NATURECALL ENVIRONMENTAL

Statutory Ecological Assessment:

Project:

Residential Subdivision of Lot 1 DP 1119830, Marshall Way, Bellwood.

Client:

Geoff Smyth and Associates Pty Ltd

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Executive Summary

The approximately 14ha property (Lot 1 DP1119830) is located at Bellwood approximately 2.9km southwest of Nambucca Heads town centre and 8.2km north of Macksville.

The site vegetation consists of highly modified open forest and woodland that has been heavily logged and underscrubbed in the past, and is currently in a state of early regeneration with a high level of weed infestation by pastoral grasses. Areas of derived grassland have been maintained by slashing in the east of the site.

No threatened flora species were found on the site, and none were considered potential occurrences due to the disturbance history. A patch of swamp forest occurs in the northwest of the site, however this did not quality as an EEC due to the absence of underlying alluvial soils in this area.

Fauna surveys have been completed on the site and nearby lands in the past, and further surveys were conducted over the site in March 2015. These consisted of spotlighting, call playback and Yangochiropteran bat call recording over 3 nights along with bird, herpetofauna, secondary evidence surveys and habitat assessments. This led to the detection of 5 threatened species in the study area consisting of the Little Lorikeet, Yellow-bellied Glider, Grey-headed Flying Fox, Little Bent-wing Bat and East-coast Freetail Bat. A number of other threatened fauna species have been recorded in the study area during previous surveys, and several more were considered potential occurrences based on the habitats occurring in the study area and presence of local/regional records in similar habitats.

Parts of the site qualified as Potential Koala Habitat, but survey determined it was not Core Koala Habitat due to lack of evidence indicating Koalas regularly use the site.

The proposal is for a residential subdivision which will involve the creation of 133 residential Lots along with internal access roads. This will result in the loss of about 14.5ha of vegetation on site, most of which consists of scattered trees, with some patches of modified forest/woodland, grassland and young regrowth. Approximately 1.5ha will remain as 2 deferred Lots in the southeast. This area and more so the unformed road reserve contains almost all of the site's hollow-bearing trees and active Yellow-bellied Glider sap trees (mostly in the road reserve and including a known den site of the Yellow-Bellied Glider). Part of the road reserve will be subject to vegetation thinning for the APZ, however will still retain connectivity from the habitat on the deferred Lot to Nambucca State Forest to the west and south.

While the removal/modification of up to about 14.5ha of vegetation (including 3 hollow-bearing trees and 1 Yellow-bellied Glider sap tree) on site will have the generic negative effect of removal of some known/potential foraging habitat and reduced carrying capacity: in context of the ecology of known and potentially occurring threatened species; extent of remaining habitat on and adjacent to the site which are more important to the maintenance of viable local populations: this action is not considered likely to have an impact of sufficient order of magnitude to place a local population at risk of extinction.

Hence no referral to DoE or a Species Impact Statement is considered required.

1.0 Introduction

Biodiversity Australia Pty Ltd trading as Naturecall Environmental (hereafter referred to as 'Naturecall') has been requested by the landowner to undertake a statutory ecological assessment for a proposed subdivision of Lot 1 DP 1119830, Marshall Way, Bellwood (Figure 1). The findings of this assessment are to be submitted with the Development Application (DA) to Nambucca Shire Council (NSC).

The statutory ecological assessment for this development proposal was undertaken in accordance with the *Environmental Planning and Assessment Act 1979*, as amended by the *Threatened Species Conservation* (TSCA) *Act 1995* which in turn has been amended by the *Threatened Species Conservation Legislation Amendments Act 2002* (Seven Part Test for Significance); NSW SEPP 44 - *Koala Habitat Protection*; and the Commonwealth *Environment Protection and Biodiversity Conservation* (EPBCA) *Act 1999* - Matters of National Environmental Significance (MNES).

The survey and assessment was performed in consideration of the draft *Threatened Species Survey and Assessment – Guidelines for Developments and Activities* (DEC 2004), and the *Threatened Species Assessment Guidelines – Assessment of Significance* (DECC 2007). The assessment has also been undertaken in accordance with the Ecological Consultants Association of NSW – Code of Ethics (2002) available at www.ecansw.org.au.

2.0 Background Information

2.1. Development Proposal

As shown in Figure 2 and 3, the development proposal is a residential subdivision over the site which will involve creation of 133 residential Lots and 2 larger deferred Lots in the southeast. The subdivision will be created in 7 stages depending on market demand, moving from the northeast to the southwest. New sealed access roads to service the Lots will connect to Marshall Way in the east.

The proposed development will require Asset Protection Zones in all directions. The widths of these will be 14m to the northwest, 21m to the east, 42m to the south and 33m to the west (Bushfiresafe 2015). These will be either contained within the site (east and west) or will extend offsite (north and south).

This will require the removal of most of the vegetation on site as well as some adjacent vegetation for the APZs which comprises patches of highly modified open forest, open woodland and young regrowth scattered over an area which was intensively logged/partially cleared in 2004. The most significant habitat on site is retained in the southeast within the deferred Lots adjacent to the undeveloped road reserve.

2.2. Location of the Study Site and Key Definitions

The site is located at the end of Marshall Way in the suburb of Bellwood, approximately 2.9km southwest of Nambucca Heads town centre and 8.2km north of Macksville (Figure 1). Nambucca State Forest adjoins the site to the west.

The **site** is defined as the area subject to the proposed subdivision on Lot 1 DP1119830, and the adjoining offsite APZ and is approximately 16.5ha in area. The **study area** is land within an at least 100m radius of the site (minimum extent to which indirect impacts such as edge effects will be detectable), and the **locality** is land within a 10km radius of the site.

Figure 1: Site location

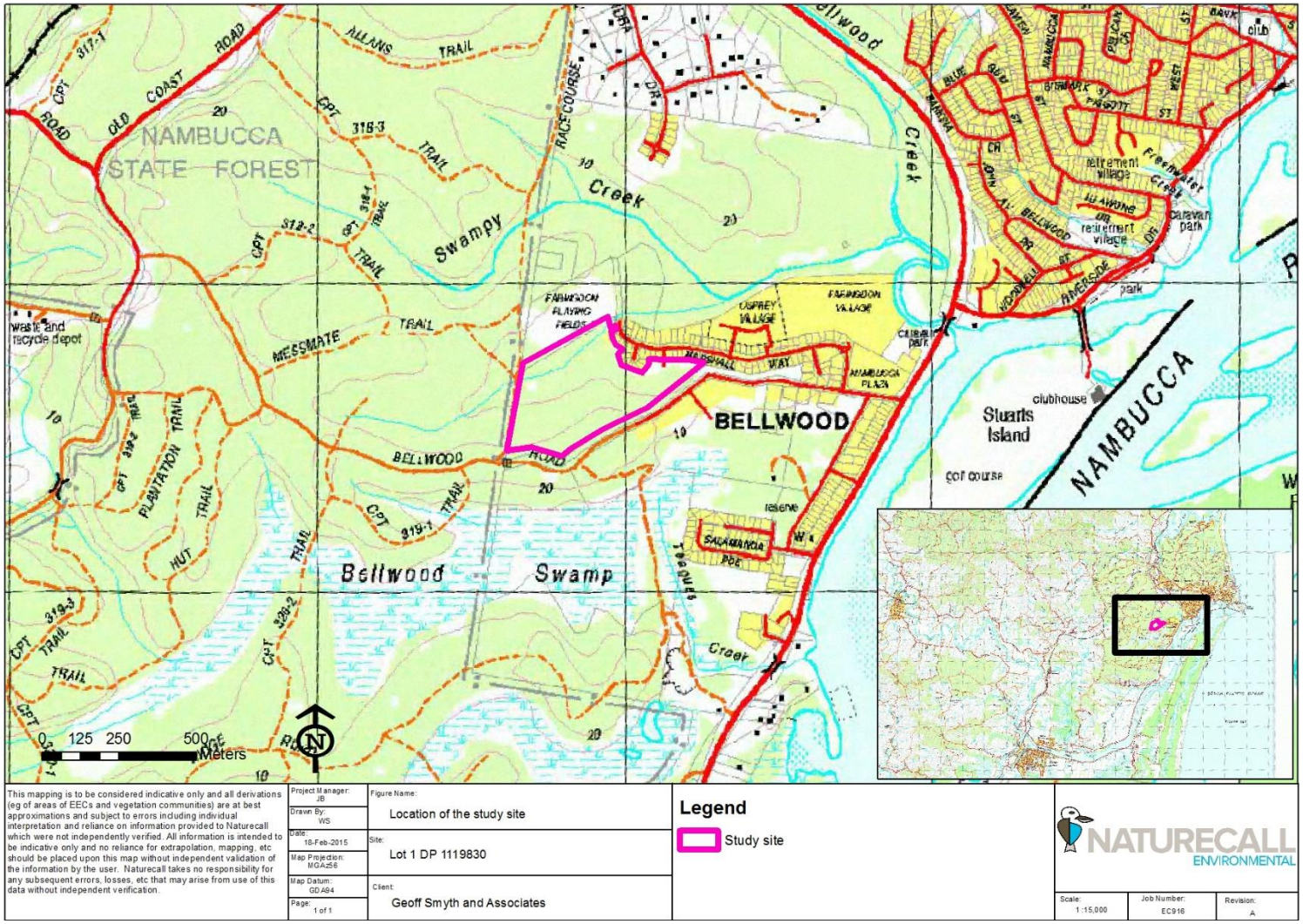


Figure 2: Proposed development layout

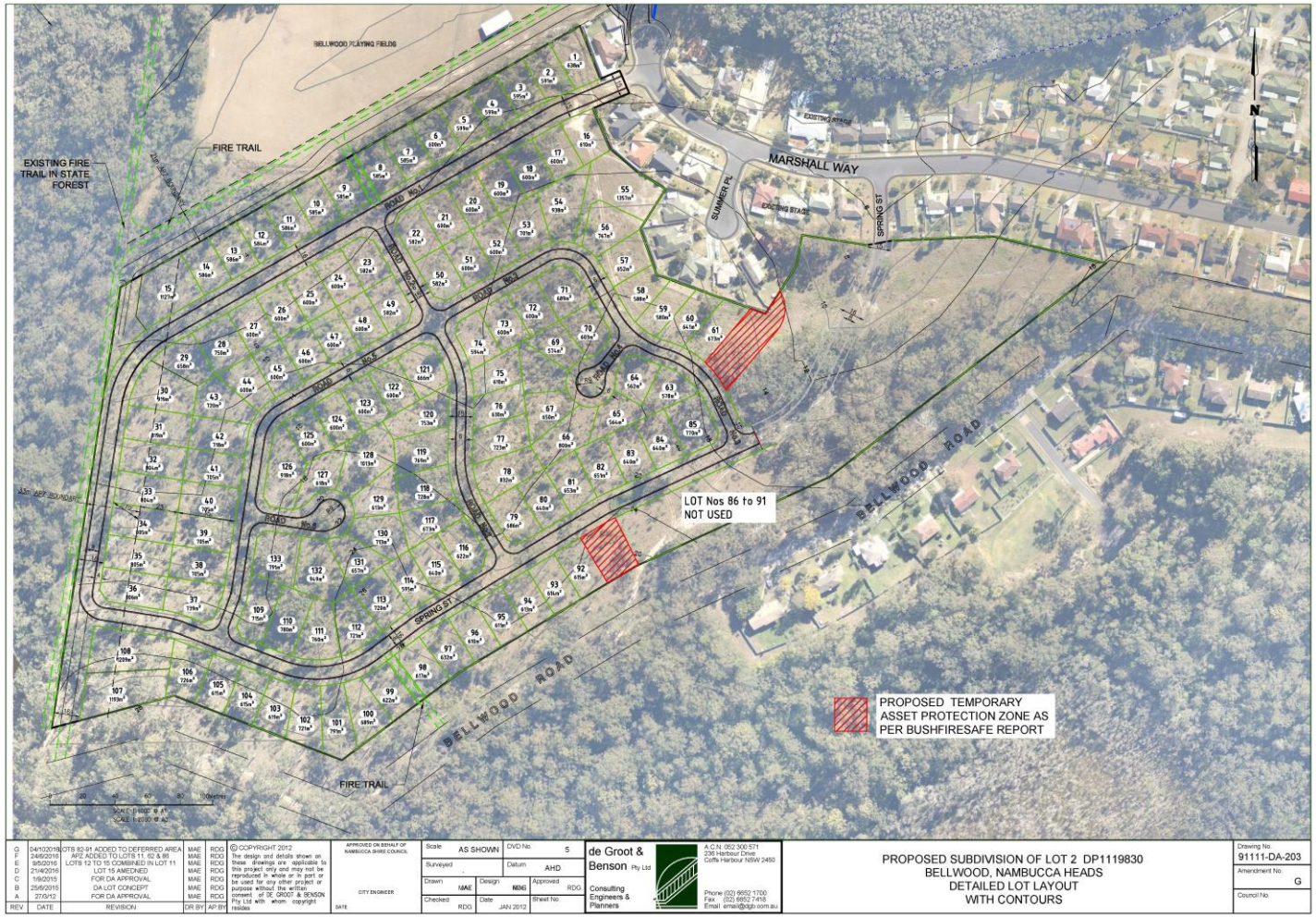
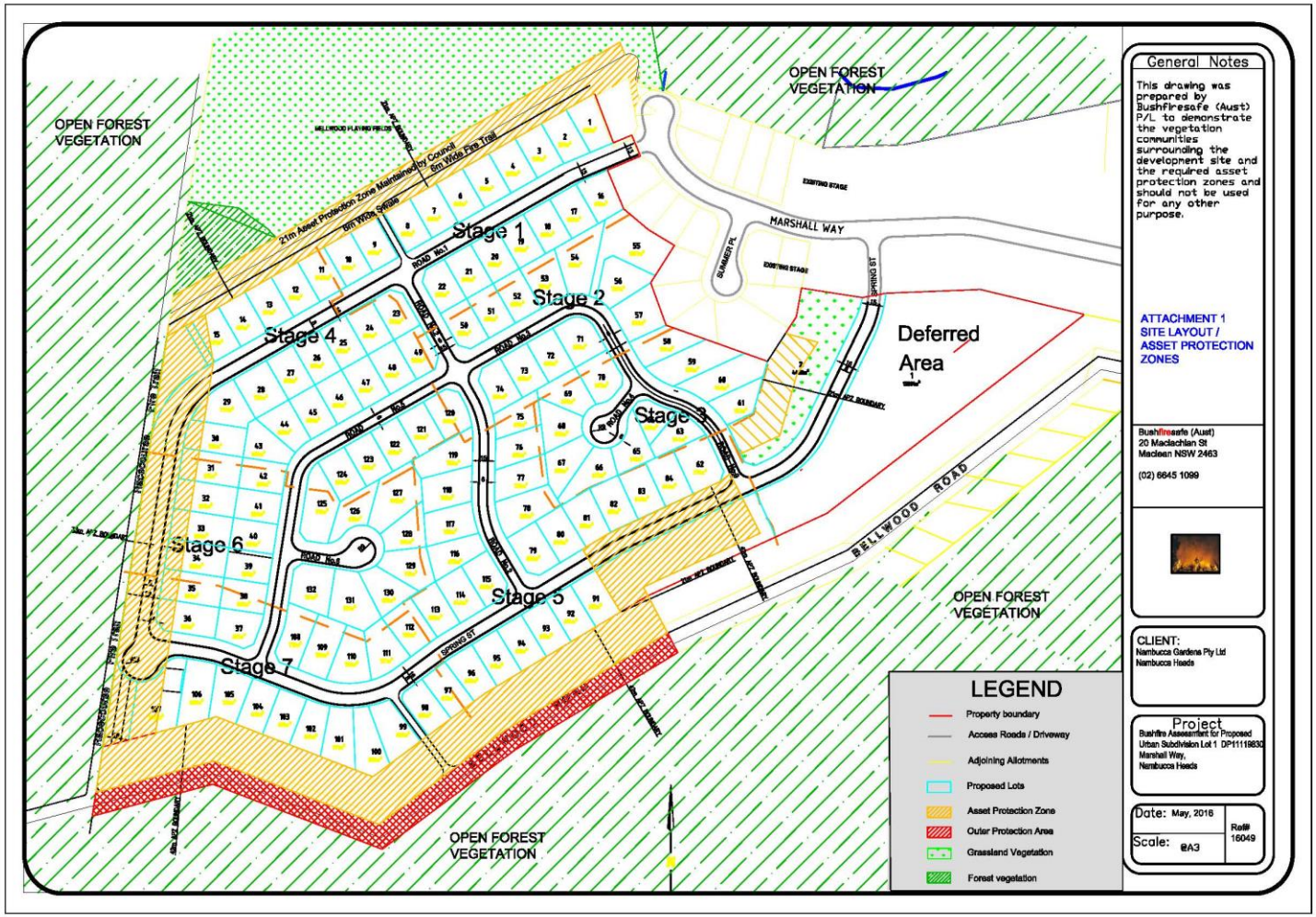


Figure 3: Development layout showing Asset Protection Zones



2.3. Previous Ecological Surveys

2.3.1. JWA (2004 - 2005)

James Warren and Associates (JWA) conducted a vegetation survey over the subject site in 2004. In 2005, a targeted Yellow-bellied Glider survey over the site and a constraints assessment relating to a proposed residential subdivision was undertaken. The findings of these surveys have been incorporated into the current updated assessment.

The JWA study mapped and described 6 vegetation communities over the site. This mapping has been adopted for the current assessment and any changes since the 2004/2005 survey have been noted (see Section 3.2).

The 2005 targeted survey detected the presence of a Yellow-bellied Glider colony using the site for foraging, and denning was confirmed in a large tree in a road reserve adjacent to the southern site boundary. The Gliders were observed and heard vocalising on numerous occasions and nightly movements patterns were identified from the den tree moving west across the site and southern road reserve to the adjacent State Forest.

The constraints analysis recommended a 50m buffer be established around the identified den tree and retention of the patch of intact open forest in the southeast of the site which contained a number of active sap trees used by the Yellow-bellied Glider.

2.3.2. JWA (2007, 2010, 2013)

JWA (2007) prepared an ecological assessment for the residential development of Lot 115 DP 1057175, Bellwood and Lot 2 DP 1119830). This study site is located about 500m north, and is separated from the site by SEPP 14 Coastal Wetland #362 and residential development which lie to its south and east. The site joins Nambucca State Forest to the north.

The flora and fauna assessment occurred over 2004-2007, and included targeted survey methods including trapping. JWA (2005) recorded 8 frogs, 4 reptiles, 78 birds and 24 mammals (including bats).

No threatened plants were found, but swamp forest in the SEPP 14 was considered to be Coastal Floodplain EECs. Review of more recent 1:25 000 Quaternary soil landscape mapping however suggests the extent of these EECs is over-estimated as most of the SEPP 14 wetland falls on Coastal Barrier geomorphology.

Survey recorded the following threatened fauna species:

- Brown Treecreeper
- Varied Sittella
- Little Lorikeet
- Glossy Black Cockatoo

- Osprey (adjacent to site)
- East-Coast Freetail Bat
- Little Bent-wing Bat
- Eastern False Pipistrelle
- Yellow-bellied Glider (in State Forest adjacent to site)
- Grey-headed Flying-fox

Several migratory birds were also recorded ie White-breasted Sea-eagle, Rufous Fantail, Black-faced Monarch, and Spectacled Monarch.

2.3.3. EcoLogical (2013)

EcoLogical prepared a flora and fauna report for a link road between Alexandria Drive and Marshwall Way, Bellwood. The road will link the existing and future residential development areas, as part of a Voluntary Planning Agreement. Survey was limited to a rapid assessment.

The site is largely cleared, and only an EEC was recorded in the study area by this survey.

2.4. Soils, Topography and Geology

The site is situated on a slight north-facing slope and ranges in elevation from 20m in the south to <10m in the north. A shallow gully bisects the centre of the site which directs runoff to the north.

A swampy depression is located in site's northwest and a drainage line runs along the edge of the adjacent sports fields on the northern site boundary. This flows east into Swampy Creek which passes under the Pacific Highway and continues into the Nambucca River.

Soils observed in the elevated parts of the site consisted of light brown to yellow-brown silty loams which generally contained a surface layer of quartz pebbles and small rocks. No large rock outcrops were observed. The low-lying parts of the site in the north contained heavy clays which were often saturated and contained a rotting organic layer.

The site is underlain by Permian Basin bedrock, which comprises phyllite and schist. A small alluvial formation associated with the drainage line extends along part of the northern site boundary and is described as 'Valley Fill', which has alluvial plain deposition (Figure 4). This is considered likely to comprise silt, clay, fluvial sand and gravel (Troedson and Hashimoto 2008).

2.5. Landuse and Disturbance History

2.5.1. Clearing and Land Use

The site currently consists of a parcel of mostly cleared vacant land and is zoned R1 – *General Residential* under the *Nambucca Shire Council Local Environmental Plan 2010*.

A study undertaken over the site by JWA (2005) indicated that site has been subject to heavy logging and partial clearing which mostly occurred in 2004. This event spared only a patch of open forest in the southeast, with the remainder of the being largely scattered trees with small clumps of young trees. Most of the previously cleared areas are currently regenerating with young eucalypts and pioneer species such as wattles, Bush Pea and Cheese Tree, but the groundcover is heavily dominated by pasture grasses. A band of grassland has been maintained along the eastern boundary adjacent to dwellings via regular slashing/mowing to establish a bushfire buffer.

The site is bordered by Nambucca State Forest to the west; a sports field and residential areas to the southeast, north and east; and forested private land to the south. A large SEPP 14 wetland system occurs 250m south of the site (Bellwood Swamp) and a smaller wetland system is associated with Swampy Creek to the north. Beyond here to the north, there is a large area of modified land approved for residential subdivision (JWA 2007), which Alexander Drive is to be eventually interconnected to via Marshall Way (EcoLogical 2013).

The new alignment of the Pacific Highway is located roughly 1.1km west of the western site boundary. Clearing and construction for this section has commenced and the realignment will see substantial loss of habitat and fragmentation of currently intact forest contained within Nambucca State Forest (SKM 2010).

2.5.2. Fire History and Weed Invasion

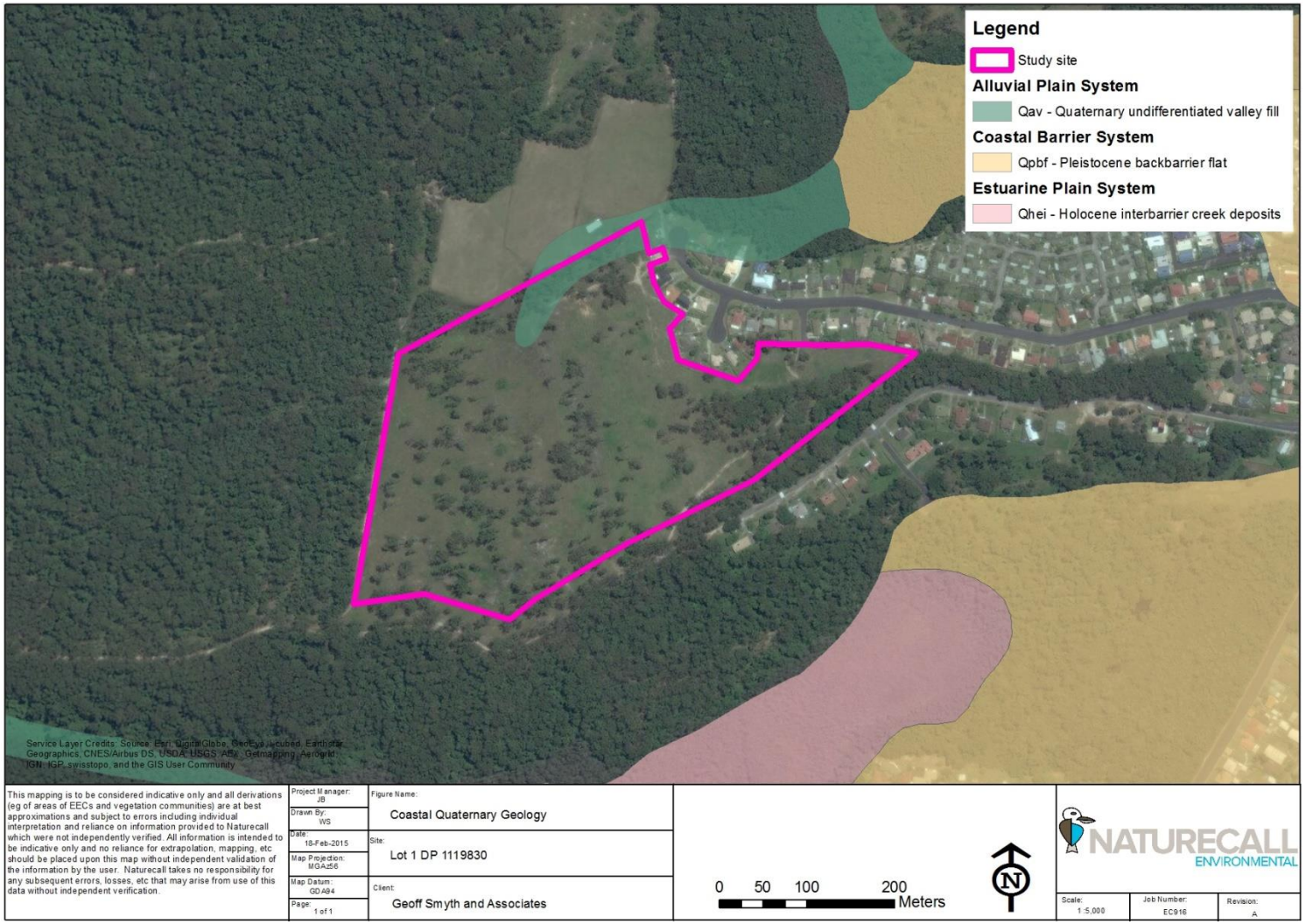
The previous fire history of the site was not obtained, and the vegetation on site showed no signs of a recent fire. Some recent patch burning appears to have taken place in the State Forest to the west.

Weed infestations on the site predominantly consist of exotic pasture grasses such as Whisky Grass, Carpet Grass, Common Paspalum and Vasey Grass, along with common pasture weeds such as Cobblers Pegs, Fireweed and Cotton Bush. Small patches of Crofton Weed were observed in the site's northeast and several Lantana thickets were noted throughout the site (Photo 2).

Photo 1: Large cut stump indicative of past logging

Photo 2: Weed infestation on the site

Figure 4: Quaternary geology



3.0 Flora Survey

Previous vegetation survey results and mapping of the site by JWA (2005) is used for this assessment and hence the flora survey focussed on noting changes in vegetation structure/composition and collation of an updated species list for the site.

The work required to update the previous assessment to current requirements is detailed below.

3.1. Survey and Assessment Methodology

The flora assessment consisted of the following components:

- Classification of the vegetation communities to NSW CMA vegetation community classifications (biometric).
- Database (OEH Atlas of Wildlife/Bionet, EPBCA – MNES) and literature review for local threatened species records and predicted occurrences
- Identification, mapping and condition assessment of any Endangered Ecological Communities listed under the *Threatened Species Conservation Act 1995* (TSC Act), *and Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on the site.
- Searches for and (if found) mapping of threatened species listed under the *Threatened Species Conservation Act 1995* (TSCA), and *Environment Protection and Biodiversity Conservation Act 1999* (EPBCA).

3.1.1. Threatened Ecological Community Assessment

The previous report for the site by JWA (2005) did not consider the presence of Threatened Ecological Communities (TECs). An assessment of possible TECs on the site was undertaken based on the data collected by the previous flora survey and this site inspection, review of the relevant listings on the OEH website (www.environment.nsw.gov.au) and Department of Environment – MNES SPRAT website (DoE 2015a) and quaternary geological/soil landscape mapping by Troedson & Hashimoto (2008) and Atkinson (1999).

3.1.2. Threatened Flora Species Searches and Occurrence Assessment

3.1.2.1. Searches

Searches for the locally recorded threatened flora recorded in the LGA and regionally (OEH 2015a, DoE 2015b) in similar habitats to those occurring on the site (see Appendix 1), were carried out over the survey period.

The site was searched during the survey via both dedicated transects in the best potential habitat on site and opportunistically during other activities.

3.1.2.2. Potential Occurrence Assessment:

Potential occurrence assessment of threatened flora species is provided in Appendix 1. This section assesses all considered threatened species listed under the TSCA 1995 and EPBCA 1999 for their potential to occur on site based on the following factors (DEC 2004, Forest Fauna Surveys 1997, DECC 2007):

- Presence/absence of suitable habitat.
- Condition and disturbance history of habitat.
- Local and regional records.
- Location of site within known distribution of the species.
- Connectivity with habitat where species is known to occur.

3.2. Flora Survey Results

3.2.1. Site Vegetation Communities

Six vegetation communities were recorded on the study site by JWA (2005). An overview of these is provided in the following table (see JWA 2005 for full descriptions). Photos showing the current state of these communities follow the table. The JWA vegetation map is provided in Figure 5.

Table 1: Overview of site vegetation communities

	Community 1	Community 2	Community 3
Type	Tall Open Dry Sclerophyll Forest 1	Tall Open Dry Sclerophyll Forest 2	Tall Dry Sclerophyll Woodland
Dominant canopy species	• Scribbly Gum *(Eucalyptus signata)* • Tallowwood *(E. microcorys)* • Pink Bloodwood (*Corymbia intermedia*) • Turpentine (*Syncarpia glomulifera*) • Blackbutt (*E. pilularis*) • Smooth-barked Apple (*Angophora costata*)	• Blackbutt (*E. pilularis*) • Tallowwood *(E. microcorys)* • Pink Bloodwood (*C. intermedia*)	• Blackbutt (*E. pilularis*) • Tallowwood *(E. microcorys)* • Pink Bloodwood (*C. intermedia*) • Red Bloodwood (*C. gummifera*) • Turpentine (*S. glomulifera*)
Biometric Vegetation Class	Scribbly Gum – Red Bloodwood heathy open forest of the coastal lowlands of the North Coast	Blackbutt – Turpentine – Tallowwood shrubby open forest of the coastal foothills of the central north coast	Disturbed form of Scribbly Gum – Red Bloodwood heathy open forest of the coastal lowlands of the North Coast
Keith (2000) Vegetation Formation	Dry Sclerophyll Forests	Dry Sclerophyll Forests	Grassy Woodlands
Current Extent and Structure/Composition	Same extent as stated in previous report (1.04ha). Structure and composition appears to be similar, however no Forest Red Gum was found in this community in contrast to JWA (2005).	Same extent as stated in previous report (0.2ha). This is the dominant vegetation community in adjacent forest and only the edges occur on site. Structure and composition appears to be similar, however again no Forest Red Gum was found in this community.	Estimated to cover a slightly smaller extent (3.3ha) than stated in previous report (3.4ha). Structure and composition appears to be similar, however again no Forest Red Gum was found in this community and the understorey has regenerated further to a height of approximately 6 metres over most of its extent aside from the northeast patch.
Condition	Good condition overall and represents the least disturbed vegetation on the site. Low levels of weed invasion.	Good condition, although has been heavily logged in the past. Very low levels of weed invasion.	This community is in a state of recovery from past logging and underscrubbing. Appears to be in reasonable condition, however some trees are suffering from dieback. Low to

			moderate levels of weeds in the understorey and groundcover.
Threatened plants recorded or potential habitat	None recorded and poor potential habitat.	None recorded and poor potential habitat.	None recorded and poor potential habitat.
Threatened Ecological Community or Endangered Population	No. Does not meet floristic and geomorphological criteria.	No. Does not meet floristic or geomorphological criteria.	No. Does not meet floristic or geomorphological criteria.
	Community 4	**Community 5**	**Community 6**
Type	Tall Open Swamp Sclerophyll Forest	Scattered Trees	Mid High Closed Grassland
Dominant species	• Swamp Mahogany (*E. robusta*) • Tallowwood *(E. microcorys*)	• Forest Red Gum (*E. tereticornis*) • Blackbutt (*E. pilularis*) • Tallowwood *(E. microcorys*) • Pink Bloodwood (*C. intermedia*) • Red Bloodwood (*C. gummifera*) • Turpentine (*S. glomulifera*)	• Kangaroo Grass (*Themeda australis*) • Blady Grass *(Imperata cylindrica*) • Whisky Grass (*Andropogon virginicus*)
Biometric Vegetation Class	Swamp Mahogany swamp forest of the coastal lowlands on the North Coast	Disturbed form of Scribbly Gum – Red Bloodwood heathy open forest of the coastal lowlands of the North Coast	NA
Keith (2000) Vegetation Formation	Forested Wetlands	NA	NA
Current Location and Extent	Estimated to cover a smaller extent (0.6ha) than stated in previous report (0.84ha). Tallowwood was rare (only a few specimens on the southern edges) and Swamp	Scattered canopy trees are still present, however the lower stratum has strongly regenerated since the 2005 survey. It is comprised of a mix of wattles (*Acacia longifolia subsp. longifolia, Acacia binervata*, *Acacia irrorata*), Cheese Tree (*Glochidion*	This community cover a similar extent at present as stated in the previous report (1.32ha).

	Turpentine (*Lophostemon suaveolens*) was occasionally observed.	*ferdinandi*) and Black Oak (*Allocasuarina littoralis*) along with young eucalypts to a height of 3-8m. Covers similar extent as started in previous report (7.15ha).	Slashing has maintained this community in a similar state consisting of a low cover of native and exotic grasses.
Condition	Fair condition, recovering from previous clearing. Low levels of weed invasion.	In a state of recovery from previous clearing, understorey is regenerating rapidly with pioneer species and eucalypts. Some mature trees show signs of dieback.	This is a derived community that is regularly maintained by slashing. Weeds are common and consist of exotic grasses such as Whisky Grass, Common Paspalum and Vasey Grass.
Threatened plants recorded or potential habitat	None recorded and poor potential habitat.	None recorded and poor potential habitat.	None recorded and poor potential habitat.
Threatened Ecological Community or Endangered Population	No. Does not meet floristic and geomorphological criteria.	No. Does not meet floristic or geomorphological criteria.	No. Does not meet floristic or geomorphological criteria.

Photo 3: Vegetation community 1

Photo 4: Vegetation community 2

Photo 5: Vegetation community 3

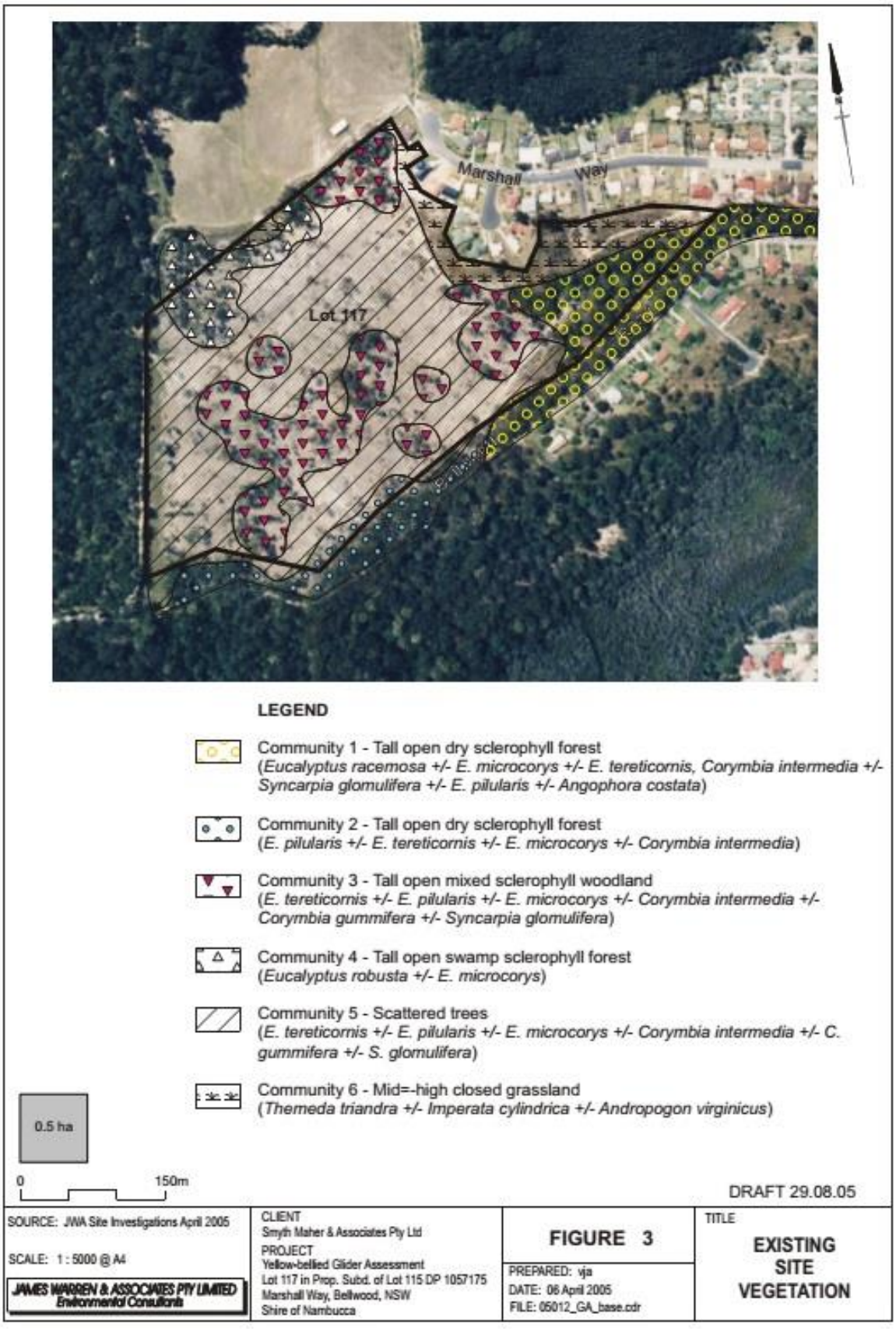
Photo 6: Vegetation community 4

Photo 7: Vegetation community 5

Photo 8: Vegetation community 6

Figure 5: Site vegetation communities

(Source: JWA 2005)



3.3. Threatened Ecological Communities

3.3.1. Site Evaluation

Soil landscape mapping by Eddie (2000) at 1:100 000 shows that most of the site is underlain by transferral soils derived from Permian basin bedrock. The exception is a small finger associated with a drainage line rising in the mid-northwest of the site which is described as a “Valley Fill”, which is mapped as an alluvial landscape by Troedson and Hashimoto (2008) at 1:25 000. Only this part of the site may broadly meet the geomorphological criteria for floodplain EECs ie soils derived from alluvial processes.

The vegetation in this part of the site is described by JWA (2005) as a tall open mixed sclerophyll woodland dominated by Forest Red Gum, Blackbutt, Tallowwood, Pink Bloodwood and Turpentine. The understorey was generally absent due to underscrubbing, and the native component of the groundcover was dominated by Kangaroo Grass, Blady Grass and Bracken Fern.

Field investigations during this survey noted the vegetation to be similar as described in JWA (2005), however it appears that Scribbly Gum had been incorrectly identified as Forest Red Gum which was not found on site during this survey. The shrub and understorey layers had also regenerated in some areas, however slashing has continued over most of this patch of vegetation.

Floristically, the above vegetation occurring on the mapped alluvial soil landscape would not qualify as any Coastal Floodplain EEC due to the lack of characteristic species listed in the respective Final Determinations. Given that for these EECs, the assemblage is considered to be indicative of the geomorphological soil formation processes and specific site edaphics (*CBD Prestige Holdings Pty Ltd v Lake Macquarie City Council [2005] NSWLEC 367, Gales Holdings Pty Limited v Tweed Shire Council [2008] NSWLEC 209, Motorplex (Australia) Pty Limited v Port Stephens Council [2007] NSWLEC 74*), the floristic assemblage could thus indicate that non-alluvial processes are dominant at this site-specific location in this soil landscape unit, which is mapped at 1:25 000 scale and hence limited in accuracy.

3.3.2. Other listed Threatened Ecological Communities and Populations

A summary review of TECs and Endangered Populations listed under the TSC Act 1995 and EPBC Act 1999 which occur in the North Coast Bioregion (OEH 2015b, DoE 2015a) and their potential for occurrence on site or in the study area, is provided in the following table.

Table 2: Review of TECs and Endangered Populations

Act	Literature Review	Significance
TSC Act	**"*Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*"** is a characteristic ecological community listed as Endangered under the TSC Act 2004. This EEC is associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Swamp Sclerophyll Forest on Coastal Floodplains (SSFCF) generally occurs below 20 m (though sometimes up to 50 m) elevation, often on small floodplains or where the larger floodplains adjoin lithic substrates or coastal sand plains. The structure of the community is typically open forest (but may be reduced to scattered trees via disturbance), and in some areas the tree stratum is low and dense ie a scrub. The community also includes some areas of fernland and tall reedland or sedgeland where trees are very sparse or absent. The most widespread and abundant dominant trees include *Eucalyptus robusta* and *Melaleuca quinquenervia*.	The swamp forest vegetation on site would floristically qualify as this EEC, however the site occurrence does not occur on alluvial soils hence cannot qualify as this EEC.
TSC Act	***"Subtropical Coastal Floodplain Forest of the NSW North Coast bioregion"*** is a characteristic ecological community listed as Endangered. This Endangered Ecological Community (EEC) is associated with clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Subtropical Coastal Floodplain Forest (SCFF) generally occurs below 50 m, but may occur on localised river flats up to 250 m elevation in the NSW North Coast bioregion. While the composition of the SCFF tree stratum varies considerably, the most widespread and abundant dominant canopy trees include *Eucalyptus tereticornis*, *E. siderophloia*, *Corymbia intermedia*, and *Lophostemon suaveolens* (latter only north of the Macleay floodplain).	Vegetation meeting the floristic and geomorphological criteria of this EEC does not occur on the study site.
TSC Act	**"*Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions*"** is an EEC associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes	Vegetation meeting the floristic and geomorphological criteria of this

Act	Literature Review	Significance
	associated with coastal floodplains. *Swamp Oak Floodplain Forest* (SOFF) generally occurs below 20m (rarely above 10m) elevation. The structure of the community may vary from open forests to low woodlands, scrubs or reedlands with scattered trees. SOFF has a dense to sparse tree layer in which Swamp Oak (*Casuarina glauca)* is the dominant species. Other trees including *Acmena smithii*, *Glochidion* spp. And *Melaleuca* spp. May be present as subordinate species. The understorey is characterised by frequent occurrences of vines i.e. *Parsonsia straminea, Geitonoplesium cymosum* and *Stephania japonica* var. *discolor*, a sparse cover of shrubs, and a continuous groundcover of forbs, sedges, grasses and leaf litter (NSWSC 2004b).	EEC does not occur on the study site.
TSC Act	"***River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions***" is an EEC associated with silts, clay-loams and sandy loams on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. *River-flat Eucalypt Forest on Coastal Floodplains* (RfEF) generally occurs below 50m elevations, but may occur on localised river flats up to 250m above sea level. In the North Coast, the most widespread and abundant dominant trees include *Eucalyptus tereticornis, E. amplifolia, Angophora floribunda, A. subvelutina*, *E. saligna* and *E. grandis.*	Vegetation meeting the floristic and geomorphological criteria of this EEC does not occur on the study site.
TSC Act	**"*Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*"** is an EEC associated with periodic or semi-permanent inundation by freshwater, (including areas with minor saline influence). They typically occur on silts, muds or humic loams in depressions, flats, drainage lines, backswamps, lagoons and lakes associated with coastal floodplains i.e. habitats where flooding is periodic and standing fresh water persists for at least part of the year in most years (NSWSC 2004e). The *Freshwater Wetlands on Coastal Floodplains* EEC generally occur below 20m elevations, and the structure of the community varies from sedgelands and reedlands, to herbfields. Woody species of plants are generally scarce. The structure and composition of the community varies both spatially and temporally depending on the water regime (Yen and Myerscough 1989, Boulton and Brock 1999).	Vegetation meeting the floristic and geomorphological criteria of this EEC does not occur on the study site.
TSC Act	"***Lowland Rainforest on Floodplains on the NSW North Coast Bioregion***" generally occupies riverine corridors and alluvial flats with rich, moist silts often in sub-catchments dominated by basic volcanic substrates. Small, scattered remnants remain on the floodplains of the Tweed, Richmond, Clarence, Bellinger, Macleay, Hastings, Manning, and Hunter Rivers. In its natural state, this community supports a rich diversity of flora and	Vegetation meeting the floristic and geomorphological criteria of this EEC does not occur on the study site.

Act	Literature Review	Significance
	fauna. Tree species often present include Figs, (*Ficus spp*.), Palms (*Archontophoenix cunninghamiana, Livistona australis*), Lilly Pilly's (*Syzygium spp*.) and vines (*Cissus spp., Pandorea pandorana, Flagellaria indica*).	
TSC Act	***"Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregion***" has been listed as an Endangered Ecological Community since December 2006 on Schedule 1 – Part 3 of the TSC Act 1995. Lowland Rainforest, in a relatively undisturbed state, has a closed canopy, characterised by a high diversity of trees whose leaves may be mesophyllous and encompass a wide variety of shapes and sizes. Typically, the trees form three major strata: emergents, canopy and sub-canopy which, combined with variations in crown shapes and sizes, give the canopy an irregular appearance (Floyd 1990). The trees are taxonomically diverse at the genus and family levels, and some may have buttressed roots. A range of plant growth forms are present in Lowland Rainforest, including palms, vines and vascular epiphytes. Scattered eucalypt emergents may occasionally be present. In disturbed stands the canopy continuity may be broken, or the canopy may be smothered by exotic vines.	Vegetation meeting the floristic and geomorphological criteria of this EEC does not occur on the study site.
EPBC Act	***"Lowland Rainforest of Subtropical Australia"*** is found from Maryborough to the Hunter. Predominantly occurs on basalt and alluvial soils, or enriched rhyolitic and metasediments. Generally occurs <300m above sea level but may occur >300m on north-facing slopes, and only in areas with annual rainfall >1300mm. May intergrade with ***Littoral Rainforest and Coastal Vine Thickets*** but usually occurs >2km from ocean. Typically tall (20-30m) closed forest often with multiple tree layers dominated by diversity of rainforest species with emergent non-rainforest species constituting <30%. Emergents are typically figs, Hoop Pine and Brushbox.	Vegetation meeting the floristic and geomorphological criteria of this EEC does not occur on the study site.
TSC Act	***"Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions"*** is typically a closed forest, the structure and composition of which is strongly influenced by its proximity to the ocean. The plant species of this community are predominantly rainforest species while emergent Eucalypts or Lophostemons are present in some stands. This community grows only in coastal areas within maritime influence on sand dunes and soil derived from underlying rocks.	Vegetation meeting the floristic and geomorphological criteria of this EEC does not occur on the study site.
EPBC Act	"***Littoral Rainforest and Coastal Vine Thickets of Eastern Australia***" is a Critically Endangered Ecological Community listed under the EPBC Act 1999, which is generally identical to the TSC Act listing.	Vegetation meeting the floristic and geomorphological criteria of this

Act	Literature Review	Significance
		EEC does not occur on the study site.
TSC Act	***"Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregion"*** has been listed as an Endangered Ecological Community under the TSC Act 1995. Coastal Saltmarsh is the ecological community occurring in the intertidal zone on the shores of estuaries and lagoons along the NSW coast. Characteristic species include: *Baumea juncea, Juncus kraussii, Sarcocornia quinqueflora, Sporobolus virginicus, Triglochin striata, Isolepis nodosa, Samolus repens, Selliera radicans, Suaeda australis, Zoysia macrantha.*	Vegetation meeting the floristic and geomorphological criteria of this EEC does not occur on the study site.
EPBC Act	"***Subtropical and Coastal Saltmarsh***" is listed as an Endangered Ecological Community under the EPBC Act 1999. This EEC includes the forms listed under the TSC Act 1995.	Vegetation meeting the floristic and geomorphological criteria of this EEC does not occur on the study site.
TSC Act	A localised population of a distinctive variation of ***Glycine clandestina,*** identified as Glycine sp. "Scotts Head", has been listed as an Endangered Population. This population is restricted to part of the headland complex at Scotts Head.	Recorded in the locality at Scotts Head. The site does not contain suitable habitat for this species and is beyond its known range.
TSC Act	***"White Box Yellow Box Blakely's Red Gum Woodland"*** is an EEC predicted to occur in Macksville, Dorrigo, Grafton, Kempsey, Korogoro Part, Nambucca, Coffs Harbour and Bare Part Atlas of Wildlife databases. This community is generally restricted to the tablelands and western slopes.	The site/study area does not meet the floristic requirements of this EEC, hence it does not occur.
TSC Act	***"Hunter Lowland Red Gum Forest in the Sydney Basin and North Coast Bioregions"*** is an EEC found on gentle slopes arising from depressions and drainage flats on Permian sediments of the Hunter Valley floor in the Sydney Basin and NSW North Coast Bioregions.	Vegetation meeting the floristic criteria of this EEC does not occur on site.

Act	Literature Review	Significance
TSC Act	The "Population of *Eucalyptus seeana* in the Greater Taree Local Government Area" has been listed as an Endangered Population.	The site is well beyond the range of this endangered population, hence it does not occur.
TSC Act	***"White Gum Moist Forest in the NSW North Coast Bioregion"*** is an ECC characteristically dominated by White Gum (*Eucalyptus dunnii*) either in pure stands or with E. *saligna, E. microcorys* and/or *Lophostemon confertus* (NSWSC 2008a).White Gum Moist Forest typically occurs on the escarpment slopes and foothills of the north-east NSW, most commonly between 400 and 650 m elevation, where mean annual rainfall exceeds approximately 1000 mm and has a summer maximum (DECC 2007) on fertile soils. It is currently known from the local government areas of Clarence Valley, Coffs Harbour, Kyogle and Tenterfield.	White Gum does not occur on the site, thus the EEC does not occur.
TSC Act	***"Hunter Valley Vine Thicket in the NSW North Coast and Sydney Basin Bioregions"*** is a Critically Endangered Ecological Community (CEEC). This CEEC occurs on Carboniferous sediments (often on limestone) mainly on rocky slopes. The community typically forms a low closed forest dominated by low trees, shrubs and vines. The canopy is dominated by both varieties of *Elaeodendron australe* (Red Olive Plum), *Geijera parviflora* (Wilga), *Notelaea microcarpa var. microcarpa* (Native olive), and *Alectryon oleifolius subsp. Elongatus* (Western Rosewood). Emergent eucalypts are common and include *Eucalyptus albens* (White Box), E. dawsonii (Slaty Box), and *E. crebra* (Narrow-leaved Ironbark). Hunter Valley Vine Thicket has been recorded from the local government areas of Muswellbrook, Singleton, and Upper Hunter (NSWSC 2007b).	This community does not occur on the site which is located outside the prescribed range, thus the EEC does not occur.
TSC Act	***"Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions***" is an EEC which occurs on Carboniferous sediments of the Barrington footslopes along the northern rim of the Hunter Valley Floor, where it occupies gullies and steep hill slopes with south facing aspects. The community usually forms a closed forest 15-20m high with emergent trees 20-30m high. Vines are abundant and there is a dense shrub and ground layer (NSWSC 2007c).	This community does not occur on the site which is located outside the prescribed range, thus the EEC does not occur.
TSC Act	*"**Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions"*** is an that belongs to the Maritime Grasslands vegetation class of Keith (2004)	Vegetation meeting the floristic and geomorphological criteria of this EEC does not occur on the site.

Act	Literature Review	Significance
	and its structure is typically closed tussock grassland, but may be open shrubland or open heath with a grassy matrix between the shrubs.	
TSC Act	***"Carex Sedgelands of the New England Tableland, Nandewar, Brigalow Belt South and NSW North Coast Bioregions"*** is a preliminarily listed EEC in marshy regions dominated by sedges, grasses and semi-aquatic herbs. The species dominants are *Carex appressa, Stellaria angustifolia, Scirpus polystachyus, Carex gaudichaudiana, Carex sp. Bendemeer, Carex tereticaulis and Isachne globosa,* either as single species or in combinations. Other common species include *Geranium solanderi var. solanderi, Haloragis heterophylla, Lythrum salicaria, Epilobium billardierianum subsp. Hydrophilum and Persicaria hydropiper* (Hunter and Bell 2009).	Vegetation meeting the floristic and location criteria of this EEC does not occur on the site.
TSC Act	'***Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions'*** is an EEC that generally occurs on floodplains and on floodplains and associated floodplain rises along the Hunter River and tributaries.	This community does not occur on the site, which is located outside the prescribed range, thus the EEC does not occur.
TSC Act	'***Coastal Cypress Pine Forest in the NSW North Coast Bioregion'*** is a distinctive vegetation community dominated by Coastal Cypress Pine (*Callitris columellaris*) and is typically found on coastal sand plains, north from the Angourie area on the far north coast of NSW.	The site is far beyond the known range of this EEC and the Coastal Pine does not occur, thus the EEC does not occur.

3.4. Threatened Flora

3.4.1. Survey Results

No threatened plants were recorded on the study site during this survey or by JWA (2005). No threatened plants have been recorded on adjacent lands (OEH 2015a, JWA 2007, 2005, EcoLogical 2013).

3.4.2. Potential Occurrence Assessment

Searches of relevant literature and databases (Naturecall 2014, SKM 2010, EcoPro 2010, Ecos Environmental 2014, OEH 2015a) found records of 10 threatened flora species in the locality.

Table 3: Threatened flora species recorded in the locality

Common Name	Species	Legal Status	Distance from Study Site
Scented Acronychia	*Acronychia littoralis*	E-TSCA, E-EPBCA	Gumma reserve, Nambucca Heads, Hyland Park
Floyd's Grass	*Alexfloydia repens*	E-TSCA	Warrell Creek
Sand Spurge	*Chamaesyce psammogeton*	E-TSCA	Outdated record from Nambucca State Forest near Hyland Park
Spider Orchid	*Dendrobium melaleucaphilum*	E-TSCA	North and west of Nambucca Heads
Slender Marsdenia	*Marsdenia longiloba*	E-TSCA, V-EPBCA	Nambucca State Forest
–	*Maundia triglochinoides*	V-TSCA	West of Lumsdens Lane, Gumma Rd, Warrell Creek
Grove's Paperbark	*Melaleuca groveana*	V-TSCA	West of Scotts Head
Rusty Plum	*Niemeyera whitei*	V-TSCA	Nambucca State Forest
Milky Silkpod	*Parsonsia dorrigoensis*	V-TSCA, E-EPBCA	Viewmont State Forest
Cryptic Forest Twiner	*Tylophora woollsii*	E-TSCA, E-EPBCA	Nambucca State Forest

It was considered that the site and most of the study area's significant disturbance history (eg logging, clearing, underscrubbing, slashing, weed invasion) have resulted in major habitat changes (eg to dispersal of propagules, microclimates, soil characteristics, etc) that have likely excluded any threatened species from occurring on the site/study area.

Given this and that no threatened flora species were detected during this or previous surveys of the site, it is considered highly unlikely that any such species would occur on the study site. Thus no threatened flora species are considered in the subsequent statutory assessments.

4.0 Fauna and Habitat Survey and Assessment

4.1. Survey Methods

In consideration of the threatened species recorded in the locality and previous survey by JWA (2005), available habitats on site, and potentially occurring species: the following survey methods were employed:

- Qualitative and quantitative habitat assessment
- Koala survey as per SEPP 44 requirements
- Spotlighting and stag watching over 3 nights
- Call playback over 3 nights
- Yangochiropteran bat call recording
- Hollow-bearing tree survey
- Diurnal reptile and bird survey
- Physical searches of habitat e.g. leaf litter, etc.
- Opportunistic sightings, scratches and scats.

It is acknowledged that the full range of techniques (e.g. trapping) which could be used and extent of effort is less than specified by the DEC (2004) guidelines. However, as provided for in the guidelines, a full survey is not considered warranted in this instance given the previous surveys over the site and adjacent land, and the consultant's high level of ecological knowledge of the area.

4.1.1. Habitat Evaluation

The site was surveyed to determine the available potential habitats, and the support value of these habitats for threatened species. Habitats were defined according to parameters such as:

- Structural and floristic characteristics of the vegetation e.g. understorey type and development, crown depth, groundcover density, etc.
- Degree and extent of disturbance e.g. fire, logging, weed invasion, modification to structure and diversity, etc.
- Soil type and suitability e.g. for digging and burrowing.
- Presence of water in any form e.g. dams, creeks, drainage lines, soaks.
- Size and abundance of hollows and fallen timber.
- Availability of shelter e.g. rocks, logs, hollows, undergrowth.
- Wildlife corridors, refuges and proximate habitat types.
- Presence of mistletoe, nectar, gum, seed, sap, etc. sources.

Species identification was assisted by Morcombe and Stewart (2010), Pizzey and Knight (2003), Tyler and Knight (2009), Wilson and Knowles (1992), Strahan (2008), Triggs (1996), Robinson (1996), Swan *et al* (2004) and Schodde and Tideman (1990).

4.1.2. Koala Survey

Survey for Koalas consisted of diurnal searches in trees over 5 days, and 3 Spot Assessment Technique (SAT) surveys. Koalas were also surveyed by spotlighting and call playback over 3 nights for a total effort of 10hrs of nocturnal survey.

The SAT surveys consisted of checking the ground and leaf litter for Koala scats in a 2m radius around 30 trees tree for a period of two minutes per tree or until a scat was found. This technique is recognised as a very efficient method of detecting Koala presence, and in some instances, is a method used to identify areas of major Koala activity/significance eg Core Koala Habitat (Phillips and Callahan 2011, Jurskis and Potter 1997, NPWS 2001, DECC 2008, Biolink 2013).

4.1.3. Spotlighting and Stag Watching

Spotlighting was conducted for at least 1 hour from dusk over 3 nights. This was more than sufficient to completely cover the site's limited tree cover; inspect the crown of every tree on site (100% coverage); and minimise disturbance to surrounding residents caused by barking dogs. The procedure involved walking with a hand held 50-100 watt spotlight over the site, targeting the trunks and branches of canopy trees and understorey.

Stag watching involved observing hollow-bearing trees on dusk with binoculars to watch for signs of fauna emerging from the hollows. At least 1 tree per night was watched and this was conducted for a total of 1 hour each night giving a total of 3 hours spent on the activity during the survey. Stag watching coincided with call playback surveys on and after dusk.

Conditions were overcast on the first night and clear on the second and third night. Wind ranged from placid to moderate. The moon phase was full over the survey period but was obscured by clouds on the first night.

4.1.4. Call Playback

Recorded calls of the following species were routinely played in the site and study area:

- Masked, Barking and Powerful Owls
- Bush-Stone Curlew
- Yellow Bellied Glider
- Squirrel Glider
- Koala

Calls were played through a portable MP3 player via a 30W PA system from the rear of a utility at a level approximating natural intensities of the species. The general methodology involved an initial period of listening and spotlighting; followed by playback of the calls simulating a natural pattern. This was followed by 10 minutes of listening and 10-15 minutes spotlighting for fauna attracted by the calls (but not responding vocally), within 100m radius of the playback point.

Calls were generally played soon after dusk, when such calls are normally heard. Playback was utilised over the area over 3 nights for a total of 3 hours of this activity.

4.1.5. Yangochiropteran Bat Call Detection

Anabat call detection was undertaken using 2 Anabat detectors fitted with ZCAIMs. Recording was conducted during spotlighting on all 3 nights with units either stationary or carried around. The units were left overnight on the second and third nights of the survey. This resulted in >36 hours of recording.

The recordings were forwarded to Dr Anna McConville of Echo Ecology, a bat call identification consultant, for identification of the bat species.

4.1.6. Diurnal Reptile and Bird Survey

Birds were surveyed by detecting calls and searching by binoculars during area searches over the whole site and actively listening/searching for birds. This along with reptile searches were conducted opportunistically and during other activities (e.g. flora survey and habitat evaluation).

This information provided short-term data on bird occurrences in the area for the particular season (DEC 2004).

4.1.7. Herpetofauna and Secondary Evidence Searches

Physical habitat searches of the site were undertaken during the survey which involved:

- Lifting up of debris to search for reptiles and frogs.
- Inspection of dense vegetation for bird nests.
- Raking of leaf litter for frogs and reptiles.
- Observation of likely basking sites (i.e. reptiles and frogs).
- Searches for scats, tracks, digging, sap incisions and scratches (e.g. Koala, gliders, etc.) over the site.
- Searches for scats, owl regurgitation pellets and guano deposits.

A total of 4 hours was specifically spent on general habitat searches with opportunistic searches also undertaken during other activities.

4.1.8. Hollow Bearing Tree Survey

All hollow bearing trees and stags on the study site and in the adjacent road reserve were located and recorded via hand held GPS. Each tree was quantified (height, trunk diameter, number of

hollows, location in tree and aperture diameter), marked with red and white flagging tape and pink spray paint, and assigned an identifier number.

4.1.9. Limitations

All surveys are limited in their ability to fully document all species of flora and fauna likely or actually occurring on a site. Surveys such as these are merely “snapshots” in time, and can only be expected to provide an indicative not absolutely comprehensive representation of a site’s species assemblage (DEC 2004, Forest Fauna Surveys 1997).

To counter this limitation and maximise certainty, this survey has employed methods recommended in literature and known from personal experience to best detect the target species under the site and weather conditions at the time, or implemented a conservative occurrence assessment, as follows. A comprehensive literature review including several previous assessments in the wider area have also contributed heavily to assessment, limiting the need to implement some survey methods which have animal welfare issues eg trapping.

Fauna detectability is limited by seasonal, behavioural or lifecycle characteristics of each species, and even by habitat variations (e.g. flowering periods), which can occur within a year, between years, decades, etc. (DEC 2004).

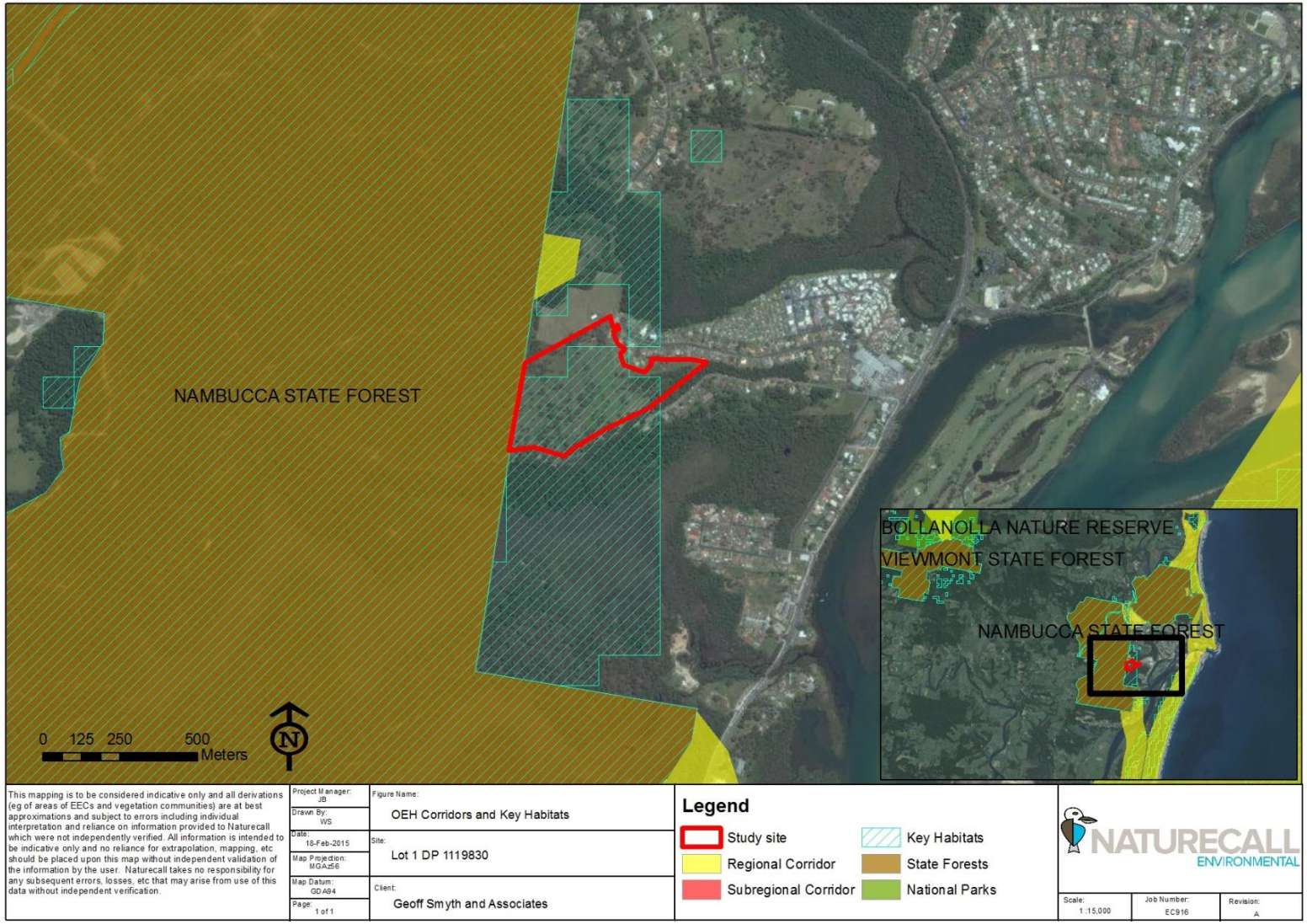
The fauna survey period fell in late summer which is a period of high to moderate activity for most fauna eg arboreal mammals, Yangochiropteran bats and reptiles (DEC 2004). Detection of seasonal breeding frogs would be limited for species breeding in late summer, or year-round. Winter longitudinal and latitudinal migrants such as the Swift Parrot would not be present at this time of year. High rainfall preceding the survey is likely to have increased frog detection for a broad range of species known to breed at this time of year, but timing and season is recognised as a limitation for some frogs.

To counter any limitations, qualitative and quantitative habitat evaluation was used as well as a standard ecological field survey to assess the site’s significance to threatened species. Habitat evaluation conservatively assesses the potential occurrence of threatened species based on potentially suitable habitat and local records, providing a prediction of the likelihood of a particular threatened species occurring in the study area (DEC 2004, DECC 2007, Forest Fauna Surveys 1997). This approach is considered best practice to address the Principle of Uncertainty.

4.2. Corridors and Key Habitats

See Figure 6 showing the following:

Figure 6: OEH Corridors and Key Habitats



4.2.1. Regional Corridors

Regional corridors are typically >500m wide and provide a link between major and/or significant areas of habitat in the region. Ideally they are of sufficient size to provide habitat in their own right and at least twice the width of the average home range area of fauna species identified as likely to use the corridor (OEH 2015c, Scotts 2002).

The site does not fall within a regional corridor, however the mapping suggests the adjacent State Forest is a key part of a regional corridor, and the site lies adjacent to this area. However, due to urban and physical barriers (ie the Nambucca River), it is not a key stepping stone in relation to this regional corridor.

4.2.2. Sub-regional Corridors

Sub-regional corridors connect larger landscaped features and are of sufficient width to allow movement and dispersal (generally >300m), but may not provide substantial species habitat (OEH 2015c, Scotts 2002).

The site does not fall form or lie adjacent to a sub-regional corridor.

4.2.3. Local Corridors and Habitat Links

Local corridors provide connections between remnant patches of habitat and landscape features. Due to their relatively small area and width (they may be <50m), these corridors are subject to edge effects (OEH 2015c, Scotts 2002). Habitat links are evaluated in this report as links from habitat on-site directly to similar habitat on adjacent land. These would be used by fauna, which depend solely or at least partially on the site for all of their lifecycle requirements, and/or dispersal (Lindenmayer and Fisher 2006).

As evident in Figure 5, the site is part of a large remnant about 1500ha in extent and mostly consisting of the western half of Nambucca State Forest. In this context, the site is located on the lower mid-eastern side, and is directly connected to Nambucca State Forest to the south and west.

Connectivity to remnant vegetation in a SEPP 14 area to the north (a key local corridor linking the State Forest to habitat along the current Pacific Highway north back to the State Forest) is broken by existing residential development and the sportsfields, and land further north (currently largely cleared) of this habitat has been approved for residential development. Furthermore, no significant linkage occurs east due to residential development and the Nambucca River. A more important local corridor to habitat to the east and south is via private land and State Forest to the south, though this again has a limited extent east due to the same barriers. Overall however, the site has no key role as a local corridor, but is in essence a cul-de-sac.

As the site has been largely cleared in the past with only a sparse or patchy canopy tree cover remaining, habitat linkages through much of the site to the adjacent forest have been significantly reduced for arboreal species. The most intact forest on site occurs in the southeast, and a key portion of this falls within a forested road reserve which extends further east offsite, but this terminates in

residential areas. The road reserve however links west and south to Nambucca State Forest and thus acts as a key habitat link for the patch of forest in the southeast corner.

Other patches occur in the mid-south central area and southwest corner, and these currently have tentative canopy connectivity to the State Forest. Sparse tree cover between here and the east are a limitation for non-gliding species, and the openness and lack of refuge dens outside the road reserve exposures arboreal animals to predation risk.

Despite this, most of the site has sufficient tree cover to be used as a movement conduit by the Yellow-bellied Glider, which was observed to move through the site to adjacent forest during previous surveys (JWA 2005). Koalas and other common arboreal species may also potentially use these linkages to some extent, however the fully forested habitats to the west and south of the site are more likely to be utilised as the primary movement corridors for biodiversity overall as the exposure and predation risk is reduced (Lindenmayer and Fisher 2006, Watson *et al* 2003, Ford 1993). Highly mobile species such as birds and bats would be able to move easily through the site.

The dense understorey regeneration and tall grassy groundcover occurring over parts of the site would provide very good cover for smaller terrestrial species such as reptiles, rodents and in some areas for gap-shy birds, and allow them to readily move through the site to the forested areas adjacent. The presence of this cover is dependent on the maintenance regime and risk of bushfire, with the latter currently a high risk due to high fuel loads (senescent pasture grasses).

Construction of the re-aligned Pacific Highway is currently occurring 1.1km west of the site. This will lead to significant fragmentation of Nambucca State Forest and isolation of habitats either side of the highway (SKM 2010). This is likely to lead to a substantial disruption of the movements and home ranges of a number of fauna species in proximity to the route, although a number of mitigation measures are proposed to ensure connectivity can be maintained (eg underpasses, glide poles and overhead arboreal crossings).

4.2.4. Key Habitat

Key Habitats are areas of predicted high conservation value for forest faunal assemblages, endemic forest vertebrates or endemic invertebrates; spatially depicted as a merging of mapped assemblage hubs, assemblage hot spots and centres of endemism (OEH 2015c, Scotts 2002).

The majority of the site and the adjacent State Forest is mapped as Key Habitat. The significant logging and clearing events that have occurred over the site since this mapping have largely diminished these values, and the long logging history of the State Forest is also a limitation.

4.3. Fauna Survey Results

4.3.1. Habitat Evaluation

The following table summarises the results of the habitat evaluation survey:

Table 4: Habitat evaluation summary

Habitat Attribute/Type	Site/Study Area	Potential Values to Threatened Species Occurrence
Groundcover	Dense over most of site, however limited in diversity and has a moderate to high weed content. Subject to maintenance and at a high risk of fire.	These habitat components overall provide limited refuge for common mammals and reptiles (i.e. rodents, dasyurids, Grass Skinks, etc.). This substrate was not considered potentially suitable for threatened species such as the Common Planigale and Eastern Chestnut Mouse due to the lack of preferred groundcover extent/diversity; recent development and dominance by exotic species; risk of fire; and extent of previous disturbances on the site and in the area, which is likely to have long displaced these species if they were present.
Leaf litter	Shallow, dry leaf litter present throughout most of site with thicker accumulations in the swamp forest.	Would only provide potential substrate for common habitat generalists such as the Garden Sun Skink and bandicoots.
Logs and debris	Only a few fallen trees and logs on the site, which were not hollow. Stumps were common from past logging events but none contained hollows suitable for fauna.	Logs and fallen trees are considered only suitable for refuge for common terrestrial reptiles and mammals (i.e. rodents, Blue-tongue Lizards, etc).
Hollows	A total of 6 hollow-bearing tree/stags were recorded on site, and these occurred mainly around the edges. The southern road reserve contained 13 hollow-bearing trees (see Figure 7, Photo 12 and Appendix 3). The site hollow-bearing trees were generally low value and only contained small to medium hollows in dead limbs and stubs. One large tree in the road reserve (H5) contained many large and medium sized hollows and was identified as a den tree for the Yellow-bellied Glider.	Limited hollows on site for medium sized hollow obligate species such as Squirrel Glider, Yellow-bellied Glider, Little Lorikeet however hollows suitable for small or medium fauna were relatively common in the road reserve. Only one tree in the road reserve (H5) may be potentially suitable for nesting of forest owls and Glossy Black Cockatoo, but it appears to be occupied by Yellow-bellied Gliders.

Habitat Attribute/Type	Site/Study Area	Potential Values to Threatened Species Occurrence
Nectar Sources	The Eucalypts and Melaleucas on and adjacent to the site offer a potential nectar source for nectivores such as the Grey-headed Flying Fox, Swift Parrot and Little Lorikeet (OEH 2015b, Smith *et al* 1995, Eby 2000a, 2000b). Most of these are summer-early autumn flowers aside from the predominantly winter flowering Swamp Mahogany. Bloodwoods were flowering during the survey period (Photo 11).	Several flowering species present providing potential nectar resources for Squirrel Glider, Grey-headed Flying Fox, Yellow-bellied Glider, Swift Parrot, Regent Honeyeater and Little Lorikeet, plus passerine birds. Some of these species may forage on the site during flowering instances (as part of their wider foraging range). The limited extent of the site however only qualifies it as a fraction of the seasonal lifecycle requirements of these species.
Wattles, Melaleucas, Callistemons and Banksias (shrub layer)	Wattles are common in the regenerating vegetation on site and melaleucas and callistemons are reasonably common in the north of the site As these mature and develop into understorey trees, these would provide a nectar source and insect attractant.	Flowering species would provide nectar and attract insects during flowering periods, but were not considered a key habitat component for any threatened species eg Eastern Pygmy Possum.
Sap and gum sources	Pink and Red Bloodwood, Scribbly Gum and Red Mahogany are preferred sap sources for Squirrel and Yellow-bellied Gliders (NPWS 2003a, Gibbons 2002, pers. obs.). These species are common on the site. Other species present such as Blackbutt and Tallowwood are less preferred.	Good range of potential sap sources for Squirrel Gliders and Yellow-bellied Gliders. Yellow-bellied Glider feeding incisions noted on several Scribbly Gums and Bloodwoods during survey (Photo 10, Figure 8 and Appendix 3). Some trees showed smaller feeding incisions typical of a Sugar Glider.
Primary preferred Koala browse trees	A 0.3ha stand of Swamp Mahogany is present in the northwest of the site, and Tallowwood and Scribbly Gum are common to occasional canopy species over the site, primarily in the retained forest in the southeast. Despite localised occurrences, limited extent of preferred browse trees on the site overall.	Overall limited abundance of preferred browse trees on site which would be unlikely to support a resident Koala population.
Allocasuarinas	Black Oak has a scattered occurrence over the site with some larger stands occurring along the northern boundary. Most trees are young and had not developed fruit.	The limited number of Allocasuarinas on site is unlikely to attract this species. No evidence of feeding (chewed cones) found during survey.

Habitat Attribute/Type	Site/Study Area	Potential Values to Threatened Species Occurrence
Aquatic	Limited to small pools of standing water in the swamp forest and a drainage line running along the northern boundary. Small pools also occur along the boundary roads and internal roads in tyre ruts and pot holes.	Generic potential Green-thighed Frog foraging habitat and potential low quality breeding habitat in swamp forest. No habitat for stream breeding frogs, Wallum Froglet or Green and Golden Bell Frog. Aquatic habitat on site unlikely to provide foraging habitat for threatened waterbirds due to limited extent and previous disturbance.
Fruiting species	Cheese Tree and Rose Myrtle are the main fruiting species observed on the site. Exotic species such as Wild Tobacco and Lantana provide a potential fruit source. Overall marginal resource suitably mainly for common fauna.	Overall lack of preferred species used by Wompoo Fruit-dove, Rose-crowned Fruit-dove or Barred Cuckoo Shrike. Small potential fruiting source for Grey-headed Flying Fox.
Passerine bird habitat	Previous clearing over most of the site has modified the understorey habitats resulting in low diversity and poor structure for passerine birds. Some areas are regenerating which has created cover and foraging resources for passerines.	May be sufficient abundance of passerine birds for site overall to form minute fraction by raptors such as the Square-tailed Kite and Little Eagle.
Caves, cliffs, overhangs, culverts, bridges	Absent.	N/A
Terrestrial prey	Low abundance of gliders and possums would provide potential arboreal prey, with perhaps common dasyurids and rodents such as Black Rat and Bush Rat plus House Mouse most likely to form main prey base.	Small terrestrial and arboreal prey species over wider study area likely to be sufficient to support some periodic seasonal foraging by forest owls, but due to limited prey diversity and carrying capacity of the site; and given extent of more optimal habitat in State Forest: site at best only forms minute and more marginal part of a large area of potential foraging habitat within these species very large foraging range.

Photo 9: Typical Yellow-bellied Glider feeding notches in a Scribbly Gum on site

Photo 10: Flowering Bloodwood on site

Photo 11: Large hollow-bearing tree (H5)

Figure 7: Approximate location of hollow-bearing trees

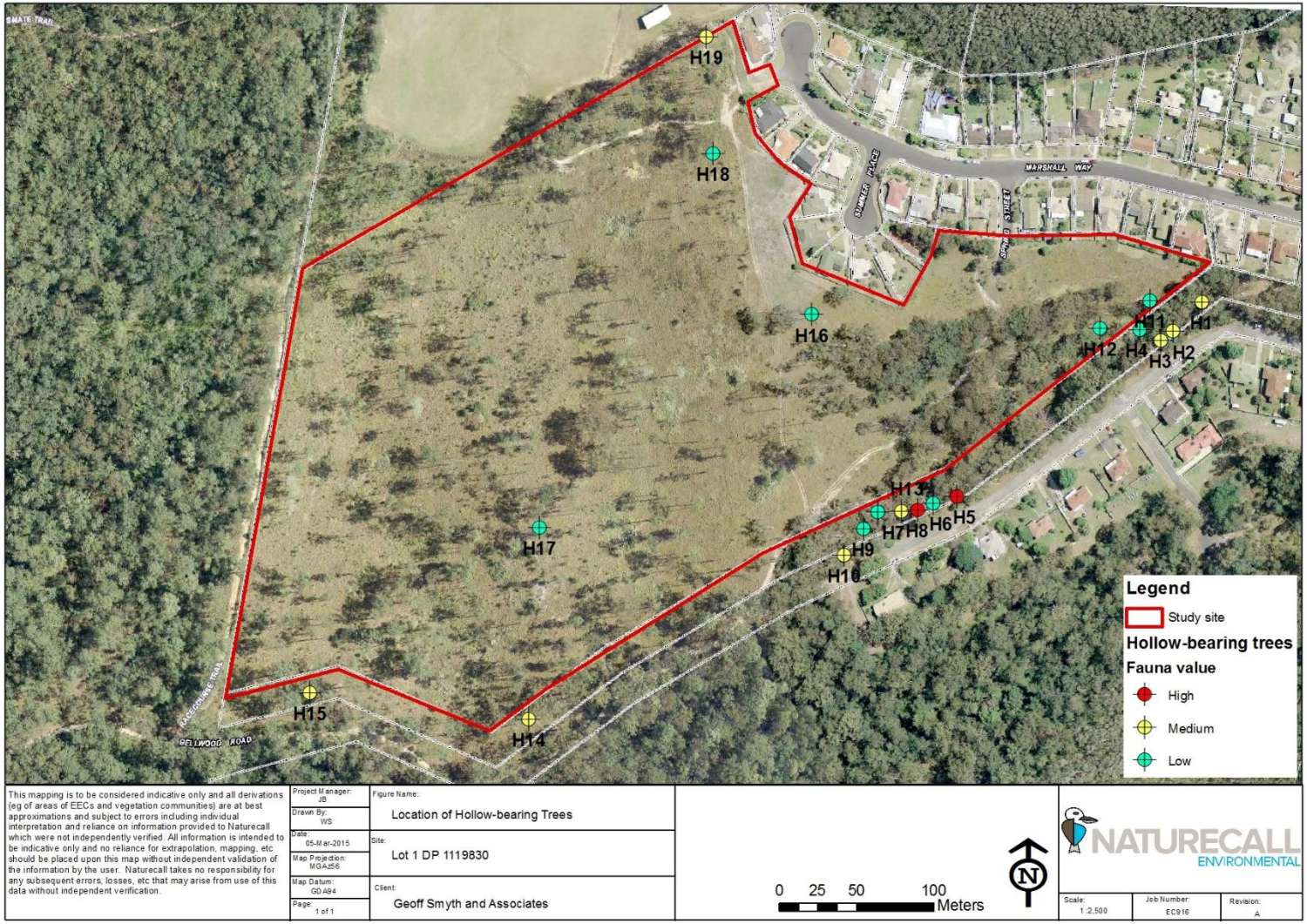
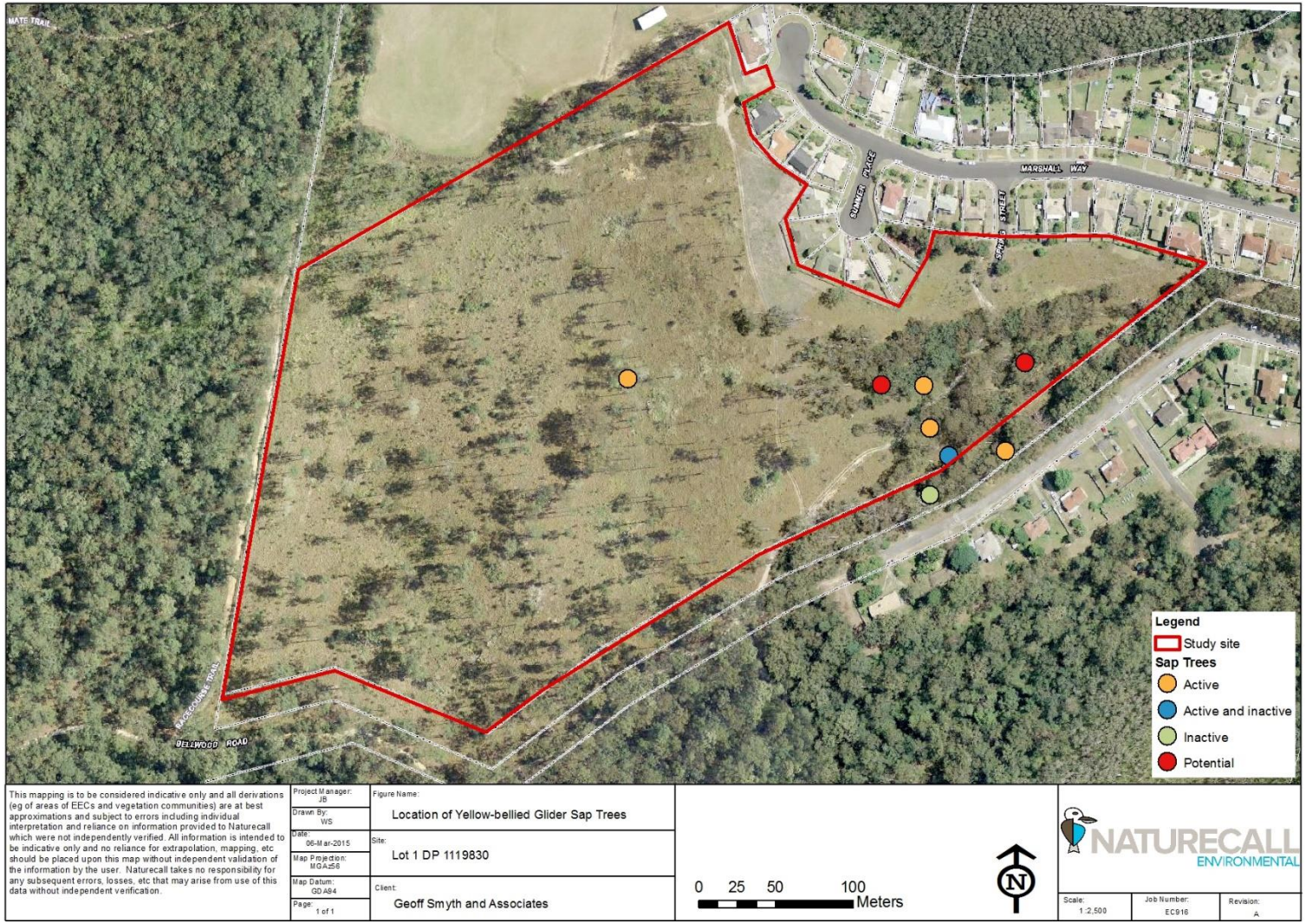


Figure 8: Location of Yellow-bellied Glider sap trees



4.3.2. Call Playback, Identification and Recording

4.3.2.1. Birds

Call playback failed to gain a response from any of the target species. A number of common birds were detected by call identification (see Table 13).

4.3.2.2. Frogs

Frogs were heard calling in relatively low abundance from around the adjacent swamp forest in the south and to the northeast. Only the following common species were heard:

- Common Eastern Froglet (*Crinia signifera*)
- Tusked Frog (*Adelotus brevis*)
- *Uperoleia* sp.
- Striped Marsh Frog (*Limnodynastes peronii*)

4.3.2.3. Arboreal Mammals

On the first night of call playback, a pair of Yellow-bellied Gliders readily responded to broadcast calls. They were initially heard vocalising from forest south of the site, and were observed shortly after in the road reserve where a key den tree and a cluster of sap trees occur (these are actively defended – NPWS 2003). Here they continued to vocalise and appeared agitated by the territorial calls played earlier. Call broadcast on the second and third nights did not gain a response from the Yellow-bellied Glider, indicating the local colony ranges widely beyond the study area within its home range (call playback and detection is often successful for these species well over 200m from the survey point, and as these species regularly vocalise and respond readily to their own and Powerful Owl playback, it stands to reason they were likely to be beyond hearing range).

No other mammal species responded to call playback.

4.3.2.4. Yangochiropteran Bats

Yangochiropteran bat calls recorded during the survey were sent to Dr Anna McConville Echo Ecology, a recognised Yangochiropteran bat ecologist for identification. The results are shown in the table below.

Table 5: Yangochiropteran bat call identification

Note: **bold** indicates species listed as Vulnerable on Schedule 2 of the TSCA Act 1995

Scientific Name	Common Species Names	No. of Definite Passes	No. of Probable Passes
Chalinolobus gouldii	Gould's Wattled Bat	3	15
Miniopterus australis	**Little Bent-wing Bat**	13	8
Vespadelus pumilus	Eastern Forest Bat	118	2

Scientific Name	Common Species Names	No. of Definite Passes	No. of Probable Passes
Mormopterus norfolkensis	**East-Coast Freetail Bat**	-	1
Rhinolophus megaphyllus	Eastern Horseshoe Bat	-	1

Those species listed as "*definite*" are most likely to be the species actually recorded. As shown above, one threatened Yangochiropteran bat species was confirmed as occurring by this survey: the Little Bent-wing Bat (V-TSCA). A second threatened species, the East-Coast Freetail Bat (V-TSCA) was a probable detection.

4.3.3. Spotlighting

On the first night of spotlighting, 3 Yellow-bellied Gliders (Vulnerable TSCA) were observed and heard calling. The first two were a pair initially heard calling and then observed in the road reserve mid-way along the southern site boundary. From here they continued to glide along the southern edge of the site in a northeasterly direction.

The third glider was observed alone in the canopy of a bloodwood next to the large hollow-bearing Scribbly Gum (H5). Although it was not seen exiting a hollow in this tree, it is presumed to be denning here. Denning by Yellow-bellied Gliders in this tree was confirmed during JWA surveys in 2005.

No Yellow-bellied Gliders were detected on the second and third nights as noted previously.

Many Grey-headed Flying Foxes (Vulnerable TSCA & EPBCA) were observed flying over the site during spotlighting and foraging on flowering Bloodwoods on the site. A large Flying Fox camp is located 2.7km to the northeast in Nambucca Heads (pers. obs.).

Other fauna recorded during spotlighting were common species including a pair of Sugar Gliders, Brushtail Possum and a number of sleeping birds. Most of these species were observed along the southern or western edges of the site.

4.3.4. Secondary Evidence

4.3.4.1. Trunk Scratches

Examination of tree trunks showed variable levels of arboreal activity depending on species. Scratches were relatively common and easily detected on smoothed barked trees (i.e. Scribbly Gum), though these were generally restricted to the mature trees (>40cm trunk DBH).

Most scratches were small and attributed to arboreal mammals such as possums and gliders. Large scratches observed on a Scribbly Gum in the southern road reserve were attributed to a Lace Monitor.

4.3.4.2. Scats, Tracks and Bones

No Koala scats were observed during scat searches over the site. Scats of Eastern Grey Kangaroo were commonly observed and a few Brushtail Possum scats were found under a Scribbly Gum in the road reserve.

The only tracks observed were from Eastern Grey Kangaroos and Wallabies. These were mostly found in mud in the northwest of the site. No bones or road kill were found during the survey.

4.3.4.3. Chewed Allocasuarina Cones

No chewed cones indicative of foraging by the Glossy Black Cockatoo were identified in the site or study area.

4.3.4.4. Sap Incisions

Characteristic sap incisions from Yellow-bellied Gliders were observed on a number of trees in the southeast of the site, as shown in Figure 7. Scribbly Gum and Red Bloodwood were the only species utilised and showed varying levels of use.

Many trees also had small incisions typical of feeding activity by Sugar Gliders which were also observed during the survey.

4.3.5. Opportunistic observations

4.3.5.1. General

Table 6 lists all the species (with the exception of Yangochiropteran bats) detected by this survey on and adjacent to the study site. A total of 53 species were recorded, comprising 40 birds, 7 mammals, 2 reptiles and 4 frogs.

4.3.5.2. Birds

A single threatened bird species was observed during the survey: the Little Lorikeet (V-TSCA). These were regularly seen flying over the site in small flocks of up to 15 birds, perching in trees (Photo 12) and foraging in flowering Bloodwoods. This bird was previously recorded

Two migratory bird species were detected during the survey, these being the Rainbow Bee-eater and Rufous Fantail.

Bird activity on the site was generally low, and most species were detected while traversing the southern and western periphery roads which occurred adjacent to the State Forest. Species commonly observed or heard calling included Grey-shrike Thrush, Eastern Yellow Robin, Golden Whistler and White-throated Gerygone. Flowering paperbarks in the northwest attracted a number of honeyeaters such as the Eastern Spinebill, Little Wattlebird and Lewin's Honeyeater. Diversity and abundance would vary with season ie latitudinal migrants, flowering periods and prey abundance.

Bird activity over the remainder of the site was generally low and mostly limited to foraging Lorikeets, Rainbow Bee-eaters and small passerines in the understorey such as Red-backed Fairy Wren, Red-browed Finch and Grey Fantail.

4.3.5.3. Reptiles

Reptile activity on the site was low with only 2 species detected – the Lace Monitor and Garden Sun-skink. This result was indicative of the habitats present and disturbance history, but also the limited survey period and density of groundcover which limited detection. Common species of snakes and skinks are also likely to be present.

4.3.6. Total Fauna Observed

The following table lists all fauna recorded by this survey. The location of detected threatened species (excluding Yangochiropteran bats) is shown in Figure 9.

Table 6: Fauna recorded on and adjacent to the site

Group	Common Name	Species	Detection Method
Mammals	Eastern Grey Kangaroo	*Macropus gigenteus*	Obs, scats, tracks
	Red-necked Wallaby	*Macropus rufogriseus*	Tracks, scats
	Grey-headed Flying Fox[+]	*Pteropus poliocephalus*	Obs
	Northern Brown Bandicoot	*Isoodon macrourus*	Obs, diggings
	Brushtail Possum	*Trichosurus vulpecula*	Obs, scats
	Yellow-bellied Glider	*Petaurus australis*	Obs, HC
	Sugar Glider	*Petaurus breviceps*	Obs
Birds	Australian Hobby	*Falco longipennis*	HC
	Masked Lapwing	*Vanellus miles*	Obs
	Grey Shrike-thrush	*Colluricincla harmonica*	Obs
	White-throated Treecreeper	*Cormobates leucophaea*	Obs, HC
	Australian Magpie	*Cracticus tibicen*	Obs, HC
	Noisy Miner	*Manorina melanocephala*	Obs, HC
	Crested Pigeon	*Ocyphaps lophotes*	Obs
	Rainbow Lorikeet	*Trichoglossus haematodus*	Obs, HC

Group	Common Name	Species	Detection Method
	Eastern Rosella	*Platycercus eximius*	Obs, HC
	Laughing Kookaburra	*Dacelo novaeguineae*	Obs, HC
	Willie Wagtail	*Rhipidura leucophrys*	Obs, HC
	Pied Butcherbird	*Cracticus nigrogularis*	Obs, HC
	Rainbow Bee-eater[#]	*Merops ornatus*	Obs, HC
	Grey Fantail	*Rhipidura albiscapa*	Obs
	Rufous Fantail[#]	*Rhipidura rufifrons*	Obs
	Eastern Yellow Robin	*Eopsaltria australis*	Obs
	White-browed Scrubwren	*Sericornis frontalis*	Obs
	White-cheeked Honeyeater	*Phylidonyris niger*	Obs
	Black-faced Cuckoo Shrike	*Coracina novaehollandiae*	Obs, HC
	Little Lorikeet	*Glossopsitta pusilla*	Obs, HC
	Scaly-breasted Lorikeet	*Trichoglossus chlorolepidotus*	Obs, HC
	Rainbow Lorikeet	*Trichoglossus haematodus*	Obs, HC
	Red-backed Fairy Wren	*Malurus melanocephalus*	Obs
	Brown Thornbill	*Acanthiza pusilla*	Obs
	White-throated Gerygone	*Gerygone albogularis*	Obs, HC
	Magpie Lark	*Grallina cyanoleuca*	Obs
	Red-browed Finch	*Neochmia temporalis*	Obs
	Yellow-tailed Black Cockatoo	*Calyptorhynchus funereus*	HC
	Brown Gerygone	*Gerygone mouki*	HC
	Lewin's Honeyeater	*Meliphaga lewinii*	Obs, HC
	Eastern Whipbird	*Psophodes olivaceus*	HC
	Little Wattlebird	*Anthochaera chrysoptera*	Obs

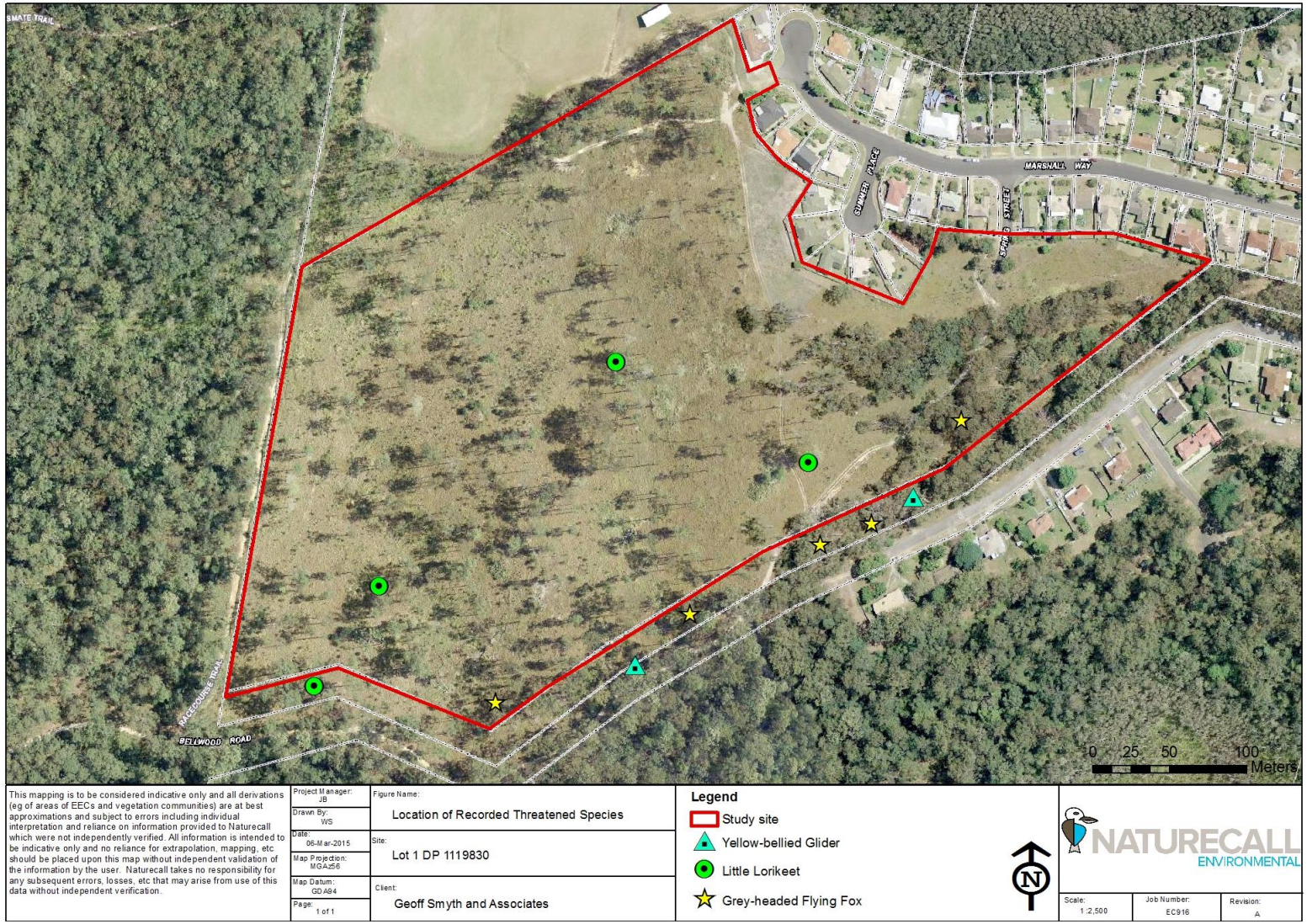
Group	Common Name	Species	Detection Method
	Eastern Spinebill	*Acanthorhynchus tenuirostris*	Obs
	Golden Whistler	*Pachycephala pectoralis*	HC
	Noisy Friarbird	*Philemon corniculatus*	Obs, HC
	Superb Fairy Wren	*Malurus cynaeus*	Obs
	Australian King Parrot	*Alisterus scapularis*	Obs
	Pheasant Coucal	Centropus phasianinus	HC
	White-headed Pigeon	*Columba leucomela*	Obs
	Yellow Thornbill	*Acanthiza nana*	Obs
Reptiles	Garden Sun-skink	*Lampropholis delicata*	Obs
	Lace Monitor	*Varanus varius*	Resident report, potential trunk scratches
Amphibians	Common Eastern Froglet	*Crinia signifera*	HC
	Toadlet	*Uperoleia sp.*	HC
	Tusked Frog	*Adelotus brevis*	HC
	Striped Marsh Frog	*Limnodynastes peronii*	HC

Key: **Bold**: Vulnerable under TSCA
[+] Vulnerable under EPBCA
[#] Migratory under EPBCA
* Indicates introduced species.
Observation Key: Obs – Observation; HC – heard calling

Photo 12: Little Lorikeets recorded on the site

Photo 13: Rainbow Bee-eater

Figure 9: Location of detected threatened species



4.3.7. Locally Recorded Threatened Fauna

The following table lists threatened species known to occur in the locality (OEH 2015a, JWA 2007, JWA 2005, Darkheart 2011b, Berrigan 2002, SKM 2010).

Table 7: Threatened species recorded in the locality

Group	Common Name	Species	Legal Status	Distance From Study Site/General Location
	Koala	*Phascolarctos cinereus*	V-TSCA	Warrell Creek, Macksville, Gumma, Nambucca State Forest, Scotts Head, Valla
	Spotted-tailed Quoll	*Dasyurus maculatus*	V-TSCA, E-EPBCA	North Macksville, Valla, Bald Hill Rd
	Brushtailed Phascogale	*Phascogale tapoatafa*	V-TSCA	Bald Hill Road, Scotts Head, Warrell Creek, Nambucca Heads
	Common Planigale	*Planigale maculate*	V-TSCA	Valla Beach
	Squirrel Glider	*Petaurus norfolcensis*	V-TSCA	North of Scotts Head, Gumma, Bald Hill Rd
	Yellow-bellied Glider	*Petaurus australis*	V-TSCA	Numerous records in locality including on site and nearby land to north, Nambucca State Forest, Valla
	Little Bent-wing Bat	*Miniopterus australis*	V-TSCA	Recorded on site, Scotts Head, South Macksville, Nambucca State Forest, Nambucca Heads
	Eastern Bent-wing Bat	*M. orianae oceanensis*	V-TSCA	Record on site, Nambucca State Forest, Gumma, South Macksville
	Greater Broad-nosed Bat	*Scoteanax rueppellii*	V-TSCA	Record on site, Nambucca State Forest, Nambucca Heads
	East-coast Freetail Bat	*Micronomus norfolkensis*	V-TSCA	Recorded on site, Nambucca State Forest, Nambucca Heads, Macksville
	Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V-TSCA	Bellwood, Hyland Park, Blakebrook

Group	Common Name	Species	Legal Status	Distance From Study Site/General Location
	Eastern Cave Bat	*Vespadelus troughtoni*	V-TSCA	East West Road
	Southern Myotis	*Myotis macropus*	V-TSCA	Record on site, Nambucca Heads, Nambucca State Forest
	Eastern Blossom Bat	*Syconycteris australis*	V-TSCA	Scotts Head, Gumma
	Grey-headed Flying Fox	*Pteropus poliocephalus*	V-TSCA, V-EPBCA	Recorded on site, Scotts Head, Nambucca State Forest, Macksville, Gumma, Bowraville, Newee Creek
Birds	Glossy Black-Cockatoo	*Calyptorhynchus lathamii*	V-TSCA	Wirrimbi, Scotts Head, Yarrahappini NP, Gumma, Newee Creek, Nambucca State Forest
	Square-tailed Kite	*Lophoictinia isura*	V-TSCA	Macksville, Nambucca Heads, Gumma, Nambucca State Forest
	Powerful Owl	*Ninox strenua*	V-TSCA	<500m north of site, Viewmont State Forest, Nambucca State Forest, Yarrahappini NP.
	Masked Owl	*Tyto novaehollandiae*	V-TSCA	Yarrahappini NP, Donnellyville, Way Way Creek Rd
	Sooty Owl	*Tyto tenebricosa*	V-TSCA	Viewmonst State Forest, Nambucca State Forest
	Wompoo Fruit Dove	*Ptilinopus magnificus*	V-TSCA	Nambucca State Forest, Viewmont State Forest
	Superb Fruit Dove	*Ptilinopus superbus*	V-TSCA	Valla
	Barred Cuckoo-shrike	*Coracina lineata*	V-TSCA	Yarrahappini NP, Gumma, Nambucca State Forest
	Varied Sittella	*Daphoenositta chrysoptera*	V-TSCA	Bellwood, Gumma, Nambucca State Forest
	Scarlet Robin	*Petroica boodang*	V-TSCA	Valla Beach

Group	Common Name	Species	Legal Status	Distance From Study Site/General Location
	Brown Treecreeper	*Climacteris picumnus*	V-TSCA	Bellwood
	Little Lorikeet	*Glossopsitta pusilla*	V-TSCA	Bellwood, Nambucca Heads
	Regent Honeyeater	*Anthochaera Phrygia*	E-TSCA, E-EBCA	Macksville
	Osprey	*Pandion haliaetus*	V-TSCA, EPBCA-Migratory	Record on site, Macksville, Gumma, Nambucca State Forest, Congarinni North, Nambucca River.
	Jabiru/Black Necked Stork	*Ephippiorhynchus asiaticus*	E-TSCA	Macksville, Nambucca River, Talarm, Gumma, Warrell Creek, Valla, 100 Acre Swamp, Taylors Arm
	Brolga	*Grus rubicunda*	V-TSCA	South Macksville, Bald Hill
	Black Bittern	*Ixobrychus flavicollis*	V-TSCA	South Macksville
	Beach Stone-curlew	*Esacus neglectus*	E-TSCA	Gumma, Nambucca Heads area
Frogs	Giant Barred Frog	*Mixophyes iteratus*	E-TSCA, E-EPBCA	South of Viewmont
	Green and Golden Bell Frog	*Litoria aurea*	E-TSCA, V-TSCA	Outdated record (1975) from South Macksville
	Green-thighed Frog	*Litoria brevipalmata*	V-TSCA	Record in study area, Nambucca Heads, Nambucca State Forest
Insects	Black Grass-dart Butterfly	*Ocybadistes knightorum*	E-TSCA	Numerous records along Warrell Creek banks, Gaagal Wanggaan National Park

The study area is located on land and does not encompass any ocean or estuarine areas, thus sea birds, etc., are not considered in this assessment.

The following species are considered likely to occur in the locality (excluding sea birds, etc.) due to suitable habitat and regional records in similar habitat (some have been recorded within 20km).

Table 8: Threatened fauna potentially occurring in the locality

* listed under the EPBC Act 1999.

Animal Group	Potentially Occurring Species
Mammals	Rufous Bettong, Long-nosed Potoroo*, Eastern Chestnut Mouse, Eastern Pygmy Possum, Golden-tipped Bat, Eastern Long-eared Bat, Hoary Wattled Bat, Yellow-bellied Sheathtail Bat, New Holland Mouse*
Birds	Barking Owl, Grass Owl, Spotted Harrier, Flame Robin, Hooded Robin, Bush Stone-curlew, Grey-crowned Babbler, Olive Whistler, Ground Parrot, Australasian Bittern*, Painted Snipe, Blue-billed Duck, Freckled Duck, Comb-crested Jacana, Magpie Goose, White-fronted Chat, Swift Parrot*
Reptiles	Pale-headed Snake, Stephens Banded Snake, Three-toed Snake-tooth Skink*
Frogs	Stuttering Frog*, Wallum Sedge Frog*, Wallum Froglet

4.4. Potential Occurrence Assessment

Each of the species listed in the above two tables have been evaluated for their potential to occur on the study site/area, as well as for the likely significance of the proposal and thus their eligibility for Seven Part Test assessment, in Appendix 1.

4.4.1. New South Wales

The following species listed under the NSW *Threatened Species Conservation Act* are considered to potentially occur:

Table 9: Threatened species potentially occurring on the site/study area

Species	Occurrence Type	Occurrence Likelihood (See Appendix 1)
Square-tailed Kite	Potential to form minute portion of large foraging territory. Generic potential nest trees.	Fair chance as periodic forager.
Little Eagle	Potential to form minute portion of large foraging territory. Generic potential nest trees.	Low chance as periodic forager as no local records.
Powerful Owl	Study area contains broadly suitable foraging habitat that may form small part of a territory.	>Moderate chance of periodic forager in study area due to prey species and extent of State Forest.
Masked Owl	Study area contains broadly suitable foraging habitat that may form small part of a territory.	>Fair chance of periodic forager on marginal fringe of core range.

Species	Occurrence Type	Occurrence Likelihood (See Appendix 1)
Varied Sittella	Study area contains broadly suitable foraging habitat that may be used seasonally. Some potential to nest within interior habitat in State Forest.	Fair chance on southern and western fringes of site on edge of State Forest as forage, in State Forest. Moderate to high chance in State Forest in study area as recorded within 700m north.
Brown Treecreeper	Southern and western edges of site and adjacent forest may be suitable foraging habitat. More likely on edge of State Forest due to harassment by Noisy Miners and other medium-sized woodland birds.	Low chance foraging across site, fair chance in study area.
Koala	Site has some preferred forage species which are mostly concentrated in the northwest and southeast. More abundant and extensive in adjacent forest.	Low chance foraging on site or as transient.
Yellow-bellied Sheathtail Bat	Site/study area offers potential foraging and marginal roosting habitat in tree hollows.	Low to fair chance of foraging within forest canopy on the site; moderate chance in State Forest.
Eastern False Pipistrelle	Site/study area offers potential foraging and marginal roosting habitat in tree hollows.	Low chance of foraging over sparse forest canopy on the site; moderate to high chance of occurring in State Forest as recorded within 700m north.
Hoary Bat	Potential foraging habitat on site and in study area with potential roosts.	Low to fair with at least fair potential to occur in State Forest.
Green-thighed Frog	Marginal potential breeding habitat in northwest corner where some water pooling occurs, but considered too ephemeral. Generic potential foraging habitat on site and in study area. Less disturbed habitat and better breeding opportunities to south in State Forest.	Recorded in study area. Low to fair potential for non-breeding foraging on site. >Fair potential to occur on site.

4.4.2. Commonwealth

The following species are considered by the DoE Matters of National Environmental Significance search tool as potential occurrences in the locality. Marine birds, mammals and reptiles and all fish listed in the search are irrelevant as the site/study area does not contain habitat and the proposal has no potential to impact these species.

4.4.2.1. Threatened Species

Table 10 summarises the species predicted by the search tool as potential occurrences, and other species with potential to occur in the locality, for their potential to occur on site, in the study area or on the property. The potential for these species to occur on the site is also reviewed in Appendix 1.

Table 10: EPBC Act threatened fauna species potential occurrence assessment

Note: Likelihood of occurrence derived from opinions of consultants in consideration of known ecology of each species (see Appendix 1); and quality of habitat on-site. * indicates listed on DoE website search.

Group	Common Name	Scientific Name	Listing Status	Recorded In Locality	Suitable Habitat On Site/Study Area	Likelihood Of Occurrence
Birds	*Regent Honeyeater	*Xanthomyza phrygia*	CE	Y	Very small extent of potential foraging resources on site in northwest swamp forest.	Unlikely to occur due to limited preferred foraging resources and lack of local records indicating seasonal occurrence.
	*Australian Painted Snipe	*Rostratula australis*	V	N	No potential habitat on site.	Unlikely to occur
	*Red Goshawk	*Erythrotriorchis radiatus*	E	N	Generic potential habitat forming minute fraction of such habitat. Not	Unlikely as not seen south of Clarence River.
	*Eastern Bristlebird	*Dasyornis brachypterus*	E	N	No suitable habitat.	Unlikely to occur.
	*Australasian Bittern	*Botaurus poiciloptilus*	E	N	No suitable habitat.	Unlikely to occur.
	*Swift Parrot	*Lathumus discolor*	E	N	Very small extent of potential foraging resources on site in northwest swamp forest.	Unlikely to occur due to limited preferred foraging resources and lack of local records indicating seasonal occurrence.
Mammals	*Long-nosed Potoroo	*Potorous tridactylus*	V	N	No suitable habitat.	Unlikely potential to occur – no local records and patchy coastal records throughout its distribution. Highly likely to be foxes, cats and wild dogs.

Group	Common Name	Scientific Name	Listing Status	Recorded In Locality	Suitable Habitat On Site/Study Area	Likelihood Of Occurrence
	*Koala	*Phascolarctos cinereus*	V	Y	Site has some preferred forage species which are also likely to be common on adjacent land.	Low chance foraging on site or as transient.
	*Spotted-tail Quoll	*Dasyurus maculatus*	E	Y	Marginal at best foraging and denning habitat on site.	Unlikely to occur as only degraded edge of large body of potential habitat, however extensive interface with rural and urban zones raises risk of conflicts (eg chicken raiding); and highly likely to compete with feral cats, foxes and possibly wild dogs.
	*Grey-headed Flying Fox	*Pteropus poliocephalus*	V	Y	Eucalypts and Melaleucas on site suitable for seasonal nectar foraging.	**Recorded on site**
	*Dwyer's/Large Pied Bat	*Chalinolobus dwyeri*	V	N	Generic forage habitat over forest. No potential roosts in study area.	Unlikely to occur due to lack of local records or likely roosts.
	*Brushtailed Rock Wallaby	*Petrogale penicillata*	V	N	No suitable habitat in locality.	Unlikely to occur.
	*New Holland Mouse	*Pseudomys novaehollandiae*	E	N	Site habitat too disturbed and not preferred type.	Unlikely to occur.
Frogs	*Green and Golden Bell Frog	*Litoria aurea*	V	Y	No suitable habitat.	Unlikely to occur.
	*Stuttering Frog	*Mixophyes balbus*	V	N	No suitable habitat in study area.	Unlikely to occur.

Group	Common Name	Scientific Name	Listing Status	Recorded In Locality	Suitable Habitat On Site/Study Area	Likelihood Of Occurrence
	Wallum Sedge Frog	*Litoria olongburensis*	V	N	No potential habitat and site located outside known distribution.	Unlikely to occur.
	*Giant Barred Frog	*M. iteratus*	*E*	Y	No suitable habitat in study area.	Unlikely to occur.

4.4.3. Migratory Species

The Rainbow Bee-eater and Rufous Fantail were the only EPBC Act migratory species recorded on the site by the survey. A record of the Osprey is located on the site (OEH 2015a), but this is likely to be a flyover from a nest about 1km north (JWA 2013).

A significant number of other EPBC Act 1999 listed migratory bird species are known (OEH 2015a, JWA 2013, 2007) or considered potential occurrences in the locality (DoE 2014a). A search of the MNES website and literature review (Readers Digest 1990, DoE 2015b) also produced a list of likely occurrences. All of these species plus some considered by the consultant as potential occurrences in the LGA in similar habitat to that on the property are also shown in the following table, with an evaluation made on likelihood of occurrence based on cited ecology. Note this list excludes seabirds, etc, due to lack of habitat in the study area, as detailed above.

Table 11: EPBC Act migratory species potential occurrence assessment

Common Name	Scientific Name	Predicted Type of Occurrence	Recorded In Locality (10km Radius)	Suitable Habitat On Site/Study Area	Likelihood Of Occurrence
*White-Bellied Sea-Eagle	*Haliaetus benghalensis*	Species and/or habitat likely to occur within area	Y	No suitable foraging habitat on site – chance fly-over only.	Unlikely
Osprey	*Pandion cristatus*	-	Y	As for White-Bellied Sea-Eagle.	**Bionet Atlas record on site** – probably chance fly over from nearby river or nest
Latham's Snipe	*Gallinago hardwickii*	Species or habitat may occur in area	Y	No suitable habitat.	Unlikely
Australian Painted Snipe	*Rostratula benghalensis (australis)*	Species and/or habitat may occur in area	N	No suitable habitat.	Unlikely
Great Egret	*Egretta alba*	Species/habitat may occur in area	Y	No suitable habitat.	Unlikely
Rainbow Bee-eater	*Merops ornatus*	Species/habitat may occur in area	Y	Suitable foraging habitat over most of site.	**Recorded on site**
Regent Honeyeater	*Xanthomyza phrygia*	Species/habitat may occur in area	Y	Very small extent of potential foraging resources on site in northwest swamp forest.	Unlikely to occur due to limited preferred foraging resources and lack of local records indicating seasonal occurrence.

Common Name	Scientific Name	Predicted Type of Occurrence	Recorded In Locality (10km Radius)	Suitable Habitat On Site/Study Area	Likelihood Of Occurrence
Swift Parrot	*Lathumus discolor*	Species/habitat may occur in area	N	Very small extent of potential foraging resources on site in northwest swamp forest.	Unlikely to occur due to limited preferred foraging resources and lack of local records indicating seasonal occurrence.
Rufous Fantail	*Rhipidura rufifrons*	Breeding or breeding habitat may occur in area	Y	Southern and western edges of site and adjacent forest comprise suitable habitat	**Recorded on southern edge of site**
Satin Flycatcher	*Myiagra cyanoleuca*	Breeding or breeding habitat likely in area	Y	Southern and western edges of site and adjacent forest comprise suitable habitat	Low to fair
Black Faced Monarch	*Monarcha melanopsis*	Breeding or breeding habitat may occur in area	Y	Southern and western edges of site and adjacent forest comprise suitable habitat	Low
Spectacled Monarch	*M. trivirgatus*	Breeding or breeding habitat likely in area	Y	Southern and western edges of site and adjacent forest comprise suitable habitat	Low
White-throated Needletail	*Hirundapus caudacutus*	Species/habitat likely to occur in area	N	Yes as part of a broader area	Moderate-high, as transient, between Dec-April
Fork-tailed Swift	*Apus pacificus*	Species/habitat may occur in area	N	Yes as part of a broader area	Fair potential, as transient, between Oct-April

5.0 SEPP 44 - Koala Habitat Assessment

5.1. Potential Koala Habitat

From visual observation alone, it is readily clear that the site clearly contains a sufficient density of Schedule 2 primary-preferred food trees (ie Tallowwood, Scribbly Gum and Swamp Mahogany) over at least 1ha, and thus qualifies as Potential Koala Habitat (PKH). A formal count was thus redundant.

An assessment to determine if Core Koala Habitat (CKH) is present was undertaken and is detailed in Appendix 4.

5.2. Core Koala Habitat

As detailed in Appendix 4, the site failed to qualify as Core Koala Habitat as:

- Lack of recent or historical sightings of Koalas on site or nearby.
- Failure to detect Koalas eg via spotlighting, diurnal searches and call playback.
- Failure to identify an Area of Major Activity.

Consequently, a Koala Plan of Management is not required.

6.0 Impact Identification and Assessment

6.1. Direct Impacts

6.1.1. Habitat Loss

As mentioned previously, the proposal is a residential subdivision of the site, with the creation of 133 residential Lots and 2 deferred Lots in the southeast. The footprint of the development is approximately 14.5ha (most of which is mapped as scattered trees) which comprises the residential Lots, internal access roads and the APZs extending offsite to the north and south.

The development will require the removal of most of the previously disturbed vegetation on the site (see table 12) aside from the open forest (vegetation community 1) in the deferred Lots in the southeast. For the APZ, a cleared separation area of 5m width is proposed along the southwestern site boundary as well as selective canopy and understorey vegetation thinning in the road reserve. Some selective vegetation removal may also be required for the APZ in the north of the site.

Up to three low value hollow-bearing trees fall in the development footprint and require removal. These are identified as H16, H17 and H18. An identified Yellow-bellied Glider sap tree in the centre of the site and potentially one in the southeast will also require removal. Hollow-bearing trees falling in the Asset Protection Zones can be retained via removal of other trees.

Table 12: Approximate areas of vegetation to be removed/modified

Community	Area to be removed
VC1: Tall Open Dry Sclerophyll Forest 1	0.1ha
VC2: Tall Open Dry Sclerophyll Forest 2	1.5ha
VC3: Tall Open Mixed Sclerophyll Woodland	3.5ha
VC4: Tall Open Swamp Sclerophyll Forest	0.8ha
VC5: Scattered Trees	7.8ha
VC6: Mid-high Closed Grassland	0.8ha
Total	**14.5ha**

6.2. Indirect Impacts

The following indirect impacts are generally associated with residential to rural development. The following table evaluates the likelihood of occurrence and potential significance:

Table 13: Indirect impacts associated with the proposal

Threat	Literature Review	Assessment Of Proposal
Direct mortality via clearing and habitat destruction	Animals within hollows and fallen logs, as well as dense vegetation and leaf litter may be killed during clearing of these structures (RMS 2011). This risk increases during breeding seasons (generally spring to late autumn), and cooler season when mammals and reptiles enter torpor.	As mentioned above, 3 hollow- bearing trees may potentially be removed for the development, hence there is a risk of mortality during clearing. Hollow-bearing tree removal protocol recommended to be followed. Much of the site has a very dense cover of tall, rank pastoral grasses, as well as stumps and logging remains which offers cover and habitat for a range of small to medium terrestrial reptiles, mammals and frogs. During clearing with bulldozers, some of these fauna will be at risk of mortality by direct (eg crushing and burial) and indirect (eg predation due to displacement and lack of refugia). These will be a mix of protected native species and exotics. Recommendations are made to minimise this risk.
Fragmentation and Landscape change	Fragmentation and the associated landscape changes at all scales is major factor in the decline of biodiversity, the modification of ecosystems, and alteration of ecosystem processes. Its effects vary with factors such as distance of fragments from similar habitat, their position in the landscape, the forms of habitat modification of isolates that occurs (e.g. due to edge effects), and types of surrounding land uses in the matrix, the ecology of the species affected, and how these factors influence the movement of organisms between the isolates and larger areas of habitat (Lindenmayer and Fisher 2006, OEH 2015b). Edge effects (eg microclimate change, weed invasion, nest predation, conspecific competition, etc) further add to the cumulative negative effect, resulting in impacts on biodiversity and even viability of	The proposal will incrementally and cumulatively increase fragmentation in the study area, which has been progressively fragmented by urban development as per land zoning for several decades. Historical fragmentation has already reduced linkage to a SEPP 14 wetland to the north. The proposal will affect the movement patterns of some species that currently use the site to access the State Forest to the west via the shortest route possible from the east (eg Yellow-bellied Glider from the habitat in the southeast deferred Lots and the unformed road reserve). However the site is not a key habitat linkage or part of a local corridor, and sufficient connectivity will remain around the site

	local populations.	(especially along the southern side due to the unformed road reserve), hence effective isolation of habitats in the study area will not result. The Yellow-bellied Glider was recorded using the unformed road reserve as a primary route to the south and west, and despite the vegetation here being modified for the APZ, this linkage will remain post-development to allow this species to utilise the retained sap trees and known den site in the southeast.
Fencing	Fences have potential to obstruct the movement of threatened fauna across the site via acting as barriers eg sheet metal fencing. Some threatened fauna can be injured by collision with wire fences, particularly barbed wire eg the Yellow-Bellied Glider, owls and Squirrel Glider have been recorded being injured by barbed wire fences (Lindenmayer 2002, Berrigan 2001c, Woodford 1999).	Fencing around the site is likely to consist of wooden palings and sheet metal, hence is not likely to pose a risk of entanglement. No fence will be erected around the deferred Lots or bisecting any vegetation, hence no barrier to access will be created here.
Weed Invasion	Disturbance of soil provides the opportunity for weed invasion. Weeds may also be transported to the site from vehicle, people (e.g. on clothing), etc., who visit the development area, and via introduced fill material. New edges which have higher solar radiation inputs also provide new habitat and invasion points for weeds. Weed significance varies with the weed type eg a transformer weed can invade and modify native vegetation communities, while these and others can stall regeneration of disturbed sites. Other weeds will only persist in localised areas due to habitat constraints or ecological processes eg bushfire and drainage.	Soil disturbance will occur, providing opportunity for weed invasion, but this will occur within the development envelopes where the groundcover will be intensively managed. Lantana is the only main transformer weed present. This may establish on new edges post-development. Green wastes may be dumped into the road reserves and edge of the State Forest over fences, or in the State Forest along trails via new residents. This poses a risk of garden escapees establishing in these edges. These seldom comprise transformer weeds however, and are unlikely to see significant degradation of vegetation integrity.
Vehicle Strike	Wildlife and particularly Koala road kills and injuries predominantly occur on high volume, high speed (60-100km/hr) streets and roads with poor visibility through sight interference (eg crests and corners) or poor visibility (eg inadequate street lighting) (Wilkes and	Two new primary entrances are proposed off Marshall Way. One will partially front the State Forest to the west, while the main access off Spring St will pass through the habitat on the deferred Lots. Both roads will be zoned

	Snowden 1998, Connell Wagner 2000, Port Stephens Council 2001, Lunney et al 1999, DECC 2008, AKF 2007). Furthermore, habitat adjacent to black spots (road sections characterised by high wildlife mortality) may also act as "sinks" to surrounding populations ie constant loss of recruits replacing previously killed individuals (Jones 2000, Gibbons and Lindenmayer 2006, Lindenmayer and Fisher 2006, AKF 2007, DECC 2008, Goldingay and Taylor 2005, Rhodes *et al* 2008).	50km/hr. These roads are considered to pose a low threat of vehicle strike given Koalas are not present; the area of habitat in the southeast will contain a limited diversity of fauna which may be at risk of this threat (none threatened); and most of the roads will pass through developed areas and not bisect vegetation. Proximity to the State Forest and formal connection via a bush fire access in the southwest corner suggests residents may use recreational 4WD on State Forest roads. Due to road conditions, speeds should be low and hence strike risk is not considered a key threat.
Noise, Vibration, and Anthropogenic Disturbances	Noise effects on fauna in Australia are relatively poorly studied (Clancy 2001, Berrigan 2001d). Most evidence presented is anecdotal, but suggests most fauna have at least a fair degree of tolerance and adaptation at least to residential noise depending on species, situation, habitat/lifecycle stage affected, habitat significance, etc. Vibration can be an issue for cave-roosting fauna, or potentially fauna in hollows. Vibration is usually associated with mining/quarrying (eg blasting), major earthworks and heavy vehicles. Some species also show a sensitivity to human presence eg nesting birds, waders, etc, and presence of pets (eg dog scats and scent marking). This can lead to avoidance of habitat interfaces, range contraction, etc. Other impacts can include increased mortality due to pest or threat perception ie risk of stock predation; collection for pets; or direct interference eg disturbing nests or roosts. This can manifest into minor short term impacts (eg temporary avoidance), to loss of key breeding animals, and the decline of diversity in spatially limited and poorly	Currently, noise is derived from residential areas and roads to the east and north of the site in the form of mowers, vehicles and human activities. During the development's establishment, noise will be highest during construction, but limited to day time hence will only impact diurnal birds and mammals above current levels. Post-development, noise will be typical of the adjacent residential area which is generally low to nil at night after the first few hour after dusk, and increasing during the day via traffic and mowers. Almost of the subject fauna have been recorded in peri-urban situations, and given current levels in proximity to the site, this impact is not considered likely to lead to a significant range contraction or long term avoidance. Potential direct access to the State Forest poses the risk of recreational 4WD. This could lead to elevated activity in the State Forest (mostly diurnal) which may deter sensitive fauna. Given recreational 4WD and motorbikes are likely to currently

	connected areas.	frequent the State Forest this is considered a low impact threat. Other anthropogenic impacts are considered a minor impact given none of the known or potentially occurring threatened species are recognised as particularly susceptible, and it is unlikely (due to exposure to edge effects and predators) that any bird nests on site.
Artificial Lighting	Lighting may potentially discourage particularly nocturnal native species from foraging near areas of development (ie Squirrel Gliders), especially given light may travel significant distances and it can have a similar effect to a full moon on the hunting success of predators such as owls, or a behavioural avoidance impact by potential prey species (DEC 2004a, Andrews 1990, Grayson and Calver 2004). Lighting has also been observed to delay emergence from hollows and alter Yangochiropteran bat assemblages in peri-urban habitats (Hourigan *et al* 2009). Conversely, wallabies, kangaroos, Tawny Frogmouth Owls, Kookaburras, Magpies and possums have been noted foraging under artificial lighting in residential areas eg around Lake Innes, Port Macquarie and Kendall (personal observations). Artificial lighting may also be beneficial to Yangochiropteran bats by localised aggregation of insects, with these animals being observed foraging under streetlights, and even landing on lit footpaths in Horton St Port Macquarie to scamper for insects (personal observations). Squirrel Gliders have been recorded in caravan parks with all night street lighting and rural residential areas (Darkheart 2005a, 2005b 2005c, 2005d, 2005f, 2004a, 2004b), and both the Squirrel Glider and the Yellow-bellied Glider has been recorded in rural-residential to peri-urban remnants subject to light spillage (Darkheart 2011, 2010, 2008a, 2005e, 2005g2004a). These are likely to represent local adaptions via acclimatisation. Artificial lighting can also have the positive impact of increasing sight detection of fauna	Light spillage will mainly be from street lighting and in localised areas from external lighting on houses. This will be a new impact on the western and southern edges of the State Forest due to the proximity of new dwellings. Light spillage is an issue for the access road which will pass through the southeast corner where the Yellow-bellied Glider periodically occurs. It is also a potential issue for hollow-bearing trees in the road reserve which will be bound between residential areas on two sides. Some acclimatisation to these impacts is expected to have occurred, and are likely to occur post-development, but recommendations are made to mitigate these impacts.

	on roads, thus reducing risk of road kills eg Koalas (Wilkes and Snowden 1998, AKF 2007, Connell Wagner 2000, Port Stephens Council 2001, Lunney et al 1999, OEH 2015b).	
Erosion and Sedimentation	Sedimentation and erosion impacts can occur at both the construction and establishment phases. Erosion/sedimentation may occur via erosion of fill material and disturbed soils, scouring of exposed soil, earthen banks and habitats adjacent to the development area via directed flow (e.g. stormwater), or where runoff is concentrated.	Standard mechanisms and controls should ensure the prevention of erosion and sedimentation during construction and post-development and such impacts do not extend beyond the footprint of the dwelling envelopes and access roads. Increased use of forestry trails by 4WD and motorbikes pose a risk of increased erosion. The bush fire access road in the southwest corner is thus recommended to be gated to deter this threat.
Introduction of feral/introduced species	Urban, industrial and rural developments are often associated with the introduction of non-native species i.e. rodents, cats and dogs accidentally and intentionally e.g. via creating habitat for such species (e.g. rats, Indian Myna) or as pets. Residential development is also associated with a higher density of pet cats and dogs, which has been demonstrated to contribute to biodiversity declines in peri-urban areas and urbanised remnants (White and Burgin 2004, Lunney *et al* 2007, AKF 2007, McAlpine *et al* 2006). Feral cats and foxes are significant predators of native species (NSWSC 2000a, Dickman 1996, May and Norton 1996, OEH 2015b), and domestic dogs are significant threats to species such as the Koala (Wilkes and Snowden 1998, Port Stephens Council 2001, Connell Wagner 2000b, AKF 2007, DECC 2008, OEH 2015b). The mere presence of these predators has also been shown to affect fauna behaviour e.g. avoidance and range contraction. Rodents compete with native species but also form a component of native predator diets eg forest owls, snakes and Quolls (OEH 2015b, Debus 1993).	The conversion of the site to a residential land use is likely to result in the introduction of non-native pet species such as dogs and cats to the study area as pets, increasing their local density and abundance. The introduction of dogs on the site has the potential to increase the risk of attack on Koalas. However given that Koalas have not been found to have a significant association with the site or study area (not Core Koala Habitat), and dogs currently occur on adjoining lands, this risk is unlikely to be significantly increased. The introduction and/or higher density of cats poses a predation risk to passerine birds and small mammals, and to a lesser extent frogs and reptiles if cats are allowed to roam adjacent habitat. This has to potential to elevate mortality rates. Restrictions on cat ownership are difficult to enforce, hence this is not recommended, especially given adjacent residential areas are not bound by such restrictions. Both cats and dogs will be largely restricted to yards if sheet metal fencing is used where yards adjoin habitats, and

		hence this is recommended.
Firewood Collection	*Removal of dead wood and dead trees* is listed as a Key Threatening Process under TSC Act 1995. Firewood is the main reason for removal, and can have a range of impacts on biodiversity from loss of refugia to impacts on nutrient cycles and bushfire survival.	New residents may seek to collect firewood from the State Forest. This can remove habitat for a range of fauna, and contribute to a Key Threatening Process. This should be discouraged by signage and a locked gate at the bush fire access in the southwest.

7.0 Recommendations and Mitigation Measures

7.1. Primary Recommendations

The following are recommended to be included as conditions of consent if the proposal is approved in order to mitigate the major potential ecological impacts of the proposal. The conclusions of this assessment assume these measures are implemented and effective in mitigating impacts.

7.1.1. Clearing to Minimum Required

The clearing limit at each stage of development is to be marked (eg with bunting tape) to clearly delineate the clearing area and retained vegetation. All trees/vegetation falling outside the required minimum clearing area are to remain undisturbed.

This is particularly important around the deferred Lots where habitat is to be retained. The sap trees in the southwest deferred Lots are also to be avoided by the access road, and hence both the final road design and clearing marking will need to ensure this outcome.

Clearing and earthworks is to avoid damage to root zones of the retained trees eg no parking of vehicles or storage of materials (including soils) under retained trees.

No clearing or modification of vegetation is to occur in the deferred area.

7.1.2. Selective Vegetation Removal in APZ

Vegetation removal required for the Asset Protection Zone to the north and south of the site must be to the minimum extent necessary and must avoid removing any hollow-bearing trees. Canopy separation/thinning requirements are to be achieved via pruning limbs where possible (to avoid entire tree removal), and removing understorey vegetation and non-hollow-bearing trees. Removal of Scribbly Gums and Bloodwoods should also be avoided as these are preferred sap trees for the Yellow-bellied Glider.

To ensure this is achieved, an ecologist must be present when clearing is taking place to mark habitat/sap trees and ensure they are retained in situ.

7.1.3. Pre-clearing Habitat Load Reduction

Due to the disturbance history of the site (ie logging) and associated dense regrowth in the groundcover to understorey stratums on site, there is risk of protected native fauna being killed during clearing of these stratums.

To minimise this risk, it is recommended that the area of the development stage be slashed at least 1 week prior to clearing and grubbing. Slashing will encourage range contraction//avoidance/evacuation from the impending construction area and hence reduce the risk of fauna within dense groundcover being killed during clearing.

If this is not a practical option (eg due to stumps), then an ecologist/fauna spotter-catcher should supervise this clearing phase and undertake the necessary fauna capture/relocation and welfare activities to minimise mortality.

7.1.4. Hollow-Bearing Tree Felling Protocol

The hollow bearing trees that may be removed could contain fauna at the time of clearing. Such fauna may be placed under stress, injured or killed during tree felling via:

- Being nocturnal or in torpor, and unable to escape prior to the tree falling.
- Collapse of the hollow when it impacts the ground.
- Collision with internal walls or via being thrown out when the tree falls.
- Being present as young eg eggs.

Any hollow bearing tree removal must be undertaken via a method that will minimise the risk of injury/mortality of potentially denning/roosting fauna within the limitations of Occupational Health and Safety (OH&S) Guidelines. Undertaken with due care, this practice can demonstrably avoid mortality of common and threatened species during felling of hollow-bearing trees, thereby substantially reducing the potential significance of development impacts. The following general guidelines are recommended:

1. Clearing should occur in two stages. Stage 1 should see removal of all non-habitat (hollow-bearing) trees and all lower stratums, with habitat trees left standing for at least 24hrs to allow voluntary evacuation of resident fauna. Stage 2 is the removal of the habitat trees. This strategy is widely employed by NSW RMS (2011) and throughout Qld with high levels of success.
2. Hollow-bearing trees are to be removed via a method that does not require traditional tree felling methods i.e. clear-drop chainsaw cut or bulldozer/excavator “rip and push” methods are not to be utilised due to the violence of tree-ground impact and associated high risk of injury/mortality to fauna (e.g. via hollow collapse, collision with walls, etc). Options include:
    - The use of an excavator or similar machine with a pincer/harvester head attachment, which can hold the trunk while the tree base is sawn, and then the lowers the tree to the ground for inspection (preferred method).
    - Use of a crane to hold the tree while the base is sawn, and then lower the tree to the ground for inspection (preferred method).
    - Employment of an arborist to lop hollow-bearing limbs or tree sections, and lower to the ground with ropes and pulleys or crane, with the non-hollow bearing remainder of the tree later felled by traditional methods (preferred method).
    - An ecologist and arborist to use a man-box, and be lifted by crane to inspect the hollows (eg with torches and inspection cameras). If hollows are vacant, the entrance is to be blocked (eg trunk hollow) or the hollow-limb felled. If fauna can be removed, the ecologist is to remove the fauna.

- If the above is not practical, an excavator can cut the roots and slowly push over the tree, counterbalancing the fall rate by pushing down on the root ball to minimise acceleration and final impact (least preferred method).

3. If a rip and push method is employed, the tree is to be bumped at least 3-5 times at approximately one-minute intervals to initiate evacuation of any residents. Caution will be required not to risk personal injury via falling branches.

4. An ecologist/fauna spotter-catcher must be present during felling of the hollow bearing trees to monitor clearing, capture any resident animals injured or not evacuating, and undertake appropriate emergency actions if required e.g. transport animal to veterinary treatment (care at proponent's cost) or care by FAWNA (with a donation by proponent to cover costs). Hollows are to be immediately inspected once the tree is felled (within OH&S guidelines) for injured individuals or abandoned offspring, and appropriate measures undertaken. All rehabilitated animals are to be released in the retained habitat directly on/or adjacent to the site.

5. If hollows cannot be cleared of fauna, the fallen tree must either be allowed to sit overnight, or may be sectioned by chainsaw to clear hollows of fauna. It may then be destroyed/stacked for destruction.

A report detailing dates, personnel, qualifications, licenses and results is to be provided to Council within 14 days of the monitoring event.

7.1.5. Street Lighting in Deferred Area

Street lighting is recommended not to be placed within the deferred area to minimise potential impacts on the use of this area by the Yellow-bellied Glider.

If lighting is required in this area, it must be of a design which minimises spillage and is directional.

7.1.6. Fencing

Lots which back onto habitat (eg State Forest, deferred Lots or the unformed road reserve) should be required by title covenant to use sheet metal fencing for boundaries.

This is recommended to minimise native fauna entering yards and being at risk of attack by pets, and pets roaming bushland.

7.1.7. No Formal Access to State Forest

To discourage ready access for 4WD use and unauthorised firewood collection (a permit is required to collect firewood from State Forests), the bushfire access trail in the southwest which links to State Forest trail is recommended to be gated with access only by the Rural Fire Service, State Forests, and NSC.

7.1.8. Sedimentation and Erosion Control

Standard soil and sedimentation control measures will be required by Council in the construction stage of the proposal to ensure that habitats on the site and in the study area, as well as subsequent wetlands/aquatic habitats nearby are not substantially affected by the proposed development.

Proposed drainage systems need to be adequately designed and effectively established to prevent the risk of any substantial impacts (eg erosion and sedimentation) as per statutory obligations.

7.2. Secondary Recommendations

7.2.1. External Artificial Lighting

To ensure anthropogenic impacts are minimised, it is recommended that external artificial lighting at dwellings which back onto retained habitat be kept to a minimum and be of a localised and low luminosity, with light directed to the ground and not onto retained trees/adjacent vegetation.

7.2.2. Specifications for Landscape Plantings

Any landscaping proposed as part of the development should give due consideration to the establishment of native plants as ornamental species to maintain and/or increase biodiversity, provide replacement habitat, and maximise water efficiency.

Recommended species for planting should include locally indigenous *Eucalypts, Angophoras, Grevilleas, Banksias, Melaleucas, Acacias, Allocasuarinas* and *Callistemons* (especially winter-flowering species which are useful for the Little Lorikeet, gliders, honeyeaters and Grey-headed Flying Fox e.g. *Banksia integrifolia*); and fruiting rainforest species such as Brush Cherry (*Syzygium australe*), figs, *Acronychia* spp*, Cryptocarya* spp, etc.

Where possible, plantings should preferably not be in parkland style or isolated trees as this minimises their effectiveness to provide habitat to all but common medium sized species (e.g. Currawongs and Indian Mynahs) and may become detrimental to the presence of other species (Catterall 2004). Rather, plantings should be planned to recreate a natural structure (i.e. layered). Such plantings thus would consist of at least one or two canopy trees, underlain by a few understorey trees, and finally a number of shrubby species. This multi-layered planting can provide effective aesthetics while supporting passerine birds (who depend on the lower stratums and structural complexity), Yangochiropteran bats, and canopy species such as birds, arboreal mammals and Yinpterochiropteran bats (Catterall 2004).

8.0 Seven Parts Test Assessment

8.1. General Overview

The 7 Part Tests are used to determine whether a proposed development is likely to have a significant effect on threatened species, Endangered Ecological Communities, Endangered Populations and Critical Habitat listed under schedules of the *Threatened Species Conservation Act 1995* known or considered reasonably likely to occur in the area influenced by a development proposal. Considerations must be given to the possible significant impacts a proposed development may have on threatened species, populations, ecological communities, and their habitats (DECC 2007).

The content of the 7 Parts are specified by Section 5A of the *Environmental Planning and Assessment Act 1979*, as amended by the *Threatened Species Act 1995*, which in turn has been amended by the *Threatened Species Conservation Amendments Act 2002*.

8.1.1. Entities to be assessed

No threatened plants were found on site during this or previous surveys and none are considered potential occurrences. No EECs occur on the site.

The following threatened fauna species were detected during the site survey:

- Little Bent-wing Bat
- East-coast Freetail Bat
- Grey-headed Flying Fox
- Yellow-bellied Glider
- Little Lorikeet

The OEH Bionet database also shows the following threatened fauna species recorded in the study area (accuracy varies):

- Green-thighed Frog
- Eastern Osprey
- Greater Broad-nosed Bat
- Eastern Bent-wing Bat
- Southern Myotis

The above species are subject to 7 Part Test Assessment.

The following species (see Appendix 1) are also subject to the 7 Part Tests as they are considered to have at least a low potential to use some habitat in the study area at some time (e.g. now or if they were to potentially recover and expand):

- **Mammals:** Koala, Yellow-bellied Sheathtail Bat, Eastern False Pipistrelle, Hoary Bat.
- **Birds:** Masked Owl, Powerful Owl, Square-tailed Kite, Little Eagle, Varied Sittella, Brown Treecreeper.

Brief ecological profiles are provided in Appendix 1 for these species. More complete profiles can be found online (DoE 2015b, OEH 2015b), and these and the references listed in this assessment were used in combination with personal knowledge when undertaking the impact assessment.

8.1.2. Local Population and Local Occurrence Definitions

The guidelines associated with the revised factors have provided definitions for key terms with the most significant being that of the "*local population*" and "*local occurrence*" as follows (DECC 2007):

> **"Local population**: the population that occurs in the study area. The assessment of the local population may be extended to include individuals beyond the study area if it can be clearly demonstrated that contiguous or interconnecting parts of the population continue beyond the study area, according to the following definitions.
>
> - The *local population* of a threatened *plant* species comprises those individuals occurring in the study area or the cluster of individuals that extend into habitat adjoining and contiguous with the study area that could reasonably be expected to be cross-pollinating with those in the study area.
> - The *local population* of *resident fauna* species comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area.
>
> The *local population* of *migratory or nomadic fauna* species comprises those individuals that are likely to occur in the study area from time to time…."

The local population of the potentially occurring threatened species is thus defined as follows:

Table 14: Definition of local population

Species	Local Population
Masked Owl Powerful Owl	The local breeding pair for which the study area may constitute a minute portion of larger potential foraging territory which would extend over most if not all of western Nambucca Heads State Forest given known territory size of these birds. Local population thus requires much more habitat than found within study area to meet lifecycle requirements.
Square-tailed Kite Little Eagle	Any individuals potentially using habitat within the study area depending on prey abundance as part of larger range. Ecology of these species and limited extent of site determines that local population requires much more habitat than found within study area to meet lifecycle requirements.
Osprey	Given no habitat on site and nest within 1km north, and extensive high quality foraging habitat to east in Nambucca River, local population clearly extends well off site and the study area.
Little Lorikeet	Due to nomadic nature of this species depending on flowering seasons, competition with conspecifics for nesting hollows: the local population would be any individuals and small flocks seasonally using habitat within the study area depending on flowering incidences. Local population requires much more habitat than found within study area to meet lifecycle requirements.

Species	Local Population
Varied Sittella Brown Treecreeper	The family group/s which may potentially use the site and adjoining habitat in the study area for foraging and breeding. Given the marginal value of habitat on site, the local population would meet the majority of its lifecycle requirements off-site and beyond the study area.
Grey-headed Flying Fox	Any individuals using habitat on site/in the study area depending on seasonal flowering incidences. Local population thus requires much more habitat than found within study area to meet lifecycle requirements.
Yellow-bellied Glider	The colony which claims the site and adjacent road reserve as part of its home range, and extending well into the adjacent State Forest for the bulk of their range. The local population may also include other colonies which use habitat within the study area (overlapping with the colony which claims the site). Local population thus ranges beyond the study area.
Koala	Any individuals using habitat on the site and or study area as part of a larger home range. Lack of potential habitat and evidence of usage on site indicates local population would require habitat mostly outside the site and study area to meet lifecycle requirements.
Bent-Wing Bats, Hoary Bat, East-coast Freetail Bat, Greater Broad-nosed Bat, Yellow-bellied Sheathtail Bat, Eastern False Pipistrelle, Southern Myotis	Any individuals/colonies which may use forest in the site/study area for foraging and roosting at some stage of their lifecycle which will see them ranging over a far wider range. Local population requires much more habitat than found within study area to meet lifecycle requirements.
Green-thighed Frog	Any individuals potentially occurring on the site and adjoining habitats in the study area.

8.2. Seven Part Test Assessment

8.2.1. Seven Part Test Structure

To minimise repetition and superfluous information, the responses to the 7 Part Tests are structured as follows:

- In Part (a), species are grouped together based on broadly common ecology (i.e. mobile bird species such as the owls or species with similar habitats such as the Yangochiropteran bats) or similar impacts, and subject to a common 7 Part Test response to part (a).
- Parts (d) and (f) are collectively depending. Part (b) deals with Endangered Populations of which none are relevant to the proposed development. Part (c) applies specifically to EECs, which is not relevant to this study. Part (e) deals with Critical Habitat, which is not relevant to the subject proposed development.

8.2.2. Seven Part Test Responses

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

The proposal will see the site converted to a residential subdivision with 133 Lots and internal access roads. This will remove most of the remaining vegetation on site as well as modification of vegetation in the road reserve to the south, and potentially contribute to a range of secondary impacts.

The impact of the proposal will vary in significance and context per species/species groups as follows:

Yellow-bellied Glider

a) Habitat on site and in the study area

The site contains limited foraging habitat for this species, as much of the vegetation is in a modified state from past clearing and logging events. Currently, the site vegetation is represented by patches of open forest, scattered trees and young regrowth. This vegetation contains preferred sap species for the glider with Red Bloodwood and Scribbly Gum being the only species showing signs of usage (ie showing active feeding incisions). Only a few trees of these two species were identified to contain active incisions in the east of the site and in the road reserve, which is consistent with research that shows that the gliders will only select a small number of individual trees from a few species at any one site (Eyre and Goldingay 2005), with tree selection believed to be based on flow rates of sap (Lindenmayer 2002).

Other foraging resources which may be used seasonally on the site include nectar, arthropods and insect exudates (NPWS 2003). The site and study area was noted to contain a wide variety of eucalypt and Corymbia species which form part of the local resource providing a year-round nectar supply for the local population of Yellow-bellied Glider.

The site forms a highly modified spur of habitat off the mid-east side of a large body of forest (about 1500ha) mostly contained within Nambucca State Forest, with forested private land also occurring to the north (not directly linked to the site) and south (Bellwood Swamp), but is not a key local corridor or habitat linkage to other habitats, hence in effect is a cul-de-sac. Review of landscape scale vegetation mapping shows a mosaic of vegetation communities in and beyond the study area to the west and especially south, which is ideal for this species as it provides a range of seasonal nectar flows and hence foraging opportunities (NPWS 2003).

Given the ecology and cited home range of the species (NPWS 2003); diversity, condition and spatial distribution of habitat on site known to and potentially being used by the species; the extent and range of habitat types in study area (particularly to the south and west); and the site's context in terms of the larger remnant that the site forms a cul-de-sac of habitat of: the site habitat and study area would only form part of the home range of the resident colony and local population.

b) Extent of local population

The OEH Bionet shows numerous records of this species in the locality, including 21 records on the site (dated from 2002-2003, with many records representing sap trees); 13 records on retained habitat on private land to the north; and 46 records in the adjacent Nambucca State Forest.

The above information indicates that a sizeable Yellow-bellied Glider population resides in Nambucca State Forest, with the study area being used by at least one family group for foraging and denning. As demonstrated in this survey, this group would forage over a wide area depending on availability of food resources over time and season, as typical of their ecology (NPWS 2003).

Field observations indicate the site is used occasionally as both a movement conduit from the den tree in the southeast, and to supplement food resources within its larger range; with core habitat likely to be forest to the west and south due to its higher connectivity and carrying capacity. The unformed road reserve adjacent to the site and associated southeast clump of forest are the most important area relative to the site due to the denning tree and cluster of sap incised trees, and the corridor value of the unformed road reserve.

As noted above, the local population would thus be defined as the colony which claims the site and adjacent road reserve as part of its home range, and whose home range also extends well into adjacent habitats to the south and west; and related colonies that occur within interconnected habitat in Nambucca State Forest and forested lands to the north and south, and use habitat within the study area and exchange genetic information with the site colony.

c) Seven Part Test Response

During the survey, the Yellow-bellied Glider was detected on the southern edges of the site and in the adjacent road reserve on the first night of spotlighting. The first observation was of two adults vocalising and gliding along the road reserve and onto the southwest of the site. The second observation was of a separate individual in a Bloodwood further east along the road reserve.

Observations of this species by JWA (2005) recorded the glider foraging in the southeast and central areas of the site, and moving in a westerly direction either through the site or the road reserve into Nambucca State Forest. Denning was recorded in the large Scribbly Gum in the road reserve identified as H5 (see Figure in Appendix 1).

This species prefers to den in large hollow-bearing trees (NPWS 2003) and as noted above, this survey noted that suitable denning trees in the study area are sparse, with only 1 known den tree (H5) present in the road reserve, with 2 others in the road reserve that may be marginally suitable. The adjacent Nambucca State Forest and land to the south was noted to comprise largely regrowth due to its logging history, and few suitable denning trees were observed in traverses of proximate sections of this adjacent habitat. Hence denning opportunities are likely to be spatially limited within the study area, and this may contribute to the extent of the home range of this species given it practises den-swapping and different hollows have different values depending on lifecycle stage and internal dimensions of the hollow (Gibbons and Lindenmayer 2002).

The proposal will have the following direct impacts for this species:

- Loss/modification of approximately 13.7ha (comprising 7.8ha of scattered trees and about 5.9ha of open/swamp forest/woodland) which represents known foraging habitat. This includes loss of two active sap trees, as well as generic nectar and insect resources.
- Reduction in connectivity to the west.

This development proposal would also remove 3 hollow-bearing trees recorded on the site, however none of these would be suitable as den trees for this species at present due to the small size and poor quality of hollows. These trees and other large trees on the site however represent recruit hollow-bearing trees which may have potential to provide denning habitat in the future. Potential for hollow-recruitment is however retained in the adjacent State Forest under legally binding harvest conditions for this species (Forests NSW 2013).

The loss of foraging and connective habitat would impact the family group in the short term by disrupting current foraging and movement patterns; and removing known sap trees which complement the range of food resources used by the family group. This will add to the historical loss of this habitat when it was logged and partially cleared in 2004, and the gliders have since adjusted to (eg most likely via increasing their home range into the adjacent State Forest). The net effect thus will be an incremental and cumulative reduction of the foraging resources accessible to the colony, resulting in a greater reliance on the adjacent habitat to the west and southwest of the site. This may lead to increased competition for resources with other colonies, and will see a permanent reduction in carrying capacity of the study area and the larger remnant of which it forms part of.

While the State Forest, road reserve and adjacent habitat contains abundant preferred sap tree species, these may not necessarily be suitable at all times or ever for the gliders, which only select a few sap trees within a home range for poorly understood reasons (Eyre and Goldingay 2005).

The State Forests Threatened Species Licence (Forests NSW 2013) states that all sap feed trees along with 15 trees within a 100m radius must be retained in logging compartments to allow for varying seasonal selection and usage, and maintain carrying capacity. The approved Yellow-bellied Recovery Plan for the species (NPWS 2003) also expects a similar level of habitat protection for developments. By retaining the known foraging area in the southeast of the site, the proposal has largely complied with these requirements, as detailed in part (f).

No denning habitat will be removed as a result of the proposal, thus given current use of habitat in a peri-urban area, the site recorded colony are considered likely to continue to use the den tree in the road reserve adjacent to the site, along with other dens in adjacent forest within their home range.

The loss of connective habitat through to the west of the site will impact some of the movement patterns of the colony, which were noted in the previous JWA study moving from the den tree in a northwesterly direction across the site to the State Forest, hence using the site as a shortcut from the road reserve den site. Sufficient connectivity will however remain along the southern road reserve (despite this area partially forming an APZ for the

development) which was noted in this and the previous study to be used as a movement corridor; as well as around the southwestern and western sides of the site via the State Forest. Thus they are likely to readily adjust to using the road reserve as a primary means of movement into adjacent habitats from the den tree, but will be forced to follow a more circuitous route.

Potential secondary impacts on the Yellow-bellied Glider as a result of the proposed development include the following:

- Artificial lighting affecting habitat use,
- Anthropogenic activity in the early evening,
- Pet predation (low risk given arboreal nature and body size).

Given that the despite the extent of habitat in the intact forest to the west and south, gliders have persisted in the area which is currently closely fringed by urban development; and continue to den in the road reserve despite the nearby residential presence: this suggests they are to an extent tolerant of these secondary impacts and are unlikely not be displaced by an incremental increase in residential development, especially as the development will proceed in stages over time and this may encourage acclimatisation. This is further evidenced by records of the species in very similar situations. Recommendations are however given to mitigate impacts of artificial lighting.

Overall thus, the removal of habitat from the site including two sap trees and alteration of direct connectivity to the northwest, may incur some form of stress on the site colony both directly (ie loss of sap trees which are also social meeting points for colony members) and indirectly. This colony is however expected to continue to den and forage in the road reserve, and may increase their range into study area. This could potentially see an increase in territorial aggression with other colonies in the study area and beyond. This is a net negative impact, but given most of the affected habitat is scattered trees with only about 5.9ha of forest habitat to be removed; the cited home range of the species; its evident use of adjacent habitat which is diverse and extensive, and well connected to the retained habitat; the retention of the best foraging habitat on site and most of the sap trees; and no loss of known or potential den trees: it is considered unlikely that this net negative impact will be sufficient to place a local viable population at risk of extinction.

Koala

The Koala was not detected on site during the survey despite extensive scat searches, spotlighting and call playback. Previous survey of the site (JWA 2005) and land to the north (JWA 2007, 2013) also failed to detect the Koala. The Bionet database (OEH 2015a) shows the Koala to be relatively uncommon in the locality with the nearest records occurring in Nambucca State Forest approximately 1km to the west. Survey for the adjacent route of the Pacific Highway detected the Koala in the new corridor (SKM 2010).

The dry sclerophyll forest patch in the southeast and northwestern swamp forest patch qualified as Potential Koala habitat as per SEPP 44, however as determined in Appendix 4, this area is not Core Koala Habitat, and no evidence of Koala usage occurs. The remainder of the site has few preferred browse species and is in a disturbed state, hence overall has low Potential Koala Habitat values. In

a local context, the site is connected to known habitat in Nambucca State Forest to the west, and large areas of potential habitat also occur to the south.

The habitat limitations on site and lack of usage indicate the site is unlikely to be significant to the Koala for foraging. At best, it may occur infrequently as part of a low density population in the wider area, or as a transient during specific lifecycle stages e.g. breeding season dispersal of sub-adults. Thus the local population would extend well beyond the confines of the site/study area and home ranges would be largely centred on adjacent and interconnected habitat.

The proposal will see removal of approximately 5.9ha of open/swamp forest/woodland and about 7.8ha of scattered trees containing preferred/primary browse species. In context of habitat in the wider area and known records, this represents only a minor contraction of the potential local foraging resource. Further, the patch of dry sclerophyll forest in the southeast containing a moderate abundance of Tallowwoods and Scribbly Gums will be retained.

New roads will be constructed on site which have the potential to increase vehicle collisions, however these are unlikely pose a significant risk or barrier to the Koala given that limited habitat will be retained within the site, likely low speed of these roads, and Koalas do not have an association with the site.

Dog attack may also pose a potential risk due to the increased number of pet dogs that may eventuate, however dogs may already exist on adjacent properties; and the site is not Core Koala Habitat. The proposal will thus incrementally add to this cumulative threat in the study area.

Overall, the proposal will see some loss of potential habitat and an incremental increase in other threats which currently occur in the wider area. Given neither Core Koala Habitat or an area of major activity is impacted; and connectivity is not effectively prevented between proximate habitat; the proposal is considered unlikely to result in impacts of sufficient order of magnitude to place a local viable population at risk of extinction due to loss of viability.

Grey-headed Flying Fox

Numerous Grey-headed Flying Foxes were recorded on site and in the southern road reserve during spotlighting and were noted to be foraging on flowering Bloodwoods. These are likely to be individuals from a large camp in Nambucca Heads (pers. obs.). Numerous Bionet records of this species also fall on the site and adjacent land to the north (OEH 2015a).

The site habitat has suffered from significant past disturbances and as such is in a modified state. Only small areas of intact forest remain in the southeast with the remainder mostly comprising modified woodland and scattered trees. The site does however lie adjacent to large areas of forest comprising a diverse range of communities, extending to the west and south which is mostly contained within Nambucca State Forest. In this context, the site habitat only represents a very small area of foraging habitat for the local population and consequently, they would need to fulfil the majority of their lifecycle requirements well beyond the site/study area.

The proposal will remove/modify up to 5.9ha of open forest/swamp forest/woodland along with about 7.8ha of scattered trees which represent foraging habitat for the Grey-headed Flying Fox. Given the

ecology of the species, extent of local habitat, and extent of habitat removed, this loss is clearly not capable of disrupting the lifecycle of a local population of these bat species. The site is also not considered suitable as a roost.

Overall, given the ecology of these species i.e. that the seasonally variable range of the species is measured in terms of tens to hundreds of thousands of hectares (Eby 2002, 2000a, 2000b), and hence the habitat loss is miniscule in this context; that no barrier to connectivity for these species will be created; that the subject species are also known to forage in rural areas and in retained habitat within or adjacent to rural-residential and urban areas (hence are likely to occur in the study area post-development to an equivalent level of current probability); the order of magnitude of the proposal's sum negative effect is not considered sufficient to result in a direct decline (i.e. reduce viability) of a local population of these species.

Masked Owl and Powerful Owl

These species of owl have not been recorded on the site but have been recorded in the locality to the west and northwest in Nambucca State Forest (OEH 2015a).

The subject owls require very large territories, or seasonably variable ranges that far exceed the study area (OEH 2015b, Smith *et al* 1995, DECC 2006a, Debus 1994, 1995, NPWS 2003). Hence the study area only has potential to form a small to minute part of a local pair's range, and consequently, a local population needs to fulfil its lifecycle requirements well beyond the study area.

The proposal will impact these owls via a minor but incremental and cumulative loss of foraging habitat within their territory. This may result in a minor reduction of potential habitat for prey species such as rodents, possums and birds, however populations of these prey species would already be very low on site and limited in diversity due to habitat limitations and previous disturbances, and these owls would rely on adjacent habitats. Yellow-bellied Gliders and Greater Gliders are a preferred food source for the Powerful Owl, and both are known to occur widely across the larger remnant.

No suitable hollow-bearing trees for these species occur on the site, hence none will be removed by the proposal. A large hollow-bearing tree suitable for nesting does occur in the southern road reserve, however this is not known to be a nest tree for these owls and high competition with the Yellow-bellied Glider and other common species (eg Brushtail Possum) is likely to significantly reduce its potential for nesting (the Yellow-bellied Glider has been noted to harass its predator).

Given that no barrier for these species will be created; that the subject species are also known to forage in rural areas and in retained habitat within or adjacent to rural-residential and urban areas (hence are likely to occur in the study area post-development), and that the local populations of the subject species would extend well beyond the confines of the site/study area to meet the majority of their life cycle requirements: the order of magnitude of the proposal's sum negative effect is not considered sufficient to result in a direct decline (i.e. reduce viability) of a local population of these species.

Square-tailed Kite, Little Eagle and Osprey

These raptors were not recorded by the survey, however a record of the Osprey occurs on site (a nest occurs about 1km north) and the Square-tailed Kite has been recorded within the locality (OEH 2015a).

The Little Eagle and Square-tailed Kite require very large territories, or seasonably variable ranges that far exceed the site/study area (OEH 2015b, Debus 2012, NSWSC 2009). Hence the site only has potential to form a small to minute part of their range, and consequently, a local population needs to fulfil its lifecycle requirements well beyond the study area. The site and study area does not contain any habitat for the Osprey, and the record is likely to be an over-fly from the local pair foraging in the nearby estuary.

The site and study area overall offers some generic potential foraging opportunities for the Square-tailed Kite and Little Eagle, although due to the extent of modification, prey abundance is limited.

The proposal will impact the Square-tailed Kite and Little Eagle via a relatively minor but incremental and cumulative loss of potential foraging habitat within their territory. The territories of these species is measured in terms of square kilometres (Debus 2012), hence the relatively minor loss of carrying capacity to their territories, while a negative impact, is not sufficient to undermine the local pair's ability to obtain sufficient forage to raise young to fledging. No known nest sites will be removed, hence there is negligible risk of direct mortality.

Overall, due to the ecology of the subject species; that no critical habitat will be removed; and the presence of extensive areas of forest adjacent and within range of the site/study area: the proposal will essentially constitute a minute contraction of their wider foraging range.

Given this; that no barrier to connectivity for these species will be created; that the subject species are also known to forage in rural to urban areas and in retained habitat within or adjacent to rural-residential and urban areas (hence are likely to occur in the study area post-development), and that the local populations of the subject species would extend well beyond the confines of the site/study area to meet the majority of their life cycle requirements: the order of magnitude of the proposal's sum negative effect is not considered sufficient to result in a direct or indirect decline (i.e. reduce viability) of the local population of the subject species.

Little Lorikeet

Small flocks of the Little Lorikeet were recorded on site each day of the survey moving between the site and the adjacent forest to the west and south. They were observed perching in trees and foraging on flowering Bloodwoods with large mixed flocks of common Lorikeets (Scaly-breasted Lorikeet and Rainbow Lorikeet). The site thus comprises known foraging habitat for this bird.

Hollow-bearing trees containing potential nest sites also occur, however due to rarity and high competition with more aggressive common Lorikeets that were observed nesting in and defending these habitat trees, the Little Lorikeet would be unlikely to nest on site.

This bird traverses over a very large range according to seasonal flowering (OEH 2015b, NSWSC 2009). Hence the study area would only form a small to minute part of a population's seasonal range, and consequently, a local population needs to fulfil its lifecycle requirements well beyond the study area.

The proposal will result in the removal up to 5.9ha of modified dry sclerophyll forest/swamp forest/and woodland along with about 7.8ha of scattered canopy trees which represent potential foraging resources for the Little Lorikeet. This will see a contraction of the extent and diversity of foraging resources in the study area, however given the large seasonal range of this bird, this loss would not represent a significant portion of their foraging requirements and would be unlikely to directly affect breeding success. The large extent of other habitat remaining locally (eg Nambucca State Forest, Bellwood Swamp) would be readily capable of supporting the local population.

As previously stated, 3 hollow-bearing trees on site that will require removal are unlikely to be used for nesting due to the small size/poor quality of hollows and high competition. Thus no breeding habitat of this bird is likely be affected by the proposal.

Given the above; the ecology of the subject species; that no barrier to connectivity for this species will be created, and that the local populations of the species would extend well beyond the confines of the site/study area to meet life cycle requirements: the order of magnitude of the proposal's sum negative effect is not considered sufficient to result in a direct decline of a local population of the Little Lorikeet.

Varied Sittella and Brown Treecreeper

These species have not been recorded on site, however both were recorded during investigations over land to the north of the site (JWA 2007). Local records of the Varied Sittella also occur to the south between the Pacific Highway and Bellwood Swamp (OEH 2015a). Both birds are expected to use the diverse range of habitats in the adjacent State Forest for foraging and breeding.

The site habitat is considered marginal overall for these birds given its exposure to predators, conspecifics and harassment by medium sized woodland birds. Retained habitat in the southeast of the site, along with dry sclerophyll fringes in the west and south and the adjacent State Forest qualify as the best potential habitat on site.

The loss of habitat on site will have relatively little consequence on the Varied Sittella or Brown Treecreeper given that it would only represent the marginal fringe of their foraging range, and sufficient habitat to meet the needs of the local population occurs in the adjacent State Forest. Thus the current potential carrying capacity of the study area is unlikely to be significantly reduced.

The potential increased presence of cats will incrementally add to the predation risk, however cats would be largely confined to yards (especially if appropriate fencing is used) and predation on other common bird species using landscaping would be more likely to occur.

Overall, considering the minor amount of habitat loss relative to the extent of habitat in the study area and beyond, the order of magnitude of impacts associated with the proposal is not considered

likely to be sufficient to be considered likely to place a local population of these birds at risk of extinction.

Yangochiropteran Bats: *East-coast Freetail Bat, Eastern Bent-wing Bat, Little Bent-wing Bat, Greater Broad-nosed Bat, Yellow-bellied Sheathtail Bat, Eastern False Pipistrelle, Southern Myotis, Hoary Bat.*

The Little Bent-wing Bat and East-coast Freetail Bat were recorded in the study area during this survey, and a number are shown on the Bionet Atlas as occurring on the site (OEH 2105a). No local records occur for the Hoary Bat or Yellow-bellied Sheathtail Bat, however both are likely to occur in Nambucca State Forest.

The study site/area is considered to provide some suitable foraging and roosting habitat and hollow-bearing trees present may provide potential roosts. This habitat is a fraction of similar and more optimum habitat located to the west and south.

The OEH Bionet atlas shows a Southern Myotis record on site in the northern drainage line. There was very little water in here during the survey, and this is only likely to provide foraging habitat in wetter years. Bellwood Swamp to the south and Bellwood Creek to the north are likely areas of key habitat for this species locally. The site thus only at best offers some potential roosting habitat in tree hollows, but this would be limited by competition with conspecific bats, birds, mammals and reptiles.

For all but the Myotis, the proposal will remove an estimated 5.9ha of dry sclerophyll forest/swamp forest/woodland along with about 7.8ha of regrowth and scattered trees. This habitat in total would represent a small amount of known/potential foraging habitat for these bats and its loss would not impact on their foraging success or ability to raise young.

Three hollow-bearing trees containing potential roosts for all these species will require removal, leading to a minor but incremental and cumulative reduction in potential roosting habitat over their range and a possible risk of injury or mortality during clearing.

Considering the minor amount of habitat loss relative to the extent of habitat in the area, and that a local population of these bats would extend well beyond the site and study area: the order of magnitude of impacts associated with the proposal is not considered likely to place a local population of the subject bats at risk of extinction.

Green-thighed Frog:

The Green-thighed Frog was not detected on the site during the survey, but is extremely difficult to detect when not breeding (which is typically limited to a short period after >75mm of rain). When not breeding, this cryptic frog may range into a variety of habitats including dry sclerophyll forest for foraging, using dense groundcover, leaf litter and even cicada larvae holes for refuge (pers. obs.).

Bionet shows that this species has been recorded close to the site in 2003, with and other records occur in and to the north of Nambucca Heads (OEH 2015a).

The site overall due to its often dense cover offers potential non-breeding foraging habitat for this frog. A drainage line in the mid-northwest offers only at best marginal potential breeding habitat due to lack of any significant pools that may persist long enough for tadpoles to mature.

Conversely, a potential local population would be likely to be based in higher quality habitat on adjacent land to the east south associated with Bellwood Swamp. In this area, is a complex mosaic of potential breeding and foraging habitat, and hence the species is considered much more likely to occur here and perform most of the critical phases of its life cycle. Occurrence on site thus is more likely to be at the outer fringe of its core habitat, for non-breeding.

The proposal will require removal of most of this potential habitat which will see a reduction in potential non-breeding forage and refuge habitat for a local population. Given the relatively poor quality of this habitat, and the extent of remaining higher quality habitat in the study area and adjacent land in which the local population is likely to be based; this loss is considered incapable of significantly impacting breeding or foraging potential of this species.

Potential impacts on downstream water quality may arise from the proposal eg. sedimentation and polluted stormwater runoff. Standard mitigation measures that apply to the proposal are however likely to manage these impacts and ensure downstream water quality is not adversely impacted. More importantly, drainage will not be directed to potential habitat to the south in Bellwood Swamp.

New roads for the subdivision will pose an increased risk of road kill to the Green-thighed Frog. However given that the species has not been confirmed to occur on the site and that minimal habitat will be contained within the subdivision, this risk is considered negligible. Similarly, predation by cats is also a low threat given lack of retained habitat.

Given the above, the order of magnitude of impacts associated with the proposal are not considered likely to be sufficient to be considered likely to place a local population at risk of extinction.

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

No Endangered Population occurs on site or in the study area, hence none are affected by the proposal.

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

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

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

No EECs occur on the site or are likely to be affected beyond the study area.

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

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

Establishment of a residential subdivision and APZ over the site will require the removal/modification of an estimated 5.9ha of dry sclerophyll forest/swamp forest/woodland along with about 7.8ha of regrowth and scattered trees.

This includes the removal up to 3 low value hollow-bearing trees, along with a number of primary browse species for the Koala, and up to 2 active sap trees for the Yellow-bellied Glider.

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

The site is not mapped as a regional or sub-regional corridor. The site is essentially a spur off a large remnant (about 1500ha in extent), and does not form a local corridor to habitat, essentially forming a cul-de-sac.

The proposal will see removal of most of the vegetation on the site which will to an extent lead to increased local fragmentation and is likely to alter the current movement patterns of some species who use the site as an east-west conduit from the unformed road reserve which extends off site to the east to form the tip of the habitat cul-de-sac. Given the current state of the habitat on site however and the presence of extensive forested areas to the south and west of the site, the majority of fauna movements in the study area are likely to primarily utilise these forested areas and effective connectivity and linkages to adjacent habitat for the subject species will remain around the site. Thus no area of habitat is likely to become isolated as a result of the proposal.

For the Yellow-bellied Glider, the currently fragmented site habitat is known to be used to move to adjacent habitat in State Forest to the west and south from a den tree in the mid-east. It may also be used by gliders moving onto and through the site from the State Forest to the south to the northwest eg moving from den to den depending on foraging requirements and territorial defence. The gliders have also been observed on several occasions during this and the previous study moving through retained habitat in the road reserve which borders the site's southern boundary, and this is considered the primary linkage between the den tree and the State Forest.

The removal of the habitat on site is likely to modify the current movement patterns of the gliders via making a longer route west from the den tree in the road reserve. The primary linkage in the road reserve will be partially modified for the APZ, however as only selective vegetation removal will be required and sufficient canopy connection will remain post development, they will still be able to readily access habitats to the west in a similar manner.

Hence no area of habitat will be effectively isolated by the proposal.

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

As noted in part (a), the study site generally offers some known/potential foraging and refuge (denning, roosting, etc.) habitat for a number of threatened fauna species. However, to meet all lifecycle and routine foraging requirements, the range of all the species is considered likely to extend off the site/study area due to key habitat constraints (e.g. hollow-bearing trees, foraging resources, breeding habitat, etc).

For the Yellow-bellied Glider, in terms of the cited home range of the species of 20-85ha (NPWS 2003), the estimated 5.9ha of forest/woodland habitat and 7.8ha of scattered trees and regrowth to be removed over the site may only form a small part of the site colony and local population's range given the low density/abundance of den trees, sparseness of canopy over the majority of the site, variability in foraging resources (eg flowering seasons) requiring a large home range, and den swapping nature of the species.

Large areas of foraging habitat will remain for the local population in the study area/locality in the State Forest to the west and south which appear to form the majority of this larger entity's range and most of the range of the site colony. The active sap trees in the southeast of the site appear to be important to the local colony, as these have been favoured as a sap source over the many other trees the study area. These trees will be retained in the deferred area along with the intact patch of open forest here to mitigate impacts and comply with the Recovery Plan.

As detailed in part (a), the loss of habitat associated with the proposal, while an incremental and cumulative loss to the study area's carrying capacity and contributing to threatening processes responsible for the species' decline and negatively affected the site colony's current viability, is not considered likely to be sufficient to undermine the local population's ability to obtain sufficient food or denning requirements due to the extent of remaining habitat in the locality.

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

No relevant areas of critical habitat have been declared, as yet, under Part 3 of the TSCA.

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

Draft/final recovery plans have only been prepared for the Yellow-bellied Glider, Forest Owls, Grey-headed Flying Fox and Koala (NPWS 2003, DEC 2006, DECCW 2009, DECC 2008). Priority actions have been identified for all of the other species, and the EECs (OEH 2014b).

The Recovery Plan for the Yellow-bellied Glider (NPWS 2003) outlines that habitat alteration and reduction is the major threat to Yellow-bellied Gliders throughout their range. The proposal conflicts

with the Recovery Plan as it will see the loss/modification of habitat within the known range of a colony of the species, and increase current fragmentation.

Objective 2 of the recovery plan outlines mitigation measures that should be implemented for developments affecting Yellow-bellied Glider habitat. This states that mitigation should be of at least the standard provided by the NSW Forestry Corporation for forestry activities which are as follows:

a) A 50m radius exclusion zone must be implemented around Yellow-bellied Glider dens.

b) All Yellow-bellied Glider sap feed trees must be retained. All Yellow-bellied Glider Sap feed trees must be marked for retention.

c) Where there is a record of a Yellow-bellied Glider in a compartment or within 100 metres outside the boundary of the compartment, the following must apply:

   i. Within a 100 metres radius of each retained Yellow-bellied Glider sap feed tree, observation or den site record, 15 feed trees must be retained. Yellow-bellied Glider sap feed trees must not be counted towards these 15 feed trees. Retained feed trees must have good crown development and should have minimal butt damage and should not be suppressed. Mature and late mature trees must be retained as feed trees where these are available.

   ii. Within a 200 metres radius of a Yellow-bellied Glider call detection site record, 15 feed trees must be retained. Retained feed trees must have good crown development and should have minimal butt damage and should not be suppressed. Mature and late mature trees must be retained as feed trees where these are available.

   iii. The feed trees retained in condition (c) (i) and (ii) must be of the same species as the identified sap feed tree or identified den tree, or should be trees that shed their bark in long strips, eg. species from Blue, Flooded, Grey, Red and White Gum groups.

   iv. The feed trees retained in condition (c) (i) and (ii) must be marked for retention

To comply with the above, the intact area of open forest in the southeast of the site is proposed to be retained in a deferred area. This will ensure the retention of most of the identified sap trees and provide a buffer around the den tree in the road reserve. A similar level of protection was proposed by JWA (2005) in their targeted Yellow-bellied Glider survey and constraints assessment. The proposal has also not designed a road to utilise or an access the site to avoid loss of habitat in the unformed road reserve.

For all other species, the proposal may remove vegetation from the site which by strict interpretation could be considered as adding to the main threatening process affecting these species (habitat loss), and hence is inconsistent with the recovery of these species. However, given the marginal quality and small extent of the habitat to be affected, current maintenance regime, and the abundance of similar habitat on adjacent land and in the locality; the loss is considered to be insignificant to the long term recovery of these species.

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

The TSCA 1995 defines a “threatening process” as “a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities”. Loss and fragmentation of habitat due to urban, residential and rural development is a recognised threat to these species (Smith *et al* 1995, Lindenmayer and Fisher 2006, Johnson *et al* 2007, Smith *et al* 1995, Gibbons and Lindenmayer 2002, OEH 2015b, NPWS 1999b, Watson *et al* 2003, Gilmore and Parnaby 1994, NPWS 2003b, etc.). The proposal thus generically qualifies as a class of activity that is considered a threatening process.

For all of the subject species, the proposal will or may contribute (to varying extents) to the following Key Threatening Processes:

Table 15: Key threatening processes

KTP	Extent/Manner Which Proposal Affects KTP	Mitigable?
Clearing of native vegetation (NSWSC 2001c).	An estimated 5.9ha of open forest and woodland, and 7.8ha of scattered trees and regrowth will be removed or modified in the APZ.	Subdivision has retained the open forest in the southeast of the site, however most of remaining vegetation will require removal.
Loss of hollow-bearing trees (NSWSC 2007)	Likely loss of 3 hollow-bearing trees	As above and hollow-bearing tree removal protocol recommended to reduce impacts on fauna during clearing.
Human caused climate change (NSWSC 2000d).	As above and generation of greenhouse gasses by machinery during construction.	As above.

9.0 Matters of National Environmental Significance

9.1. General Assessment Overview

The provisions of the EPBCA 1999 require determination of whether the proposal has, will or is likely to have a significant impact on a "*matter of national environmental significance"*. These matters are listed and addressed in summary as follows:

1) **World Heritage Properties**: The site is not listed as a World Heritage area nor does the proposal affect any such area.
2) **National Heritage Places**: The site is not listed as a National Heritage Place nor does the proposal affect any such area
3) **Ramsar Wetlands of International Significance**: A Ramsar wetland does not occur on the site, nor does the proposal affect a Ramsar Wetland.
4) **EPBCA listed Threatened Species and Communities:** The Grey-headed Flying Fox (Vulnerable) has been recorded on site and the Koala (Vulnerable) is considered a potential occurrence. As detailed in section 9.3, none are considered at risk of a significant impact.
5) **Migratory Species Protected under International Agreements**: No Migratory species is likely to be significantly affected by the proposal as assessed below.
6) **The Commonwealth Marine Environment (CME)**: The site is not within the CME nor does it affect such
7) **The Great Barrier Reef Marine Park:** The proposal does not affect the Great Barrier Reef Marine Park.
8) **Nuclear Actions**: The proposal is not a nuclear action.
9) **A water resource, in relation to coal seam gas development and large coal mining development:** The proposal is not a mining development.

The proposal thus is not considered to require referral to Department of Environment (DoE) for approval under the EPBCA.

9.2. Koala Referral Assessment

The habitat on site has been assessed using the Koala habitat assessment tool from the EPBC Referral Guidelines (DoE 2014). To qualify as critical habitat, it must score 5 or more. This is shown in the following table:

Table 16: Koala habitat assessment

Attribute	Score	Reason	
Koala occurrence	1	Desktop	OEH Bionet has records of Koalas within 2km of the site within the last 5 years. EPBC PMST report identified the Koala as 'known to occur' in the study area.
		On-ground	No evidence of Koalas found on site.
Vegetation structure and composition	2	Desktop	Previous vegetation mapping of site shows patches of dry sclerophyll forest and open woodland. Dominant species include Scribbly Gum, Tallowwood, Blackbutt and Bloodwood
		On-ground	Site surveys confirmed presence of 2 or more known Koala food trees species present eg. Tallowwood and Swamp Mahogany
Habitat connectivity	2	Site is part of a contiguous landscape >500ha	
Key existing threats	1	Desktop	OEH Bionet has records of Koala road kill in local area.
		On-ground	No evidence of Koala road kill found during survey however risk from Marshall Way and Bellwood Road. No evidence of wild or domestic dogs on site however domestic dogs are present in adjacent residential areas and are likely to roam onto the site.
Recovery value	0	The following factors indicate that the habitat to be removed is unlikely to be important for achieving the interim recovery objectives for the Koala: • Lack of Koala activity in the study area • No proximate Core Koala Habitat • High risk of dog attack and car strike in study area	
Total	**6**	**Site qualifies as critical habitat**	

As per the Koala habitat assessment tool, the site just qualifies as critical habitat. An assessment has been undertaken to determine if the proposal will adversely affect this habitat and/or interfere substantially with the recovery of the Koala and require referral to the Minister.

The following table derived from the Koala Referral Guidelines (DoE 2014) assesses whether the proposal is likely to adversely affect habitat critical to the survival of the Koala.

Table 17: Critical habitat assessment

Factor	Y/N	Reason
Does impact area contain habitat critical to the survival of the Koala	Y	Site scores 6 as per the Koala habitat assessment tool.
Do the areas proposed to be cleared contain known Koala food trees	Y	Habitat to be removed contains a mix of eucalypts which are known Koala food tree species.
Are you proposing to clear<2ha of habitat containing known Koala food trees in an area with a habitat score of ≤5	N	Proposal will remove an estimated 11.7ha of varying quality potential habitat containing Koala food trees
Are you proposing to clear >20ha of habitat containing known Koala food trees in an area with a habitat score of ≥8	N	Proposal will remove an estimated 11.7ha of potential habitat containing Koala food trees
Outcome	Impact uncertain, further assessment required (see section 9.3.2)	

The assessment of significance for the Koala has been addressed in the following section. This assessment has determined that the proposal is unlikely to lead to a significant impact. Thus a referral to DoE would not be required.

9.3. EPBCA Threatened Species

9.3.1. Protected Species Assessments

The following EPBCA threatened species require assessment:

- Grey-headed Flying Fox (Vulnerable)
- Koala (Vulnerable)

9.3.1.1. Factors to be Considered for a Vulnerable Species:

The guidelines to assessment of significance to this Matter, define an action is as likely to have a significant impact on a Vulnerable species, if it will:

a) Lead to a long-term decrease in the size of an important population of a species, or:

b) Reduce the area of occupancy of an important population, or:

c) Fragment an existing important population into two or more populations, or:

d) Adversely affect habitat critical to the survival of a species, or:

e) Disrupt the breeding cycle of an important population, or:

f) Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or:

g) Result in invasive species, that are harmful (by competition, modification of habitat, or predation) to a Vulnerable species, becoming established in the Vulnerable species' habitat, or:

h) Introduce disease that may cause a species to decline, or:

i) Interferes substantially with the recovery of the species.

An *important population* is one that is necessary for a species' long-term recovery. This includes such populations as:

- Key populations either for breeding or dispersal.
- Populations that are necessary for maintaining genetic diversity, and or:
- Populations that are near the limit of the species range

9.3.1.2. Assessment of Significance

This section addresses each of the previous points listed.

For the purposes of discussion, the "*important population*" of Grey-headed Flying Foxes is defined as that population of the species likely to depend on colonial roosts in the locality (e.g. Nambucca Heads), or within foraging range of the site.

For the Koala, the important population would be any Koalas in the adjacent State Forest which is likely to be a key source population.

a) Lead to a long-term decrease in the size of an important population (Vulnerable) or population (Endangered) of a species, or:

Grey-headed Flying Fox:

In the context of the species ecology, the site provides an extremely minute area of foraging habitat. It is not known nor considered suitable as roosting habitat for the species, thus no such areas are affected by the proposal.

The proposal will require the removal/modification of an estimated 13.7ha of varying quality known foraging habitat which provides an extremely small nectar resource for the population. While in very strict terms a negative effect, this loss will have a very low impact on the local Grey-headed Flying Fox population as the site in total would only form a very minute fraction of this species wider opportunistic/seasonally variable foraging range. The site is also not known or considered suitable as a roost (Eby 2000) and better quality alternative foraging habitat in the locality is evidently extensive. Thus the proposal will thus not lead to a long-term decrease in the size of an important population.

Koala:

Potential Koala Habitat occurs on site, however no evidence of Koalas has been found by site surveys including scat surveys, spotlighting and call playback. Given the large areas of potential

habitat in the area, the site is only likely to at best form the marginal fringe of a single Koalas territory or be used by transient Koalas.

The removal/modification of 13.7ha of scattered trees, modified open forest, swamp forest and woodland vegetation on site, including primary and secondary browse species will reduce the current habitat potential of the site for this species and contribute to secondary impacts. However as the habitat affected is not of primary importance to the Koala; that no impassable barriers will result from the development; sufficient connectivity will remain around the site; and that more than sufficient habitat occurs within range of the site to meet the lifecycle needs of the Koala: the proposal would not be capable of leading to a long term decrease of an important population.

b) Reduce the area of occupancy of an important population (Vulnerable) or population (Endangered), or:

The area of occupancy of the local population of the Grey-headed Flying Fox would extend well beyond the confines of the site (as their ecology indicates an area of occupancy is likely to be tens if not hundreds of thousands of hectares – Eby 2000a, 2000b, Eby and Lunney 2002, Eby 2002).

As mentioned previously, establishment of the proposal will require the removal of a small number of trees which offer generic potential forage for the Grey-headed Flying Fox. This loss is only a minor fraction of the potential habitat remaining in the study area. In this context, and in the context of the species' area of occupancy as discussed above, the proposal will reduce only a very minute portion of the habitat available to an important population.

For the Koala, up to 13.7ha of scattered trees, modified open forest, swamp forest and woodland habitat will require removal/modification for the proposal. As demonstrated by the survey, Koalas do not currently occupy this habitat and at most it only has some minor potential forage and linkage value. Given this and that Core Koala Habitat or an area of major activity is not impacted, the proposal is not likely to reduce the area of occupancy of an important population.

c) Fragment an existing important population (Vulnerable) or population (Endangered) into two or more populations, or:

The Grey-headed Flying Fox is highly mobile and known to be capable of crossing human-modified habitat (personal observations, Eby 2002, Parry-Jones 2006, Smith 2002). The proposal will thus offer no barrier to movement and hence will not fragment an existing important population of these species.

The Koala is also relatively mobile, able to cross clearings and roads, though is highly susceptible to other threats such as dog attack and vehicle strike. Koala movement across the open areas of the site may be inhibited by the subdivision, however access to the residual habitat in the southeast should remain. Connectivity for the local population will also remain around the site linking to the State Forest. Given this, there is no potential for fragmentation or isolation of an important population.

d) Adversely affect habitat critical to the survival of a species, or:

According to the MNES guidelines, "*critical habitat*" refers to areas critical to the survival of a species or ecological community and may include areas that are necessary for/to:

- Activities such as foraging, breeding, roosting or dispersal.
- Succession.
- Maintain genetic diversity and long term evolutionary development, or
- Reintroduction of populations or recovery of the species/community.

As mentioned previously, the study site/area is not known roosting habitat for the Grey-headed Flying Fox, nor is any significant extent of potential or known foraging habitat affected by the proposal.

As demonstrated in Section 9.2, the site qualifies as critical habitat for the Koala. To determine if the proposal is likely to adversely affect this habitat (and thus require a referral) the proposed development has been assessed against the following factors (DoE 2014):

- ***The score calculated for the impact area:*** The site scored 6 out of a possible 10, and only just qualified as critical habitat.
- ***Amount of Koala habitat being cleared:*** The proposal will remove or modify up to 13.7ha of modified/regrowth potential Koala habitat. Some potential habitat on site will be retained in the southeast.
- ***Method of clearing:*** The proposal will require removal of most of the vegetation within the development footprint due to engineering and long term practicality constraints.
- ***The density or abundance of Koalas:*** There is a low density and limited number of Koala records in the locality (42), and these are generally well spaced over the entire locality indicating a low density population. No Koalas have been recorded within about 1km of the site and no Koalas were recorded on site by the survey or surveys on adjacent land, further suggesting a very low density population in the area.
- ***Level of fragmentation caused by the clearing:*** The proposal will remove patches of modified open forest on site which will only incrementally increase the current level of fragmentation in the area and will not create any impassable barriers for the Koala.

Given the above, the proposal is not considered to significantly affect habitat critical to the survival of the Koala or other subject species.

e) Disrupt the breeding cycle of an important population, or:

The proposal will not disrupt the breeding cycle of an important population/population given that:

- The site/study area do not represent potential or known breeding habitat for any of the subject species;
- The potential for these species to occur on the site/in the study area will be retained post development;
- The site/study area only forms a minute part of their local range, and hence lifecycle requirements.
- Alternative potential habitat in the locality is extensive.

f) Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or:

As detailed previously, the degree of possible vegetation loss imposed by the proposed development is not significant enough to affect the local population of the subject species to the point that it could cause a decline of the species.

g) Result in invasive species, that are harmful (by competition, modification of habitat, or predation) to an Endangered species, becoming established in the Vulnerable and/or Endangered species' habitat, or:

No new invasive species that affects any of the subject species is likely to be introduced as a result of the proposed subdivision. The introduction of more domestic dogs and cats into the area would incrementally increase the risk of attack on Koalas utilising or transiting through the site. Given the low potential for occurrence of Koalas on the site, this impact is considered unlikely to be significant.

h) Introduce disease that may cause a species to decline, or:

No disease that poses a potential risk to these species is likely to be introduced to the site.

i) Interferes substantially with the recovery of the species.

Ideally, the goal in threatened species recovery is to increase the abundance and range of the threatened species, so that it is not in risk of becoming extinct. One major means of achieving this is to avoid habitat loss which is the principal cause of threatened species decline (Eby and Lunney 2002, Eby 2000a, 2000b, Richards 2000, Smith 2002, DECC 2007a, OEH 2015b, DoE 2015).

As detailed previously, the proposal is unlikely to significantly impact on the Grey-headed Flying Fox or Koala thus it will have no significant effect on the recovery of these species.

9.3.2. Conclusion

The proposal is not considered likely to have a significant impact on the Koala or Grey-headed Flying Fox.

9.4. Migratory Species

The Rainbow Bee-eater and Rufous Fantail were the only migratory species observed on site during the survey, although a record appears to show an Osprey fly over. The site also offers potential habitat for a number of species such as the White-throated Needletail, Fork-tailed Swift and Satin Flycatcher. These species are collectively assessed below.

9.4.1. Factors To Be Considered

The guidelines to assessment of significance to this Matter, define an action as likely to have a significant impact on a migratory species, if it will:

a) Substantially modify (including fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species, or;

b) Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat of the migratory species, or;

c) Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

An important area of habitat is:

1. Habitat used by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, or:
2. Habitat utilised by a migratory species which is at the limit of the species range, or;
3. Habitat within an area where the species is declining.

9.4.2. Assessment of Significance

This section addresses each of the previous points listed.

The site is not considered likely to constitute an important area of habitat on the basis of the following:

1. The site is not of sufficient extent to support an ecologically significant proportion of any of the above listed species (at most, only a small group or transient individuals). This value of the habitat is as a fraction of a significant extent of similar habitat not only in the LGA, but the North Coast Bioregion.
2. While some migratory species occurring in the locality may be at the limits of their range, no such species were recorded in the survey area.
3. If the site was located at the limits of a species whose abundance and range is declining, it would not be considered significant as such habitat is locally abundant in the area, and habitat with greater capability occurs within 10km e.g. State Forest, conservation reserves, etc.

In regards to point (**a**): The proposal does not affect important habitat (as detailed above). Occurrence of the subject species on site/study area is considered most likely to be as a short term seasonal forager with the site constituting a small part of their large seasonal nomadic range. The value of habitat on the site/study area is as a minor fraction of the significant area of potential habitat in the LGA and the North Coast Bioregion.

In regards to point (**b**): An invasive species is one that may become established in the habitat, and harm the migratory species by direct competition, modification of habitat, or predation. The proposal will not introduce any such invasive species.

In regards to point (**c**): No disruption of the lifecycle of any migratory bird is likely as:

- Habitat affected is either only marginally suitable, and/or locally abundant eg. pasture and open woodland.

- No significant nesting/breeding habitat is affected.
- No significant foraging habitat will be affected ie pasture habitat identical to the site is locally abundant.

In view of the above, no migratory bird is considered likely to be significantly affected by the proposal.

10.0 Conclusion

The site and nearby land have been subject to previous assessments which have detected a population of the Yellow-bellied Glider in the study area and in the adjacent State Forest. Surveys for this study confirmed that the Yellow-bellied Glider population continue to use the site after a major disturbance event in 2004, and an additional 4 threatened fauna species were detected: the Little Lorikeet, Grey-headed Flying Fox, Little Bent-wing Bat and East-coast Freetail Bat. The Bionet Atlas shows records of a further 5 threatened fauna species in the study area, and another 10 were considered potential occurrences using the study area as part of a wider range based on the habitat types present and local records.

The site has been subject to a significant disturbance history, with a large portion of the site logged and underscrubbed around 2004. Large areas have partially regenerated, while some areas in the east of the site have been maintained via regular slashing. Hollow-bearing trees are very sparse on the site, however are more common along the unformed road reserve bordering the southern site boundary. No threatened flora species were recorded or considered potential occurrences due to the disturbances and lack of proximate records. None of the site's vegetation communities qualified as Endangered Ecological Communities.

The proposed development, which consists of a residential subdivision over the site, will remove/modify an estimated 5.9ha of modified open forest, swamp forest and woodland, along with about 7.8ha of young regrowth and scattered trees, and an area of maintained grassland. This includes 3 low value hollow-bearing trees and at least 1 known sap tree.

This will incrementally and cumulatively reduce the amount of habitat available to the subject species in the locality; add to existing threats; increase fragmentation; see some loss of known and potential habitat components; and contribute to Key Threatening Processes. While having a net negative effect, the proposal is not expected likely to result in an impact of sufficient order of magnitude capable to place a known or potentially occurring threatened species in the study area at the risk of extinction due to the scale of the development, current low habitat values of the site, presence of extensive alternative habitat, and ecology of the species.

Consequently, the proposal is not considered to require a Species Impact Statement, or referral to the DoE for approval under the EPBC Act 1999.

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CBD Prestige Holdings Pty Ltd v Lake Macquarie City Council [2005] NSWLEC 367

Gales Holdings Pty Limited v Tweed Shire Council [2008] NSWLEC 209

Motorplex (Australia) Pty Limited v Port Stephens Council [2007] NSWLEC 74

Appendix 1: TSC Act – Seven Part Test Eligibility

A1.0 Potential Occurrence Assessment

The following tables are used as a summary to address threatened species (as detailed below) in terms of potential occurrence, and likelihood of being significantly affected by the proposal, and hence requiring formal 7 Part Test assessments. Threatened species have been assessed if it is:

a) Recorded on-site;

b) Not recorded on site, but recorded within a 10km radius (the locality), and may occur to some degree on-site or in the study area (land within 100m of site) due to potential habitat, key habitat component, etc.;

c) Not recorded in the locality as yet, but recorded in the bioregion, and thus may occur in the locality, and possibly to some extent, may occur on the site, due to potential habitat.

The "*habitat requirements*" column is derived from the previously listed references. Likelihood of occurrence is based on the probability of occurrence in terms of:

- Habitat extent (e.g. sufficient to support an individual or the local population; comprises all of home range; forms part of larger territory, etc.); quality (i.e. condition, including an assessment of threats, historical land uses on and off-site, and future pressures); interconnectivity to other habitat; and ability to provide all the species life-cycle requirements (either the site alone, or other habitat within its range);
- Occurrence frequency (i.e. on-site resident; portion of larger territory; seasonal migrant or transitory opportunist and thus when and how often, etc.)
- Usage ie breeding or non-breeding; opportunistic foraging (e.g. seasonal, migratory or opportunistic); marginal fringe of core range; refuge; roosts; etc.

An indicative 1-5 scale used by the author to indicate the likelihood of the species to potentially occur in the habitat on the study sites (if they have not been recorded in the locality) is as follows:

- 0: *Unlikely* (<1% probability) - no potentially suitable habitat; too disturbed; or habitat is very poor. No or few records in region or records/site very isolated eg by pastoral land, urbanisation, etc.
- 1: *Low* (1-10%)- few minor areas of potential habitat; highly modified site/habitat; or few habitat parameters present, but others absent or relatively insignificant (sub-optimum habitat). Usually very few records in locality.
- 2: *Fair* (11-25%) - some significant areas of potential habitat, but some habitat parameters limited. Potential for occasional foraging eg from nearby more optimal areas or known habitat. Records at least within 10-15km radius of site.
- 3: *Good* (26-50%) - significant abundance of habitat parameters/areas of habitat, and more locally e.g. adjacent. Potential part of larger territory, but probably unable to support breeding in isolation. Recorded within 10km in similar habitat/environs.

- 4: *Moderate* (51-75%) - quite good potentially suitable habitat on and adjacent to the site, and/or good quality and abundance of some vital habitat parameters. Records within <10km, or adjacent to site, or adjacent to high quality habitat where species likely to occur.
- 5: *High* (>75%) - very good to optimum habitat occurring on or adjacent to the site (support breeding pair or population). Recorded within 5-10km of site in same or similar habitat.

The "*Assessment of Significance*" column is based on consideration of the habitat on-site, likelihood of occurrence, and consideration of the DECC guidelines for assessment under the 7 Part Tests (DECC 2007). Recognising that some species with very large ranges or varying tolerances to habitat modification, some species which may have low potential to occur in the study area and will obviously not be significantly affected by the proposal will not be formally assessed to avoid production of superfluous information. Rather these species are assessed in the final column with justification for this assessment. However, recognising that significance is open to interpretation, the decision on whether a species is formally assessed or not by the 7 Part Tests in this assessment is based on the following rules:

a) If there is *any* justifiable risk, based on consideration, of a significant impact as a result of direct or indirect impacts, a 7 Part Test is required (ie the Principle of Uncertainty is applied).

b) Any threatened species recorded on-site or in the study area, or of at least fair chance of occurrence on-site in terms of potential habitat, is **automatically** selected for the 7 part Tests, unless the proposal has no effect (justification provided).

A1.1 Flora

Searches of relevant literature and databases (OEH/Bionet 2015a) found records of 10 threatened flora species in the locality. These species are assessed for their potential to occur in the following table:

Table 18: Eligibility for Seven Part Test Assessment - Flora

Species	Status	Habitat Requirement	No. of records	Likelihood of Occurrence and Impact Significance	7 Part Test Required?
Scented Acronychia *(Acronychia littoralis)*	E-TSCA, E-EPBCA	A small understorey tree to 6m in height found in littoral rainforest on sand, generally within 2km of the coast. This species occurs coastally from Fraser Island to Port Macquarie.	5	Site/study area does not contain suitable habitat for this species. No significant impact is therefore likely.	NO
Floyd's Grass *(Alexfloydia repens)*	E-TSCA	A creeping grass found in moist Casuarina forest and above the king tide zone above mangrove forest in the Coffs Harbour district. It is known from only 10 locations south of Coffs Harbour.	4	Site/study area does not contain suitable habitat for this species. No significant impact is therefore likely.	NO
Sand Spurge *(Chamaesyce psammogeton)*	E-TSCA	A herb that grows on fore dunes and exposed sites on headlands. Recorded on Bare Point, Kempsey, Hastings, Nambucca, Coffs Harbour, Port Stephens and Bulahdelah LGA databases.	1	Site/study area does not contain suitable habitat for this species. No significant impact is therefore likely.	NO
Spider Orchid *(Dendrobium melaleucaphilum)*	E-TSCA	An epiphyte on *Melaleuca styphelioides*, rainforest trees or rocks in coastal districts north from the Blue Mountains. It has square stems, similar to *D. tetragonum* and it flowers Jul.-Oct.	15	The small patch of swamp forest on site is highly unlikely to support this species given its poor quality and the site disturbance history. Unlikely to occur.	NO

Species	Status	Habitat Requirement	No. of records	Likelihood of Occurrence and Impact Significance	7 Part Test Required?
Slender Marsdenia *(Marsdenia longiloba)*	E-TSCA, V-EPBCA	A slender climber with clear, watery latex (sap). Occurs in rainforest and moist eucalypt forest adjoining rainforest, at no particular altitude, sometimes in areas with rock outcrops. Found at scattered sites from Barrington Tops to SE Queensland (NPWS 2000).	30	No suitable habitat on site or study area and not found by survey. Recorded in locality but unlikely to occur on site.	NO
Maundia triglochinoides	V-TSCA	An aquatic herbaceous plant found in swamps or shallow fresh water on heavy clay on the north and central NSW coast. Recorded on Hastings and Kempsey databases	3	No suitable habitat on site or study area and not found by survey. Recorded in locality but unlikely to occur on site.	NO
Grove's Paperbark *(Melaleuca groveana)*	V-TSCA	A paperbark shrub/small tree that grows in dry sclerophyll, heath and exposed sites generally at higher elevations, though this consultant has recorded it in dry sclerophyll forest on a basalt ridge about 50m asl at Scotts Head (pers. obs.).	3	The dry sclerophyll forest on site marginally qualifies as generic potential habitat for this species however it is disturbed and it was not found during the survey. Unlikely to occur.	NO
Rusty Plum *(Niemeyera whitei)*	V-TSCA	Small to medium sized tree with leaves 5-15cm long and 2-5cm wide. Found in littoral and warm-temperate rainforest, as well as riparian and gully vegetation. Generally found on less fertile soils derived from metasediments or rhyolite. Recorded on coast up to at least 700m ASL in the Nambucca LGA, Lismore LGA, Clarence Valley LGA, Byron LGA, Bellingen LGA, Tweed LGA, Ballina LGA and Coffs Harbour LGA.	4	No suitable habitat on site or study area and not found during survey. Unlikely to occur.	NO

Species	Status	Habitat Requirement	No. of records	Likelihood of Occurrence and Impact Significance	7 Part Test Required?
Milky Silkpod *(Parsonsia dorrigoensis)*	V-TSCA, E-EPBCA	A climber found in sub-tropical and warm temperate rainforest, and sclerophyll forest often on brown clay soils on the north coast south to the Hastings River. It is associated with Blackbutt, Tallowwood, Brush Box, Crabapple, Lilly Pilly, Tree Heath and Water Gum. It may favour some disturbance, including fire.	12	Site habitat very marginal with significant disturbance history. Unlikely to occur.	NO
Cryptic Forest Twiner (*Tylophora woollsii*)	E-TSCA, E-EPBCA	A twiner found in wet sclerophyll and rainforest in the northern ranges and slopes of NSW from Barrington Tops NP to southern Queensland (NPWS 1999). It has also been recorded within in the Bonville-Archville area and along disturbed roadside verges (NPWS 1999). Associated species include: *Acacia melanoxylon, A. binervata, Caldcluvia, Ehretia, Schizomera, Syncarpia, Eucalyptus microcorys and E. saligna*.	1	No suitable habitat on site or study area and not found during survey. Unlikely to occur.	NO

A number of other species (see table below) are known or considered potential occurrences within the locality. However due to a number of factors, these species were not considered potential occurrences on site. Thus the proposal is not considered to have a significant impact on the viability of any local population of the subject species and Seven Part Test evaluation was not required.

Table 19: Threatened flora unlikely to occur

Preferred Habitat	Species	Site considered unsuitable habitat	Disturbance history likely to have excluded this species	Lack of local records
Dry Sclerophyll Open Forest Woodland	*Acacia ruppii*	X		X
	Ancistrachne maidenii	**X**		**X**

Preferred Habitat	Species	Site considered unsuitable habitat	Disturbance history likely to have excluded this species	Lack of local records
	Angophora inopina	X		X
	Angophora robur	X		X
	Babingtonia prominens	X		X
	Banksia conferta subsp. Conferta	X		X
	Bertya sp.(Chambigne NR, M Fatemi 24)	X		X
	Bertya ingramii	X		X
	Bertya sp. Cobar-Coolabah	X		X
	Boronia hapalophylla	X		X
	Caesia parviflora var. minor	X	X	X
	Chiloglottis anaticeps	X		X
	Cynanchum elegans	X		X
	Diuris venosa	X	X	X
	Diuris disposita	X		X
	Diuris pedunculate	X	X	X
	Diuris praecox	X	X	X

Preferred Habitat	Species	Site considered unsuitable habitat	Disturbance history likely to have excluded this species	Lack of local records
	Dillwynia tenuiflora		X	X
	Eucalyptus tetrapleura	X	X	X
	Grevillea banyabba	X		X
	Grevillea beadleana	X		X
	Grevillea caleyi	X	X	X
	Grevillea quadricuada	X		X
	Hakea archaeoides	X		X
	Hakea trineura	X		X
	Hibbertia superans	X		X
	Leucopogon confertus	X		X
	Lindsaea incisa	X		X
	Macrozamia johnsonii	X		X
	Melichrus hirsutus	X		X
Rainforest Wet Sclerophyll Forest Riparian	*Olax angulata*	X		X
	Philotheca obovatifolia	X		X

Preferred Habitat	Species	Site considered unsuitable habitat	Disturbance history likely to have excluded this species	Lack of local records
	Polygala linariifolia	X		X
	Corybas dowlingii	X		X
	Dracophyllum macranthum	X		X
	Acacia chrysotricha	X	X	X
	Acalypha eremorum	X	X	X
	Arthraxon hispidus	X		X
	Arthropteris palisotii	X		X
	Boronia umbellata	X		X
	Calophanoides hygrophiloides	X		X
	Corynocarpus rupestris subsp. Rupestris	X		X
	Dendrocnide moroides	X		X
	Desmodium acanthocladum	X		X
	Diospyros mabacea	X		X
	Diploglottis cambelli	X		X
	Eidothea hardeniana	X		X

Preferred Habitat	Species	Site considered unsuitable habitat	Disturbance history likely to have excluded this species	Lack of local records
	Endiandra floydii	X		X
	Endiandra hayesii	X		X
	Eucalyptus tetrapleura	X	X	X
	Gingidia montana	X		X
	Grammitis stenophylla	X		X
	Grevillea guthrieana	X	X	X
	Haloragis exalata subsp. velutina.	X		X
	Harnieria hygrophiloides	X		X
	Lindsaea brachypoda	X		X
	Macadamia tetraphylla	X		X
	Olearia flocktoniae	X	X	X
	Peristeranthus hillii	X	X	X
	Phyllanthus microcladus	X		X
	Plectranthus nitidus	X		X
	Pomaderris queenslandica	X		X

Preferred Habitat	Species	Site considered unsuitable habitat	Disturbance history likely to have excluded this species	Lack of local records
	Psilotum complanatum	X		X
	Quassia sp. Moonee Creek	X		X
	Sarcochilus dilatatus	X		X
	Sarcochilus fitzgeraldii	X		X
	Sarcochilus hartmannii	X		X
	Siah's Backbone (Streblus pendulinus/brunonianus)	X	X	X
	Syzygium paniculatum	X		X
	Tinospora smilacina	X		X
	Tinospora tinosporoides	X		X
	Triplarina imbricata (formerly Baeckea camphorata)	X	X	X
Swamp Forest Aquatic Freshwater Wetland Estuarine	*Oberonia titania*	X		X
	Typhonium sp. aff. brownii	X		X
	Uromyrtus australis	X		X
	Cyperus aquatilis	X		X
	Eleocharis tetraquetra	X		X

Preferred Habitat	Species	Site considered unsuitable habitat	Disturbance history likely to have excluded this species	Lack of local records
	Phaius tancarvilleae		X	X
	Phaius australis		X	X
	Melaleuca biconvexa			X
	Melaleuca tamariscina ssp irbyana	X		X
Heathland Shrubland Grasslands	***Allocasuarina defungens***	X		X
	Allocasuarina simulans	X		X
	Sophora tomentosa subsp. australis	X		X
	Babingtonia silvestris	X		X
	Centranthera cochinchinensis	X		X
	Chamaesyce psammogeton	X		X
	Diuris sp. aff. chrysantha	X		X
	Lindernia alsinoides			X
	Rotala tripartita	X		X
	Elyonurus citreus	X		X
	Eucalyptus approximans	X		X

Preferred Habitat	Species	Site considered unsuitable habitat	Disturbance history likely to have excluded this species	Lack of local records
	Glycine clandestina (Broad leaf form)	X		X
	Pimelea spicata	X	X	X
	Rutidosis heterogama	X		X
	Zieria prostrata	X		X
Various Habitats, Miscellaneous, Other.	*Pultenaea maritima*	X		X
	Cryptostylis hunteriana (Leafless Tongue Orchid)		X	X
	Galium australe (Tangled Bedstraw)	X	X	X
	Zieria prostrata	X		X
	Hibbertia hexandra	X	X	X
	Neoastelia spectabilis	X		X
	Zieria lasiocaulis	X		X
	Kennedia retrorsa	X		X
	Tetratheca juncea	X	X	X

Preferred Habitat	Species	Site considered unsuitable habitat	Disturbance history likely to have excluded this species	Lack of local records
	Prostanthera spnosa	X		X
	Senecio spathulatus	X		X
	Styphelia perileuca	X		X

A1.2 Fauna

As previously noted in section 4, a significant number of threatened fauna have been recorded in the locality, and a number of others are considered potential occurrences by the consultant. In the table below, these species are evaluated for their potential to occur on the site; significance of the proposal to this potential occurrence; and thus their eligibility/requirement for Seven Part Test assessment.

Table 20: Eligibility for Seven Part Test Assessment – Fauna

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
BIRDS	Glossy Black Cockatoo (*Calyptorhynchus lathamii*)	112	V-TSC Act	Dry sclerophyll forest and woodland containing Allocasuarina and Casuarina, and large tree hollows. Preferred regional forage species are *A. littoralis* and *A. torulosa*. Requires sufficient extent of forage within home range to support breeding. Breeds Mar-Aug, takes 90 days to hatch and fledge (Lindsey 1992).	Limited number of mature Allocasuarinas on site is unlikely to attract this species other than as rare transients. No nest trees to be removed, and limited impact on potential foraging habitat. No risk of impact and very low to unlikely to occur. Seven Part Test not required.
	Powerful Owl (*Ninox strenua*)	7	V-TSC Act	Wet and dry sclerophyll forests. Nests in tree hollows. Requires high diversity and abundance of medium-sized arboreal prey. Very large territory (500-5000ha).	Small area of potential foraging habitat with only one possibly suitable nesting tree in southern road reserve. Appears to be limited arboreal prey abundance and diversity on the site, with rodents, bandicoots and possibly hares offering terrestrial prey. Adjacent State Forest known to support preferred prey, and study area likely to fall within territory. Moderate potential to occur in study area

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
					using it periodically as part of the wider foraging range of this species. No loss of potential nest trees but will see loss of prey habitat. **Seven Part Test required** as potential to occur.
	Masked Owl (*Tyto novaehollandiae*)	4	V-TSC Act	Eucalypt forest and woodlands with sparse understorey. Nests in tree hollows. Requires high diversity and abundance of prey 200-600g weight. Large territory.	As for Powerful Owl. **Seven Part Test required**.
	Barking Owl (*Ninox connivens*)	0	V-TSC Act	Well-forested hills and flats, eucalypt savannah (especially), and riverine woodland in coastal and subcoastal areas. Prefers hunting in more open country for mammals (rabbits, rats, mice, small bats and small marsupials) and birds (small up to Frogmouths and Magpies). Large territories. Nest in hollows.	Some generic potential habitat in study area but artificially derived and backs onto extensive forest not open woodland. No local records, sparse NSW distribution, hence unlikely to occur. No risk of impact, hence 7 Part Test not required.
	Square-tailed Kite (*Lophoictinia isura*)	18	V-TSC Act	Open forests and woodlands in coastal and sub-coastal areas. Forages low over, or in, canopy for eggs, nestlings, passerines, small vertebrates and invertebrates. Large home range (>100km^2). Observed foraging in residential areas of Port Macquarie. Large stick nest in high fork of living tree. Breeds July-December. Lays 2-3 eggs with 1-2 birds fledging after 100days. Appears to be adapting to an abundance of passerines in well-vegetated outer	Site offers some generic potential habitat, and foraging opportunities. Considered fair chance of occurrence as opportunistic forager in study area. **7 Part Test required** as fair potential to occur.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
				fringes of cities. Probably migrates to northern Australia in winter. (Debus 1998, NSW NPWS 2000)	
	Little Eagle (*Hieraaetus morphnoides*)	0	V-TSC Act	Occupies habitats rich in prey within open eucalypt forest, woodland or open woodland, sheoak or acacia woodlands and riparian woodlands of interior NSW are also used (Marchant and Higgins 1993; Aumann 2001a). For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring. It eats birds, reptiles and mammals, occasionally adding large insects and carrion (Marchant and Higgins 1993; Aumann 2001b; Debus et al. 2007). It is distributed throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment (Marchant and Higgins 1993). It occurs as a single population throughout NSW.	Generally as for Square-tailed Kite however no local records. Low chance of occurrence. **Seven Part Test required.**
	Spotted Harrier (*Circus assimilis*)	0	V-TSC Act	Occurs in grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe (e.g. chenopods) (Marchant and Higgins 1993; Aumann 2001a). It is found mostly commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. The species builds a stick nest in a tree and lays eggs in spring (or sometimes autumn), with young remaining in the nest for several months. Diet includes terrestrial mammals, birds and reptiles, occasionally large insects and rarely carrion (Marchant and Higgins 1993;	General area including site largely unsuitable in structure and no local records. Unlikely to occur. No risk of impact, hence 7 Part Test not required.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
				Aumann 2001b). Many of the remaining key prey species (e.g. terrestrial grassland birds such as quail, button-quail, pipits, larks and songlarks) require ground cover and are sensitive to habitat degradation from grazing (Marchant and Higgins 1993).	
	Regent Honeyeater (*Anthochaera Phrygia)*	1	E-TSC Act. E-EPBC Act	Nomadic, may move coastwards in late summer. Inhabits temperate eucalypt woodlands and open forest, including forest edges, woodland remnants on farmland and urban areas. Also uses *Casuarina cunninghamiana* gallery forests. Requires reliable and ample nectar supplies to support semi-permanent (core breeding) habitat. Favoured nectar sources are *E. sideroxylon, E. albens, E. melliodora, E. leucoxylon, E. robusta, E. planchoniana*, and heavy infestations of mistletoe. Also take insects and orchard fruits. Coastal forests of Swamp Mahogany or Spotted Gum an important drought refuge. Preference for large emergent trees. Breeds in pairs or small colonies in open woodland/forest and occasionally more disturbed woodland near housing and farmland, depending on food availability, from August-January. Breeding less likely to occur if nectar flows are low or unreliable, or heavy competition with more aggressive honeyeaters eg Noisy Miner, Red Wattlebirds and Noisy Friarbirds. (Menkhorst *et al* 1999).	General area unlikely to be a preferred non-breeding locality due to lack of records indicating regular season occurrence. The site contains a very small extent of preferred foraging resources which are unlikely to attract this bird other than as a extremely rare/opportunistic foraging event due to local flowering. Proposal highly unlikely to impact as unlikely to occur and limited loss of potential foraging resources relative to extent of habitat in study area. Seven Part Test not required.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Swift Parrot (*Lathumus discolor*)	0	E-TSC Act, E-EPBC Act	Breeds in Tasmania and winters on mainland, from Victoria to southern Queensland. Feeds mostly on pollen and nectar of winter flowering eucalypts and banksias, but also on fruit, seeds, lerps and insect larvae (Schodde and Tideman 1990). Favoured species are *E. robusta*, *Corymbia gummifera*, *E. globulus, E. sideroxylon, E. leucoxylon, E. labens, E. ovata, E. maculata, Banksia serrata* and *B. integrifolia.* In coastal NSW, Swamp Mahogany, Spotted Gum and Bloodwood forests are important foraging habitats and larger trees may be selected. Disperse according to changing local food resources.	Small stand of Swamp Mahogany on site provides potential nectar resources, however no local records to indicate locality is a seasonally significant area for non-breeding migrations, and large areas of higher quality habitat occur locally. Unlikely to occur. Proposal highly unlikely to impact given limited habitat loss. Impact clearly insignificant, Seven Part Test not required.
	Varied Sittella (*Daphoenositta chrysoptera*)	10	V-TSC Act	Sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands, with a nearly continuous distribution in NSW from the coast to the far west (Higgins and Peter 2002; Barrett *et al.* 2003). It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. 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.	Open forest along southern and western boundaries and adjacent in study area is marginal potential foraging habitat, although potentially limited by high competition from other species. Remainder of site unsuitable as too exposed. Recorded on nearby land to north of site. Fair chance on southern and western fringes of site on edge of State Forest as forage, in State Forest. Moderate to high chance in State Forest in study area. **7 Part Test required** as potential to occur.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Brown Treecreeper	1	V-TSCA	Medium-sized insectivorous bird occupying eucalypt woodlands, particularly open woodland lacking a dense understorey. Sedentary and nests in tree hollows within permanent territories, breeding in pairs or communally in small groups (Noske 1991). Birds forage on tree trunks and on the ground amongst leaf litter and on fallen logs for ants, beetles and larvae (Noske 1979). Distributed through central NSW on the western side of the Great Dividing Range and sparsely scattered to the east of the Divide in drier areas such as the Cumberland Plain of Western Sydney, and in parts of the Hunter, Clarence, Richmond and Snowy River valleys, Coffs Harbour and Great Lakes Shire.	As for Varied Sittella. **Seven Part Test required.**
MAMMALS	Spotted-tailed Quoll (*Dasyurus maculatus*)	5	V-TSC Act, E-EPBC Act	Various forested habitats with preference for dense forests. Requires tree hollows, hollow logs or caves for nesting. Large home range (>500ha) and may move over several kilometres in a few days. Tends to follow drainage lines.	Lack of suitable habitat on site - consists largely of scattered trees and young regrowth with minimal denning opportunities, and likely to support feral cats and foxes. More likely to occur in interior habitat of State Forest. Unlikely to occur. No risk of significant impact hence 7 Part Tests not undertaken.
	Brushtailed Phascogale	3	V-TSC Act	Range of forest habitats but prefers drier sclerophyll forest with sparse ground cover. Forages on large rough-barked trees for small fauna, also utilises eucalypt nectar. Rests in tree hollows, stumps, bird nests. Requires tree hollows	Site habitat largely unsuitable as a result of past disturbances and limited denning trees would be subject to high competition. No

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	(*Phascogale tapoatafa*)			for nesting. (NPWS, 2000) Breeds May-July. Occupies territory of 20-100ha. Has been recorded in swamp forest.	proximate records, with nearest at Valla. Unlikely to occur No risk of significant impact hence 7 Part Tests not undertaken.
	Common Planigale (*Planigale maculata*)	1	V-TSCA	Wide variety of habitats. Preference for areas of dense groundcover due to heat/dehydration problems. May prefer ecotones of dry/wet habitats (Denny 1982). Preys on arthropods, small vertebrates, shelters in nest under/in fallen timber or rock (Strahan 1995). Home range about 0.5ha. Breeds Oct-Jan (NSW NPWS 2000).	No nearby records and considered unlikely to occur on site due to significant disturbance history. Nearest record is on Gumma Peninusular. No risk of significant impact hence 7 Part Tests not undertaken.
	Koala (*Phascolarctos cinereus*)	42	V-TSCA, V-EPBCA	A large arboreal marsupial to 12kg for males and 8kg for females. Spends most of its time in trees and has large claws adapted for climbing. Largest populations in NSW occur on the central, mid-north and north coast with scattered populations on the south coast, tablelands and western districts. Koalas inhabit eucalypt forests and woodlands where they feed on the leaves of a wide range of eucalypts and will select preferred browse species in an area. Home range size varies depending on quality of habitat, ranging from two to several hundred hectares in size (DECCW 2010; Van Dyck and Strahan, 2008).	Concentrations of primary browse trees occur in the northwest and southeast of the site and in the southern road reserve. No evidence was found during the survey. Recorded in Nambucca State Forest to west of site. Considered low chance of occurrence on site as occasional forager or transient. Proposal will remove potential habitat and contribute to secondary impacts. **Seven Part Test undertaken** to evaluate.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Squirrel Glider (*P. norfolcensis*)	17	V-TSC Act	Moist and dry tall mature eucalypt forest and woodland. Requires mature hollow-bearing trees, winter-flowering eucalypts, suitable sap-feeding eucalypt species and a mosaic of forest types (NPWS 1999). Sap trees utilised include: *E. propinqua, E. tereticornis, E. microcorys, & E. resinifera* (NPWS 2000). Home range of 30-65ha (NPWS 1999).	Site contains some preferred sap species and nectar sources, however most of site subject to high exposure and edge effects. Competition for food and hollows with recorded Sugar Gliders and Yellow-bellied Gliders would also reduce potential. No proximate records, unlikely to occur.
	Yellow-bellied Sheathtail Bat *(Saccolaimus flaviventris*)	0	V-TSC Act	Ecology poorly known. Found in almost all habitats, particularly wet and dry sclerophyll forests and woodlands below 500m altitude, and also open woodland, Acacia shrubland, mallee, grasslands and desert. Roosts mainly in tree hollows, but also under bark, under roof eaves and in other artificial structures. Fast flying species, believed to forage above the canopy or closer to the ground in open areas. Insectivorous. May be Summer migrant.	Site and more so the State Forest may provide generic foraging habitat. Potential roosts in tree hollows but subject to competition with other hollow-obligates. Low to fair chance of foraging within forest canopy on the site; moderate chance in State Forest. **7 Part Test required** due to potential to occur.
	Eastern False Pipistrelle (*Falsistrellus tasmaniensis)*	2	V-TSCA	A large vespertilionid which feeds on moths and insects. Known to roost in caves, abandoned buildings, but mostly in trees hollows higher rainfall forested areas. It is suspected that some populations migrate in Winter from higher altitudes to coastal areas, or may simply enter torpor. Prefers tall forests (>20m high) and extensive movements (eg 12km recorded between foraging and roost sites).	As for Yellow-bellied Sheathtail Bat but recorded on land to the north hence **Seven Part Test required.**
	Eastern Long-eared Bat	0	V-TSCA	Found in lowland subtropical rainforest and wet and swamp eucalypt forest, extending into adjacent moist	Unlikely to occur on the site given it is beyond the species typical distribution range and not

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	(*Nyctophilus bifax*)			eucalypt forest. Coastal rainforest and patches of coastal scrub are particularly favoured. Roosts in tree hollows, the hanging foliage of palms, in dense clumps of foliage of rainforest trees, under bark and in shallow depressions on trunks and branches, among epiphytes, in the roots of strangler figs, among dead fronds of tree ferns and less often in buildings. They appear to be confined to the coastal plain and nearby coastal ranges, extending south to the Clarence River area, with a few records further south around Coffs Harbour. The species can be locally common within its restricted range.	preferred habitat – more often associated with high clutter habitats ie littoral rainforest. Proposal unlikely to impact and unlikely to occur hence 7 Part Test not required.
	Eastern Cave Bat (*Vespadelus troughtoni*)	1	V-TSCA	Rare and poorly known bat. Cave dwelling bat roosting in small (5-50) to large (500) groups in sandstone overhang caves, boulder piles, mines, tunnels and sometimes buildings. Tend to roost in well-lit portions of caves in avons, domes, cracks and crevices. Occasionally found along cliff lines in wet eucalypt forest and rainforest on the coast and dividing range, but extend into drier forest on western slopes.	Lack of preferred roosting habitat within range of site and only single record in locality suggests unlikely to occur. Seven Part Tests not considered required as no risk of significant impact.
	Hoary Bat (*Chalinolobus nigrogriseus*)	0	V-TSCA	Occurs in a range of habitats, such as monsoon forest, tall open forest, open woodland, vine thickets, coastal scrub, sand dunes, grasslands, floodplains, watercourses and dams. Roosts in eucalypt tree hollows, as well as rock crevices. Breeding colonies have been recorded in roofs of buildings. Preferred prey is beetles and moths, but also	Some potentially suitable habitat on site and adjacent, although no local records. Low to fair with at least fair potential to occur in State Forest.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
				spiders, mantids, crickets, grasshoppers, cicadas, bugs, diving beetles, flies and ants (thus may land and forage).	Proposal unlikely to impact but **7 Part Tests required** as potential to occur.
	Golden-tipped Bat (*Kerivoula papuensis*)	0	V-TSC Act	Spider eating specialist, capable of hovering and high manoeuvrability. Normally found in rainforest and along rainforest gullies within wet sclerophyll forest (often when lot of vines which suit prey species), but has been recorded in recently logged dry sclerophyll forest, and also known to forage in areas of mosaic forest (dry and wet sclerophyll). Roosts in abandoned nests of gerygones and scrubwrens, but also found in dense foliage, rooves, and caves.	Lack of preferred foraging and roosting habitat suggests unlikely to occur. 7 Part Tests not considered required as no risk of significant impact.
FROGS	Green-thighed Frog (*Litoria brevipalmata*)	3	V-TSC Act	Poorly known. Found in range of habitats such as warm temperate open forest, rainforest, wet sclerophyll, paperbark swam forest, to forestry dams and ephemeral drainage lines in dry open forest; breeding aggregations around oxbow lakes, ditches, flooded paddocks, overflows, ephemeral creeks and drainage lines, and grassy semi-permanent ponds. Males call only for few days after spring and early summer rains. Possibly a lowland forest ground-dweller. Seeks refuge in dense groundcover, leaf litter and cavities such as cicada nymph burrows.	Marginal potential breeding habitat in northwest corner where some water pooling occurs, but considered too ephemeral. Generic potential foraging habitat on site and in study area. Less disturbed habitat and better breeding opportunities to south in State Forest. Recorded in study area. Low to fair potential for non-breeding foraging on site. >Fair potential to occur on site. **7 Part Tests required** as recorded in study area.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
INSECTS	Black Grass-dart Butterfly *Ocybadistes knightorum*	37	E-TSCA	A small butterfly with a wingspan of 18-19mm. The species has an extremely restricted distribution on the NSW mid north coast from Diggers Head and Warrell Creek. It is only found in Swamp Forest or coastal headlands where its sole food plant, Floyd's Grass (*Alexfloydia repens*), grows which is also listed as endangered in NSW (OEH, 2011a).	Disturbance history and unlikely presence of Floyd's Grass would preclude occurrence on site. Proposal will have no effect on this species and unlikely to occur. Seven Part Test not required.

A number of other species (see table below) are known or considered potential occurrences within the locality. However due to a number of factors, these species were not considered potential occurrences on site. Thus the proposal is not considered to have a significant impact on the viability of any local population of the subject species and Seven Part Test evaluation was not required.

Table 21: Fauna unlikely to occur on site

Preferred Habitat	Species	Site considered unsuitable habitat	Presence of predators likely to have excluded the species	Disturbance history likely to have excluded this species	Lack of local records
Dry Sclerophyll/Open Woodland/Grassy Open Woodland	Painted Honeyeater (*Grantiella picta*)	X		X	X
	Black-chinned Honeyeater (*Melithreptus gularis gularis*) eastern subspecies				X
	Scarlet Robin (*Petroica boodang*)	X			X
	Flame Robin (*Petroica phoenicea*)	X			X
	Hooded Robin (*Melanodryas cucullatacucullata*) southeastern form	X			X
	Bush-stone Curlew (*Burchinus grallaris*)	X	X	X	X
	Diamond Firetail (*Stagonopleura guttata*)	X			X
	Grey-crowned Babbler (*Pomatostomus temporalis temporalis*) eastern subspecies	X		X	X
Rainforest/Wet Sclerophyll Forest	Olive Whistler (*Pachycephala olivacea*)	X			X
	Sooty Owl (*Tyto tenebricosa)*	X			Recorded in locality

Preferred Habitat	Species	Site considered unsuitable habitat	Presence of predators likely to have excluded the species	Disturbance history likely to have excluded this species	Lack of local records
	Wompoo Fruit Dove (*Ptilinopus magnificus*)	X			Recorded in locality
	Rose-Crowned Fruit Dove (*P. regina*)	X			X
	Superb Fruit Dove (*P. superbus*)	X			Recorded in locality
	Barred Cuckoo Shrike (*Coracina lineata*)	X			Recorded in locality
	Parma Wallaby (*Macropus parma*)	X	X	X	X
	Three-Toed Snake-Tooth Skink (*Coeranoscincus reticulatus*)	X		X	X
	Pale-Headed Snake *(Hoplocephalus bitorquatus)*	X		X	X
	White-Crowned Snake (*Cacophis harriettae*)	X		X	X
	Long-nosed Potoroo *(Potorous tridactylus)*	X	X	X	X
	Red-Legged Pademelon *(Thylogale stigmatica)*	X	X	X	X
	Giant Barred Frog (*Mixophyes iteratus)*	X		X	Recorded in locality
	Stuttering Frog *(M. balbus)*	X		X	X

Preferred Habitat	Species	Site considered unsuitable habitat	Presence of predators likely to have excluded the species	Disturbance history likely to have excluded this species	Lack of local records
Swamp/ Aquatic/ Freshwater Wetland/ Estuarine/ Marine	Pink Underwing Moth (*Phyllodes imperialis*) southern species	X			Recorded in locality
	Blue-Billed Duck (*Oxyura australis*)	X			X
	Freckled Duck (*Stictonetta naevosa*)	X			X
	Magpie Goose (*Anseranas semipalmata*)	X			X
	Painted Snipe *(Rostratula benghalensis)*	X			X
	Brolga (*Grus rubicunda*)	X			Recorded in locality
	Black-necked Stork (*Ephippiorhynchus asiaticus*)	X			Recorded in locality
	Comb-crested Jacana *(Irediparra gallinacea)*	X			X
	Australasian Bittern (*Botaurus poiciloptilus)*	X			X
	Black Bittern *(Ixobrychus flavicollis)*				Recorded in locality
	White-fronted Chat (*Epthianura albifrons*)	X			X

Preferred Habitat	Species	Site considered unsuitable habitat	Presence of predators likely to have excluded the species	Disturbance history likely to have excluded this species	Lack of local records
	Green and Golden Bell Frog (*Litoria aurea*)	X		X	Recorded in locality
	Wallum Froglet (*Crinia tinnula*)	X			X
	Olongburra Sedge Frog (*Litoria olongburensis*)	X		X	X
Shrubland/Heathland/ Grassland	Eastern Pygmy Possum (*Certatetus nanus*)	X	X	X	X
	Common Blossom Bat (*Syconycteris australis)*	X		X	X
	New Holland Mouse (*Pseudomys novaehollandiae)*	X	X	X	X
	Eastern Chestnut Mouse (*Pseudomys gracilicaudatus*)	X	X	X	X
	Grass Owl (*Tyto capensis*)	X			X
	Ground Parrot (*Pezoporus wallicus wallicus*)	X	X	X	X

Appendix 2: Site flora species list

Frequency: C Common,
D Dominant at least in some areas,
C Common,
U Uncommon,
R Rare on site, few specimens.

Community: DSF Dry Sclerophyll/Open Forest
OW Open Woodland
SF Swamp Forest
P Pasture/scattered trees

* Denotes an introduced species
Bold – Vulnerable under TSC Act

Common Name	Scientific Name	Community	Frequency
Canopy Trees			
Swamp Oak	*Casuarina glauca*	SF	R
Pink Bloodwood	*Corymbia intermedia*	DSF, OW, P	C
Red Bloodwood	*Corymbia gummifera*	DSF, OW, P	C
Red Mahogany	*Eucalyptus resinifera*	DSF	U
Tallowwood	*Eucalyptus microcorys*	DSF, OW	O
Swamp Mahogany	*Eucalyptus robusta*	SF	U
Scribbly Gum	*Eucalyptus signata*	DSF, OW, P	D
Small-fruited Grey Gum	*Eucalyptus propinqua*	DSF	R
Smooth-barked Apple	*Angophora costata*	DSF	R
Turpentine	*Syncarpia glomulifera*	DSF, SF	O
Blackbutt	*Eucalyptus pilularis*	DSF	C
Broadleaf Paperbark	*Melaleuca quinquenervia*	SF	U
Brush Box	*Lophostemon confertus*	DSF	R
Understorey Trees			
Black Oak	*Allocasuarina littoralis*	OW	R
Green Wattle	*Acacia irrorata*	P	R
Swamp Turpentine	*Lophostemon suaveolens*	SF	O
Willow Bottlebrush	*Callistemon salignus*	SF	U
Two-veined Hickory	*Acacia binervata*	OW, P	D
Prickly Tea-tree	*Melaleuca styphelioides*	SF	O
Native Lasiandra	*Melastoma affine*	SF	R
Cheese Tree	*Glochidion ferdinandi*	DSF, OW, P	D
-	*Melaleuca sieberi*	SF	U
Camphor Laurel	*Cinnamomum camphora*	DSF	R
Shrubs			
Fringed Wattle	*Acacia fimbriata*	OW, P	C
-	*Persoonia stradbrokensis*	DSF	O
Coffee Bush	*Breynia oblongifolia*	DSF	O
Sydney Golden Wattle	*Acacia longifolia subsp. longifolia*	DSF, OW, P	C
Lantana	*Lantana camara**	OW, P	O
Hop Bush	*Dodonaea triquetra*	DSF, OW	C

Common Name	Scientific Name	Community	Frequency
Rough-fruit Pittosporum	*Pittosporum revolutum*	DSF	R
Red Ash	*Alphitonia excelsa*	SF	R
Broom Pea	*Jacksonia scoparia*	DSF, OW	O
Wild Tobacco	*Solanum mauritianum**	OW, P	U
Narrow-leaved Palm Lily	*Cordyline stricta*	SF	R
Elderberry Panax	*Polyscias sambucifolia*	DSF	R
Hairy Bush Pea	*Pultenaea villosa*	DSF, OW, P	O
Notched Bush Pea	*Pultenaea retusa*	OW	O
Hairpin Banksia	*Banksia collina*	DSF, OW, P	C
-	*Leucopogon lanceolatus*	DSF	U
Blueberry Ash	*Elaeocarpus reticulatus*	DSF	R
Groundsel Bush	*Baccharis halimifolia**	OW	R
Lilly Pilly	*Acmena smithii*	SF	R
Tantoon	*Leptospermum polygalifolium*	DSF	U
Wedge Guinea Flower	*Hibbertia diffusa*	DSF	U
Rose Myrtle	*Archirhodomyrtus beckleri*	DSF	O
Dogwood	*Ozothamnus diosmifolius*	DSF	O
Crinkle Bush	*Lomatia silaifolia*	DSF	U
Ferns			
Rainbow Fern	*Calochlaena dubia*	DSF	O
Swamp Water Fern	*Blechnum indicum*	SF	R
Bracken Fern	*Pteridium esculentum*	DSF, OW, P	D
Grasses			
Whisky Grass	*Andropogon virginicus**	OW, P	C
Carpet Grass	*Axonopus fissifolius**	P	C
Vasey Grass	*Paspalum urvillei**	P	O
Setaria	*Setaria sphacelata**	OW, P	C
Wiry Panic	*Entolasia stricta*	DSF	O
Browns Lovegrass	*Eragrostis brownii*	DSF	O
Blady Grass	*Imperata cylindrica*	DSF, OW, P	D
Basket Grass	*Oplismenus aemulus*	DSF	O
Barbed Wire Grass	*Cymbopogon refractus*	DSF	O
Two-colour Panic	*Panicum simile*	DSF	U
Common Paspalum	*Paspalum dilatatum**	OW, P	O
Broadleaf Paspalum	*Paspalum mandiocanum**	OW, P	U
Parramatta Grass	*Sporobolus africanus**	P	O
Kangaroo Grass	*Themeda australis*	P	D
Rhodes Grass	*Chloris gayana**	P	O
Sedges, rushes, aquatics			
Red-fruit Saw-sedge	*Gahnia sieberiana*	DSF, SF	U
Saw Sedge	*Gahnia clarkei*	SF	U
Spiny-Headed Matrush	*Lomandra longifolia*	DSF	D
-	*Lepidosperma laterale*	DSF	O
Goto-Kola	*Centella asiatica*	SF	U
Groundcovers			
Billygoat Weed	*Ageratum houstonianum**	SF	U
Slender Rice Flower	*Pimelea linifolia*	DSF, OW	U
Fireweed	*Senecio madagascariensis**	P	U
Lambs Tongue	*Plantago lanceolata**	P	U

Common Name	Scientific Name	Community	Frequency
Cats Ear	*Hypochaeris radicata**	P	O
Kidney Weed	*Dichondra repens*	DSF, OW	O
Blueberry Flax Lily	*Dianella caerulea*	DSF	O
White Root	*Pratia purpurascens*	DSF	O
Forest Goodenia	*Goodenia hederacea*	DSF	U
-	*Dampiera stricta*	DSF	U
Paddy's Lucerne	*Sida rhombifolia**	OW, P	U
Crofton Weed	*Ageratina adenophora**	SF	R
-	*Ptilothrix deusta*	DSF	U
-	*Poranthera microphylla*	DSF	O
Fringed Violet	*Thysanotus tuberosus*	DSF, OW	U
Balloon Cotton Bush	*Gomphocarpus physocarpus**	P	O
Native Violet	*Viola hederacea*	DSF, SF	C
Large Tongue Orchid	*Cryptostylis subulata*	DSF	R
Native Wandering Jew	*Commelina cyanea*	DSF	U
Black-eyed Susan	*Tetratheca thymifolia*	DSF	U
Climbers and Scramblers			
Climbing Guinea Flower	*Hibbertia scandens*	DSF	U
Scrambling Lily	*Geitonoplesium cymosum*	DSF	C
False Sarsaparilla	*Smilax glyciphylla*	DSF	U
Glycine	*Glycine clandestina*	DSF, OW	U
Snake Vine	*Stephania japonica*	DSF	U
Sweet Morinda	*Morinda jasminoides*	SF	R
Monkey Rope	*Parsonsia straminea*	SF	U
-	*Desmodium rhytidophyllum*	DSF, OW	O
Morning Glory	*Ipomoea indica*	DSF, SF	U
Purple Coral Pea	*Hardenbergia violacea*	DSF	O
Wild Parsnip	*Trachymene incisa*	DSF	U
Appleberry	*Billardiera scandens*	DSF	U
Water Vine	*Cissus hypoglauca*	DSF	R
Silver-leaved Desmodium	*Desmodium uncinatum**	DSF	U

Appendix 3: Hollow-bearing tree and sap tree data

Number	Species	Height	DBH (cm)	Easting	Northing	Hollow type/size	Location	Evidence of use	Fauna value
H1	Bloodwood	20	55	498246	6608708	2 med 2 small branch hollows in dead limbs	Road Reserve		Medium
H2	Scribbly Gum	23	140	498225	6608678	1 large, 3 medium and 2 small branch hollows	Road Reserve		Medium
H3	Scribbly Gum	23	130	498225	6608674	2 medium and 3 small branch hollows	Road Reserve	Lorikeets potentially nesting	Medium
H4	Tallowwood	20	65	498213	6608694	Termitaria. 2 medium and 2 small branch hollows. Senescent	Road Reserve		Low
H5	Scribbly Gum	30	200	498087	6608582	1 large basal cavity, 3 very large upper trunk hollows, at least 7 large and 5 medium branch hollows.	Road Reserve	Yellow-bellied Glider den tree. One hollow with worn edges, trunk scratches	High
H6	Scribbly Gum	25	110	498074	6608569	Large basal cavity. Medium branch hollow in dead lower limb	Road Reserve		Low
H7	Scribbly Gum	25	100	498058	6608575	2 small branch hollows, medium trunk hollow	Road Reserve	Lorikeets potentially nesting, trunk scratches	Medium
H8	Scribbly Gum	30	110	498062	6608569	2 medium branch hollows in dead stubs, 1 good medium branch hollow in live limb	Road Reserve	Active hollow, likely Sugar Glider den, trunk scratches	High
H9	Scribbly Gum	23	75	498027	6608561	Medium branch hollow in dead limb. Small branch hollow.	Road Reserve		Low

H10	Scribbly Gum	25	75	498014	6608544	4 medium and 1 small branch hollows	Road Reserve		Medium
H11	Stag	20	65	498225	6608712	5 small branch hollows	Study Site		Low
H12	Scribbly Gum	27	110	498180	6608691	Medium hollow in fork	Study Site	Lorikeets potentially nesting	Low
H13	Blackbutt	27	85	498036	6608572	1 medium hollow stub, 2 small branch hollows	Road Reserve	Lorikeets potentially nesting	Low
H14	Scribbly Gum	25	80	497814	6608434	3 medium and 2 small branch hollows	Road Reserve		Medium
H15	Blackbutt	27	100	497662	6608457	3 medium and 2 small hollows in dead limbs	Road Reserve		Medium
H16	Bloodwood	25	80	497993	6608700	Dead upper trunk, exposed chimney	Study Site		Low
H17	Stag	18	40	497817	6608562	1 medium trunk and 2 small branch hollows	Study Site		Low
H18	Smooth-barked Apple	18	60	497932	6608792	At least 3 small hollows in dead branches	Study Site		Low
H19	Scribbly Gum	22	100	497937	6608869	2 medium and 1 small branch hollow	Study Site		Medium

Number	Species	Type	Location	Easting	Northing	Comments
T1	Scribbly Gum	Active and inactive	On site	498085	6608608	Old scars and active incisions
T2	Scribbly Gum	Inactive	Road reserve	498067	6608594	Old sap tree, healed incisions
T3	Scribbly Gum	Active	On site	498080	6608628	Weeping sap from small incisions in upper trunk
T4	Scribbly Gum	Active	On site	498066	6608657	Weeping sap from small horizontal notches
T5	Bloodwood	Potential	On site	498015	6608659	Weeping sap from possible YBG feeding incision
T6	Bloodwood	Active	On site	497875	6608658	
T7	Bloodwood	Active	Road reserve	498141	6608612	
T8	Scribbly Gum	Potential	On site	498129	6608664	Weeping sap but no distinct feeding notches

Appendix 4: Core Koala Habitat Assessment

1.0 Potential Koala Habitat Assessment

As detailed in section 5.1, some areas of the site clearly easily qualify as Potential Koala Habitat (PKH) due to the presence/dominance of Tallowwood, Scribbly Gum and Swamp Mahogany over at least 1ha.

A Core Koala Habitat assessment has been undertaken and is provided below.

2.0 Core Koala Habitat Assessment

2.1 INTRODUCTION

2.1.1 Koala Ecology

2.1.1.1 Diet

2.1.1.1.1 General Ecology

Koalas feed primarily but not exclusively on (and also intra-specifically, depending on poorly understood edaphic, chemical and socio-behavioural factors) selected species of the genus *Eucalyptus*. Nationally, they have been observed feeding or resting in about 120 eucalypt species (66 in NSW) and 30 non-eucalypt (7 in NSW) species. In the Hastings and Macleay regions, some eucalypt species not listed under Schedule 2 of SEPP 44 that are known to be used by Koalas are: *E. amplifolia, E. seeana* and *E. propinqua.* Non-endemic species also used by koalas include *E. nicholii* and *E. citriodora.*

Some non-eucalypt species reported to be used for feeding or other behavioural purposes (some in this region) are *Acacia costata, A. mearnsii, A. melanoxylon, Allocasuarina torulosa, Bombax malabrica, Lophostemon conferta, L. suaveolens, Exocarpus cupressiformis, Leptospermum laevigatum, Melaleuca ericifolia, M. quinquenervia, Pinus radiata* and *Cinnamonum camphora* (Martin and Lee 1984, Kel Mackay pers. comm.). Koalas have also been observed using trees with dense foliage or retreating to rainforest during adverse weather such as high temperatures, strong wind or heavy rain (Jurskis and Potter 1997).

Research by the Australian Koala Foundation (AKF) suggests that usage of habitat by koalas may be a function of the abundance of the present species. The AKF describes Primary Habitat as areas where the dominant tree species are preferred browse species, with their usage being independent of the species' density. However, in some areas, a species considered a secondary browse species may be preferentially used as a primary tree, often where its occurrence in the area is infrequent.

A koala food tree is usually identified by a significant number of scats at its base, though such trees may also be used for roosting. Contrary to a long held assumption though, observation of Koalas resting in a tree does not always indicate it is a feed tree (Phillips 2000b, NPWS 2003).

Koalas appear to prefer young leaves rather than mature leaves, and preferred foliage usually has a threshold for minimum moisture content (which may vary seasonally) and nitrogen content (Jurskis and Potter 1997, Pahl and Hume 1990). Other studies have also shown threshold levels for essential oils, with preferred species having more volatile oils and less heavy oils (Hume 1995); preferences for higher concentrations of crude protein, phosphorous and potassium, and lower concentrations of fibre (Ullrey et al 1981); and more simple sugars and less complex sugars (Osawa 1993). These components all vary interspecifically and intraspecifically, and factors such as species, age, size and crown condition also influence the physiological processes that ultimately affect nutritional quality and palatability, especially in a suboptimal environment (Jurskis and Potter 1997).

Species, individual tree and foliage selection for browsing by koalas hence, is still poorly understood. In addition to the above, it also varies with season (which may be an indication of varying nutritional value), as well as location (koalas may feed on one particular species at a specific location, and ignore it at another); and may also be influenced by local abundance of food species, as well as social organisation of the population (Hindell and Lee 1990; Reed, Lunney and Walker 1990). As mentioned above, nutritional quality of individual trees may also be a factor, with nutrition shown to vary inter and intraspecifically (Braithwaite, Turner and Kelly 1983, Anon 1999).

Usage may also be determined by site-dependant edaphic factors eg soil type (Sharp and Phillips 1999), which affects the nutrient quality of forage. A gradient in nutrient concentration in soils and foliage is a major determinant of the distribution of arboreal fauna (Anon 1999, Gibbons and Lindenmayer 2002). Forest consisting of primary browse species associations located on deep, fertile soils on floodplains, in gullies and along watercourses are generally considered preferred habitat. This may possibly be a reflection of the nutritional value of the foliage.

Other research suggests that concentrations of plant chemical defences (especially diformyl-phloroglucinols or DFPs) may be a key factor. Koalas may be selecting trees with lower concentrations of DFPs. This would suggest that Koala preference is not based on species, but on an individual tree basis, as DFP level vary intraspecifically as well as interspecifically (Anon 1999). DFP level also does not appear to vary due to environmental factors, as trees of the same species within the same area can vary widely (Anon 1999).

Structural features may also be important in individual tree selection eg on hot days, koalas are often observed in trees with greater foliage cover. Large trees are thought by some researchers to be preferred for their greater amount of foliage which reduces the need for returning to the ground to move to another tree, and thus risking predator attack (Hindell and Lee 1990; Reed, Lunney and Walker 1990) although research in other areas has found highest activity on younger trees eg 20-30cm trunk dbh (Mackay 1996) which could be a function of nutrition (eg varies with vigour/health or age) or forest structure (eg age classes may have been modified by logging) (Jurskis and Potter 1997).

Research for the Pine Creek State Forest KPOM (Smith and Andrews 1997) found a preference for trees with trunk dbh 40-100cm (and a dislike for <20cm dbh), while Lunney *et al* (1999) found a preference for trees from 50-60cm dbh in the Coffs Harbour area.

Jurskis and Potter (1997) suggest that climbing “mechanics” may be a factor, as they found Koalas near Eden to prefer trees 30-90cm diameter. They suggest Koalas climb more efficiently if tree

diameter is close to the combined reach of the forelegs, and are physically/mechanically disadvantaged when tree width is significantly less than the Koalas reach.

2.1.1.1.2 North Coast Preferred Species

Phillips (2000a) produced a list of Primary, Secondary and Tertiary preferred browse species per Koala Management Area for NSW, which are detailed in the draft Koala Recovery Plan (NPWS 2003). For the North Coast Management area, the following table lists the species considered as Primary, Secondary and Tertiary Species that occur in the Shire:

Table 22: Preferred Koala browse species in the Shire

Source (DECC 2008)

Primary	Secondary	Tertiary
Tallowwood (*E. microcorys*)	Small Fruited Grey Gum (*E. propinqua*)	Thin-Leaved Stringybark (*E. eugenioides*)
Forest Red Gum (*E. tereticornis*)	Grey Gum (*E. biturbinata*)	White Stringybark (*E. globoidea*)
Swamp Mahogany (*E. robusta*)	Narrow-Leaved Red Gum (*E. seeana*)	Blue-Leaved Stringybark (*E. agglomerata*)
Cabbage Gum (*E. amplifolia*)	Red Mahogany (*E. resinifera)*	
	Grey Box (*E. moluccana*)	

The significance of this information is that several of the species previously considered (mostly on the basis of observation of Koalas within these trees) to be Primary Preferred Browse Species in the Shire (Connell Wagner 2000a, 2000b) ie Blackbutt, Scribbly Gum and *Melaleuca quinquenervia*, are not listed even as Tertiary species. As noted above, the basis of the draft Koala Recovery Plan refutes the assumption that the observation of a Koala within a specific tree can be considered a reliable indicator of the tree being a preferred food species (NPWS 2003, Phillips 2000a, 2000b).

Most significantly, Scribbly Gum (*E. signata*), currently listed as a Primary Preferred Browse Species under SEPP 44, is not listed, while two other species not listed in Schedule 2 are considered Primary Browse Species. Personal communication (2002) with Dr Phillips led to advice following extensive work in the Hastings area (eg Area 13 – Thrumster) for Hastings Council that Scribbly Gum (as well as Blackbutt and *Melaleuca quinquenervia*) was not a preferred browse species. These species are often in association with preferred species such as Tallowwood and Swamp Mahogany, and hence Koala use of these non-browse species was considered to be either due to non-foraging purposes (eg shelter) or detection of scats falling from the adjacent food tree. However, Scribbly Gum and other species such as Broad-Leaved Paperbark may be used intensively in some situations even constituting (via other evidence) Core Koala Habitat as found by this consultant (Darkheart 2004m, 2004q). Consequently, it is considered by this consultant that each site should be treated individually, in order to encompass the full range of habitats and browse species utilised by Koalas, and the circumstances they exist in.

2.1.1.2 Population and Life Cycle Characteristics

Koalas are solitary, and territorial (particularly males), yet live in established, sedentary polygynous breeding aggregates arranged in matrix of overlapping home ranges, whose size varies according to sex (males tend to be larger so that they overlap the ranges of several females), and carrying capacity of the habitat (usually measured in terms of density of primary browse species) (Phillips and Callaghan 1995). These aggregates basically consist of an alpha (dominant) male, with his harem of at least 2-4 females and their offspring (juveniles and/or sub-adult koalas) of varying stages of maturity and independency (Phillips 1997).

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

A Koala may live for around 15 years (especially females, though 8-10yrs is likely to be the average age), with breeding for most females occurring at 1.5-2years, and for males about 4 years (when they reach a sufficient size to defend a territory) (Martin and Lee 1984, Biolink 2005b). Young remain in the pouch for 5-6 months, and associate with the mother until at least about 11 months (and up to 2 years), after which they disperse into a population (generally coinciding with reaching sexual maturity).

Female koalas do not necessarily breed every year; perhaps due to the dependence on quality foraging resources (dependant on variety of factors eg seasonality and condition of habitat), density of other breeding females/competition for resources, demand for high site philopatry (movement is restricted to known areas within their home range with high quality forage potential required for lactation), and the physiological demand of raising offspring (Phillips 1997).

Young, sub-dominant and senescent males are often forced into secondary habitats by dominant males. Such habitat is generally located on the outer periphery of the core breeding/high quality habitat, and characterised by poorer soils, greater disturbance, and lower frequency/poorer condition of preferred browse species (Martin and Lee 1984). These animals have more ephemeral home ranges, sometimes moving between established populations, which is desirable for maintaining genetic flow. Consequently though, this group has a higher mortality rate (Phillips 1997).

2.1.1.3 Home Range and Home Range Trees

(a) Home Range

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

Home range and hence Koala density varies per region due to the above factors. For example, Jurskis and Potter (1997) collated Koala densities from Queensland to Victoria, and showed Koala

density ranging from 0.006-7.5 Koalas/ha. Koalas have been recorded at very low densities in areas as a result of dispersed food resources and possibly due to historical disturbances eg clearing of fertile lands for agriculture (eg Jurskis and Potter 1997). Within such large home ranges, a few specific areas may be subject to a relatively higher level of use, while others are less commonly used (Jurskis and Potter 1997).

As mentioned previously, the alpha male has a large home range to overlap those of his females, thus he may include secondary (lower quality) habitat within his home range to achieve this. The alpha male's home range is also vigorously defended from other males to ensure rights to food resources and females (Phillips 1997).

In the initial stages of independence, a young female koala usually remains within its mother's home range for about a year, until they establish their own, often overlapping with their mother's, or dispersing to other aggregates. In contrast, a young male is often turned out of the maternal home range (usually around 2 years of age), and becomes a nomad (forced out of other koala home ranges by the dominant males especially during breeding season) for up to 3-4 years, until they are of sufficient size to establish their own home range. During their younger years, these males may be forced into marginal habitats, and become more generalist in their dietary intake.

Both sexes may travel and are also capable of traversing large distances, depending on demand (eg up to 50km over a few weeks or months), which is more often driven by the need to find other koalas (ie to mate), than potential habitat (Phillips 1997). Movements, distances and reasons for such are considered complex and poorly understood (Dr Steven Phillips, pers. comm.). Distance travelled per day will vary with many factors such as topography, distance between forage trees, season/climate, breeding state, and threats. Koalas have been recorded moving from 10m to several hundred metres during the day, and >1.3km overnight when they are typically more active (Jurskis and Potter 1997, Kel Mackay pers. comm.). Movement is greatest during the breeding season, especially by males (Kel Mackay, pers. comm.), with a female recorded moving 2.6km out of its range to mate, presumably in response to male territorial calls, and returned to its home range (Lee and Martin 1998, Lee *et al* 1998).

(b) Home Range Trees

Within a home range, a few specific trees (*home range trees*) are used by koalas to mark territories and identify individual koalas. Such trees are often recognisable by heavy scratching and collections of scats close to the tree base, and may also have significant forage value (Phillips and Callaghan 1995, Hume 1989). Male koalas may leave their scent by rubbing the gland on their chest against the bark. Koalas frequently return to these trees, or deliberately seek them out during travel (koalas have been recognised to have the ability to know where they are and return to a discrete location (Phillips 1997). Such trees are very important as they maintain social cohesion through identification of population members and assist geographical location (Phillips 1997, Sharp and Phillips 1999).

2.1.2 Definition of Core Koala Habitat

Under SEPP 44, Core Koala Habitat is defined as "*an area of land with a resident population of koalas, as evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a koala population*" (Source: State Environment Planning Policy No. 44 - Koala Habitat Protection).

The definition “an area of land” is interpreted as the land to which the development application applies (if it exceeds 1ha in area, together with any land in the same ownership).

Information to determine if a resident population of koalas exists on the site was obtained by direct survey of the site using standard survey techniques (direct survey of koalas, call playback, scat searches, and tree usage/activity levels assessment) and review of relevant published information and records.

2.2 METHODS AND RESULTS

2.2.1 Literature Review

Koala records in the area relatively sparse, with only 42 recorded in a 10km radius and 12 within 5km by the OEH Bionet/ Atlas of Wildlife (2015a). Most of these records occur in the north around Valla Beach and land to the west of here. The nearest record from the site is 900m to the west in Nambucca State Forest where only 6 Koala records occur. Surveys for the Warrell Creek to Nambucca Highway Upgrade also recorded Koalas here and the Environmental Assessment noted that a Koala population currently resides in the State Forest (SKM 2010).

2.2.2 Field Survey

2.2.2.1 Methods

The site was surveyed for Koalas by the following methods:

- Opportunistic observations over 4 days
- Scat searches undertaken at three locations over the site (Figure 9) in accordance with the Spot Assessment Technique (SAT).
- Spotlighting and call playback over 3 nights
- Searches for definitive Koala scratches.

Searches for scats consisted of checking the ground and leaf litter in a 2m radius around a designated tree. This technique is recognised as a very efficient method of detecting Koala presence, and in some instances, is a method used to identify areas of major Koala activity/significance eg Core Koala Habitat (Phillips and Callahan 1995, 2000, Biolink 2009, 2005a, 2005b, Jurskis and Potter 1997, NPWS 2001, 2004a).

This technique is limited by the following factors:

- *Scat life* – scats naturally deteriorate over time due to insect attack, weather condition (eg rain), fire (though scats have been recorded surviving wildfire) and other disturbances eg mowing and slashing, bulldozing, etc.
- *Groundcover/leaf litter density*: Scats may be hidden in dense groundcover or leaf litter, or searches may be physically impossible in areas of tall, dense groundcover, or waterlogged/swampy areas.
- *Identification*: The observer must be able to identify Koala scats and scratches from other scats and scratches.

- *Bark type*: Rough barked trees do not show evidence of scratch marks like smooth barked gums, thus identification or even detection of climbing may not be determinable. Scratch marks are not usually obvious on Tallowwood unless the tree is heavily used, for example a home range tree.

2.2.2.2 Results

No Koalas were observed or responded to call playback during the survey. This correlates with previous site survey by JWA (2005) and survey of nearby land (JWA 2007).

The SAT searches did not detect any Koala scats hence the activity level was 0%.

Some animal scratches were found on rough and smooth barked trees, however none were attributed to Koalas.

2.3 DISCUSSION AND CONCLUSION

SEPP 44 defines Core Koala Habitat as "an area of land with a resident population of koalas, as evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a koala population". The attributes are provided as examples of only some of characteristics a Core Koala Habitat may demonstrate, and thus to meet the definition of Core Koala Habitat, a site does not necessarily need to show all of these attributes, and may even show other evidence indicating the site is Core Koala Habitat. In regards to the two identified attributes though, the following is provided:

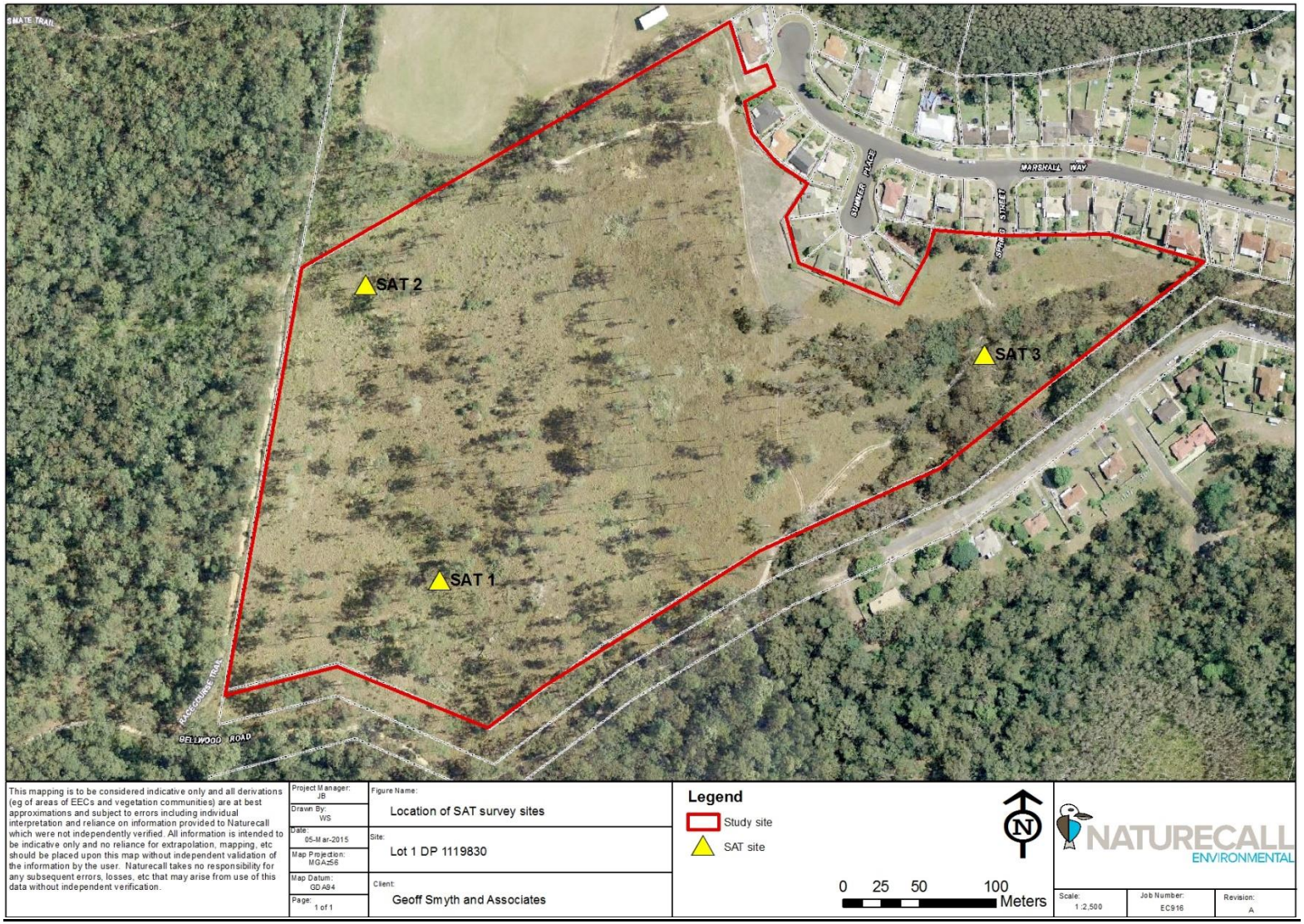
1) "*Breeding females (that is, females with young)*". This and the previous survey failed to detect any evidence of breeding female Koalas on site.

2) "*Recent sightings and historical records of a Koala population*". As mentioned previously no Koalas were observed during the surveys and only small numbers of scats were found in parts of the site with suitable food trees. Thus, while the Koala may have an association with the site, it would only form a small part of a single Koalas territory or be used as transitory habitat.

Despite the occurrence of Potential Koala Habitat on site, no Koalas were observed and the activity levels of the SAT surveys were nil as no scats were recorded. As such the site cannot be considered an area of major Koala activity as per Phillips and Callahan (2011).

This was not unexpected given the extent of habitat modification in the study area and the lack of proximate records (OEH 2015a). As the site does not qualify as an area of major Koala activity and there have been no recent sightings or historical records of Koalas, the site is not Core Koala Habitat and hence a Koala Plan of Management is not required for the proposal.

Figure 10: Location of SAT surveys



NATURECALL ENVIRONMENTAL

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Monday, 27th June 2016

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Dear Geoff,

RE: Response to Issues Raised by OEH and Nambucca Shire Council for Development Application 2015/099, Bellwood Road Nambucca Heads.

Please find our response below to issues raised by the Office of Environment and Nambucca Shore Council regarding subdivision of Lot 1 DP 1119830, Lot 76 DP 832082 & Lot 23 DP 790194, Bellwood Road, Nambucca Heads.

Table 1: Response to OEH issues

Issue	OEH Recommendation	Comment
Swamp Sclerophyll Forest on Coastal Floodplains EEC	(a) The soil type underlying swamp forest vegetation be determined following a field-based assessment of the soils present. The information collected in the field can then be used to determine the presence or absence of EEC within the subject site. (b) If EEC is confirmed to exist on site, the OEH's first preference would be for efforts to be made to avoid impacts on all EEC vegetation. An alternative to avoiding EEC would be the lodgement of an application for a BioBanking Statement.	OEH have misread section 3.3.1 and not referred to Figure 3 Quaternary geology map, illustrating the mapped extent of alluvial soils (legally defined as habitat of this EEC). It is detailed in section 3.3.1 that 1:25 000 scale Quaternary mapping, not the 1:100 000 scale soil landscape mapping which shows this area does not appear to occur on alluvial soils but occurs on residual soils.
Requirement for offset.	(c) Regardless of the conservation status of the vegetation on the subject site, all vegetation proposed to be removed will need to be offset.	No statutory obligation to provide offsets. The majority vegetation remaining on this site also comprises scattered trees left over from previous logging, hence limited value.
Yellow-bellied Glider – protection of deferred area.	(d) Council require the applicant to permanently protect the area currently referred to as 'the deferred area' to maximise the likelihood for the persistence of the local population of the yellow-bellied glider. To this end, OEH suggests the use of an appropriate mechanism to protect and manage this area, such as a Biobanking Agreement.	Our understanding is that the purpose of the deferred area is to allow a more comprehensive assessment of the local population of the yellow-bellied glider and to determine the extent of habitat use in this location.
Protection of other Yellow-bellied Glider habitat on NSC land.	(e) Depending on their anticipated future use, Council consider pursuing a BioBanking Agreement (or a similar mechanism) for the area of land known as Lot 23 in DP 790194 (zoned RE1 Public Recreation) and the road reserve described as Lot 359 DP 755550 (partially zoned R1 - General Residential and RU2 - Rural Landscape) to ensure their long term protection and management to maximise the likelihood for the persistence of the existing local population of the yellow-bellied glider.	It is understood that Council is considering the revegetation of parts of the Faringdon playing fields adjoining this site. This could provide a suitable offset for vegetation loss associated with the proposal given its contiguous location with habitat. In the interim the vegetation corridor along Bellwood Road is considered to provide an adequate link to the Nambucca State Forest to maintain current usage by the local population of the Yellow-bellied Glider

Issue	OEH Recommendation	Comment
Asset Protection Zones	(f) That the layout of the proposed subdivision be redesigned to relocate the APZ wholly onto the subject site.	Statutory/planning issues to be resolved by NSC, planners and bushfire consultants.
Asset Protection Zones	(g) The required southern APZ be located outside of yellow-bellied glider habitat, given the known significance of this vegetation to this threatened species.	The APZ can be established in the road reserve via selective removal of vegetation to achieve fuel loading and canopy separation, and both avoid sap trees and habitat trees, and maintain connectivity. The species can glide up to 140m (NPWS 2003), hence provided trees suitable for launch/landing points (eg at least 20-30m tall) are no more than 30m apart, connectivity can be retained. It is understood that a bushfire risk can be managed adequately with only a 5m canopy separation and the control of ground fuel loads. This will not prevent the corridor being utilised by the Yellow-bellied Glider.
Asset Protection Zones	(h) That the redesigned layout of the proposed subdivision incorporate perimeter roads as part of any required APZs. (i) The subdivision be redesigned to exclude APZs from 'the deferred area'. (j) The subdivision be redesigned to ensure adequate provision of any required APZs along the northern subject site given the future intended vegetated state of the Faringdon Fields. The appropriate location of the APZ over the northern parts of the subject site can only be determined once the recommended additional field work has been undertaken to determine the presence of swamp sclerophyll forest on floodplain EEC, and an appropriate management/design response determined.	Statutory/planning issues to be resolved by NSC, planners and bushfire consultants. The APZ can be minimised by increasing the BAL rating to BAL 29. Statutory/planning issues to be resolved by NSC, planners and bushfire consultants. Current 1:25 000 soil landscape mapping does not indicate suitable habitat for the EEC.

Issue	OEH Recommendation	Comment
Yellow-bellied Glider	(k) That council require the applicant to exclude all infrastructure from within 'the deferred area', given the value of this area to yellow-bellied glider, including but not limited to roads, street lighting, pipelines, and any other infrastructure associated with the proposed subdivision.	Artificial lighting is already recommended to be excluded from this area, or if required, to utilise environmentally friendly designs eg bollards. Services such as pipelines can be routed to avoid Tree Protection Zones. Infrastructure through this area can be located to ensure that relevant sap trees are protected and access will not be impeded. Road verge maintenance can be minimised to allow for remainder of this deferred area (if protected for habitat in perpetuity, and allowing for bushfire provisions) to regenerate and buffer against edge effects and also increase carrying capacity. Given current use of peri-urban habitat and records in similar situations, expected to continue to use this area post-development.
Biodiversity	(l) The council require, as a condition of consent, the proponent to prepare a comprehensive Environmental Management Plan (EMP), should the proposal be approved. Minimum EMP inclusions are listed in Attachment 1 of this submission.	Concur – the measures proposed generally include existing recommendations in the ecological assessment.
Requirement for offsets	(m) That the biodiversity loss be quantified using a best-practice bio-metric to determine an appropriate offset. The OEH considers that the BioBanking Credit Calculator is the most appropriate tool for this purpose. (n) An appropriate offset site should be determined in accordance with the OEH's 13 principles for offsetting which can be found at the following web address http://www.environment.nsw.gov.au/biodivoffsets/oehoffsetprincip.htm (o) The offset site must be protected and managed in-perpetuity and secured with an appropriate mechanism, such as a BioBanking Agreement. The inclusion of 'the deferred area' as a Biobank Agreement site is likely to partially fulfil the offset requirements determined by the Credit Calculator.	No statutory obligation to provide offsets in this case.

Issue	OEH Recommendation	Comment
Aboriginal Heritage	(p) The area is known to have significance to the local Aboriginal community. However, no evidence of Aboriginal consultation for the subject land is apparent in the dated, broader area, Aboriginal cultural heritage assessment provided to support the proposal.	Issue to be resolved by others.

Yours faithfully,

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