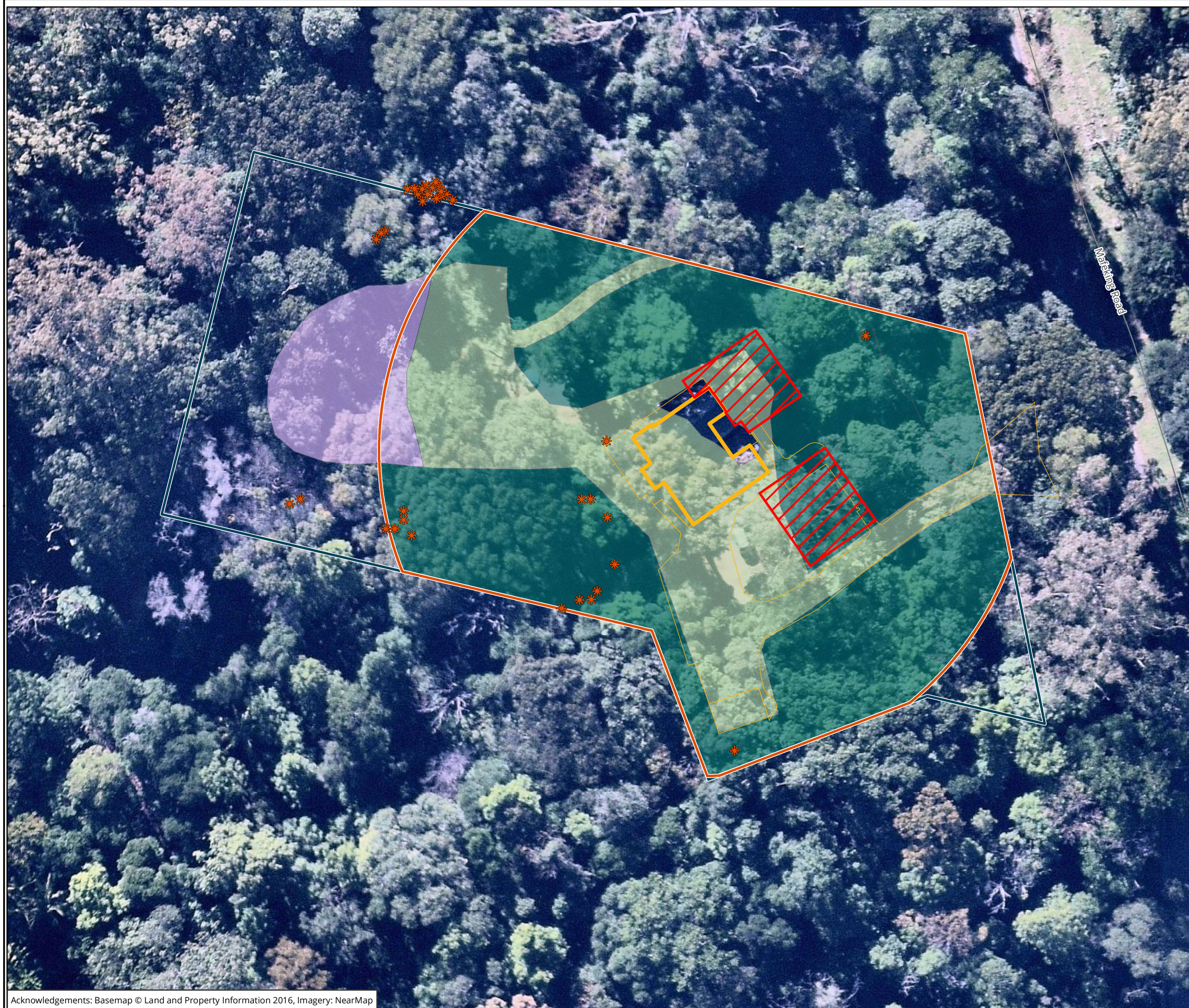
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Metres

Scale: 1:12,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56



Albury, Ballarat, Melbourne,
Newcastle, Sydney, Wangaratta & Wollongong

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Date: 16 July 2019,
Checked by: RBA, Drawn by: AEDM, Last edited by: amurray
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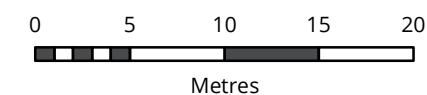
Legend

- Study area
- Property boundary
- Subject land
- Existing development - main dwelling
- Existing development
- ✱ Hicksbeachia pinnatifolia - Red Boppel Nut

Vegetation

- Canopy over cleared area
- PCT 1302 - White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion
- Weeds and exotics

Figure 4 Vegetation of the subject land



Scale: 1:400 @ A3
Coordinate System: GDA 1994 MGA Zone 56



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3 Native vegetation

The extent of native vegetation, threatened ecological communities and vegetation integrity within the study area was determined using the results of field investigations, previous studies undertaken at the site (Wildsite 2006) and Chapter 5 and Appendix 6 of the BAM (OEH 2017).

3.1 Methods

3.1.1 Background review

Regional vegetation mapping (Byron Shire Council 2017) and existing site reports (Wildsite 2006) as well as database searches (see Section 0) and BAM Calculator results were reviewed to inform the site investigations. Based on the results of the background review and the requirements of the BAM with respect to this BDAR, appropriate surveys were designed for the subject land.

3.1.2 Site investigation

A floristic assessment of the study area was undertaken by Biosis on 9 October 2018 by a qualified and experienced ecologist, Renae Baker, an accredited BAM assessor. The study area was surveyed in accordance with the BAM (OEH 2017), the *NSW Guide to Surveying Threatened Plants* (OEH 2016) and random meander methods (Cropper 1993). This involved:

- The identification and mapping of vegetation and assignment of PCT.
- Undertaking one plot/transect survey in accordance with Section 5 of the BAM (OEH 2017).
- The identification of native and exotic plant species, according to the Flora of NSW (Harden 1992, 1993, 2000, 2002), with reference to recent taxonomic changes.
- Targeted searches for plant species of conservation significance according to the *NSW Guide to surveying Threatened Plants* (OEH 2016).
- Identification of fauna habitats, assessment of their condition and assessment of their potential value to threatened fauna species.
- Recording observations of animal activity and searches for indirect evidence of fauna (such as scats, nests, burrows, hollows, tracks, scratches and diggings).
- Identification of previous and current factors threatening the ecological function and survival of native vegetation within and adjacent to the study area.

The conservation significance of plant species and plant communities was determined according to:

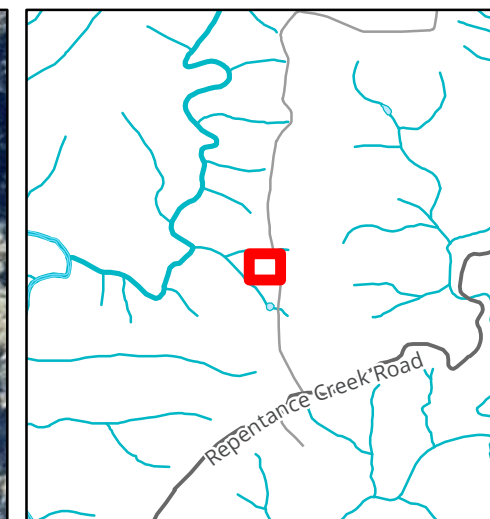
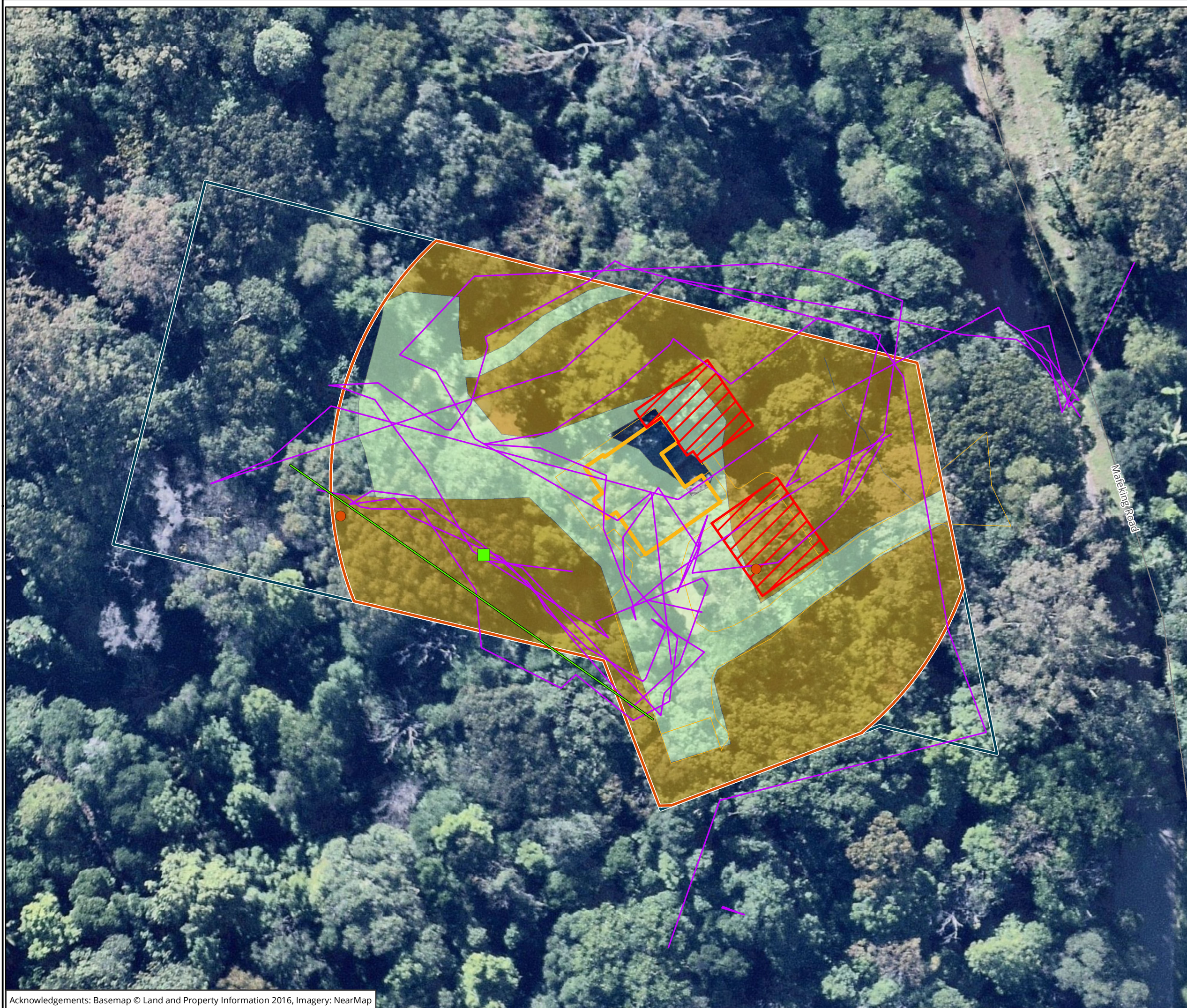
- BC Act for significance within NSW.
- EPBC Act for significance within Australia.

Detailed mapping of PCTs was conducted using hand-held (uncorrected) tablet units (Samsung Galaxy Tab 3) using the ArcGIS Collector application and aerial photo interpretation. Areas of native vegetation for which a PCT could validly be assigned were identified and delineated in the field, and their condition determined. Identification of PCTs within the study area was confirmed with reference to the community profile descriptors (and diagnostic species tests) held within the OEH mapping project and NSW BioNet Vegetation Classification database.

Limitations

Due to the very small size of the subject land, survey was undertaken within the subject land and broader study area to gain an understanding of the values of the site. However, as the property and study area are also small in area, parts of the plot and transect were located on, and for a small section of the transect, just outside of the boundary of the property. This could not be avoided, as this part of the property was the only section long enough to accommodate the 50 metre transect and plot area. The plot was located at the 20 metre mark of the transect, also to allow for the size and shape of the available survey area. As there is no discernible difference between the vegetation of the study area and that of the adjacent property, and no fence line occurs here, it was considered representative of the community of the study area and was not considered likely to affect survey results. The location of the floristic plot and transect surveyed at the study area is shown on Figure 5. Survey tracks from the GPS are also shown on Figure 5. Tracking appears to have been affected somewhat by the dense rainforest canopy, which has resulted in positioning of some tracks not being mapped accurately on the aerial imagery, or being representative of parts of the survey.

The areas of the study area identified as 'canopy over cleared' were not large enough to accommodate a plot or transect (0.1 hectares mapped across the entire study area). To obtain a vegetation integrity score for these areas, the plot data from Plot 1 were used as a surrogate (see below for further detail).



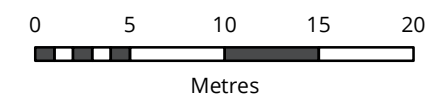
Legend

- Study area
- Property boundary
- Subject land
- Existing development - main dwelling
- Existing development
- Camera trap
- Plot location
- Transect
- Survey tracks

Vegetation zones

- VZ1 - PCT 1302 good
- VZ2 - PCT 1302 canopy over cleared

Figure 5 Vegetation zones and survey effort



Scale: 1:400 @ A3
Coordinate System: GDA 1994 MGA Zone 56



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Matter: 30430
Date: 17 July 2019
Checked by: RBA, Drawn by: AEDM, Last edited by: amurray
Location: P:\30400s\30430\Mapping\30430_BDAR_F5_VegZones_SurveyEffort

3.2 Results

3.2.1 Vegetation description

Vegetation across the study area has been subject to various levels of disturbance including previous historical clearing, APZ management and general disturbance associated with being adjacent to a residence. The study area supports approximately 0.29 hectares of native vegetation occurring as two condition types: 'Good/moderate' and 'canopy over cleared'. The vegetation immediately surrounding the house and carport has been cleared and altered through planting of garden species and cultivation of household vegetation and herb gardens. Native canopy species overhang these areas, including the house (see Plate 1 and Plate 2). These areas were mapped as 'canopy over cleared'.



Plate 1 Canopy over cleared areas

Plate 2 Cleared driveway and garden path

Vegetated parts of the study area that contained all structural layers were dominated by native species, predominantly Native Ginger *Alpinia caerulea*, which grew to a height of up to 1.5 metres. Canopy species were present, showing regeneration, and diverse. Saplings and small trees were present but not in great abundance. Herbs, vines and ferns were also reduced in cover and abundance (see Plate 3). To the west, downslope of the house, a garden has been developed and weeds occurred in greater cover and abundance (see Plate 4 and Plate 5).



Plate 3 **Vegetated parts of the study area**



Plate 4 **Garden to the west of the house**



Plate 5 West of the house, note weeds surrounding the garden area

To the east of the existing driveway, the vegetation has been fenced and exhibited a greater diversity and less disturbance than other areas.

The vegetation present within the study area is characteristic of Lowland Rainforest. The subtropical Lowland Rainforests of the local area are of conservation significance and are listed as:

- *Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions* Endangered Ecological Community (EEC) under the BC Act.
- *Lowland Rainforest of Subtropical Australia* Critically Endangered Ecological Community (CEEC) under the EPBC Act.

BAM Plot 1 (Figure 5) survey results and the results of the previous flora assessment (Wildsite 2006) were assessed using the BioNet PCT identification tool. This indicated the PCT within the site could be either PCT 1201 *Soft Corkwood - Yellow Carabeen - Cryptocarya spp. subtropical rainforest of the NSW North Coast Bioregion* or PCT 1302 *White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion*. Further assessment of the PCT at the study area is provided below.

3.2.2 Native vegetation extent

Error! Reference source not found. provides a map of the native vegetation extent recorded within the study area and subject land, as assessed during field investigations undertaken in October 2018. The figure includes all areas of native vegetation. Parts of the study area mapped as canopy over cleared are shown on **Error! Reference source not found.** and represent areas where the rainforest canopy overhangs cleared gardens, the driveway, developed footprints of the car port and house, and boundary easements.

Areas not shown as native vegetation cover within **Error! Reference source not found.** are not included for further assessment in accordance with Section 5.1.1.5 of the BAM (OEH 2017).

3.2.3 Plant community types

One PCT was recorded as present within the study area:


- PCT 1302 *White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion*

Table 2 provides a detailed description of PCT 1302 recorded within the study area.

Table 2 Vegetation description

PCT 1302 <i>White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion</i>	
Vegetation formation	Rainforest
Vegetation class	Subtropical Rainforest
Extent within study area	0.30 ha
Extent within subject land	0.016 ha (5.3% of the study area vegetation)
Condition	<p>The condition of the vegetation within the study area was considered good/moderate, with some disturbance present in the form of weed invasion (predominantly in the west) and previous APZ management and clearing.</p> <p>PCT 1302 occurred as two condition types within the study area:</p> <p>PCT 1302 Good/moderate condition (0.19 hectares)</p> <p>PCT 1302 Canopy over cleared (0.1 hectares)</p> <p>Weeds and exotic were mapped across 0.01 hectares.</p>
Description	<p>The vegetation within the study area in good/moderate condition comprised a closed forest with canopy trees between 20 – 35 metres in height. Species recorded within the canopy included Red Cedar <i>Toona ciliata</i>, Yellow Carabeen <i>Sloanea woollsii</i> and emergent Flooded Gum <i>Eucalyptus grandis</i>. Vines were present but not abundant and included Water Vine <i>Cissus antarctica</i> and Wonga Wonga Vine <i>Pandorea pandorana</i> as the most common. Groundcover species were sparse across most areas and included Basket Grass <i>Oplismenus imbecilis</i>, Birds Nest Fern <i>Asplenium australasicum</i> and Blue Flax Lily <i>Dianella caerulea</i>, while the shrub layer was dominated by Native Ginger <i>Alpinia caerulea</i>. A species list is provided as Appendix 2 and includes all species recorded within the study area during this assessment. Large rocks and fallen logs were common, with leaf litter to approximately 4 centimetres in depth in all areas (see photo below).</p> <p>Vegetation within the canopy over cleared areas consisted of gardens, paths, development and hardstand areas with an overhanging native canopy (see photo below).</p>
Survey effort	Vegetation of the study area and subject land was surveyed over approximately 5.5 hours. This included the plot/transect survey and targeted searches for threatened flora species.
Justification of PCT	<p>PCT 1302 was selected as the best fit PCT for the vegetation of the subject land because:</p> <ul style="list-style-type: none"> • It occurs as a subtropical rainforest. • It represents the Lowland Rainforest endangered ecological community. • It is found within the South Eastern Queensland IBRA bioregion and the Scenic Rim subregion. • It's position in the landscape is at relatively low altitude compared to other locally-occurring rainforest types. • The PCT Identification tool identified two PCTs, 1201 and 1302, as having potential to represent the vegetation of the study area based on survey results. <p>PCT 1302 was chosen as the most likely PCT, based on landscape position, which BioNet cites</p>

PCT 1302 White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion

	<p>as: <i>Low altitudes on fertile soils near sea level, in sheltered mid altitude valleys or on basalt terraces.</i></p> <p>In contrast, PCT 1201 was cited as occurring at intermediate to high altitudes in high rainfall areas on moderately fertile to fertile soils on plateaux and high mountain gullies along the escarpment. The classification confidence level of both of these PCT's \ is cited as 'very low' within the BioNet Vegetation Classification database. Very Low Confidence (Level 5): Community type is based on informal analysis, anecdotal information, or community descriptions, and is not based on any plot data analysis. Local experts have often identified these types. Although there is a high level of confidence that they represent significant vegetation entities that should be incorporated in the PCT List, it is not clear that they would meet the standard for floristic types in concept or in the PCT classification approach if data were available. (OEH 2018 – BioNet).</p>
Ecological Community Status	<p>BC Act – EEC</p> <p>EPBC Act – CEEC</p>
Estimate of percent cleared value of PCT	75 %
Photo: Start of transect	

PCT 1302 White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion

**Photo: PCT 1302 Canopy
over cleared - Main
extension (red rope)**



PCT 1302 White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion

Photo: PCT 1302
Good/moderate:
Proposed studio area



3.2.4 Threatened ecological communities

Vegetation within the subject land (PCT 1302) was considered to represent the EEC, *Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions* under the BC Act. The equivalent community, *Lowland Rainforest of Subtropical Australia*, is also listed as a CEEC under the EPBC Act. Approximately 0.29 hectares of this Lowland Rainforest community was recorded within the study area. Approximately 0.016 hectares of this community will be removed for development of the proposed studio and extension to the main house, occurring as two condition types.

3.2.5 Vegetation zones

Two Vegetation Zones were mapped within the study area and subject land (see Table 3).

Table 3 Vegetation zones mapped within the subject land

Plant community type	Vegetation zone	Condition	Area	Patch size class
PCT 1302 - White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion	VZ1	Good/Moderate	0.01ha	100 ha
PCT 1302 - White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion	VZ2	Canopy over cleared	0.006 ha	100 ha

3.2.6 Vegetation integrity

Vegetation Zone 1 vegetation integrity score was obtained using data from the BAM plot/ transect surveyed in an adjacent area, as per the methodology outlined in Section 5.3.4 of the BAM (OEI 2017). Plot data was collected via:

- A 20 metre x 50 metre quadrat and 50 metre transect, for assessment of site attributes and function.
- A 20 metre x 20 metre quadrat, nested within the larger quadrat, for full floristic survey to determine composition and structure of the PCT.

The minimum number of BAM plots per vegetation zone was determined using Table 4 of the BAM (OEI 2017). A total of one BAM plot was completed. An assessment of vegetation integrity was undertaken using benchmark data collected as outlined in Subsection 5.3.3 of the BAM. No additional local data was used for this assessment.

Vegetation Zone 2 was too small to be subject to a BAM plot/transect survey and there were no adjacent areas where a BAM plot/transect survey could have been undertaken as a substitute. This zone was characterised by rainforest canopy overhanging cleared parts of the study area, such as the driveway, garden and main house extension (see Plate 1 and Plate 2). For the purposes of assessing vegetation integrity for this zone, the BAM Plot data collected for Vegetation Zone 1 was used. A description of the data used and a justification for each is provided in Table 4.

Table 4 Vegetation data used for Vegetation Zone 2 assessment

Zone data	Score given	Justification
Canopy composition	0	No trunks occur, these are included in the PCT 1302 Good/moderate area
Canopy structure	114.2	Equivalent present cover score to PCT 1302 Good/moderate to account for overhanging canopy cover
Shrub composition	0	No trunks occur, these are included in the PCT 1302 Good/moderate area
Shrub Structure	0	Shrubs absent from zone
Grass and grass like, forbs, ferns and other composition	See justification notes	All scores given were equivalent to PCT 1302 Good/moderate, to account for presence of some native species in the ground cover of cleared areas
Grass and grass like, forbs, ferns and other structure	See justification notes	All scores given were equivalent to PCT 1302 Good/moderate, to account for presence of some native species in the ground layer of cleared areas
Function – stems, trees	0	No stems or trees occur, these are accounted for in PCT 1302 Good/moderate
Function – leaf litter	0	Leaf litter largely absent and not functional in this zone
Function – coarse woody debris	0	There is no woody debris accumulated

		in these areas, they are used frequently.
Function – high threat weed cover	30.3	Equivalent to PCT 1302 Good/moderate, to account for Camphor Laurel in the canopy and some Madeira Vine in the ground layer.

A list of flora species was compiled, and records of all flora species will be submitted to OEH for incorporation into the NSW BioNet Atlas of Wildlife. Flora species recorded from the plot survey are provided in Appendix 2. BAM Plot data are also provided in Appendix 2.

3.2.7 Vegetation integrity score

Plot data were entered into the BAM calculator to determine vegetation integrity score. Vegetation integrity scores for the vegetation zones in the subject land are provided in Table 5. As the proposal is a development proposal, future scores are shown as zero.

Table 5 Vegetation zone integrity scores

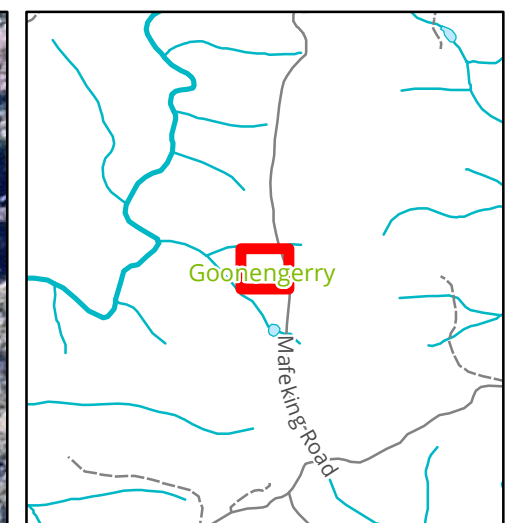
Vegetation zone	Composition condition score		Structure condition score		Function condition score		Vegetation integrity score	
	Current	Future	Current	Future	Current	Future	Current	Future
VZ1	61.8	0	56.2	0	70.6	0	62.6	0
VZ2	29.7	0	54.9	0	0	0	11.8	0

As outlined in Section 10.3.1 of the BAM, an offset is required for impacts to native vegetation where the vegetation integrity score is:

- ≥ 15 where the PCT is representative of an endangered or critically endangered ecological community.
- ≥ 17 where the PCT is associated with threatened species habitat (as represented by ecosystem credits), or is representative of a vulnerable ecological community.
- ≥ 20 where the PCT is not representative of a TEC or associated with threatened species habitat.

VZ1 is an endangered ecological community and associated with some threatened species habitat. As such, for VZ1 PCT 1302, with a vegetation integrity score of 62.6, offsets are required for impact to this area of native vegetation. Figure 6 shows the area requiring offsetting.

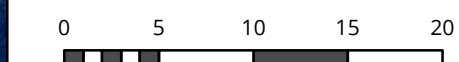
VZ2 is also representative of an endangered ecological community. However, the vegetation integrity score is 11.8. Therefore this zone does not require offsetting and is not considered further in terms of credit requirements. Measures to reduce potential for impacts from the development in this area are addressed further in Chapter 5.



Legend

-  Study area
-  Property boundary
-  Subject land
-  Existing development - main dwelling
-  Existing development
-  Offsetable areas

Figure 6 Areas requiring offset



Metres
Scale: 1:400 @ A3
Coordinate System: GDA 1994 MGA Zone 56



Albury, Ballarat, Melbourne,
Newcastle, Sydney, Wangaratta & Wollongong

Matter: 28740
Date: 17 July 2019,
Checked by: RBA, Drawn by: AEDM, Last edited by: amurray
Location: P:\30400s\30430\Mapping\30430_BDAR_F6_Offset

4 Assessment of habitat suitability for threatened species

This proposal will result in the removal of two small areas of vegetation totalling 0.016 hectares. The assessment of habitat suitability for threatened species within the subject land is based on the potential impacts of the proposal to these areas of vegetation, and any potential indirect impacts associated with removal of the vegetation from the subject land.

In terms of species habitat, direct impacts of the proposal include:

- Removal of 0.016 ha of PCT 1302 in two condition types
- Removal of garden plants
- Removal of 0.01 ha of leaf litter
- Relocation of woody debris and rocks

4.1 Predicted species (ecosystem species)

A list of predicted species (ecosystem credit species) expected to occur within the study area was refined as per Section 6 of the BAM. Impacts to these species require assessment, however targeted survey is not required as these species are assumed to occur, based on the occurrence of the Lowland Rainforest community. The following ecosystem credit species could not be discounted based on geographical restrictions from using the subject land as foraging habitat, on occasion:

- Barred Cuckoo-shrike *Coracina lineata*
- Common Blossom-bat *Syconycteris australis*
- Eastern Bentwing-bat *Miniopterus schreibersii oceanensis* (foraging)
- Eastern Freetail-bat *Mormopterus norfolkensis* (foraging)
- Eastern Long-eared Bat *Nyctophilus bifax* (foraging)
- Eastern Tube-nosed Bat *Nyctimene robinsoni*
- Golden-tipped Bat *Kerivoula papuensis*
- Greater Broad-nosed Bat *Scoteanax rueppellii*
- Grey-headed Flying-fox *Pteropus poliocephalus* (foraging)
- Little Bentwing-bat *Miniopterus australis* (foraging)
- Long-nosed Potoroo *Potorous tridactylus*
- Northern Free-tailed Bat *Mormopterus lumsdenae*
- Powerful Owl *Ninox strenua* (foraging)
- Red-legged Pademelon *Thylogale stigmatica*
- Rose-crowned Fruit-Dove *Ptilinopus regina*
- Spotted-tailed Quoll *Dasyurus maculatus*
- Superb Fruit-Dove *Ptilinopus superbus*

- Wompoo Fruit-Dove *Ptilinopus magnificus*
- Yellow-bellied Sheath-tail-bat *Saccolaimus flaviventris*

These species were considered when prescribing management and mitigation measures for the proposal. The potential presence of most these species could be discounted based on the lack of suitable habitat present within the study area, the location and type of habitat to be affected within the subject land, and the habitat preferences of the predicted species. An assessment of their potential occurrence and potential for impact within the subject land is provided in Appendix 3.

4.2 Species credit species

Appendix 2 (Flora) and Appendix 3 (Fauna) provide the lists of species credit species predicted to occur within the subject land based on the presence of PCT 1302 *White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion* within a patch greater than 100 hectares. The potential for a species to occur within the subject land was assessed in accordance with Sections 6.3 and 6.4 of the BAM and species with geographical restrictions not matching that within the subject land were not required to be surveyed. These species were considered to have 'low' chance of occurrence and a 'low' potential for impact. Targeted searches were undertaken for remaining species, considered to have a 'moderate' or 'high' chance of occurrence within the subject land. Detailed assessments considering the known habitats of species credit species and justification for their occurrence or non-occurrence are included in Appendix 2 (Flora) and Appendix 3 (Fauna).

The species listed in Table 6 were targeted in surveys, and have been considered in the impact management and mitigation measures recommended for this proposal. Justification for occurrence/non-occurrence within the subject land is provided in Appendix 2 (Flora) and Appendix 3 (Fauna).

Table 6 Threatened species credit species targeted in surveys

Species name	Common name
<i>Acacia bakeri</i>	Marblewood
<i>Acalypha eremorum</i>	Acalypha
<i>Niemeyera white</i>	Rusty Plum, Plum Boxwood
<i>Angiopteris evecta</i>	Giant Fern
<i>Archidendron hendersonii</i>	White Lace Flower
<i>Gossia fragrantissima</i>	Sweet Myrtle
<i>Baloghia marmorata</i>	Jointed Baloghia
<i>Belvisia mucronata</i>	Needle-leaf Fern
<i>Bosistoa transversa</i>	Yellow Satinheart
<i>Clematis fawcettii</i>	Northern Clematis
<i>Cryptocarya foetida</i>	Stinking Cryptocarya
<i>Cupaniopsis serrata</i>	Smooth Tuckeroo
<i>Cynanchum elegans</i>	White-flowered Wax Plant
<i>Cercartetus nanus</i>	Eastern Pygmy-possum

<i>Cyperus semifertilis</i>	Missionary Nutgrass
<i>Desmodium acanthocladum</i>	Thorny Pea
<i>Diospyros mabacea</i>	Red-fruited Ebony
<i>Diploglottis campbellii</i>	Small-leaved Tamarind
<i>Choricarpia subargentea</i>	Giant Ironwood
<i>Coeranoscincus reticulatus</i>	Three-toed Snake-tooth Skink
<i>Corchorus cunninghamii</i>	Native Jute
<i>Corokia whiteana</i>	Corokia
<i>Davidsonia jerseyana</i>	Davidson's Plum
<i>Davidsonia johnsonii</i>	Smooth Davidson's Plum
<i>Dendrocide moroides</i>	Gympie Stinger
<i>Drynaria rigidula</i>	Basket Fern
<i>Elaeocarpus sedentarius</i>	Minyon Quandong
<i>Elaeocarpus williamsianus</i>	Hairy Quandong
<i>Endiandra floydii</i>	Crystal Creek Walnut
<i>Endiandra hayesii</i>	Rusty Rose Walnut
<i>Endiandra muelleri subsp. bracteata</i>	Green-leaved Rose Walnut
<i>Floydia praealta</i>	Ball Nut
<i>Fontainea australis</i>	Southern Fontainea
<i>Coatesia paniculata</i>	Axe Breaker
<i>Hicksbeachia pinnatifolia</i>	Red Boppel Nut
<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake
<i>Hoplocephalus stephensii</i>	Stephens' Banded Snake
<i>Isoglossa eranthemoides</i>	Isoglossa
<i>Lindsaea brachypoda</i>	Short-footed Screw Fern
<i>Litoria brevipalmata</i>	Green-thighed Frog
<i>Macadamia tetraphylla</i>	Rough-shelled Bush Nut
<i>Macropus parma</i>	Parma Wallaby
<i>Marsdenia longiloba</i>	Slender Marsdenia
<i>Melicope vitiflora</i>	Coast Euodia
<i>Nurus atlas</i>	Atlas Rainforest Ground-beetle
<i>Nurus brevis</i>	Shorter Rainforest Ground-beetle
<i>Oberonia complanata</i>	Yellow-flowered King of the Fairies

<i>Ochrosia moorei</i>	Southern Ochrosia
<i>Owenia cepiodora</i>	Onion Cedar
<i>Phyllanthus microcladus</i>	Brush Sauropus
<i>Phyllodes imperialis southern subspecies</i>	Southern Pink Underwing Moth
<i>Planigale maculata</i>	Common Planigale
<i>Pomaderris notata</i>	McPherson Range Pomaderris
<i>Psilotum complanatum</i>	Flat Fork Fern
<i>Randia moorei</i>	Spiny Gardenia
<i>Rhodamnia rubescens</i>	Scrub Turpentine
<i>Myrsine richmondensis</i>	Ripple-leaf Muttonwood
<i>Sarcochilus dilatatus</i>	Brown Butterfly Orchid
<i>Sarcochilus weinthalii</i>	Blotched Sarcochilus
<i>Senna acclinis</i>	Rainforest Cassia
<i>Sophora fraseri</i>	Brush Sophora
<i>Symplocos baeuerlenii</i>	Small-leaved Hazelwood
<i>Syzygium hodgkinsoniae</i>	Red Lilly Pilly
<i>Syzygium moorei</i>	Durobby
<i>Thersites mitchellae</i>	Mitchell's Rainforest Snail
<i>Tinospora tinosporoides</i>	Arrow-head Vine
<i>Peristeranthus hillii</i>	Brown Fairy-chain Orchid
<i>Ozothamnus vagans</i>	Wollumbin Dogwood

4.3 Threatened species surveys

Targeted flora and fauna surveys of the study area were undertaken 9 October 2018 and 8-22 November 2018. Weather observations for survey dates are shown in Table 7.

Table 7 Weather observations during flora and fauna surveys (Lismore weather station*)

Survey Date	Minimum temperature (°C)	Maximum temperature (°C)	Rainfall (mm)	Direction of maximum wind gust	Speed of maximum wind gust (km/h)
9/10/2018	10.9	28.0	20.6	NE	30
8/11/2018	20.4	22.9	0	E	48
9/11/2018	13.3	22.9	0	SE	30
10/11/2018	8.7	26.6	0	NE	37
11/11/2018	16.4	26.5	4.6	SE	33
12/11/2018	9.1	25.9	0	SSE	41
13/11/2018	10.1	27	0	E	31
14/11/2018	10.6	28.3	0	NE	35
15/11/2018	15.3	30.8	0	ENE	41
16/11/2018	16.9	29.8	0	E	39
17/11/2018	17	29	0	S	67
18/11/2018	16.9	25.2	47	ESE	37
19/11/2018	15.7	25.6	1.2	S	31
20/11/2018	12.7	28.5	0	ENE	37
21/11/2018	16.6	33.7	0	W	59
22/11/2018	21.2	30.8	1.8	WNW	59

*Information from the Australia Government Bureau of Meteorology website

4.3.1 Threatened flora habitat and survey

Habitat for threatened flora species at the subject land included PCT 1302, in a modified state, with some high threat weeds present (predominantly Camphor Laurel). A comprehensive flora assessment and significant species targeted searches were undertaken previously by Wildsite (Wildsite 2006). This survey recorded approximately 40 individual Red Boppel Nut *Hicksbeachia pinnatifolia* and one Durobby *Syzygium moorei* at the study area. The Red Boppel Nut trees have persisted at the study area. However, the Durobby could not be located within the study area during the current survey and it is assumed this species has been lost due to ill health or possibly storm activity, since 2006, or its location was incorrectly recorded. The locations of Red Boppel Nut are shown on Figure 4. All of the Red Boppel Nut individuals will be retained at the study area and none occur within the subject land. One Red Boppel Nut occurs within the deck of the existing house, and one adjacent the existing car port. These individuals will also be protected and retained.

In accordance with the BAM, targeted surveys were undertaken in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016) for candidate species with potential habitat within the subject land and study area. Targeted searches across the subject land and more broadly within the study area for all candidate threatened flora species were undertaken on 9 October 2018, following the plot/transect survey. Random meanders following a roughly 2 metre wide transect were undertaken within the subject land.

Slender Marsdenia *Marsdenia longiloba* was surveyed out of the season specified in the BAM calculator. However, all species of vine and all Marsdenia species were identified to species within the subject land and therefore the presence of this species could be discounted on that basis. *Sarcochilus dilatatus* Brown Butterfly Orchid was also surveyed out of season. However this species could also be discounted from occurring because there were no orchids of this type growing amongst the trees to be removed, none were observed within the subject land and no other trees will be impacted in the study area.

Although many of the candidate threatened species are associated with PCT 1302, the limited area proposed for modification and removal for this proposal (0.016 hectares) and the previous disturbance at the study area limits the potential for these species to occur, and limits the potential for impacts to these species. A detailed assessment of each species, their preferred habitat requirements, geographical restrictions and the potential for the species to occur was undertaken and is provided in Appendix 2 (Flora) and Appendix 3 (Fauna).

4.3.2 Fauna habitat assessment and field survey

Fauna habitat assessment was undertaken prior to the field survey to determine whether the vegetation to be impacted by the proposed development contained microhabitats suitable to support the threatened fauna species outlined in Appendix 3. The habitat assessments focussed on the presence of the following features within the subject land:

- Habitat trees including large hollow-bearing trees, availability of flowering shrubs and feed tree species for candidate threatened species.
- Condition of native vegetation and evidence of disturbance.
- Presence of high threat weeds.
- Presence of free water.
- Quantity of ground litter and logs.
- Searches for indirect evidence.
- Evidence of past land management practices.

Potential habitat for threatened fauna species recorded within the subject land included:

- Leaf litter to a depth of 4 centimetres and cover of average 70 %
- Foraging tree species including three Guioa, one Red Cedar
- Limited cover and diversity of midstorey species
- Low cover and diversity of vines and climbers
- Rocks and woody debris

There was no free water or waterbodies within the subject land or study area. There was a paucity of ground foraging material such as grasses and grass like plants; these were mostly restricted to the garden to the west of the house and pathways around the house.

Although many of the candidate threatened species are associated with PCT 1302, the limited area proposed for modification and removal for this proposal and the previous disturbance at the study area limits the potential for these species to occur at the site, and limits the potential for impacts to these species. A detailed assessment of each species, their habitat requirements and the potential for the species to occur was undertaken and is provided in Appendix 3.

In accordance with the BAM, targeted surveys were undertaken for candidate species with potential habitat within the subject land. Targeted surveys were undertaken in accordance with the *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft* (Department of Environment and Conservation [DEC] 2004) and tailored to meet the limitations of the subject land and the predicted impacts from the proposal.

Surveys included active detection methods such as rock turning, woody debris inspection and turning, and passive detection methods including motion detection camera deployment. Cameras were installed at two locations; one in the existing APZ zone of the study area to the south west of the house and one within the proposed studio area (see Figure 5). Surveys were undertaken across the study area in appropriate weather conditions (calm and warm). Survey details are provided in Table 8 below.

Table 8 Fauna survey effort details

Survey undertaken	Details	Survey dates	Target species	Survey effort
Leaf litter survey	Leaf litter was searched by hand, turning and searching all layers, within the subject land.	9/10/2018	Mitchells' Rainforest Snail Atlas Beetles <i>Nurus</i> species	One person hour
Log and rock survey and turning	Logs and rocks were turned and/or inspected across the study area to detect beetles, nests or reptiles.	9/10/2018	Common Planigale Stephen's banded Snake Pale-headed Snake Eastern Pygmy Possum Three-toed Snake Skink Atlas Beetles <i>Nurus</i> species Mitchell's Rainforest Snail	One person hour
Bird point survey	A bird survey was undertaken from one point location focusing on the subject land.	9/10/2018	Coxens' Fig Parrot	One person hour
Tree inspections	Trees to be removed from within the subject land were surveyed using hand and binoculars to detect hollows or nest sites. Other signs of fauna use of trees was made across the study area.	9/10/2018	Stephen's banded Snake Pale-headed Snake Eastern Pygmy Possum Common Planigale Microbats – species or roosts	0.5 person hours
Camera trap	A remote infra red sensor camera was deployed at two locations, focused on	8/11- 22/11/2018	Common Planigale Eastern Pygmy Possum Stephen's banded Snake	14 trap nights - Two locations

Survey undertaken	Details	Survey dates	Target species	Survey effort
	potential habitat, one within the study area and one within the subject land.		Pale headed Snake Three-toed Snake Skink Parma Wallaby	
Vine survey	A hand survey of vines within the subject land was undertaken to detect moth chrysalis.	9/10/2018	Pink Underwing Moth chrysalis	2 person hours (during targeted flora survey)

No threatened fauna species, nests or indications of their use or reliance on resources of the subject land were recorded during the field surveys as detailed above. A list of fauna species recorded within the study area is provided in Appendix 3.

Given the size of the subject land (0.016 hectares), the types of habitats present (see Plate 6 and Plate 7) and the proposed works to be undertaken at the subject land, this level of survey and survey type were considered adequate to sample the species present, target the candidate threatened species and assess whether the proposal could impact them.



Plate 6 Studio area of subject land



Plate 7 **Main house extension area of subject land**

Stage 2 – Impact assessment (biodiversity values)

5 Avoid and minimise impacts

This section identifies the potential impacts of the proposal on the biodiversity values of the study area and includes measures taken to date and additional recommendations to assist the final design of the development to further avoid and minimise impacts on biodiversity within and surrounding the subject land and study area.

5.1 Actions to avoid/minimise project impacts

The principal means to reduce impacts on biodiversity values within the study area is to avoid and minimise removal of native vegetation and fauna habitat. Additional recommendations include measures to mitigate residual impacts after all measures to avoid and minimise impacts have been considered.

Steps taken are broken down into site selection and planning, construction and operation.

5.1.1 Site selection and planning

The proposed development at the subject land has been designed to minimise impacts to the native vegetation and flora and fauna habitats present within the site and the broader study area. The proponents are sympathetic to their environment and have designed all components of their development to avoid removal of native vegetation as far as possible. This includes the incorporation of an existing Red Boppel Nut into the deck of the house, and avoidance of a mature Red Boppel Nut in reconfiguring the car port.

The proposed location of the studio is directly adjacent the existing house and a planted garden, and has been positioned to avoid as many trees as possible (Plate 8). The studio measures just 0.0056 hectares (with a 2 metre buffer this increases to 0.009 hectares). This is considered an extremely small area in the context of the vegetation within the study area and greater locality.



Plate 8 Location of proposed studio (existing house visible in background)

The extension to the existing house is within the cleared garden (PCT 1302 – Canopy over cleared) (see Plate 9), resulting in the removal of approximately three Guioa trees and one Red Cedar. Both of these species occur in other parts of the subject land and study area. The extension has been planned to be within the existing cleared area and to minimise vegetation removal and disturbance to potential fauna habitats such as large rocks will be avoided. The Burrawang *Macrozamia communis* to be removed from the garden with the aim of translocation is not a species that naturally occurs in the lowland rainforest of the locality and is most likely a planted garden species.



Plate 9 Proposed house extension location

The reconfiguration of the car port is not expected to result in removal of vegetation and has been planned to retain the Red Boppel Nut, located to the south of the existing car port.

Demonstration of avoidance and minimisation:

- The proponents redesigned the location of the studio to be adjacent to the house, in an area containing no large trees, and where understorey vegetation is currently disturbed and managed for APZ requirements.
- The house extension (bedroom) has been located within the existing garden, with minimum removal of native trees proposed (three Guioa, one Red Cedar).
- The reconfiguration of the car port and method of construction of the car port has been redesigned to avoid removal of vegetation.
- The proponents redesigned the deck to retain the existing Red Boppel Nut, and have made provision for its continued survival by seeking advice from a qualified tree expert.

5.1.2 Construction

No additional direct impacts are expected to occur as a result of the construction phase of the proposal. However, indirect impacts to retained biodiversity values have the potential to occur. This section provides specific measures to be implemented during the construction of the proposed studio and house extension, in order to avoid indirect or direct impacts to the biodiversity of the subject land. The following measures are recommended:

- No removal of logs or rocks from the subject land. The proposal includes incorporation of in situ large rocks around the proposed house addition and gardens. Smaller rocks can be pushed aside as necessary but should be retained within the subject land.
- Preclearance of all construction footprints to check for fauna. Immediately prior to construction or removal of trees, a preclearance survey by a qualified fauna handler or ecologist should be undertaken. Any fauna located during this survey should be relocated to habitats immediately adjacent, within the subject land or study area. Species targeted should include reptiles, small mammals and bird nests. No other species are predicted to be inhabiting areas proposed for construction.
- The contractors employed to undertake the works should be notified about the environmental sensitivity of the surrounding vegetation prior to commencing work. Contractors should be advised to not bring dogs to site.
- All Red Boppel Nut plants adjacent to the subject land should be flagged prior to construction works, so that they are not inadvertently trampled or impacted.
- No vegetation other than that assessed as being removed within this report should be impacted or removed during construction activities.
- All material stockpiles, vehicle parking and machinery storage should be located within cleared areas and not in areas of native vegetation that are to be retained.
- Sediment and erosion control measures should be implemented prior to construction works commencing (e.g. hay bales downslope of works areas).

5.1.3 Operation

The operation of the studio and house extension are not expected to result in additional impacts to the biodiversity values of the study area. The studio is to be used for occasional guests and is not planned to be utilised for long term residential accommodation or holiday letting.

The proposal includes management of existing native vegetation through the implementation of a Vegetation Management Plan (VMP). This VMP will ensure that the existing threat of weeds is mitigated and the vegetation of the site persists into the future. The proponents have already engaged a qualified bush regeneration specialist to undertake weed control at the study area. The VMP will apply to the study area.

The management of the APZ to reduce the risk of wildfire to assets is proposed to occur once every six months to maintain the APZ to the standards required by the RFS. The proposed management of the APZ at the study area has been designed to reduce impacts to the rainforest vegetation and Red Boppel Nut, through the use of the alternative solutions options of Planning for Bushfire Protection (RFS 2016). The management techniques and regime proposed will enable the diversity of the vegetation of the subject land to be maintained into the future. Ongoing management within the APZ includes:

- Retention of all canopy species to ensure continued high moisture content of retained vegetation and litter.
- Retention of vines on canopy and sub canopies.
- Retention of shrub / small trees within clumps, centred on threatened plants where these occur.
- Clumps separated by only 5 metres.

- Retention of all threatened flora species as the basis for retaining 'clumps'. In areas where there are no Red Boppel Nuts, other species of local significance (see Wildsite 2006) can form the basis for clump locations.
- Removal of common shrubs and ground cover such as Native Ginger, Water Vine, Gahnia, Cockspur, Bangalow Palm seedlings and saplings and Blue Flax Lily, to provide a discontinuous shrub layer.
- Removal of exotic species including Camphor Laurel.
- Limiting impacts to leaf litter to a reduction in depth to 2 centimetres. This can be undertaken using a leaf blower to further reduce potential for fauna injury from raking. Retention of leaf litter will also contribute to moisture retention.
- Retention of habitat components including rotting logs and rocks.

There are no additional impacts expected to result from operation of the proposed development at the study area.

5.2 Assessment of unavoidable impacts

Assessment of direct and indirect impacts unable to be avoided has been undertaken in accordance with the BAM (OEH 2017). The following direct and indirect impacts are unable to be avoided in progressing the proposed development.

5.2.1 Direct impacts

Direct impacts arising from the project include:

- Removal of 0.016 hectares of Lowland Rainforest, occurring as two condition types.
- Relocation of fauna habitat components from the subject land to adjacent areas.

These impacts will be permanent and will occur from the outset of the development. Mitigation measures outlined in Section 5.1 above will help to minimise the potential impacts to biodiversity values that remain present within the subject land.

5.2.2 Indirect impacts

Potential indirect impacts arising from the project are outlined and addressed in Table 9 below.

Table 9 Assessment of indirect impacts

Indirect impact	Assessment / likelihood of occurrence
Inadvertent impacts on adjacent habitat or vegetation.	All contractors will be inducted and notified about the sensitivity of the adjacent vegetation (See Section 5.1 above). A VMP is being developed to conserve the rainforest of the study area.
Reduced viability of adjacent habitat due to edge effects.	The vegetation currently exists with reduced ground cover and shrub cover. This is expected to be largely maintained and will not result in additional edge effects, particularly as the canopy is to be retained and the proposed developments are located adjacent existing cleared areas.
Reduced viability of adjacent habitat due to noise, dust or light spill.	These are not expected to increase as a result of the proposal. The operation of the proposal will be as per the existing residential use of the site.

Indirect impact	Assessment / likelihood of occurrence
Transport of weeds and pathogens from the site to adjacent vegetation.	All vehicles will enter the existing cleared gravel driveway and will not enter native vegetation. Therefore the transport of weeds or pathogens is not expected as a result of the proposal.
Increased risk of starvation, exposure and loss of shade or shelter.	This impact is not expected as a result of the proposal. The proposal is retaining rocks, logs, canopy and leaf litter.
Loss of breeding habitats.	The majority of the subject land will remain available to fauna as sites of breeding. The subject land does not provide known breeding habitat for native fauna species. 0.01 ha will be removed for development of the studio, and four trees from the area adjacent the garden. These areas were investigated and were not considered to provide breeding habitat for species of the local area.
Trampling of threatened flora species.	Measures will be implemented to control this potential impact (see Section 5.1). This includes exclusion of all personnel and vehicles from the rainforest mapped areas.
Inhibition of nitrogen fixation and increased soil salinity.	This impact is not expected as a result of the proposal.
Fertiliser drift.	This impact is not expected as a result of the proposal. No fertiliser is being used.
Rubbish dumping.	This impact is not expected as a result of the proposal – all waste will be deposited in the residential house bins at the conclusion of each day.
Wood collection.	Wood collection will not occur within the study area as a result of the proposal. In addition, the proposal will not remove logs or woody debris from the site.
Bush rock removal and disturbance.	Bush rock will not be removed from the subject land. Where rock occurs in the construction footprint, it will be moved directly adjacent to the area.
Increase in predatory species populations.	This impact is not expected as a result of the proposal. The use of the site is not changing.
Increase in pest animal populations.	This impact is not expected as a result of the proposal. The use of the site is not changing.
Increased risk of fire.	The proposal will continue to manage the required APZ to reduce the risk of fire, thereby protecting fire sensitive species and the rainforest community.
Disturbance to specialist breeding and foraging habitat, e.g. Beach nesting for shorebirds.	This impact is not expected as a result of the proposal – there is no specialist breeding or foraging habitat to be affected by the proposal.
Fragmentation of movement corridors.	No fragmentation of habitat will occur as a result of this proposal. The minor additions to the existing house will not result in fragmentation of habitat or other areas for fauna.

5.2.3 Prescribed impacts

Assessment of prescribed biodiversity impacts are outlined and addressed in Table 10 below.

Table 10 Assessment of prescribed impacts

Prescribed impact	Assessment / likelihood of occurrence
Impacts of development on the habitat of threatened species or ecological communities associated with karst, caves, crevices, cliffs and other features of geological significance.	The proposal will not result in this impact. There are no areas of geological significance at the study area.
Impacts of development on the habitat of threatened species or ecological communities associated with rocks.	Rocks occur at the subject land, however they are not currently supporting threatened species and they will be relocated to adjacent areas, not removed from the site.
Impacts of development on the habitat of threatened species or ecological communities associated with human made structures.	The proposal will not result in this impact. No human made structures are providing threatened species habitat.
Impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation.	The proposal will not result in this impact. There is no non-native vegetation providing habitat for threatened species to be affected by the proposal.
Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range.	The proposal will not result in this impact. There are no connectivity impacts expected as a result of the proposal.
Impacts of the development on movement of threatened species that maintains their life cycle.	The proposal will not result in this impact. There are no impacts that will affect movement of species associated with the proposal.
Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including subsidence or upsidence resulting from underground mining or other development)	The proposal will not result in this impact. There are no water bodies or processes within the subject land or study area that could be affected.
Impacts of wind turbine strikes on protected animals	The proposal will not result in this impact. The proposal does not include wind turbines.
Impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC	The proposal will not result in this impact. There are no long-term increases in traffic or vehicle numbers expected as a result of the proposal. All traffic will be compliant with local road rules.

5.3 Impacts to groundwater dependent ecosystems

The study area is not mapped as having Groundwater Vulnerability and is located at the top of a slope. As such, the proposal will not result in an aquifer interference activity and will not impact upon groundwater dependent ecosystems.

5.4 Adaptive management strategy

The proposed development will not result in impacts relating to karst, caves, crevices, cliffs and other geological features of significance, subsidence and upsidence, wind turbine strikes or vehicle strikes and as such as an Adaptive Management Strategy is not considered necessary.

6 Impact summary

6.1 Thresholds for assessment and offsetting

This section outlines the thresholds for assessment and offsetting in accordance with Section 10 of the BAM.

6.1.1 Serious and irreversible impacts on biodiversity values

The vegetation recorded within the study area, PCT 1302, is identified as a potential serious and irreversible impact entity (OEH 2017). However, the proposed removal of 0.016 hectares of vegetation is not likely to constitute a potential serious and irreversible impact, particularly in the context of the site condition and location of the site within the landscape. The proponents will be implementing a VMP as part of the proposal, and have already engaged a bush regeneration specialist to undertake high threat weed removal to conserve the vegetation of the study area to improve retained areas.

6.1.2 Impacts requiring offsets

Impacts native vegetation and threatened species

As outlined in Section 10.3.1 of the BAM, an offset is required for impacts on native vegetation where the vegetation integrity score is:

- ≥ 15 where the PCT is representative of an endangered or critically endangered ecological community
- ≥ 17 where the PCT is associated with threatened species habitat (as represented by ecosystem credits), or is representative of a vulnerable ecological community
- ≥ 20 where the PCT is not representative of a TEC or associated with threatened species habitat.

VZ1 is an endangered ecological community and is associated with some threatened species habitat. As such, with a vegetation integrity score of 62.6 offsets are required for impacts to this native vegetation. Vegetation integrity scores are shown in Table 11.

VZ2 is an endangered ecological community, however with a score of 11.8, offsets are not required for this zone. Table 12 shows the number of ecosystem credits required to offset the impacts of the proposal.

Table 11 Vegetation zone integrity scores – current and future

Vegetation zone	Vegetation integrity score		Change in score
	Current	Future	
VZ1	62.6	0	-62.6
VZ2	11.8	0	-11.8

Table 12 Offsets required

Vegetation Zone	PCT	Biodiversity risk weighting	Ecosystem credits required
VZ1	PCT 1302	2	1

No threatened species credit species, or high quality habitats, were recorded within the subject land and none are expected to be impacted by the proposal. One species credit species, Red Boppel Nut, was recorded in proximity to the subject land, and in abundance across the study area. This species has been existing in its current locations for many years and will be retained in all locations. It is not expected to be directly or indirectly impacted by the proposal. The proponents have engaged and sought advice from a recognised tree expert, who has provided advice regarding retention of the tree within the house deck, and close to the car port. As such no offsets are required for any species credit species.

6.1.3 Impacts not requiring offset

Impacts to the area of PCT1302 canopy over cleared (VZ2) do not require offsetting, as the vegetation integrity score is less than prescribed in the BAM as requiring offsets. However, all parts of the subject land will be subject to the recommended management and mitigation measures.

7 Biodiversity credits

Offsetting through the transfer and retirement of biodiversity credits is required for the current assessment due to impacts to native vegetation. The proposal requires that one credit of PCT 1302 *White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion* be retired to offset the impacts of the proposed development. Given the small area to be affected at the study area, no additional credits are required.

A biodiversity credit report and credit payment report are provided as Appendix 4.

A preliminary assessment of the available credits register shows that there are credits available for purchase of PCT 1302 like-for-like options.

8 Assessment against biodiversity legislation

8.1 Environment Protection and Biodiversity Conservation Act 1999

An assessment of the impacts of the proposed development on Matters of National Environmental Significance (NES), against heads of consideration outlined in Commonwealth of Australia (2013) was prepared to determine whether referral of the project to the Commonwealth Minister for the Environment is required. Matters of NES relevant to the project are summarised in **Error! Reference source not found.**

Table 13 Assessment of the project against the EPBC Act

Matter of NES	Project specifics	Potential for significant impact
Threatened species	An assessment of the potential occurrence of Matters of NES species, and potential for impact to them from the proposal is provided in Appendix 2 (Flora) and Appendix 3 (Fauna). One threatened flora species, Red Boppel Nut, was recorded within the subject land. No impacts to this species are proposed.	No potential impacts to threatened species with potential to occur, or impacts to their breeding or foraging habitats, are predicted as a result of this proposal. No impacts are proposed to occur to the Red Boppel Nut. Therefore no Significant Impact Criteria (SIC) assessments for threatened species have been undertaken.
Threatened ecological communities	One CEEC was recorded within the subject land, <i>Lowland Rainforest of Subtropical Australia</i> . 0.003 ha of this community will be removed as a result of the proposal, and 0.17 ha will be managed as an APZ, however all canopy species will be retained and understorey will be managed in clumps.	Potential impacts to this community have been assessed in a SIC assessment (See Appendix 5). The SIC assessment concluded potential impacts to this community are unlikely to be significant. Therefore, a referral is not required.
Migratory species	A list of migratory species previously recorded within 5 km of the study area is provided in Appendix 3.	No migratory species are predicted to occur within the subject land or be affected by the proposal.
Wetlands of international importance (Ramsar sites)	The closest Ramsar site is 150 km away	None

On this basis, the EPBC Act is unlikely to be triggered and referral of the proposal to the Australian Government Minister for the Environment will not be required.

8.2 Environmental Planning and Assessment Act 1979

8.2.1 Byron LEP 2014, 1988

The study area is currently zoned 'DM – Deferred Matter' under the BLEP. A number of areas with environmental values throughout the Byron Shire were deferred from being zoned in the BLEP pending the outcome of the Department of Planning and Environment's Northern Councils E Zone Review (the E Zone Review). As part of Council's implementation of the E Zone review, areas currently identified as a Deferred Matter under the BLEP are being assessed against clear criteria that must be met to rezone land to Environmental Conservation (E2) or Environmental Management (E3), based on the primary land use and the nature of existing vegetation. Deferred Matter areas that do not meet the criteria for an E Zone will have an alternative zone applied. It is expected the property will be rezoned as one of these categories.

8.2.2 SEPP 44 – Koala Habitat Protection

The study area and subject land occur within the Byron LGA, a schedule 1 listed LGA under the SEPP 44. Consequently SEPP 44 applies to the study area.

No preferred feed tree species occur within the subject land therefore no potential Koala habitat occurs there. There was no evidence of Koalas or Koalas breeding on the subject land, and therefore the subject land is not considered to be core Koala habitat. Koalas may utilise the subject land on occasion, however all canopy species will be retained and the proposal will not fragment habitat for this species.

8.3 Biodiversity Conservation Act 2016

An assessment of the likelihood of threatened species listed under the BC Act occurring within the study area is provided in Appendix 2 (flora) and Appendix 3 (fauna) along with an assessment of whether the proposal has potential to result in impacts to these species. The assessments found that threatened species were unlikely to be affected by this proposal and no further assessment or offset for species credit species is required for the proposal.

8.3.1 Biodiversity Offsets Scheme

This proposal is being assessed under the BOS, as a result of the proposed removal of native vegetation from an area declared on the Biodiversity Values Map.

8.4 Fisheries Management Act 1994

There are no waterways, marine vegetation or key fish habitats with potential to be impacted by this proposal, as such the FM Act does not apply to this proposal.

8.5 Biosecurity Act 2015

The Biosecurity Act provides for the identification, classification and control of Priority Weeds with the purpose of determining if a biosecurity risk is likely to occur. A biosecurity risk is defined as the risk of a biosecurity impact occurring, which for weeds includes the introduction, presence, spread or increase of a pest into or within the State or any part of the State. A pest plant has the potential to; harm or reduce biodiversity or out-compete other organisms for resources, including food, water, nutrients, habitat and sunlight.

One Priority Weed for the North Coast LLS Region, which includes the Byron LGA, was recorded in the study and is listed in Table 14 along with its associated Duty. Madeira Vine *Anredera cordifolia* is also a high threat weed and it is recommended this weed be controlled and removed from the site, before it spreads. The

proponents have engaged a bush regeneration specialist and removal and control of this priority weed has been undertaken and will continue to form part of the vegetation management of the property.

Table 14 Priority weeds recorded within the subject land

Scientific Name	Common Name	General Biosecurity Duty
<i>Anredera cordifoli</i>	<i>Madeira vine</i>	<i>Prohibition on dealings</i> <i>Must not be imported into the State or sold</i>

8.6 Water Management Act 2000

Works are not proposed within 40 metres of the top of the bank along any watercourse. Thus, a controlled activity permit under the WM Act is not required.

9 Conclusion

A total of 0.016 hectares of native vegetation was recorded within the subject land representing the Lowland Rainforest (EEC, BC Act; CEEC, EPBC Act).

Avoidance of impacts to native vegetation, threatened ecological communities and threatened species habitat have been undertaken to restrict proposed impacts to the removal of 0.016 hectares of vegetation from the subject land.

There were no threatened flora or fauna species recorded within the subject land and none are expected to be impacted as a result of the current proposal.

The vegetation integrity score of the vegetation to be impacted within VZ1 has been calculated as 62.6 and as such, in accordance with Section 10.3 of the BAM, offsets are required for impacts of the proposed development (See Appendix 4).

Matters of NES are not likely to be significantly impacted by the proposed development and as such, a referral of the project to the Commonwealth is not required.

References

Bushfire Risk. 2018. Bushfire Risk Assessment Proposed Development: Alterations & Additions to an Existing Dwelling & Detached Two-Storey Studio: Lot 3 DP 601327 286 Mafeking Road Goonengerry. Prepared for Sally and Hugo Peterson. Author: Jackson M.

Bureau of Meteorology, 2018. *Climate statistics for Australian locations*. Available from: <http://www.bom.gov.au/climate/data/>

Byron Shire Council 2017. Vegetation mapping Byron Shire LGA.

Commonwealth of Australia 2010. DoIW Directory of Important Wetlands.

Cropper 1993. *Management of Endangered Plants*. East Melbourne, Victoria: CSIRO.

DECC 2004. Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft November 2004. Department of Environment and Conservation (NSW). Environment Australia (EA) 2000. Revision of the Interim Biogeographic Regionalisation of Australia (IBRA) and the Development of Version 5.1. - Summary Report. Department of Environment and Heritage, Canberra.

Lismore City Council 2011. Vegetation mapping Lismore City LGA.

Morand D.T., 2009, Soil Landscapes of the Lismore-Ballina 1:100,000 Sheet Ed. 2 map, NSW Department of Environment, Climate Change and Water, Sydney.

Mitchell, P.B. 2002 (unpub). *NSW ecosystems study: background and methodology*. Unpublished report to the NSW National Parks and Wildlife Service, Hurstville.

NSW Department of Primary Industries. 2018.

Naylor, SD, Chapman, GA, Atkinson, G, Murphy CL, Tulau MJ, Flewin TC, Milford HB, Morand DT, 1998, Guidelines for the Use of Acid Sulfate Soil Risk Maps, 2nd ed., Department of Land and Water Conservation, Sydney.

OEH 2016 *NSW Guide to Surveying Threatened Plants* Office of Environment and Heritage for the NSW Government, Sydney.

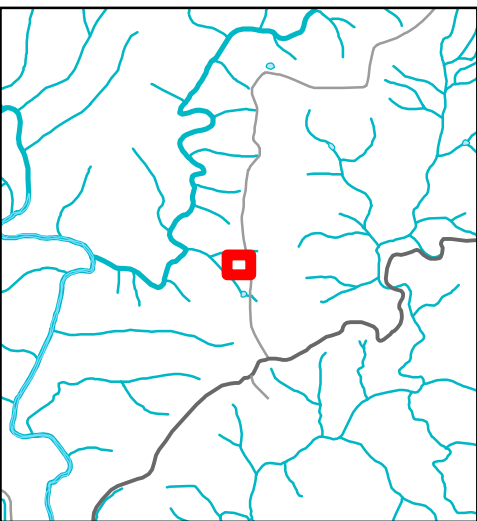
OEH 2017 Biodiversity Assessment Methodology (BAM). Office of Environment and Heritage for the NSW Government, Sydney.

State of Queensland Department of Environment and Science 2018.

Wildsite Ecological Services (WES) 2006. Lot 3 DP 601327 286 Mafeking Road Goonengerry Flora assessment. Byron Bay, NSW.

Appendices

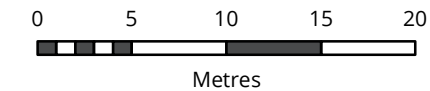
Appendix 1 APZ and 10/50 maps



Legend

-  Study area
-  Subject land
-  Property boundary
-  Existing development - main dwelling
-  Existing development
- APZ**
-  New APZ
-  Previous APZ

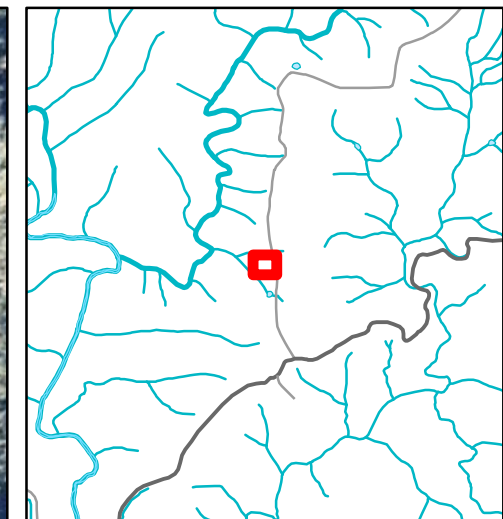
Map 1 APZ at the study area



Scale: 1:400 @ A3
Coordinate System: GDA 1994 MGA Zone 56

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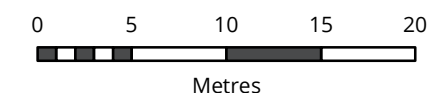
Matter: 28740
Date: 17 July 2019,
Checked by: RBA, Drawn by: AEDM, Last edited by: amurray
Location: P:\30400s\30430\Mapping\30430_M1_APZComparison



Legend

- Study area
- Subject land
- Property boundary
- Existing development - main dwelling
- Existing development
- Main dwelling - 10m buffer
- Main dwelling - 50m buffer
- Proposed development - 10m buffer
- Proposed development - 50m buffer

Map 2 10/50 areas as the study area



Scale: 1:400 @ A3
Coordinate System: GDA 1994 MGA Zone 56



Matter: 28740
Date: 17 July 2019,
Checked by: RBA, Drawn by: AEDM, Last edited by: amurray
Location: P:\30400s\30430\Mapping\30430_M2_10_50m_Comparison

Appendix 2 Flora

Flora species recorded in BAM plot

Notes to tables:

Status – EPBC Act: CE – Critically Endangered EN – Endangered VU – Vulnerable	Status – BC Act: E1 – endangered species (Part 1, Schedule 1) E2 – endangered population (Part 2, Schedule 1) E4 – presumed extinct (Part 4, Schedule 1) E4A – critically endangered V – vulnerable (Part 1, Schedule 2)
Status – Exotic # – Native species outside natural range * – priority weed species declared under the Biosecurity Act	

Table A.15 Flora species recorded from the study area

Scientific name	Common name	Recorded in BAM plot
Native species		
<i>Acmena smithii</i>	Lilly Pilly	X
<i>Adiantum hispidulum</i>	Rough Maidenhair	X
<i>Alpinia caerulea</i>	Native Ginger	X
<i>Archidendron muellerianum</i>	Veiny Lace Flower	X
<i>Archontophoenix cunninghamiana</i>	Bangalow Palm	X
<i>Asplenium australasicum forma australasicum</i>	Birds Nest Fern	X
<i>Canarium australasicum</i>		X
<i>Cissus antarctica</i>	Water Vine	X
<i>Commelina cyanea</i>	Native Wandering Jew	X
<i>Cryptocarya obovata</i>	Pepperberry	X
<i>Derris involuta</i>	Red Cedar	X
<i>Dianella caerulea</i>	Blue Flax Lily	X
<i>Endiandra pubens</i>	Hairy Walnut	X
<i>Ficus coronata</i>	Sandpaper Fig	X
<i>Guioa semiglauc</i>	Guioa	X
<i>Hicksbeachia pinnatifolia</i>	Red Boppel Nut	X

<i>Lastreopsis marginans</i>	Bordered Shield Fern	X
<i>Maclura cochinchinensis</i>	Cockspur	X
<i>Marsdenia rostratum</i>		X
<i>Neolitsea dealbata</i>	White Bolly Gum	X
<i>Omalanthus populifolius</i>	Bleeding Heart	X
<i>Oplismenus imbecilis</i>	Basket Grass	X
<i>Pandorea pandorana</i>	Wonga Wonga Vine	X
<i>Rubus molluccanus</i> var. <i>trilobus</i>	Native Raspberry	X
<i>Stenocarpus sinuatus</i>	Firewheel	X
<i>Stephania japonica</i>		X
<i>Toona ciliata</i>	Red Cedar	X
<i>Trema aspera</i>		X
<i>Wilkiea huegeliana</i>	Veiny Wilkiea	X
Exotic species		
* <i>Anredera cordifolia</i>	Madeira Vine	X
* <i>Cinnamomum camphora</i>	Camphor Laurel	X
* <i>Paspalum mandiocanum</i>	Broad leafed Paspalum	X
* <i>Passiflora suberosa</i>	Cork Passionfruit	X
* <i>Schefflera actinophylla</i>	Umbrella Tree	X

Table A.16 BAM Plot field data

OBJECTID	Plot_ID	Growth_Form	Species name	HighThreatWeed	Frequency	MAX_Cover
1	ipa1	Exotic	<i>Anredera cordifolia</i>		1	0.2
2	ipa 1	Exotic	<i>Cinnamomum camphora</i>	Y	1	30
3	ipa 1	Shrub (SG)	<i>Capparis arborea</i>		1	0.2
4	ipa 1	Exotic	<i>Paspalum mandiocanum</i>		1	0.9
5	ipa 1	Exotic	<i>Passiflora subpeltata</i>		1	1
6	ipa 1	Exotic	<i>Schefflera actinophylla</i>	Y	1	0.1
7	ipa 1	Other (OG)	<i>Stephania japonica</i> var. <i>japonica</i>		1	0.1
8	ipa 1	Fern (EG)	<i>Adiantum hispidulum</i>		1	0.1
9	ipa 1	Fern (EG)	<i>Asplenium australasicum</i>		1	2
10	ipa 1	Fern (EG)	<i>Platyserium superbum</i>		1	0.1
11	ipa 1	Fern (EG)	<i>Pteridium esculentum</i>		1	1
12	ipa 1	Forb (FG)	<i>Alpinia caerulea</i>		1	10
13	ipa 1	Forb (FG)	<i>Commelina cyanea</i>		1	0.5
14	ipa 1	Forb (FG)	<i>Dianella caerulea</i>		1	4
15	ipa 1	Grass & grasslike (GG)	<i>Oplismenus imbecillis</i>		1	1
16	ipa 1	Other (OG)	<i>Archontophoenix cunninghamiana</i>		1	1
17	ipa 1	Other (OG)	<i>Cissus antarctica</i>		1	3
18	ipa 1	Other (OG)	<i>Derris involuta</i>		1	0.1
19	ipa 1	Other (OG)	<i>Maclura cochinchinensis</i>		1	2
20	ipa 1	Other (OG)	<i>Marsdenia rostrata</i>		1	0.2

21	ipa 1	Other (OG)	<i>Pandorea pandorana</i>		1	0.2
22	ipa 1	Other (OG)	<i>Smilax australis</i>		1	0.5
23	ipa 1	Shrub (SG)	<i>Ficus coronata</i>		1	1
24	ipa 1	Shrub (SG)	<i>Homalanthus populifolius</i>		1	0.2
25	ipa 1	Shrub (SG)	<i>Rubus moluccanus</i> var. <i>trilobus</i>		1	0.1
26	ipa 1	Shrub (SG)	<i>Trema tomentosa</i> var. <i>aspera</i>		1	0.1
27	ipa 1	Shrub (SG)	<i>Wilkiea huegeliana</i>		1	5
28	ipa 1	Tree (TG)	<i>Acmena smithii</i>		1	10
29	ipa 1	Tree (TG)	<i>Archidendron muellerianum</i>		1	0.2
30	ipa 1	Tree (TG)	<i>Canarium australasicum</i>		1	10
31	ipa 1	Tree (TG)	<i>Cryptocarya obovata</i>		1	10
32	ipa 1	Tree (TG)	<i>Diploglottis australis</i>		2	5
33	ipa 1	Tree (TG)	<i>Endiandra pubens</i>		1	2
34	ipa 1	Tree (TG)	<i>Guioa semiglauca</i>		1	25
35	ipa 1	Tree (TG)	<i>Hicksbeachia pinnatifolia</i>		2	10
36	ipa 1	Tree (TG)	<i>Jagera pseudorhus</i> var. <i>pseudorhus</i>		1	10
37	ipa 1	Tree (TG)	<i>Neolitsea dealbata</i>		2	4
38	ipa 1	Tree (TG)	<i>Stenocarpus sinuatus</i>		1	20
39	ipa 1	Tree (TG)	<i>Toona ciliata</i>		1	8

Table A.17 Function and composition data Plot 1

funHighThreatExotic	30.3
funTreeRegen	1
funTreeStem50to80	1
funTreeStem30to50	1
funTreeStem20to30	1
funTreeStem10to20	1
funTreeStem5to10	1
funLenFallenLogs	54
funLitterCover	47
funHollowtrees	0
funLargeTrees	0
strucOther	7.1
strucFerns	3.2
strucForbs	14.5
strucGrass	1.0
strucShrub	6.6
strucTree	114.2
compOther	8
compFerns	4
compForbs	3
compGrass	1
compShrub	6
compTree	12
bearing	260
northing	6833329.5 8185
easting	541586.41 8787

Threatened flora species and ecological communities

The following table includes a list of the threatened flora species that have potential to occur within the study area. The list is based on database searches outlined in Section **Error! Reference source not found.**

Notes to tables:

Conservation status – EPBC Act:	Conservation status – BC Act:
CE – Critically Endangered	E – endangered species (Part 1, Schedule 1)
E – Endangered	E2 – endangered population (Part 2, Schedule 1)
V – Vulnerable	E4 – presumed extinct (Part 4, Schedule 1)
	E4A – critically endangered
	V1 – vulnerable (Part 1, Schedule 2)

Examples of criteria for determining the likelihood of occurrence for threatened biota as a guide for writing the rationale for likelihood have been listed below.

Likelihood of occurrence	Potential criteria for likely occurrence in study area
Recorded	<ul style="list-style-type: none"> Recorded in the study area during current assessment. Records in study area, as indicated by background research.
High	<ul style="list-style-type: none"> Species/ecological communities recorded in study area during current or previous assessment/s. Aquatic species recorded from connected waterbodies in close proximity to the study area during current or previous assessment/s. Sufficient good quality habitat is present in study area or in connected waterbodies in close proximity to the study area (aquatic species). Study area is within species natural distributional range (if known). Species has been recorded within five kilometres or from the relevant catchment/basin.
Medium	<ul style="list-style-type: none"> Records of terrestrial biota within five kilometres of the study area or of aquatic species in the relevant basin/neighbouring basin. Habitat limited in its capacity to support the species due to extent, quality, or isolation.
Low	<ul style="list-style-type: none"> No records within five kilometres of the study area or for aquatic species, the relevant basin/neighbouring basin. Marginal habitat present (low quality and extent). Substantial loss of habitat since any previous record(s).
Negligible	<ul style="list-style-type: none"> Habitat not present in study area. Habitat for aquatic species not present in connected waterbodies in close proximity to the study area. Habitat present but sufficient targeted survey has been conducted at an optimal time of year and species wasn't recorded.

Table A.18 Threatened flora species assessment

Scientific name, Common name	Conservation status		Source	Surveyed	Potential occurrence in study area	Potential for impact	Rationale	Habitat description*
	EPBC	BC						
<i>Acacia bakeri</i> Marblewood		V	BAM Calculator – Candidate species	Yes	Moderate	None	Not recorded within the subject land or study area.	Marblewood is a tree of 5 – 30 m with wrinkled bark and a rounded canopy that is much darker and denser than that of most wattles. Restricted to coastal south-east Queensland and north-east NSW, where it occurs north from Mullumbimby. Most plants are on private property. Marblewood grows in or near lowland subtropical rainforest, in adjacent eucalypt forest and in regrowth of both. It usually occurs in the understorey but may occur as a large canopy tree
<i>Acalypha eremorum</i> Acalypha		E	BAM Calculator – Candidate species	Yes	Moderate	None	Not recorded within the subject land or study area.	Acalypha is an open-branched twiggy-looking shrub 2 – 4 m tall. The branches have conspicuous raised spots and often bear spines at the tips. Though widespread and moderately common in south-east Queensland, in NSW it occurs in only a few localities, including the Chaelundi, Lismore and Burringbar areas in Subtropical rainforest, dry rainforest and vine thickets.
<i>Acronychia littoralis</i> Scented Acronychia	E	E	BAM Calculator – Candidate species	No	Low	None	Preferred habitat not present, not recorded.	Scented Acronychia is a small tree to 6 m high with 5 - 16 cm long oval-shaped glossy leaves on a short stalk. The lower surface of the leaves is paler than the upper surface and there are many oil dots visible. They have a pleasant aromatic smell when crushed. Scented Acronychia is found between Fraser Island in Queensland and Port Macquarie on the north coast of NSW. Scented Acronychia occurs

Scientific name, Common name	Conservation status		Source	Surveyed	Potential occurrence in study area	Potential for impact	Rationale	Habitat description*
	EPBC	BC						
								in transition zones between littoral rainforest and swamp sclerophyll forest; between littoral and coastal cypress pine communities; and margins of littoral forest. The species mainly occurs within 2km from the coast on sandy soil.
<i>Amyema plicatula</i>	E	E	BAM Calculator – Candidate species, SPRAT	No	Low	None	No mistletoe recorded and no trees containing mistletoe will be impacted by the proposal	Mistletoe confined to the Rocky Creek area north of Lismore. Grows in a remnant rainforest fragment adjacent to agricultural land. Grows in basalt derived soils.
<i>Angiopteris evecta</i> Giant Fern		E	BAM Calculator – Candidate species	No	Low	None	One plant known in NSW, not recorded.	The Giant Fern has huge, palm-like fronds up to 7 – 8 m long. The stems are thick, strong and green with a swollen base. Common in the Queensland wet tropics, rare in southern Queensland and only one plant known in the wild in NSW, in the Burringbar Range near Murwillumbah. The NSW plant is in regrowth rainforest in a wet gully.
<i>Archidendron hendersonii</i> White Lace Flower	V		BAM Calculator – Candidate species	Yes	Moderate	None	Not recorded within the study area.	Tree with a distribution spanning from far north Queensland to the Richmond River in north-east NSW. Grows in riverine and lowland subtropical rainforest, littoral rainforest, coastal cypress pine forest and their ecotones. Grows in a variety of soils including basalt, coastal sands and metasediments.
<i>Arthraxon</i>	V	V	BAM	No	Low		Preferred	Creeping perennial grass with a distribution

Scientific name, Common name	Conservation status		Source	Surveyed	Potential occurrence in study area	Potential for impact	Rationale	Habitat description*
	EPBC	BC						
<i>hispidus</i> Hairy Jointgrass			Calculator – Candidate species, SPRAT				habitat is not present on site and the species has not been recorded within the study area	spanning from the northern tablelands to the north coast of NSW. Grows in moist, shaded areas within the vicinity of rainforest and wet sclerophyll woodland, often close to waterbodies.
<i>Baloghia marmorata</i> Jointed Baloghia	V	V	BAM Calculator – Candidate species, SPRAT	Yes	Moderate	None	Not recorded within the study area and not present within the subject land.	Shrub or small tree growing in the Lismore district. Also found in south-east Queensland in the Tambourine Mountains and Springbrook area. Grows in subtropical rainforest, notophyll vine forest and wet sclerophyll forest at elevations of between 150 - 550 metres above sea level. Grows in basaltic soils.
<i>Belvisia mucronata</i> Needle-leaf Fern		E	BAM Calculator – Candidate species	Yes	Low	None	Preferred habitat not present, not recorded.	This fern has an underground stem that is densely covered with dark coloured scales. Fronds are up to 45 cm long, with a 1-5 cm stem. In NSW, it is known from only five locations on the far north coast, north from Evans Head. Forms small clumps on trees or rocks in dry rainforest or along creeks in moist open forest.
<i>Bosistoa transversa</i> Yellow Satinheart	V	V	BAM Calculator – Candidate species	Yes	Moderate	None	Not recorded within the study area and not present within the subject land	A crooked tree up to 22 m tall with a dense dark-green crown. The broad, leathery leaves are heart-shaped at the base and paired on the stem. From Maryborough in Queensland south to the Nightcap Range north of Lismore in north-east NSW. Three-leaved Bosistoa grows in wet sclerophyll forest, dry

Scientific name, Common name	Conservation status		Source	Surveyed	Potential occurrence in study area	Potential for impact	Rationale	Habitat description*
	EPBC	BC						
								sclerophyll forest and rainforest including highly disturbed habitat up to 300 m in altitude.
<i>Brachyscome ascendens</i> Border Ranges Daisy		E	BAM Calculator – Candidate species	No	Low	None	Preferred habitat not present, known from one location, not recorded.	This perennial daisy grows up to 30 cm tall. The toothed leaves have two to eight lobes and are up to 28 mm long by 8 mm wide. The flower is lavender with a yellow centre. Currently known from only one location in NSW, on the Tweed Escarpment in the Border Ranges National Park. Additional populations may occur at other clifftop sites along the Tweed Escarpment. Montane shrubland on clifftops and benches in thin, rocky soils of basaltic origin.
<i>Bulbophyllum globuliforme</i> Hoop Pine Orchid	V	V	BAM Calculator – Candidate species, SPRAT	No	Low	None	Not recorded within the study area and no Hoop Pines within the subject land.	Epiphytic orchid restricted to the McPherson Range between NSW and QLD. Grows on the upper trunk and branches of Hoop Pines <i>Araucaria cunninghami</i> at altitudes between 300 - 600 metres in elevation.
<i>Cassia marksiana</i> Cassia marksiana		E	BAM Calculator – Candidate species	No	Low	None	Out of known distribution preferred habitat not present, not recorded at the study area or subject land.	The golden-yellow summer flowers are fragrant and hang in large clusters from the fresh, lime-green foliage. Occurs north of Brunswick Heads, around Murwillumbah, and into south-east Queensland as far as Beenleigh. Found in littoral and riverine rainforest, and in regrowth vegetation on farmland and along roadsides. It prefers more fertile soil-types and is often found in low and flat sites.
<i>Choricarpia</i>		E	BAM	No	Low	None	Out of known	Giant Ironwood grows up to 30 m tall but, in NSW,

Scientific name, Common name	Conservation status		Source	Surveyed	Potential occurrence in study area	Potential for impact	Rationale	Habitat description*
	EPBC	BC						
<i>subargentea</i> Giant Ironwood			Calculator – Candidate species				distribution preferred habitat not present, not recorded at the study area or subject land.	most specimens are less than 8 m tall and consist of clumps of crooked trunks growing in dense patches. Known in NSW only from Mount Chincogan near Mullumbimby and one recent record at Jiggi north-west of Lismore, and in Queensland from Boonah to Imbil. Giant Ironwood is found in dry rainforest regrowth consisting of thickets growing in steeply sloping paddocks on basalt-derived soil as well as in sub-tropical and warm temperate rainforest.
<i>Clematis fawcettii</i> Northern Clematis	V	V	BAM Calculator – Candidate species	Yes	Moderate	None	Not recorded within the subject land.	Northern Clematis is a vine growing high into the rainforest canopy, but it is usually recognised only as small weak plants in the understorey. Found in widely dispersed areas in southern Queensland and in north-east NSW north from Lismore. Drier rainforest, usually near streams.
<i>Coatesia paniculata</i> Axe-Breaker		E	BAM Calculator – Candidate species	No	Low	None	Marginal habitat, not recorded within subject land or study area.	Axe-Breaker grows from 3 to 6 m in height, and has a dense head of deep green to yellow-green foliage. Very rare in north-east NSW, where it is known from the Tweed, Lismore and Wardell areas. Axe-Breaker is found in dry subtropical rainforest and vine scrub, often along rivers.
<i>Corchorus cunninghamii</i> Native Jute	E	E	BAM Calculator – Candidate species	No	Low	None	Out of known occurrence area, not recorded within subject land.	A perennial semi-herbaceous shrub that grows to 1.5 m tall. The leaves are 4 - 8 cm long and have coarsely-toothed edges. Occurs from the Richmond River in north-east NSW to the Brisbane River in Queensland. In NSW populations occur at Bungabbee and Toonumbar. Occurs in ecotones

Scientific name, Common name	Conservation status		Source	Surveyed	Potential occurrence in study area	Potential for impact	Rationale	Habitat description*
	EPBC	BC						
								between wet eucalypt forest and dry to dry-subtropical rainforest on sheltered slopes and gullies, and grassy, open forest on exposed slopes and ridges. Regenerates from seed that requires some form of mechanical disturbance or fire to break its dormancy.
<i>Corokia whiteana</i> Corokia	V	V	BAM Calculator – Candidate species	NO	Low	None	Restricted distribution, not recorded within subject land.	Shrub or small tree with a restricted distribution confined to three populations at Nightcap Range, Tweed Valley and close to the coast near Brunswick Heads. Grows in ecotones between wet eucalypt forest and warm temperate rainforest at elevations up to 8000 metres. Grows in nutrient poor soils.
<i>Cryptocarya foetida</i> Stinking Cryptocarya	V	V	BAM Calculator – Candidate species	Yes	Moderate	None	Not recorded within the study area or subject land	Small to medium sized tree distributed from the Coastal regions of south-east QLD to north-east NSW south of Iluka. Grows in Littoral, Warm Temperate and Subtropical Rainforest, Wet Sclerophyll Forest and Camphor Laurel Forest. Grows in sandy soils.
<i>Cryptostylis hunteriana</i> Leafless Tongue Orchid	V	V	SPRAT	No	Low	None	Preferred habitat not present and not recorded within the subject land	Orchid with a distribution spanning from Gibraltar Range National Park southwards to the coastal area near Orbost in Victoria. Grows in a variety of communities including Sydney Coastal Dry Sclerophyll Forests, Coastal Heath Swamps, New England Dry Sclerophyll Forests and Sydney Coastal Heaths. Grows in sandy soils.
<i>Cupaniopsis serrata</i>		E	BAM Calculator –	No	Low	None	Study area is out of known	Smooth Tuckeroo is a small tree with hairy branches and leaf stems. In northern NSW, it is

Scientific name, Common name	Conservation status		Source	Surveyed	Potential occurrence in study area	Potential for impact	Rationale	Habitat description*
	EPBC	BC						
Smooth Tuckeroo			Candidate species				distribution, not recorded in study area.	confined to the Tweed Valley. Occurs on rocky hillsides and subtropical and dry rainforest.
<i>Cynanchum elegans</i> White-flowered Wax Plant	E	E	BAM Calculator – Candidate species	No	Low	None	Preferred habitat not present and not recorded within the subject land.	Climbing vine restricted to eastern NSW from Brunswick Heads to Gerroa in the Illawarra region. Grows in rainforest gully scrub and scree slope on the edge of dry rainforests in a variety of communities including Coastal Floodplain Wetlands, Maritime Grasslands, Coastal Valley Grassy Woodlands and Northern Hinterland Wet Sclerophyll Forests.
<i>Cyperus rupicola</i> Cliff Sedge		V	BAM Calculator – Candidate species	No	Low	None	Preferred habitat not present, not recorded in subject land.	The Cliff Sedge is a tussock-forming perennial herb. It has three-sided, green flower-bearing stems, which are often rough textured, up to 100 cm high and 5 mm across. It is known from only two locations in NSW, near Mt Warning and within Nightcap National Park. Cliff Sedge grows amongst rocks on the exposed tops of cliffs and on cliff faces or at the base of cliffs, near forest.
<i>Cyperus semifertilis</i> Missionary Nutgrass	V	E	BAM Calculator – Candidate species	Yes	Low	None	Preferred habitat not present, known from only on site, not recorded within the subject land.	A tall slender perennial sedge with a horizontally creeping underground stem. The three-sided stems are 30 – 55 cm tall and about 1 mm thick. Currently known from only one site in NSW, in the Mullumbimby area, with an estimated population of about 50 plants. In Queensland it is known from the Mount Glorious, Mount Tamborine and Springbrook areas. Occurs in open forest

Scientific name, Common name	Conservation status		Source	Surveyed	Potential occurrence in study area	Potential for impact	Rationale	Habitat description*
	EPBC	BC						
								dominated by White Mahogany (Eucalyptus acmenoides) and wet sclerophyll forest with Sydney Blue Gum ((Eucalyptus saligna)) and Brush Box ((Lophostemon confertus)) .
<i>Davidsonia jerseyana</i> Davidson's Plum	E	E	BAM Calculator – Candidate species	Yes	High	None	Not recorded within the study area or subject land.	Small tree restricted to north-east NSW as far as Wardell. Grows at low altitudes near coastal areas in Subtropical Rainforest and Wet Sclerophyll Forest.
<i>Davidsonia johnsonii</i> Smooth Davidson's Plum	E	E	BAM Calculator – Candidate species	Yes	High	None	Not recorded within the study area or subject land.	Bushy tree with a distribution restricted to south-east Queensland and north-east NSW, south to Tintenbar. Grows at low altitudes in disturbed Subtropical Rainforest and on the margins of Wet Sclerophyll Forest with some individuals existing as remnant trees within cleared paddocks.
<i>Dendrocnide moroides</i> Gympie Stinger		E	BAM Calculator – Candidate species	Yes	Moderate	None	Not recorded within subject land or study area.	Gympie Stinger is a shrub to 4 m tall in the nettle family. The large, heart-shaped leaves are toothed and densely covered in stinging hairs that cause intense and persistent pain when they contact the skin. From north Queensland, where it is fairly common, south to the Clarence River in north-east NSW. It is very rare in the southern-most part of its range. Occurs in lowland rainforest, especially in gaps or other disturbed sites.
<i>Desmodium acanthocladum</i> Thorny Pea	V	V	BAM Calculator – Candidate species	No	Low	None	No riverine forest present, not recorded within the	Sprawling shrub restricted to north-east NSW in the Lismore, Grafton, Coraki, Casino and Mount Warning areas. Grows at low elevations in Dry Rainforest and on the fringes of Subtropical

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	EPBC	BC						
							study area or subject land.	Rainforest in soils derived from basalt.
<i>Diospyros mabacea</i> Red-fruited Ebony	E	E	BAM Calculator – Candidate species	No	Low	None	Restricted occurrence, no rivers present, not recorded within the study area or subject land.	Small tree occurring in north-east NSW on the Tweed and Oxley Rivers near Murwillumbah, Stotts Island on the Lower Tweed River and on the Brunswick River near Mullumbimby. Grows close to rivers in Lowland Subtropical Rainforest. Grows in basalt or alluvial soils.
<i>Diploglottis campbellii</i> Small-leaved Tamarind	E	E	BAM Calculator – Candidate species	No	Low	None	Restricted occurrence to coastal lowlands, not recorded within the study area or subject land.	Large tree distributed throughout the coastal lowlands between Richmond River on the far North Coast and Mudgeeraba Creek on the Gold Coast in Queensland. Restricted to lowland areas in warm Subtropical Rainforests. Grows in basalt or quartzite derived soils.
<i>Doryanthes palmeri</i> Giant Spear Lily		V	BAM Calculator – Candidate species	No	Low	None	Restricted occurrence to rocky outcrops and cliff tops, not recorded within the study area or subject land.	Large, Succulent herb, growing in far north-east NSW from the Mount Warning Caldera to Mount Billen. Grows on exposed rocky outcrops and cliff tops on coastal ranges adjacent to Subtropical Rainforest, Warm Temperate Rainforest and Wet Sclerophyll Forest. Grows on infertile soils or bare rock in a variety of soils including sand soils.
<i>Drynaria rigidula</i>		E	BAM Calculator –	Yes	Moderate	None	Not recorded within subject	The Basket Fern grows in a large clump, and has two different frond types; the lower 'nest' fronds,

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	EPBC	BC						
Basket Fern			Candidate species				land or study area.	are short, papery, brown and shaped like an oak-leaf. The green, more erect fronds may be up to 2 m in length and are segmented into many blunt-toothed leaflets on short stalks. Occurs widely in eastern Queensland as well as islands of the Pacific and parts of south-east Asia. In NSW it is only found north of the Clarence River, in a few locations at Maclean, Bogangar, Byron Bay, Mullumbimby, in the Tweed Valley and at Woodenbong.
<i>Eidothea hardeniana</i> Nightcap Oak	CE	E	BAM Calculator – Candidate species	No	Low	None	No preferred habitat, not recorded within subject land or study area	Nightcap Oak is a newly discovered tree in the Proteaceae (Banksia and Grevillea) family. The largest specimens are up to 40 m tall, although most are smaller. The bark is grey and slightly flaky, with fine horizontal crinkling. The tough leaves are paler on the underside. Adult leaves are dark green, smooth along the edges, and have distinctive pale veins. Leaves on juvenile plants are orange to red and strongly toothed with red veins and stalks. Nightcap Oak has been found only in the Nightcap Range north of Lismore. It occurs in upland warm temperate rainforest, usually near creeks.
<i>Elaeocarpus sedentarius</i> Minyon Quandong	E	E	BAM Calculator – Candidate species	Yes	Moderate	None	Not recorded in subject land or study area	Minyon Quandong is a medium to large tree up to 30 m tall. The leaves are alternate and have a long stalk with a swelling at the outer end. Thought to be extinct until 1992, the species is now known to occur in Whian Whian State Conservation Area and Nightcap National Park north of Lismore, and in

Scientific name, Common name	Conservation status		Source	Surveyed	Potential occurrence in study area	Potential for impact	Rationale	Habitat description*
	EPBC	BC						
								Mount Jerusalem National Park west of Mullumbimby.
<i>Elaeocarpus williamsianus</i> Hairy Quandong	E	E	BAM Calculator – Candidate species	Yes	High	None	Not recorded in subject land or study area	Small tree with a distribution restricted to a few sites between Goonengerry and Burringbar in north-east NSW. Grows in disturbed Warm Temperate and Subtropical Rainforest in soils derived from metasediments. Very rare.
<i>Endiandra floydii</i> Crystal Creek Walnut	E	E	BAM Calculator – Candidate species	Yes	Moderate	None	Not recorded in subject land or study area	Small tree confined to the Tweed and Brunswick valleys and Byron Bay area. Grows in sheltered locations, gullies, slopes, creek flats and ridgelines in Warm Temperate and Subtropical Rainforest, Wet Sclerophyll Forest with a Brush Box Lophostemon confertus overstorey and also in Camphor Laurel Forest from sea level to an elevation of 430 metres.
<i>Endiandra hayesii</i> Rusty Rose Walnut	V	V	BAM Calculator – Candidate species	Yes	Moderate	None	Not recorded in subject land or study area	Small to medium sized tree distributed from Burleigh Heads in Queensland to the Richmond River in north-east NSW. Grows in lowland Subtropical Rainforest and in rainforest regrowth in cool, moist sheltered valleys. Grows in basaltic and alluvium soils alluvium.
<i>Endiandra muelleri</i> subsp. <i>bracteata</i> Green-leaved Rose Walnut		E	BAM Calculator – Candidate species	Yes	High	None	Not recorded in subject land or study area	Large tree sparsely distributed from Maclean in north-east NSW to Queensland. Grows at lower altitudes in a variety of communities including, North Coast Wet Sclerophyll Forests, Northern Escarpment Wet Sclerophyll Forests, Subtropical Rainforest, Warm Temperate Rainforest, Littoral Rainforest and Brush Box Forest including regrowth

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	EPBC	BC						
								and disturbed situations. Grows in soils derived from sedimentary, metamorphic and volcanic substrates.
<i>Floydia praealta</i> Ball Nut	V	V	BAM Calculator – Candidate species	Yes	High	None	Not recorded in subject land or study area	Tall tree consisting of small scattered populations distributed from Gympie in Queensland to the Clarence River in north-east NSW. Grows in a variety of communities including Coastal Floodplain Wetlands, Coastal Swamp Forests, Subtropical Rainforests, and Northern Escarpment Wet Sclerophyll Forests. Grows on basaltic soils.
<i>Gossia fragrantissima</i> Sweet Myrtle	E	E	BAM Calculator – Candidate species	Yes	High	None	Not recorded in subject land or study area	Multistemmed shrub or small tree with a distribution from south-east Queensland to the Richmond River in NSW. Grows in Coastal districts in a variety of communities including Coastal Floodplain Wetlands, Coastal Swamp Forests, Dry Rainforests, Littoral Rainforests, Subtropical Rainforests and Northern Hinterland Wet Sclerophyll Forests. Grows in basalt derived soils.
<i>Hicksbeachia pinnatifolia</i> Red Boppel Nut	V	V	BAM Calculator – Candidate species	Yes	High	Low	Recorded within the subject land and within the study area. No plants will be removed as a result of the proposal.	Small tree distributed along the coastal areas of north-east NSW from south-east Queensland to Nambucca Valley. Grows in Dry Rainforests, Northern Warm Temperate Rainforests, Subtropical Rainforests, Northern Hinterland Wet Sclerophyll Forests, North Coast Wet Sclerophyll Forests, and Northern Escarpment Wet Sclerophyll Forests.

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	EPBC	BC						
<i>Isoglossa eranthemoides</i> Isoglossa	E1	EN	BAM Calculator – Candidate species	Yes	Moderate	Low	Not recorded, no similar species (eg <i>Pseuderanthemum</i>) recorded within the subject land	Small herb with a restricted distribution from Tweed to the Lismore area in north-east NSW. Grows in moist areas on floodplains, slopes and the understorey of a variety of communities including Coastal Floodplain Wetlands, Dry Rainforests, Subtropical Rainforests, Littoral Rainforests and Northern Hinterland Wet Sclerophyll Forests. Grows on soils derived from basalt, metasediments or gabbro.
<i>Lepiderema pulchella</i> Fine-leaved Tuckeroo		V	BAM Calculator – Candidate species	No	Low	None	Preferred habitat not present and not recorded within the subject land.	Small rainforest tree confined to the NSW north coast with a distribution spanning from north of Brunswick Heads to Queensland. Grows in Dry Rainforests, Littoral Rainforests, Subtropical Rainforests, Northern Hinterland Wet Sclerophyll Forests, North Coast Wet Sclerophyll Forests and Northern Escarpment Wet Sclerophyll Forests. Grows on infertile metasediments, fertile basalts and backswamp alluvium in the Tweed Valley.
<i>Lindsaea brachypoda</i> Short-footed Screw Fern		E	BAM Calculator – Candidate species, SPRAT	Yes	Moderate	None	Not recorded within the subject land or study area	Small lithophytic fern found growing in a few locations north of Minyon Falls in Nightcap National Park including Tumbulgum, Mullumbimby and Mooball. Grows on banks and rocks in moist areas in Northern Warm Temperate Rainforests, Subtropical Rainforests and North Coast Wet Sclerophyll Forests.
<i>Macadamia tetraphylla</i>	V	VU	BAM Calculator –	Yes	High	None	Not recorded within the	Small to medium sized tree confined to the north of Richmond River in north-east NSW. Grows along the

Scientific name, Common name	Conservation status		Source	Surveyed	Potential occurrence in study area	Potential for impact	Rationale	Habitat description*
	EPBC	BC						
Rough-shelled Bush Nut			Candidate species				subject land or study area	coast in Coastal Floodplain Wetlands, Coastal Swamp Forests, Dry Rainforests, Littoral Rainforests, Subtropical Rainforests, North Coast Wet Sclerophyll Forests, and Northern Escarpment Wet Sclerophyll Forests.
<i>Marsdenia longiloba</i> Slender Marsdenia	V	E	BAM Calculator – Candidate species	Yes	Moderate	none	No associated species recorded within the study area, no unidentified Marsdenia species recorded within the subject land.	Slender Marsdenia is a slender climber of the milk vine group, with pairs of very finely pointed leaves and 5-6 tiny glands at the base of the leaves. At scattered sites on the north coast of NSW north from Barrington Tops. Also occurs in south-east Queensland in Subtropical and warm temperate rainforest, lowland moist or open eucalypt forest adjoining rainforest and, sometimes, in areas with rock outcrops. Associated species include Eucalyptus crebra, E. microcorys, E. acmenoides, E. saligna, E. propinqua, Corymbia intermedia and Lophostemon confertus.
<i>Melicope vitiflora</i> Coast Euodia		E	BAM Calculator – Candidate species	Yes	Moderate	None	Not recorded within the subject land or study area.	Small tree with a distribution that reaches its southern extent in north-east NSW with small, sparsely scattered populations growing in coastal areas near Brunswick Heads and Ocean Shores, Broken Head and in the Tweed Valley and Nightcap Range. Grows in Subtropical and Littoral Rainforests.
<i>Myrsine richmondensis</i> Ripple-leaf	E	E	BAM Calculator – Candidate	No	Low	None	Restricted occurrence and not recorded	A very bushy small tree or large shrub, with shiny, wavy edged foliage. Flushes of new growth are lime-green. Known only from a few populations at

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	EPBC	BC						
Muttonwood			species				within the subject land or study area	Coraki, Boatharbour near Lismore, and the Cherry Tree area west of Casino. Subtropical and dry rainforest and swamp forest on creek flats and slopes on basalt derived soil and alluvial deposits.
<i>Niemeyera whitei</i> Rusty Plum, Plum Boxwood	V		BAM Calculator – Candidate species	Yes	Moderate	None	Preferred habitat not present and not recorded within the subject land or study area	Small to medium sized tree found growing along the coast and adjacent ranges of northern NSW from the Macleay River to southern Queensland. Found growing in the understorey of a variety of communities including Coastal Dune Dry Sclerophyll Forests, Dry Rainforests, Subtropical Rainforests, Littoral Rainforests, Northern Escarpment Wet Sclerophyll Forests and Southern Tableland Wet Sclerophyll Forests. Grows in nutrient poor soils.
<i>Oberonia complanata</i> Yellow-flowered King of the Fairies		E	BAM Calculator – Candidate species	Yes	Moderate	None	Not recorded within the subject land or the study area.	Yellow-flowered King of the Fairies is a small orchid which grows on trees or rocks. Each plant possesses one to many shoots in a tight, iris-like clump. There are 3-8 leaves per shoot. Within NSW, there are several historical collections (all pre 1917) of this species from Byron Bay and Lismore, and a collection from Coffs Harbour from 1961. More recent observations of this species have been made from Lismore and Wollumbin. This species grows on trees and rocks in littoral rainforest, subtropical rainforest, dry rainforest, wet or dry eucalypt forests, dunes (including stabilised sands), stream-side areas, swampy forests and mangroves.
<i>Ochrosia</i>	E	E	BAM	Yes	Moderate	None	Not recorded	Small, sometimes crooked tree sparsely distributed

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	EPBC	BC						
<i>moorei</i> Southern Ochrosia			Calculator – Candidate species				within the subject land or the study area.	throughout north-east NSW from the Richmond River to south-east Queensland. Grows in Coastal Floodplain Wetlands, Coastal Swamp Forests, Dry Rainforests, Subtropical Rainforests, Northern Hinterland Wet Sclerophyll Forests, North Coast Wet Sclerophyll Forests and Northern Escarpment Wet Sclerophyll Forests.
<i>Owenia cepiodora</i> Onion Cedar	V	V	BAM Calculator – Candidate species	Yes	Moderate	None	Not recorded within the subject land or the study area.	Tall, evergreen tree with a distribution extending north from the Richmond River in north-east NSW to the Queensland border. Found growing in Dry Rainforests, Subtropical Rainforests, Northern Hinterland Wet Sclerophyll Forests, North Coast Wet Sclerophyll Forests and Northern Escarpment Wet Sclerophyll Forests. Grows near soils derived from basalt.
<i>Phaius australis</i> Southern Swamp Orchid	E	E	SPRAT	No	Low	None	Preferred habitat nor present and not recorded.	Terrestrial orchid with a distribution spanning from Queensland to Coffs Harbour in north-east NSW. Grows in coastal areas in swamps dominated by Broad-leaved Paperbark <i>Meleuca quinquenervia</i> and swampy forest situated at sea level in Coastal Dune Dry Sclerophyll Forests, Coastal Floodplain Wetlands, Coastal Swamp Forests, Wallum Sand Heaths, Dry Rainforests, Littoral Rainforests, North Coast Wet Sclerophyll Forests and Northern Escarpment Wet Sclerophyll Forests.
<i>Ozothamnus vagans</i>	V	E	BAM Calculator –	No	Low	None	Habitat out of known range,	A straggling, spindly shrub up to 2 m high. Branches are prominently ridged, hairless or with loose

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	EPBC	BC						
Wollumbin Dogwood			Candidate species				Not recorded within the subject land or study area.	webby hairs on young growth. Restricted to Mt Warning and the Tweed and McPherson Ranges of north east NSW and south east Queensland. Mostly recorded from open situations on the margins of, or within, wet sclerophyll forest, subtropical rainforest and cool temperate rainforest generally associated with rhyolite or basalt soils and occurs at elevations of greater than 500 m.
<i>Peristeranthus hillii</i> Brown Fairy-chain Orchid		V	BAM Calculator – Candidate species	No	Low	None	Not within geographical limitation, preferred habitat within the subject land or study area and not recorded.	An endemic Australian orchid with a pendulous habit, that grows on tree trunks and thick vines. Flowering stems hang vertically, with the flowers facing downward. Restricted to coastal and near-coastal environments, particularly Littoral Rainforest and the threatened ecological community Lowland Rainforest on Floodplain.
<i>Phyllanthus microcladus</i> Brush Sauropus		E	BAM Calculator – Candidate species	No	Low	None	No preferred habitat within the subject land or study area and not recorded.	Small shrub with a distribution confined to a few locations in the Tweed, Brunswick, Richmond and Wilson River Valleys with a further outlying population at Grafton. Found growing along creeks or rivers in rainforest or streamside forest in North Coast Dry Sclerophyll Forests, Coastal Swamp Forests, Eastern Riverine Forests, Coastal Valley Grassy Woodlands, Dry Rainforests, Northern Warm Temperate Rainforests and Subtropical Rainforests. Usually found on banks of creeks and rivers, in

Scientific name, Common name	Conservation status		Source	Surveyed	Potential occurrence in study area	Potential for impact	Rationale	Habitat description*
	EPBC	BC						
								streamside rainforest or dry rainforest.
<i>Plectranthus nitidus</i> Nightcap Plectranthus	E	E	BAM Calculator – Candidate species	No	Low	None	Habitat constraints not present, not recorded within the subject land or study area.	A small shrub that grows 30 - 150 cm tall and has rounded leaves with serrated edges. Branches are erect and sparsely covered with short hairs. The species occurs within north-east NSW and south-east Queensland. In NSW it was previously known only from Nightcap National Park near Terania Creek in northern NSW. However, the species has now been recorded as far south as Chaelundi National Park near Nymboida. Grows on rocky cliff-faces and boulders, in the shelter and shade provided by the adjacent rainforest and dry rainforest. Co-occurs with <i>Plectranthus graveolens</i> and Crofton Weed.
<i>Pomaderris notata</i> McPherson Range Pomaderris		V	BAM Calculator – Candidate species	No	Low	None	Out of geographic limitation, no preferred habitat within the subject land or study area and not recorded.	The McPherson Range Pomaderris is a shrub that grows to 2m high. The stems are short and woolly. The McPherson Range Pomaderris occurs mainly in Queensland. In NSW it is known from five sites in the McPherson and Tweed Range areas, including Mount Warning National Park, Mebbin National Park and Limpinwood Nature Reserve. McPherson Range Pomaderris is known from rocky basalt ranges in montane heaths and scrubs or in scrubby rainforest on valley floors.
<i>Psilotum complanatum</i> Flat Fork Fern		E	BAM Calculator – Candidate	No	Low	None	Possibly extinct, not recorded in the	Small epiphytic fern with a distribution in Queensland, the Pacific and tropical America and a historical record from the Ballina area in NSW but

Scientific name, Common name	Conservation status		Source	Surveyed	Potential occurrence in study area	Potential for impact	Rationale	Habitat description*
	EPBC	BC						
			species				subject land or study area.	has not been seen in many years. Found growing in Littoral Rainforests and Subtropical Rainforests.
<i>Randia moorei</i> Spiny Gardenia	E	E		Yes	Moderate	None	No preferred habitat within the subject land or study area and not recorded.	Spiny Gardenia is a tall shrub or small tree to about 8 m tall, often with coppice shoots and root suckers at the base. Found from Lismore in north-east NSW north to the Logan River in south-east Queensland. Sparsely distributed, with most records in the Tweed and Brunswick areas. Spiny Gardenia occurs in subtropical, riverine, littoral and dry rainforest. In NSW, Hoop Pine and Brush Box are common canopy species. It is found along moist scrubby water courses at altitudes up to 360 m asl, with most records below 100 m asl.
<i>Rhodamnia rubescens</i> Scrub Turpentine		CE	BAM Calculator – Candidate species	Yes	High	Low	ordered by Wildsite (2006) in the study area. Not recorded in the subject land.	Shrub or small tree to 25 m high with reddish/brown, fissured bark. Young stems densely covered in fine hairs. Occurs in coastal districts north from Batemans Bay in New South Wales, approximately 280 km south of Sydney, to areas inland of Bundaberg in Queensland. Populations of <i>R. rubescens</i> typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m a.s.l. in areas with rainfall of 1,000-1,600 mm. Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils. This species is characterised as highly to extremely susceptible to infection by Myrtle Rust. Myrtle Rust affects all plant

Scientific name, Common name	Conservation status		Source	Surveyed	Potential occurrence in study area	Potential for impact	Rationale	Habitat description*
	EPBC	BC						
								parts.
<i>Sarcochilus dilatatus</i> Brown Butterfly Orchid		E	BAM Calculator – Candidate species	No	Low	none	Very rare, only one known occurrence, Hoop Pine not present, not recorded.	Brown Butterfly Orchid grows on rainforest trees. It has greenish-red to brown flowers with a white lip marked yellow and purple. The flowers are present during summer and autumn and are followed by dry fruit capsules. Brown Butterfly Orchid occurs in Queensland and north-east NSW. In NSW it is very rare, with the only recent record being from a single location near Hortons Creek. Grows on trees in littoral rainforest, subtropical rainforest, dry rainforest and streamside forests, mainly at low to medium (up to 500m) altitudes. Plants favour Hoop Pine as a host.
<i>Sarcochilus weinthalii</i> Blotched Sarcochilus	V	V	BAM Calculator – Candidate species	Yes	Moderate	none	Not recorded within subject land.	The Blotched Sarcochilus is an orchid that grows on rainforest trees, either projecting or partly hanging from the trunks. It has fleshy aerial roots and short stems with several thin leathery leaves. yellow-green, elongated ribbed capsule up to 6cm in length. The coastal and sub-coastal ranges predominantly north from the Richmond River in north-east NSW, to south of Gympie in Queensland. Rainforest, wet sclerophyll, dry rainforest and drier scrubs, often in isolated patches, from 300 to 900 m in altitude.
<i>Senna acclinis</i> Rainforest Cassia		E	BAM Calculator – Candidate	Yes	Moderate	None	Not recorded within the subject land or	Rainforest Cassia is a shrub to 3 m tall with compound leaves to 15 cm long, each with up to 6 pairs of oval-shaped leaflets at about 15 mm

Scientific name, Common name	Conservation status		Source	Surveyed	Potential occurrence in study area	Potential for impact	Rationale	Habitat description*
	EPBC	BC						
			species				study area.	intervals along the central spine. Occurs in coastal districts and adjacent tablelands of NSW from the Illawarra in NSW to Queensland. Grows on the margins of subtropical, littoral and dry rainforests. Often found as a gap phase shrub.
<i>Sophora fraseri</i> Brush Sophora	V	V	BAM Calculator – Candidate species	Yes	Moderate	none	Preferred habitat not present, not recorded within subject land or study area.	Brush Sophora is a small sparsely branched shrub growing 1 - 2 m tall, which belongs to the pea family. The whole plant is covered in soft short hairs. Bush Sophora occurs north from the Casino district in north-east NSW, where it is very rare. Also in south-east Queensland where it is widespread but not common. Brush Sophora is usually found in wet situations in wet sclerophyll forest or vine forest, often near rainforest.
<i>Symplocos baeuerlenii</i> Small-leaved Hazelwood	V	V	BAM Calculator – Candidate species	Yes	Moderate	none	Not recorded within subject land or study area.	Tall shrub or small tree found growing between the Tweed and Brunswick Valleys including within the Nightcap and Mount Jerusalem National Parks. Found growing on the banks of watercourses, the beds of creeks or on roadsides in Littoral Rainforests, Northern Warm Temperate Rainforests and Subtropical Rainforests. Grows in soils derived from rhyolite.
<i>Syzygium hodgkinsoniae</i> Red Lilly Pilly	V	V	BAM Calculator – Candidate species	Yes	Moderate	None	Not recorded within subject land or study area	Small tree with a restricted range from the Richmond River in north-east NSW to Gympie in Queensland. Found growing in Coastal Floodplain Wetlands, Coastal Swamp Forests, Dry Rainforests, Subtropical Rainforests, Northern Hinterland Wet

Scientific name, Common name	Conservation status		Source	Surveyed	Potential occurrence in study area	Potential for impact	Rationale	Habitat description*
	EPBC	BC						
								Sclerophyll Forests, North Coast Wet Sclerophyll Forests and Northern Escarpment Wet Sclerophyll Forests. Grows in rich alluvial or basaltic soils.
<i>Syzygium moorei</i> Durobby	V	V	BAM Calculator – Candidate species	Yes	High	None	Previous record within the study area (Wildsite 2006) could not be located, not recorded within subject land or study area.	Tall rainforest tree with a distribution encompassing the Richmond, Tweed and Brunswick River Valleys in north-east NSW. Found growing at low elevations in Coastal Floodplain Wetlands, Coastal Swamp Forests, Dry Rainforests, Subtropical Rainforests, Northern Hinterland Wet Sclerophyll Forests, North Coast Wet Sclerophyll Forests and Northern Escarpment Wet Sclerophyll Forests, sometimes also occurring as an isolated paddock tree or on roadsides.
<i>Thesium australe</i> Austral Toadflax	V	V	SPRAT	No	Low	None	Preferred habitat not present, not recorded.	Small, straggling herb with a distribution comprising of small populations scattered along the coast of eastern NSW including the Northern and Southern Tablelands, Tasmania, Queensland and eastern Asia. A root parasite found growing on damp sites in grassland, grassy woodlands and coastal headlands often in association with Kangaroo Grass <i>Themeda triandra</i> in a variety of communities including New England Dry Sclerophyll Forests, Western Slopes Grasslands, Northern Tableland Wet Sclerophyll Forests, Brigalow Clay Plain Woodlands, Subalpine Woodlands and Maritime Grasslands.
<i>Tinospora</i>		V	BAM	Yes	High	None	Not recorded	Tall woody climber with a distribution spanning

Scientific name, Common name	Conservation status		Source	Surveyed	Potential occurrence in study area	Potential for impact	Rationale	Habitat description*
	EPBC	BC						
<i>tinoporoides</i> Arrow-head Vine			Calculator – Candidate species				within subject land or study area.	north from the Richmond River in north-east NSW with an additional population in south-east Queensland. Found growing in Littoral Rainforests and Subtropical Rainforests. Grows in fertile soils derived from basalt.
<i>Uromyrtus australis</i> Peach Myrtle	E	E	SPRAT	No	Low	None	Outside of geographic limitations, present, not recorded.	Tall shrub or small tree restricted to the Nightcap and Mount Jerusalem National Parks and Whian Whian State Conservation Area west of Mullumbimby. Found growing in association with Coachwood <i>Ceratopetalum apetalum</i> in Northern Warm Temperate Rainforests. Grows in low fertility soils over rhyolitic substrates.
<i>Xylosma terrae-reginae</i> Queensland Xylosma		E	Outside of geographic limitations, present, not recorded.	No	Low	None	Sands and metasediment not present, not recorded.	Queensland Xylosma is a tall shrub or small tree growing to 15 m tall. Its trunk is crooked with low branches, and has smooth grey bark with fine vertical lines. The species is found along coastal areas in north-east NSW from Ballina, north to the Maryborough region in Queensland. Littoral and subtropical rainforest on coastal sands or soils derived from metasediments.
<i>Zieria adenodonta</i> Wollumbin Zieria		E	Outside of geographic limitations, present, not recorded.	No	Low	None	Outside of geographic limitations, present, not recorded.	Wollumbin Zieria is a dense bushy shrub up to 3 m high by 2 m wide. Its branchlets are warty and felted with soft hairs. Occurs only near the top of Mount Warning in the Tweed district in NSW. Also occurs in South-east Queensland. Dense shrubby vegetation on steep rocky slopes, with tea-tree, bottlebrushes and grass-trees.

- Bold denotes species surveyed

Appendix 3 Fauna

Fauna species recorded from the study area

Below is a list of fauna species recorded from the study area during the present assessment and a list of threatened fauna species recorded or predicted to occur within the study area. Fauna species in these tables are listed in alphabetical order within their taxonomic group.

Notes to table:

Status – EPBC Act: CE – Critically Endangered E – Endangered V – Vulnerable	Status – BC Act: E – endangered species (Part 1, Schedule 1) E2 – endangered population (Part 2, Schedule 1) E4 – presumed extinct (Part 4, Schedule 1) E4A – critically endangered V – vulnerable (Part 1, Schedule 2)
	Status – Non-indigenous species * pest species not native to the area

Table A.19 Vertebrate fauna recorded from the study area (current assessment)

Scientific name	Common name	Commonwealth status	NSW status
Birds			
<i>Macropygia amboinensis</i>	Brown Cuckoo-Dove	-	-
<i>Psophodes olivaceus</i>	Eastern Whipbird	-	-
<i>Strepera graculina</i>	Pied Currawong	-	-
<i>Platycercus eximius</i>	Eastern Rosella	-	-
<i>Pardalotus punctatus</i>	Spotted Pardalote	-	-
<i>Geopelia humeralis</i>	Bar-shouldered Dove	-	-
<i>Calyptorhynchus funereus</i>	Yellow-tailed Black-Cockatoo	-	-
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	-	-
<i>Columba leucomela</i>	White-headed Pigeon	-	-
<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo	-	-
Mammals			
<i>Wallabia bicolor</i>	Swamp Wallaby	-	-
<i>Pseudocheirus peregrinus</i>	Ringtail Possum	-	-
Reptiles			
<i>Tiliqua scincoides scincoides</i>	Eastern Blue-tongued Lizard	-	-
<i>Varanus varius</i>	Lace Monitor	-	-

Scientific name	Common name	Commonwealth status	NSW status
<i>Lampropholis guichenoti</i>	Garden Skink	-	-
Snake species unidentified	Snake species unidentified		
Insects			
<i>Euschemon rafflesia</i>	Regent Skipper	-	-

Threatened fauna species

The following table includes a list of the threatened fauna species that have potential to occur within the study area. The list is based on searches outlined in Section **Error! Reference source not found..**

Notes to tables:

Conservation status – EPBC Act: CR – Critically Endangered EN – Endangered VU – Vulnerable	Conservation status – BC Act: E1 – endangered species (Part 1, Schedule 1) E2 – endangered population (Part 2, Schedule 1) E4 – presumed extinct (Part 4, Schedule 1) E4A – critically endangered V1 – vulnerable (Part 1, Schedule 2)
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Examples of criteria for determining the likelihood of occurrence for threatened biota as a guide for writing the rationale for likelihood have been listed below.

Likelihood of occurrence	Potential criteria
High	<ul style="list-style-type: none"> Species recorded in study area during current or previous assessment/s. Aquatic species recorded from connected waterbodies in close proximity to the study area during current or previous assessment/s. Sufficient good quality habitat is present in study area or in connected waterbodies in close proximity to the study area (aquatic species). Study area is within species natural distributional range (if known). Species has been recorded within 5 kilometres or from the relevant catchment/basin.
Medium	<ul style="list-style-type: none"> Records of terrestrial species within 5 kilometres of the study area or of aquatic species in the relevant basin/neighbouring basin. Habitat limited in its capacity to support the species due to extent, quality, or isolation.
Low	<ul style="list-style-type: none"> No records within 5 kilometres of the study area or for aquatic species, the relevant basin/neighbouring basin. Marginal habitat present (low quality and extent). Substantial loss of habitat since any previous record(s).
Negligible	<ul style="list-style-type: none"> Habitat not present in study area. Habitat for aquatic species not present in connected waterbodies in close proximity to the study area. Habitat present but sufficient targeted survey has been conducted at an optimal time of year and species wasn't recorded.
Transient/ Nomadic	<ul style="list-style-type: none"> Migratory or nomadic fauna species/individuals that may occur in the study area from time to time, but are not considered resident.

Table A.20 Threatened fauna species assessment

Scientific name	Type of species record	Status EPBC Act	Status BC Act	Potential occurrence in subject land	Survey required/under taken	Potential for impact	Rationale	Habitat description*
<i>Aepyprymnus rufescens</i> Rufous Bettong	Database searches (BioNet)		V	Low	Habitat assessment, indirect evidence (scats)	Negligible	Not associated with vegetation type in this area. Records rare. Recorded in wet forests of Whian Whian SCA.	Patchy distribution from Cooktown, Queensland, to north-eastern NSW as far south as Mt Royal National Park. In NSW it has largely vanished from inland areas. Occurs in a variety of habitats from coastal eucalypt forest, through tall, wet sclerophyll, to low, dry open woodland. Only occurs in areas with a sparse or grassy understorey, adjacent to areas of dense undergrowth.
<i>Antechinus arktus</i> Black-tailed Antechinus	BAM Candidate species	E	E	Low	Habitat assessment	Low	Subject land does not contain known habitat vegetation type. Subject land below high altitude area.	The Black-tailed Antechinus is a small, nocturnal, insectivorous marsupial. The species is a relatively large-bodied (46-120 g) antechinus and has a marked change of colour from greyish-brown fur on the head, chest and shoulders to an orange-brown toned rump. The species occurs in areas of highest altitude and rainfall at the summit of the Tweed Volcano caldera of far south-east Queensland and north-east New South Wales. The distribution of the species appears to be contracting altitudinally, with no recent records in some lower altitude areas where it was found in the 1970s-80s. The species is found in cool subtropical cloud forest / rainforest comprising complex notophyll vine forest and simple microphyll fern forest featuring a low canopy, very

Scientific name	Type of species record	Status EPBC Act	Status BC Act	Potential occurrence in subject land	Survey required/under taken	Potential for impact	Rationale	Habitat description*
								dense vines and a rocky substrate.
<i>Cercartetus nanus</i> Eastern Pygmy-possum	BAM Calculator – Candidate species		V	Low	Active searches for potential nests and nest sites – logs, shrubs, small trees, hollows and suitable foraging areas, Camera trap – 14 nights	Low	One existing record from 1985 in the Byron LGA. No dreys or potential nest sites recorded in the subject land. Logs and rotten stumps will be retained. No hollows will be impacted by the proposal. Unlikely to occur based on survey results and lack of understorey shrubs and preferred food sources.	Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; soft fruits are eaten when flowers are unavailable. Also feeds on insects throughout the year; this feed source may be more important in habitats where flowers are less abundant such as wet forests. Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum <i>Pseudocheirus peregrinus</i> dreys or thickets of vegetation.
<i>Chalinolobus dwyeri</i> Large-eared Pied Bat	SPRAT	V	V	Low	None	Low	No canopy trees will be removed as a result of the proposal, no caves or other roost structures will be affected.	Occurs from the Queensland border to Ulladulla, with largest numbers from the sandstone escarpment country in the Sydney Basin and Hunter Valley. Primarily found in dry sclerophyll forests and woodlands, but also found in rainforest fringes and subalpine woodlands. Forages on small, flying insects below the forest canopy. Roosts in colonies of between three and 80 in caves, Fairy Martin nests and mines, and beneath rock overhangs, but usually less than 10

Scientific name	Type of species record	Status EPBC Act	Status BC Act	Potential occurrence in subject land	Survey required/under taken	Potential for impact	Rationale	Habitat description*
								individuals. Likely that it hibernates during the cooler months. The only known existing maternity roost is in a sandstone cave near Coonabarabran.
<i>Coeranoscincus reticulatus</i> Three-toed Snake-tooth Skink	BAM Calculator – Candidate species	V	V	Moderate	Survey of leaf litter, logs and small rocks, camera survey at two locations.	Low	Marginal habitat based on soil type. No mapped records in Byron LGA. Not recorded during site surveys or by camera surveys. Preclearance survey of rocks and logs to be undertaken prior to construction	The Three-toed Snake-tooth Skink is a large burrowing lizard with a head and body length of up to 23 cm and a thick, long tail. It has four very short legs, each with three clawed toes, and has long, curved teeth. The Three-toed Snake-tooth Skink occurs on the coast and ranges from the Macleay valley in NSW to south-eastern Queensland. Habitat is rainforest and occasionally moist eucalypt forest, on loamy or sandy soils. The Three-toed Snake-tooth Skink lives in loose soil, leaf litter and rotting logs, and feeds on earthworms and beetle grubs. Also, garden beds and urban yards under leaf litter on alluvial soils.
<i>Dasyurus maculatus</i> Spotted-tailed Quoll	Ecosystem credit species	E	V	Low	Survey not required	Low	Marginal habitat, no hollows and no signs of den sites within subject land.	Occurs along the east coast of Australia and the Great Dividing Range. Uses a range of habitats including sclerophyll forests and woodlands, coastal heathlands and rainforests. Habitat requirements include suitable den sites, including hollow logs, rock crevices and caves, an abundance of food and an area of intact vegetation in which to forage. Seventy per cent of the diet is medium-sized mammals, and also feeds on invertebrates, reptiles and birds. Individuals require large areas of relatively intact

Scientific name	Type of species record	Status EPBC Act	Status BC Act	Potential occurrence in subject land	Survey required/under taken	Potential for impact	Rationale	Habitat description*
								vegetation through which to forage. The home range of a female is between 180 and 1000 ha, while males have larger home ranges of between 2000 and 5000 ha.
<i>Hoplocephalus bitorquatus</i> Pale-headed Snake	BAM Calculator – Candidate species		V	Low	Habitat survey, tree search, camera trap survey.	Low	No habitat trees within the subject land. Not observed. No records in Byron LGA.	The Pale-headed Snake is a medium-sized (up to 90 cm long), largely tree-dwelling snake. The Pale-headed Snake is a highly cryptic species that can spend weeks at a time hidden in tree hollows. Found mainly in dry eucalypt forests and woodlands, cypress forest and occasionally in rainforest or moist eucalypt forest. Shelter during the day between loose bark and tree-trunks, or in hollow trunks and limbs of dead trees.
<i>Hoplocephalus stephensii</i> Stephens' Banded Snake	BAM Calculator – Candidate species		V	Moderate	Habitat assessment, tree searches, camera survey on potential habitat areas	Low	No habitat components will be removed from the subject land. Not observed during surveys.	Stephens' Banded Snake is a medium-sized partly tree-dwelling snake up to one metre long. Rainforest and eucalypt forests and rocky areas up to 950 m in altitude. Stephens' Banded Snake is nocturnal, and shelters between loose bark and tree trunks, amongst vines, or in hollow trunks limbs, rock crevices or under slabs during the day. At night it hunts frogs, lizards, birds and small mammals.
<i>Litoria brevipalmata</i> Green-thighed	BAM Calculator – Candidate		V	Low	Habitat assessment, leaf litter survey	Low	No habitat components present, subject land is at the top of a steep	Green-thighed Frogs occur in a range of habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath, typically in areas where

Scientific name	Type of species record	Status EPBC Act	Status BC Act	Potential occurrence in subject land	Survey required/under taken	Potential for impact	Rationale	Habitat description*
Frog	species						slope, no free water, not recorded	surface water gathers after rain. Breeding occurs following heavy rainfall from spring to autumn, with larger temporary pools and flooded areas preferred. Frogs may aggregate around breeding sites and eggs are laid in loose clumps among waterplants, including water weeds. The larvae are free swimming..
<i>Macropus parma</i> <i>Parma Wallaby</i>	BAM Calculator – Candidate species		V	Moderate	Camera trap survey, habitat assessment, indirect evidence searches (scats)	Low	Marginal habitat available, no dense areas available as shelter in subject land, possible to forage occasionally but limited forage available and subject land close to house.	Preferred habitat is moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest. Typically feed at night on grasses and herbs in more open eucalypt forest and the edges of nearby grassy areas. During the day they shelter in dense cover.
<i>Miniopterus australis</i> Little Bentwing- bat	BAM Calculator – Candidate species (Breeding), Ecosystem species (foraging)		V	Low	Habitat assessment	Negligible	No breeding habitat present.	Occurs from Northern Queensland to the Hawkesbury River near Sydney. Roost sites encompass a range of structures including caves, tunnels and stormwater drains. Young are raised by the females in large maternity colonies in caves in summer. Shows a preference for well timbered areas including rainforest, wet and dry sclerophyll forests, Melaleuca swamps and coastal forests. The Little Bentwing bat forages for small insects

Scientific name	Type of species record	Status EPBC Act	Status BC Act	Potential occurrence in subject land	Survey required/under taken	Potential for impact	Rationale	Habitat description*
								(such as moths, wasps and ants) beneath the canopy of densely vegetated habitats.
<i>Miniopterus schreibersii oceanensis</i> Eastern Bentwing-bat (Breeding)	BAM Calculator – Candidate species (Breeding), Ecosystem species (foraging)		V	Low	Habitat assessment	Negligible	No breeding habitat present.	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes. At other times of the year, populations disperse within about 300 km range of maternity caves. Cold caves are used for hibernation in southern Australia.
<i>Mixophyes iteratus</i> Giant Barred Frog	BAM – species credit species	E	E	Low	Habitat assessment	Negligible	Geographical restrictions not met – survey not required	Giant Barred Frogs are found along freshwater streams with permanent or semi-permanent water, generally (but not always) at lower elevation. Although generally found within about 20m of the stream, outside the breeding season, the Giant Barred Frog may disperse away from the stream (e.g. 50m or further).
<i>Myotis macropus</i> Southern Myotis	OEH Database		V	Low	Habitat assessment	Negligible	No watercourses nearby, no roosts to be impacted. Habitat constraints not present.	Scattered, mainly coastal distribution extending to South Australia along the Murray River. Roosts in caves, mines or tunnels, under bridges, in buildings, tree hollows, and even in dense foliage. Colonies occur close to water bodies, ranging from rainforest streams to large lakes and

Scientific name	Type of species record	Status EPBC Act	Status BC Act	Potential occurrence in subject land	Survey required/under taken	Potential for impact	Rationale	Habitat description*
								reservoirs. They catch aquatic insects and small fish with their large hind claws, and also catch flying insects.
<i>Ninox strenua</i> Powerful Owl	BAM Calculator – Candidate species (Breeding), Ecosystem species (foraging)		V	Low	Habitat assessment, indirect evidence search, survey not required	Low	No breeding habitat present.	The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine <i>Syncarpia glomulifera</i> , Black She-oak <i>Allocasuarina littoralis</i> , Blackwood <i>Acacia melanoxylon</i> , Rough-barked Apple <i>Angophora floribunda</i> , Cherry Ballart <i>Exocarpus cupressiformis</i> and a number of eucalypt species. The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider.
<i>Nyctimene robinsoni</i> Eastern Tube-nosed Bat	BAM_ Ecosystem species		V	Low	Habitat assessment	Negligible	Geographical restrictions not met – survey not required	Occupies streamside habitats within coastal subtropical rainforest and moist eucalypt forests with a well-developed understorey. They are important pollinators and dispersers of native trees. This species roosts in the foliage of canopy and understorey trees during the day. In NSW, they usually forage within 200 m of their day

Scientific name	Type of species record	Status EPBC Act	Status BC Act	Potential occurrence in subject land	Survey required/under taken	Potential for impact	Rationale	Habitat description*
								roost.
Nurus brevis Shorter Rainforest Ground-beetle	BAM Calculator – Candidate species		E	Low	Habitat assessment, leaf litter searches, rock turning, log turning	Low	Outside of known occurrence area. Habitat will be maintained, not detected, burrows not seen, unlikely to be impacted.	Described in the mid 1800s, it was thought to be extinct until the early 1970s when a population was located in Lismore. Currently the only known populations occur in Lismore and the Richmond Range near Mallanganee, west of Casino. Occurs in subtropical and warm temperate rainforest.
Nurus atlas Atlas Rainforest Ground-beetle	BAM Calculator – Candidate species		E	Low	Habitat assessment, leaf litter searches, rock turning, log turning	Low	Outside of known occurrence area, preferred habitat not present, potential habitat will be maintained, unlikely to occur, not detected, unlikely to be impacted.	Historically widespread in heavily timbered high rainfall areas east of the Great Dividing Range on the north coast of NSW. The species had not been seen for many years and was thought to be extinct until it was rediscovered in Victoria Park near Lismore in 1973. Presently it is only known from this location and a few others in the Lismore-Alstonville area. Low-elevation rainforest and wet eucalypt forest with a well-developed rainforest understorey. Other habitat requirements may be relatively undisturbed old-growth forests on highly productive soils and consistently high moisture levels.
<i>Phascolarctos cinereus</i> Koala	BoiNEt	V	V	Low	Habitat assessment, scat searches, feed tree search	Low	No scats recorded, no feed trees recorded, assessed under SEPP 44	In NSW the Koala mainly occurs on the central and north coasts with some populations in the western region. Koalas feed almost exclusively on eucalypt foliage, and their preferences vary regionally. Primary feed trees include <i>Eucalyptus</i>

Scientific name	Type of species record	Status EPBC Act	Status BC Act	Potential occurrence in subject land	Survey required/under taken	Potential for impact	Rationale	Habitat description*
								<i>robusta</i> , <i>E. tereticornis</i> , <i>E. punctata</i> , <i>E. haemostoma</i> and <i>E. signata</i> . They are solitary with varying home ranges.
<i>Phyllodes imperialis</i> southern subspecies Southern Pink Underwing Moth	BAM Calculator – Candidate species	E	E	Moderate	Habitat assessment, survey of preferred vine for chrysalis and caterpillars, all butterflies and moths recorded within subject land	Low	All habitat vines will be retained, species not observed, chrysalis not observed	The Southern Pink Underwing Moth is found in subtropical rainforest below about 600 m elevation. Potential breeding habitat is restricted to areas where the caterpillar's food plant, a native rainforest vine, <i>Carronia multisepealea</i> , occurs in subtropical rainforest. Adult Southern Pink Underwing Moths require the low light conditions of the rainforest in order to breed.
<i>Planigale maculata</i> Common Planigale	BAM Calculator – Candidate species		V	Moderate	Active searches for potential nests and nest sites – logs, rocky areas, leaf litter. Camera trap – 14 nights	Low	Not recorded, no potential nest sites recorded, potential habitat will be retained as rocky areas and logs.	The Common Planigale is known to occur in a variety of habitats from weed-infested urban reserves to cool mountain forests, from sea level up to 400 m. Habitat selection is considered to be dependant on an adequate surface cover of grasses, hollow logs, rocks and leaf litter. It feeds on insects, spiders and small lizards. This species shelters under rocks, timber, rubbish and termite mounds.
<i>Potorous tridactylus</i> Long-nosed Potoroo	BAM_ Ecosystem species	V	V	Low	Habitat assessment, Survey not required	Low	Preferred habitat not within subject land	Usually found within 50 km of the coast. Inhabits coastal heath and wet and dry sclerophyll forests. Generally found in areas with rainfall greater than 760 mm. Requires relatively thick ground cover

Scientific name	Type of species record	Status EPBC Act	Status BC Act	Potential occurrence in subject land	Survey required/under taken	Potential for impact	Rationale	Habitat description*
								where the soil is light and sandy. Known to eat fungi, arthropods, fleshy fruit, seeds and plant tissue.
<i>Pseudomys novaehollandiae</i> New Holland Mouse	BioNEt		V	Low	Habitat assessment	Low	Preferred habitat not within subject land	The New Holland Mouse currently has a disjunct, fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Across the species' range the New Holland Mouse is known to inhabit open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes. The home range of the New Holland Mouse can range from 0.44 ha to 1.4 ha. The New Holland Mouse is a social animal, living predominantly in burrows shared with other individuals. The species is nocturnal and omnivorous, feeding on seeds, insects, leaves, flowers and fungi, and is therefore likely to play an important role in seed dispersal and fungal spore dispersal. It is likely that the species spends considerable time foraging above-ground for food, predisposing it to predation by native predators and introduced species. Breeding typically occurs between August and January, but can extend into autumn.
<i>Pteropus poliocephalus</i> Grey-headed Flying-fox	BAM Calculator – Candidate species	V	V	Low	Habitat assessment, survey for foraging signs	Low	No camps within study area, evidence of foraging not present, forage trees will be	Occurs along the NSW coast, extending further inland in the north. This species is a canopy-feeding frugivore and nectarivore of rainforests, open forests, woodlands, melaleuca swamps and

Scientific name	Type of species record	Status EPBC Act	Status BC Act	Potential occurrence in subject land	Survey required/under taken	Potential for impact	Rationale	Habitat description*
	(breeding) BAM – ecosystem species						retained	banksia woodlands. Roosts in large colonies, commonly in dense riparian vegetation.
<i>Scoteanax rueppellii</i> Greater Broad-nosed Bat	BAM_ ecosystem species		V	Moderate - foraging	Habitat assessment	Low	Habitat will not be removed, survey not required	Occurs along the Great Dividing Range and in coastal areas. Occurs in woodland and rainforest, preferring open habitats or openings in wetter forests. Often hunts along creeks or river corridors. Preys upon beetles and other large, flying insects, other bats and spiders. Roosts in hollow tree trunks and branches.
<i>Thersites mitchellae</i> <i>Mitchell's Rainforest Snail</i>	BAM Calculator – Candidate species	CE	E	Low	Leaf litter survey, habitat assessment, log turning	Low	Distribution and preferred habitat not present within subject land, not recorded.	Found in remnant vegetation on the coastal plain between the Richmond River and Tweed River on the NSW north coast. It has also been recorded from some adjacent mid-elevation areas including Wilsons River and Mount Jerusalem. Found in Remnant areas of lowland subtropical rainforest and swamp forest on alluvial soils. Slightly higher ground around the edges of wetlands with palms and fig trees are particularly favoured habitat. Typically found amongst leaf litter on the forest floor, and occasionally under bark in trees.
<i>Vespadelus troughtoni</i> Eastern Cave	BAM Calculator – Candidate		V	Low	Geographical restrictions not met – surveys	Negligible	Habitat constraints not present, no habitat within subject land.	Found in a broad band on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and

Scientific name	Type of species record	Status EPBC Act	Status BC Act	Potential occurrence in subject land	Survey required/under taken	Potential for impact	Rationale	Habitat description*
Bat	species				not required			the upper north coast of NSW. It roosts in small groups, often in well-lit overhangs and caves, mine tunnels, road culverts, and occasionally in buildings.
Birds								
<i>Amaurornis moluccana</i> Pale-vented Bush-hen	BAM_ ecosystem species		V	Low	Geographical restrictions not met –	Negligible	Geographical restrictions not met	In Australia, the Pale-vented Bush-hen occurs mainly in coastal and subcoastal regions from the Top End of the Northern Territory and Cape York Peninsula south through eastern Queensland to north-eastern NSW. In NSW, Bush-hens are an apparently uncommon resident from the Queensland border south to the Clarence River, though the species appears to be expanding its range southwards with recent records as far south as the Nambucca River. The Pale-vented Bush-hen inhabits tall dense understorey or ground-layer vegetation on the margins of freshwater streams and natural or artificial wetlands, usually within or bordering rainforest, rainforest remnants or forests. Key elements of their habitat are dense undergrowth 2 to 4 metres tall and within 300 metres of water.
<i>Anthochaera phrygia</i> Regent Honeyeater	Bionet	CE	E	Low	Habitat assessment	Low	Preferred habitat not available, trees will be retained	Regent Honeyeaters are semi-nomadic, occurring in temperate eucalypt woodlands and open forests. Most records are from box-ironbark eucalypt forest associations and wet lowland

Scientific name	Type of species record	Status EPBC Act	Status BC Act	Potential occurrence in subject land	Survey required/under taken	Potential for impact	Rationale	Habitat description*
								coastal forests. Nectar and fruit from mistletoes are also eaten. This species usually nest in tall mature eucalypts and sheoaks.
<i>Artamus cyanopterus cyanopterus</i> Dusky Woodswallow	Bionet		V	Low	Habitat assessment	Low	Preferred habitat not available, trees will be retained	Primarily inhabits dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. It has also been recorded in shrublands, heathlands and very occasionally in moist forest or rainforest. Also found in farmland, usually at the edges of forest or woodland.
<i>Botaurus poiciloptilus</i> Australasian Bittern	SPRATt	E	E	Low	Habitat assessment	Low	Preferred habitat not available	The Australasian Bittern is distributed across south-eastern Australia. Often found in terrestrial and estuarine wetlands, generally where there is permanent water with tall, dense vegetation including <i>Typha</i> spp. and <i>Eleocharis</i> spp. Typically this bird forages at night on frogs, fish and invertebrates, and remains inconspicuous during the day. The breeding season extends from October to January with nests being built amongst dense vegetation on a flattened platform of reeds.
<i>Carterornis leucotis</i> White-eared Monarch	BAM Calculator – Candidate species		V	Moderate	Habitat assessment, bird point survey	Low	Preferred vegetation type not present in subject land. Not recorded.	Restricted to eastern Queensland and the NSW north coast from Cape York south to Iluka at the mouth of the Clarence River and occur west only as far as the Richmond Range. Occasionally found

Scientific name	Type of species record	Status EPBC Act	Status BC Act	Potential occurrence in subject land	Survey required/under taken	Potential for impact	Rationale	Habitat description*
								further south in the vicinity of Coffs Harbour and Port Macquarie. In NSW this species occurs primarily in coastal rainforest, swamp forest and wet eucalypt forest. It appears to favour rainforest edges where trees are frequently covered with vines and through the canopy of more extensive patches of rainforest. Occurs in rainforest, sometimes mangroves and paperbark swamps.
<i>Coracina lineata</i> Barred Cuckoo-shrike	BAM C_ Ecosystem species		V	Moderate	Habitat assessment, bird point survey	Low	Habitat will be retained, no trees will be removed, not recorded	Found in rainforests, vine thickets and their margins. Also found in eucalypt forests and clearing in secondary growth forests.
<i>Cyclopsitta diophthalma coxeni</i> Coxen's Fig-Parrot	BAM Calculator – Candidate species	E	CE	Moderate	Habitat assessment, bird point survey	Low	Preferred habitat not available, no figs recorded in subject land, not recorded. Unlikely to rely on subject land for resources.	Limited to about five populations scattered between Bundaberg in Queensland and the Hastings River in NSW. The total number is thought to be less than 200 birds which makes it one of Australia's most endangered birds. Usually recorded from drier rainforests and adjacent wetter eucalypt forest but rarely seen due to its small size and cryptic habits. Also found in the wetter lowland rainforests that are now largely cleared in NSW. The bird shows a decided preference for fig trees, but also feeds on other fruiting rainforest species, lichen, nectar and grubs.
<i>Daphoenositta</i>	Bionet		V	Low	Habitat	Low	Preferred habitat nor	The Varied Sittella is a sedentary species which

Scientific name	Type of species record	Status EPBC Act	Status BC Act	Potential occurrence in subject land	Survey required/under taken	Potential for impact	Rationale	Habitat description*
<i>chrysoptera</i> Varied Sittella					assessment		available. Unlikely to rely on subject land for resources.	inhabits a wide variety of dry eucalypt forests and woodlands, usually with either shrubby understorey or grassy ground cover or both, in all climatic zones of Australia. Usually inhabit areas with rough-barked trees, such as stringybarks or ironbarks, but also in mallee and acacia woodlands, paperbarks or mature Eucalypts. The Varied Sittella feeds on arthropods gleaned from bark, small branches and twigs. It builds a cup-shaped nest of plant fibres and cobweb in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.
<i>Erythrotriorchis radiates</i> Red Goshawk	SPRAT	V	E4A	Low	Habitat assessment	Low	Preferred habitat not available	Occur in forest and woodland habitat near permanent water. In NSW prefer Melaleuca swamp forest and open eucalypt woodland. Require greater than 20 m tall trees for nesting.
<i>Lathamus discolor</i> Swift Parrot	SPRAT	CE	E	Low	Habitat assessment	Low	Preferred habitat not available	The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen and associated insects. The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW. Favoured feed trees include winter flowering species such as Swamp Mahogany Eucalyptus robusta, Spotted Gum Corymbia maculata, Red Bloodwood C. gummifera, Mugga Ironbark E. sideroxylon, and

Scientific name	Type of species record	Status EPBC Act	Status BC Act	Potential occurrence in subject land	Survey required/under taken	Potential for impact	Rationale	Habitat description*
								White Box <i>E. albens</i> . Commonly used lerp infested trees include Grey Box <i>E. microcarpa</i> , Grey Box <i>E. moluccana</i> and Blackbutt <i>E. pilularis</i> . This species is migratory, breeding in Tasmania and also nomadic, moving about in response to changing food availability.
<i>Ptilinopus regina</i> Rose-crowned Fruit-Dove	BAM – Ecosystem species		V	Moderate	Habitat assessment, bird survey	Low	Habitat will be retained	Occurs in tall tropical and subtropical, evergreen or semi-deciduous rainforest, especially with dense growth of vines. Prefers large patches of rainforest, but sometimes occurs in remnant patches surrounded by suboptimal habitat including farmlands.
<i>Ptilinopus superbus</i> Superb Fruit-Dove	BAM – Ecosystem species		V	Moderate	Habitat assessment, bird survey	Low	Habitat will be retained	The Superb Fruit Dove ranges from northern NSW to as far south as Moruya. It is found in rainforests, closed forests (including mesophyll vine forests) and sometimes in eucalypt and acacia woodlands with fruit-bearing trees. It forages in the canopy of fruiting trees such as figs and palms.
<i>Rostratula australis</i> Australian Painted Snipe	SPRAT	E	E	Low	Habitat assessment, bird survey	Low	Not recorded, preferred habitat not available	Usually found in shallow inland wetlands including farm dams, lakes, rice crops, swamps and waterlogged grassland. They prefer freshwater wetlands, but have been recorded in brackish waters. Forages on mud-flats and in shallow water. Feeds on worms, molluscs, insects and some plant-matter.

Scientific name	Type of species record	Status EPBC Act	Status BC Act	Potential occurrence in subject land	Survey required/under taken	Potential for impact	Rationale	Habitat description*
<i>Turnix melanogaster</i> Black-breasted Button-quail	SPRAT	V	E	Low	Geographical restrictions not met – survey not required, habitat assessment, bird survey	Low	Not recorded, preferred habitat not available	Within NSW, the species inhabits areas with an elevation of 200 to 700m, in dry or subtropical rainforests which contain brigalow, belah, bottletrees, hoop pine, lantana, ironbark, wattle, spotted gum, wallaby grass or rhodes grass.
Frogs								
<i>Assa darlingtoni</i> Pouched Frog	Database searches		V	Low	Habitat assessment	Low	Not recorded, preferred habitat not available	Inhabits Antarctic Beech forest and rainforest in mountainous areas. These frogs do not need free water for breeding, as eggs are laid on the ground. They spend most of the time in damp leaf litter, or under rocks and rotten logs.
<i>Mixophyes fleayi</i> Fleay's Barred Frog	Database searches	E	E	Low	Habitat assessment	Low	Not recorded, preferred habitat not available	Inhabits rainforest and wet eucalypt forest of the escarpment and foothills on the eastern side of the ranges in south-east Queensland and northeast NSW. Usually located close to gravely streams. During cool or dry periods is known to shelter under forest leaf litter.
<i>Philoria loveridgei</i> Loveridge's Frog	Database searches		E	Low	Habitat assessment	Low	Not recorded, preferred habitat not available	Typically inhabits antarctic beech, rainforest, and wet sclerophyll forests above 750 m. Occurs in the headwaters of small streams and soaks where it is dependent on high moisture levels. Burrows in loose, moist soil or moss.
Reptiles								

Scientific name	Type of species record	Status EPBC Act	Status BC Act	Potential occurrence in subject land	Survey required/under taken	Potential for impact	Rationale	Habitat description*
<i>Delma torquata</i> Adorned Delma	SPRAT	V		Low	Habitat assessment	Low	Not recorded, preferred habitat not available	The species has been recorded at the Bunya Mountains, Blackdown Tablelands National Park, Expedition National Park, Western Creek, near Millmerran, and the Toowoomba Range. A large concentration of records are from the western suburbs of Brisbane, including Kenmore, Pinjarra Hills, Anstead, Mt Crosby, Lake Manchester, and Karana Downs.

Migratory species (EPBC Act listed)

The following table includes a list of migratory species that have potential to occur within the study area. The list is based on database searches outlined in Section **Error! Reference source not found.**

Bold denotes species recorded in the study area during the current assessment.

Table A.21 Migratory fauna species recorded or predicted to occur within 5 kilometres of the study area

Scientific name	Common name	Most recent record
<i>Actitis hypoleucos</i>	Common Sandpiper	#
<i>Apus pacificus</i>	Fork-tailed Swift	2009
<i>Ardea ibis</i>	Cattle Egret	2011
<i>Ardea modesta</i>	Eastern Great Egret	2009
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	#
<i>Calidris melanotos</i>	Pectoral Sandpiper	#
<i>Cuculus optatus</i>	Oriental Cuckoo	#
<i>Gallinago hardwickii</i>	Latham's Snipe	2002
<i>Hirundapus caudacutus</i>	White-throated Needletail	2011
<i>Merops ornatus</i>	Rainbow Bee-eater	2010
<i>Monarcha melanopsis</i>	Black-faced Monarch	2011
<i>Motacilla flava</i>	Yellow Wagtail	#
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	#
<i>Plegadis falcinellus</i>	Glossy Ibis	2009
<i>Rhipidura rufifrons</i>	Rufous Fantail	2011
<i>Symposiachrus trivirgatus</i>	Spectacled Monarch	#
<i>Numenius madagascariensis</i>	Eastern Curlew	#
<i>Calidris ferruginea</i>	Curlew Sandpiper	#
<i>Pandion cristatus</i>	Osprey	2011

Appendix 4 Biodiversity Credit and credit payment reports



BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00012604/BAAS18096/19/00012605	Goonengerry Peterson	04/07/2019
Assessor Name	Assessor Number	BAM Data version *
Renae C Baker	BAAS18096	12
Proponent Names	Report Created	BAM Case Status
Hugo and Sally Peterson	18/07/2019	Finalised
Assessment Revision	Assessment Type	Date Finalised
2	Part 4 Developments (General)	18/07/2019

Potential Serious and Irreversible Impacts

Nil

Nil

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

BAM Biodiversity Credit Report (Like for like)

Predicted Threatened Species Not On Site

Name
Amaurornis moluccana / Pale-vented Bush-hen
Macropus dorsalis / Black-striped Wallaby

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
1302-White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion	Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	0.0	1.00

1302-White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion	Like-for-like credit retirement options			
	Name of offset trading group	Trading group	HBT	IBRA region
	Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions This includes PCT's: 669, 670, 770, 845, 886, 887, 1068, 1201, 1275, 1302, 1525, 1527, 1528, 1529, 1533, 1534, 1535, 1541, 1545	-	Yes	Scenic Rim, Burringbar-Conondale Ranges, Clarence Lowlands and Woodenbong. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.



BAM Biodiversity Credit Report (Like for like)

Species Credit Summary

No Species Credit Data

Biodiversity payment summary report

Assessment Id	Payment data version	Assessment Revision	Report created
00012604/BAAS18096/19/00012605	57	2	18/07/2019
Assessor Name	Assessor Number	Proposal Name	BAM Case Status
Renae C Baker	BAAS18096	Goonengerry Peterson	Finalised
	Assessment Type	Date Finalised	
PCT list	Part 4 Developments (General)	18/07/2019	

Include	PCT common name	Credits
Yes	1302 - White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion	1

Species list

Include	Species	Credits
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Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat



Biodiversity payment summary report

IBRA sub region	PCT common name	Baseline price	Dynamic coefficient	Market coefficient	Risk premium	Administrative cost	Methodology adjustment factor	Price per credit	No. of ecosystem credits	Final credits price
Scenic Rim	1302 - White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion Warning: This PCT has NO trades recorded	\$4,248.35	0.71782200	2.51860000	19.99%	\$20.00	1.0000	\$6,009.29	1	\$6,009.29
Subtotal (excl. GST)										\$6,009.29
GST										\$600.93
Total ecosystem credits (incl. GST)										\$6,610.22

Species credits for threatened species

Species profile ID	Species	Threat status	Price per credit	Risk premium	Administrative cost	No. of species credits	Final credits price
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No species available

Grand total	\$6,610.22
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Appendix 5 Significant impact criteria assessment

Critically endangered ecological community; Lowland Rainforest of Subtropical Australia

The ecological community primarily occurs from Maryborough in Queensland to the Clarence River (near Grafton) in New South Wales (NSW). The ecological community also includes isolated areas between the Clarence River and Hunter River such as the Bellinger and Hastings valleys. The ecological community occurs in the following Interim Biogeographic Regionalisation for Australia Version 6.1 (IBRA) Bioregions: South Eastern Queensland Bioregion and NSW North Coast Bioregion.

The ecological community occurs on basalt and alluvial soils, including sand and old or elevated alluvial soils as well as floodplain alluvia. It also occurs occasionally on enriched rhyolitic soils and basaltically enriched metasediments. Lowland Rainforest mostly occurs in areas <300 m above sea level. Aspect can result in the ecological community being found at >300 m altitude on north-facing slopes, but typically 300 m defines the extent of the lowlands. In addition, Lowland Rainforest typically occurs in areas with high annual rainfall (>1300 mm). The physical environment where the ecological community occurs is differentiated from the EPBC listed Littoral Rainforest and Coastal Vine Thickets of Eastern Australia ecological community (hereafter referred to as Littoral Rainforest) by the level of coastal or estuarine influence (such as windshear). Lowland Rainforest typically occurs more than 2 km from the coast, however, it can (and does) intergrade with Littoral Rainforest in some coastal areas.

The ecological community is generally a moderately tall (≥ 20 m) to tall (≥ 30 m) closed forest (canopy cover $\geq 70\%$). Tree species with compound leaves are common and leaves are relatively large (notophyll to mesophyll). Typically there is a relatively low abundance of species from the genera *Eucalyptus*, *Melaleuca* and *Casuarina*. Buttresses are common as is an abundance and diversity of vines.

Significant impact criteria

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

Reduce the extent of an ecological community

The proposal will result in the removal of 0.016 hectares of Lowland Rainforest from the study area. This area is located adjacent to an existing house and driveway. The removal of this small area from the subject land is not expected to result in the reduction of extent of the rainforest community from the local area or greater region because:

- 0.006 ha occurs as canopy over cleared
- The areas to be removed are directly adjacent the exiting dwelling house
- The retained vegetation is being improved by removal of high threat weeds, thereby reducing the threat to the community on a larger scale/

Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines

The proposal will result in the removal of 0.016 hectares of Lowland Rainforest from an area located between an existing house and driveway. Areas of vegetation in surrounding areas, including all canopy will remain

connected. Therefore the proposal will not result in fragmentation impacts to this community. On a larger scale there is local and regional connectivity which will not be affected by this proposal.

Adversely affect habitat critical to the survival of an ecological community

The small area of habitat (total 0.016 hectares) at the study area to be affected as a result of this proposal is not considered to be habitat critical to the survival of this community. Within the 1500 metre buffer to the study area there is approximately 300 hectares of similar vegetation, occurring in similar habitats and condition types.

Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns

The proposal is small in nature and is not going to modify or affect abiotic factors necessary for the rainforest community's survival.

Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting

This proposal has been planned to avoid impacts such as burning and intensive APZ management. The subject land will be managed to maintain diversity and functionality of this community into the future, this being achieved by implementation of a VMP and ongoing weed control.

Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

- assisting invasive species, that are harmful to the listed ecological community, to become established, or***
- causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or***
- Interfere with the recovery of an ecological community***

The proposal includes implementation of a VMP which includes removal of high threat weeds such as Camphor Laurel and Madeira Vine. This is expected to result in an improvement of quality of the local occurrence of the community, at the site and at the local scale.

The proponents do not use or propose to use fertilisers, chemicals or herbicides that could affect the community.

The proposal will not interfere with the recovery of this community, considering it will result in the removal of high threat weeds, one of the primary reasons for the community to have deteriorated in the local area.

Conclusion

The proposal will not have a significant impact on the Lowland Rainforest of Subtropical Australia ecological community because:

- It will not result in the reduction of extent of the community at a local scale
- It will not fragment any part of the community at a site or local scale
- It will result in improvement of quality through removal of high threat weeds from the study area
- It will maintain diversity of species and structure through planned management