



**NATURECALL**  
ENVIRONMENTAL

# Statutory Ecological Assessment:

## **Project:**

Proposed Residential Development  
on Lot 612 DP 1160096, Blackhead Road,  
Halliday's Point.

## **Client:**

Coastplan Group Pty Ltd

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## Executive Summary

The study site is approximately 16.78ha in area and is located on Blackhead Road west of Tallwoods Village, near Hallidays Point. Blackhead Road runs to the south of the site and the Tallwoods estate entrance and golf course dams are located approximately 400m to the east. To the north, lies the western arm of the Tallwoods estate with access to the site gained from The Pulpit Rd. The remainder of the local landscape is largely cleared rural to rural-residential land, with a large body of forest to the northwest comprising the nearest locally significant body of habitat.

The proposal is to seek rezoning to allow a future residential development over the entire site, and as only a generic concept layout has been provided, it has been assumed that all vegetation outside the nominated drainage reserves on the property will be removed. This will result in the removal of approximately 2.4ha of disturbed woodland as well as the pastoral grassland on site.

The site's limited remaining forest vegetation simply consists of modified dry sclerophyll open forest dominated by Tallowwood, Forest Red Gum, Grey Ironbark, Spotted Gum and Small-fruited Grey Gum. It was characterised by no understorey, with groundcover dominated by Blady Grass, Kangaroo Grass, White Clover and Fireweed. The remainder of the site is essentially improved pasture apart from waterlogged area in the northeast drainage line which was dominated by sedges and wetland plants; and 3 dams dominated by wetland plants. An undeveloped Crown road reserve adjoins the east, and contains a strip of intact dry sclerophyll forest, which probably reflects the pre-European vegetation types which may have occurred on site.

The small patch of remnant sedges and wetland plants above the dam in the northeast drainage was considered to be a low quality example of a derived *Freshwater Wetland on Coastal Floodplains* EEC. This area occurred on alluvial soils (according to 1:25 000 mapping), contained floristics which matched the Final Determination, and its extent would be within the 1:100 ARI (not mapped). This EEC appears to have been derived from the EEC – *Subtropical Floodplain Forest on Coastal Floodplains*, which occurs as two small patches in the study area: one in the Crown road reserve in the northeast drainage depression, and the other in the Blackhead Rd reserve to the south. The local occurrence of these EECs appears to be essentially restricted to the study area due to clearing, pastoralism and road construction on adjacent lands. It is recommended to retain the EEC on site, and protect it with vegetated buffers and appropriate stormwater management (latter will also benefit the off-site EECs).

A fauna survey was undertaken over the site and used a range of techniques fauna such as spotlighting, habitat assessment and scat searched. This resulted in the detection of a single threatened fauna species– the Grey-headed Flying Fox. Common woodland and fauna such as Magpies, Kookaburras and Rainbow Lorikeets were the main species detected, as expected given the habitat and its landscape context. A handful of mostly wide-ranging threatened species were also considered to have limited potential to at best use the site and/or the study area as a small part of their home range depending on factors such as season and lifecycle stage.

It is acknowledged that the proposed development will have the generic negative effect of removal of some potential foraging habitat, loss of 2 hollow-bearing trees (incrementally contributing to Key Threatening Processes), and reduced carrying capacity. However, in context of the ecology of the known



and potentially occurring threatened species, and the site and study area's limitations: the proposal is not considered likely to have an impact of sufficient order of magnitude to place a local population at risk of extinction, provided the local occurrence of the EECs is retained.

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

## 1.0 Introduction

Biodiversity Australia Pty Ltd Trading as Naturecall Environmental (hereafter referred to as 'Naturecall') was requested by Coastplan Group Pty Ltd on behalf of the proponent to undertake the required ecological and statutory assessments for a proposed residential development on Blackhead Rd, Halliday's Point. This will form part of a planning proposal for a rezoning application that will be submitted to Greater Taree City Council (GTCC) to allow future residential development of the site.

The impact assessment for this development proposal has been undertaken in accordance with Section 5A of 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 (SEPP 44 assessment); and the Commonwealth *Environment Protection and Biodiversity Conservation (EPBCA) Act 1999* - Matters of National Environmental Significance. The objective of this assessment was to demonstrate that rezoning to allow residential development can be achieved with these statutory provisions.

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](http://www.ecansw.org.au).

## 2.0 Background Information

### 2.1. Key Definitions

The **study site** is defined as Lot 612 DP1160096 which is the land subject to the proposed future development, and is approximately 16.8ha in area.

The **study area** is generally defined as land within 100m of the study site (approximate extent of detectable influence of most indirect impacts eg edge effects). The locality is defined as land within 10km radius of the site. These definitions are in line with DECC (2007).





## 2.2. Location of the Study Site

The site located on Blackhead Road, approximately 4.2km west of Halliday's Point (see Figure 1). It occurs directly south of the western section of the Tallwoods Village, a larger developing residential estate (approximately 150ha) which comprises a golf course and club encircled by Tallwoods estate.

Blackhead Rd serves as the southern border to the site.

## 2.3. Development Proposal

The proponent has engaged Coastplan to prepare a planning proposal to allow rezoning of the land to allow a future residential development. A preliminary concept have been provided for this assessment, and is shown in Figure 2.

This plan is conceptual only, and can be modified to have regard for various constraints (Mr Gavin Maberly-Smith, pers. comm.), but the general extent and orientation is expected to be similar to that proposed.

## 2.4. Soils, Topography and Geology

The site falls over a low ridgeline running roughly north-south, with an elevation of 30m along the northwestern boundary, falling to 10m in the southeastern boundary. The upper limits of three drainage depressions occur on site – one on the southern end, one in the west-northwest, and one in the northeast. All three have had a small dam (<10m wide) constructed within them near the boundary fence. These do not have defined channels on site, hence are considered open drainage depressions.

As shown in Figure 3, the southern and northeastern drainage depressions contains areas mapped as alluvial formations described as 'high-level terrace' and 'valley fill'. These formations are reportedly comprised of silt, gravel, clay and fluvial sand, and are elevated well above the nearest active alluvial plain formations to the south associated with Darawank Creek and Frogalla Swamp (Troedson & Hashimoto 2008). Soils encountered throughout the site consist of grey silty-clay loams. Surface rocks were found to be generally scarce and no rock outcrops were observed.

## 2.5. Landuse and Disturbance History

The subject land has clearly been long mostly cleared and converted to beef cattle grazing on improved pastures, and is currently maintained for this use. Remnant native vegetation is limited to two main clumps of regrowth forest, some scattered paddock trees, and some remnant wetland vegetation in the northeast drainage depression. Regeneration is minimal due to cattle grazing and routine maintenance.

The vegetation in the forested road reserve was also noted to be predominantly even-aged regrowth with limited mature trees. Habitat here is subject to the extremes of edge effects due to its extremely high edge to volume ratio.



Figure 1: Site location

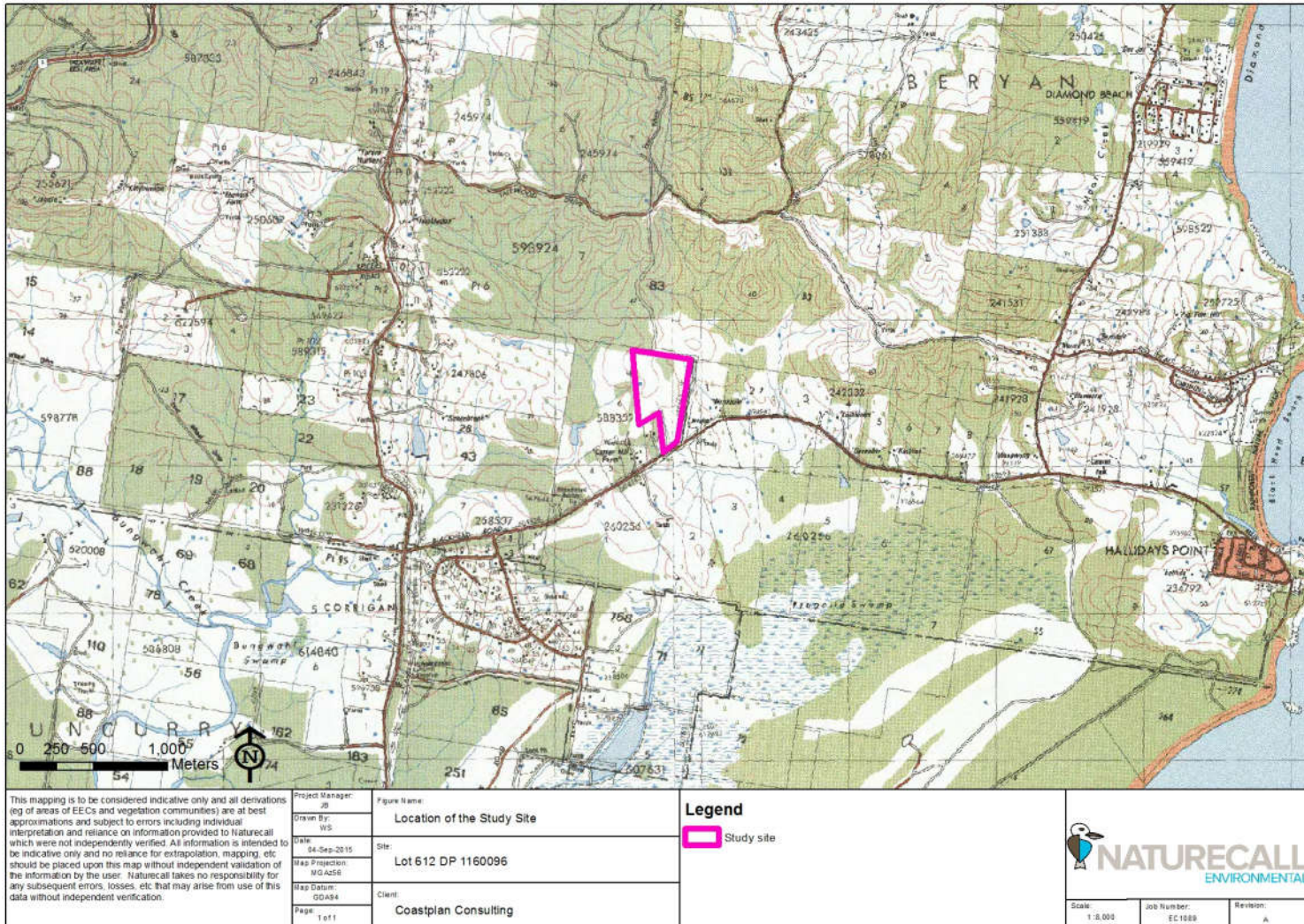




Figure 2: Concept development layout

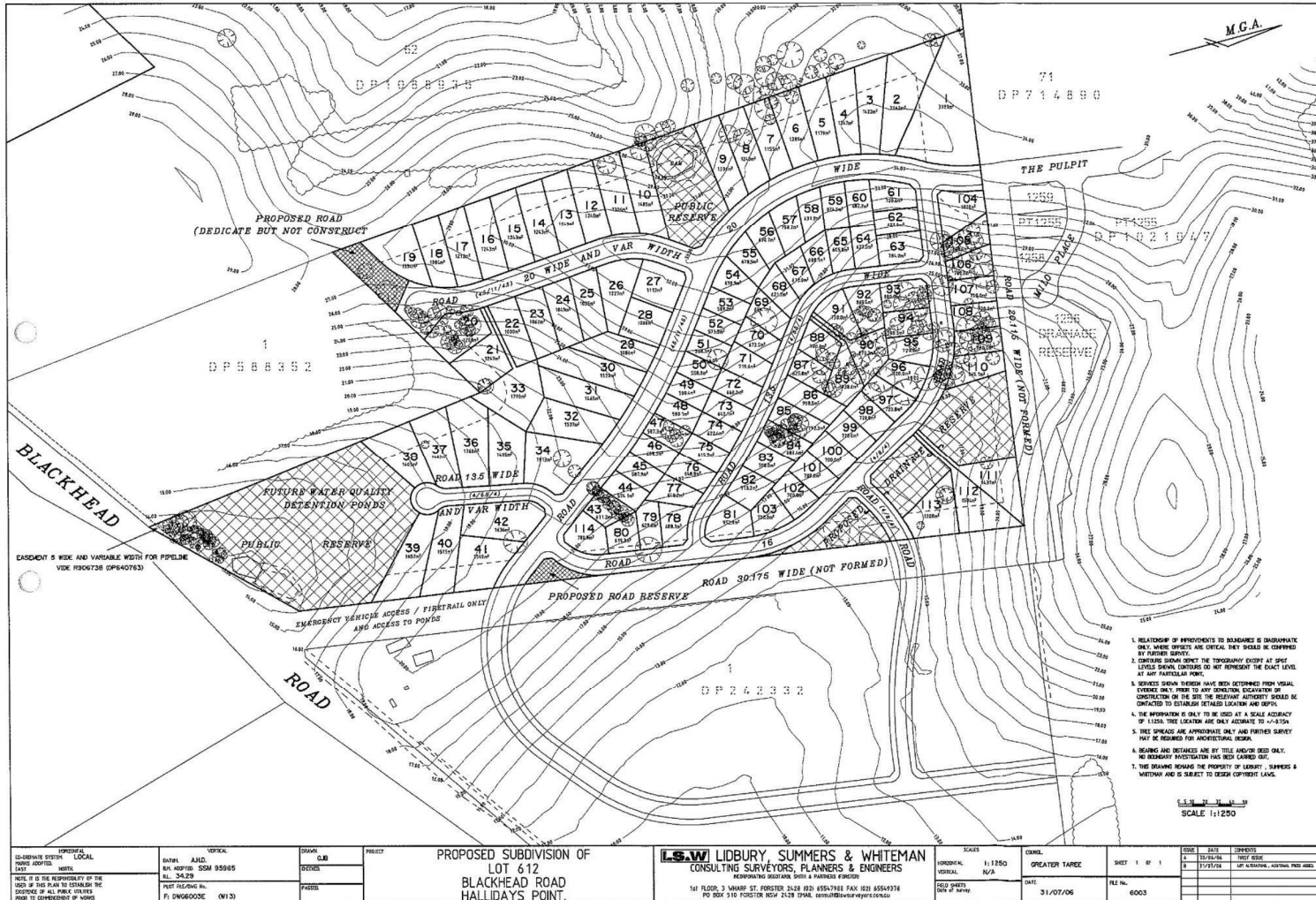
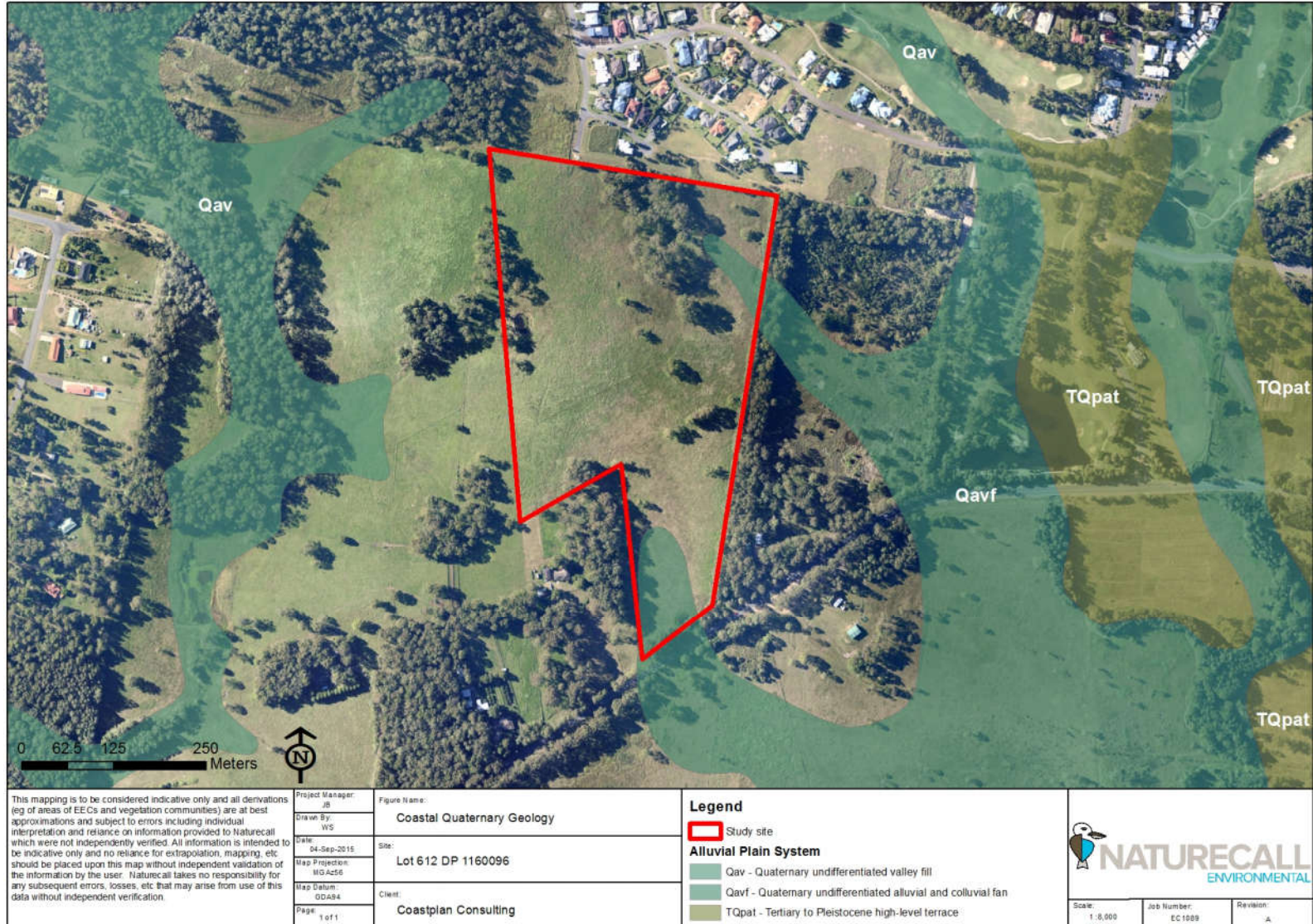




Figure 3: Coastal quaternary geology





## 2.6. Adjacent Developments and Activities

In the wider study area, historic disturbances such as logging and agriculture and more recently, clearing associated with the Tallwoods Village and golf course have resulted in fragmentation, simplification of species and structural diversity, reduction of potential fauna habitat, weed invasion and increased pressure from predation by dogs and cats.

The site adjoins the western side of Tallwoods village to the north, and will form a southwest extension if residential development is approved. A large lot development occurs approximately 500m to the west. Mostly cleared rural properties occur on adjoining land to the south, west and immediately east.

Beyond here, the local landscape consists of a mosaic of rural-residential areas, partially cleared rural properties, and native forest on private land and Mid Coast Water holdings. Frogalla Swamp and Darawank Nature Reserve occur to the south, and extensive forest (evidencing intensive logging) contained within Kiwarrak State Forest, Talawahl Nature Reserve and Khappinghat Nature Reserve occurs further to the north and northwest

## 3.0 Survey Methods

### 3.1. Flora

Previous survey has been undertaken by Travers Bushfire and Ecology (2014), hence the flora survey was limited to:

- Review of potential occurrence of any Endangered Ecological Communities
- Searches for threatened species.

#### 3.1.1. Known Threatened Flora Records

A search of the OEH Atlas of Wildlife (OEH 2015) indicated that 5 threatened species occur within 10km of the site. These are shown in the following table.

**Table 1: Threatened Flora recorded species in the locality**

Common Name	Species	Legal Status	Distance from Study Site/General Location
Dwarf Heath Casuarina	<i>Allocasuarina defungens</i>	E-TSCA, E-EPBCA	Nabiac sand plains, Aerodrome Road, Khappinghat Creek area
Trailing Woodruff	<i>Asperula asthenes</i>	V-TSCA, V-EPBCA	Darawank, Frogalla Swamp
White-Flowered Wax Plant	<i>Cynanchum elegans</i>	E-TSCA, E-EPBCA	Saltwater Reserve, Black Head
Noah's False Chickweed	<i>Lindernia alsinoides</i>	E-TSCA	Failford, Wallamba River
Rainforest Cassia	<i>Senna acclinis</i>	E-TSCA	Red Head, Hallidays Point, Black Head,



### 3.1.2. Survey Methods

The flora survey essentially routinely consists of two components:

- 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).
- 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).

#### 3.1.2.1. Vegetation Communities

##### **Species Identification:**

Species identification was made with the assistance of PlantNET, GTCC (2007), Bale (1993), Beadle (1982), Harden (1990, 91, 92, 93, 2000), Williams and Harden (1984), Williams and Harden (1980), Robinson (1994), and Brooker and Kleinig (1999). Plant species were identified to species or subspecies level and nomenclature conforms to that currently recognized by the Royal Botanic Gardens and follows Harden and PlantNET for changes since Harden (1990-1992, 2000).

##### **Conservation Status Assessment:**

Identification of possible Threatened Ecological Communities (TECs) was based on the data collected by the survey and review of the relevant listings on the OEH website ([www.environment.nsw.gov.au](http://www.environment.nsw.gov.au)) and Department of Environment – MNES SPRAT website (DoE 2014a)

#### 3.1.2.2. Threatened Flora

##### **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 intensively searched over one day by two ecologists, consisting of undertaking random meanders and targeted habitat searches over the entire site.

##### **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. Fauna

### 3.2.1. Survey Methods

All field surveying was conducted as per the conditions of the consultant's Animal Research Authority and Section 120 Scientific License.

#### 3.2.1.1. Habitat Evaluation and Fauna Survey Methodology

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).

#### 3.2.1.2. Spotlighting and Stag Watching

Spotlighting was conducted for 1 hour by 2 ecologists for 1 night. This was more than sufficient to completely cover the small site and the adjacent Crown Road reserve, inspect the crown of every tree on site, and minimise disturbance to surrounding residents caused by barking dogs. The procedure involved walking with a hand held 50 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. Only one tree per night was watched and this was conducted for a total of 0.75 hours by 2 ecologists for 1 night giving a total of 1.5 hours spent on the activity during the survey. Stag watching coincided with call playback surveys on and after dusk.

Conditions varied from clear to partially overcast. Wind was very light to placid.



### 3.2.1.3. Diurnal Bird Survey

Birds were generally surveyed by detecting calls and searching by binoculars during area searches over the whole site and actively listening/searching for birds. A total of 5 hours was spent on this activity. Birds were also surveyed opportunistically during other activities eg flora survey and spotlighting.

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

### 3.2.1.4. Herpetofauna and Secondary Evidence Searches

Physical habitat searches of the site were undertaken each day during the survey in early January. Survey 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 (ie reptiles and frogs).
- Searches for scats, tracks, digging and scratches (eg Koala, gliders, etc) over the site.
- Searches for scats, owl regurgitation pellets and guano deposits under every tree.
- Census and binocular inspection of tree hollows within the study area for signs of use eg worn edges.

A total of 4hrs was specifically spent on general habitat searches by two ecologists.

### 3.2.1.5. Koala Survey

Survey for Koalas over the site consisted of diurnal searches, scat surveys as per the Spot Assessment Technique (SAT) and spotlighting for 1 night. This is detailed further in Appendix 4.

### 3.2.1.6. Habitat Tree Survey

All hollow-bearing trees on site were located and recorded using an Ipad with GIS Kit Pro (Garafa Inc). Each tree was quantified (number of hollows, location in tree and aperture diameter),

This collated information is provided in Appendix 3 and location is shown in Figure 6.

## 3.3. Survey Limitations

### 3.3.1. Flora

The study site was intensively traversed by foot during specific flora surveys and during other survey activities during the survey period. The survey was undertaken in spring when many plants are in a high growth or flowering phase. This, and the extremely high accessibility of the site and limited diversity, resulted in a very high detection rate of plants present.





Regardless, any short-term survey will only provide a list of plants detected during a brief interval of time (DEC 2004). The total species list of an area is usually much greater than can be detected in such a short time and it can be influenced by factors such as: size of the property, fire history, time since disturbance, flowering season (particularly orchids), and presence of reproductive material (DEC 2004).

### **3.3.2. Fauna**

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 site was only subject to a field survey over 1 day, however has been previously surveyed by Travers Bushfire & Ecology (2004, 2104) over a collectively longer period. This thus provides a range of seasons and weather conditions over which the site has been surveyed.

To counter these limitations, qualitative and quantitative habitat evaluation was used as well as a suite of standard ecological field survey techniques 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). It relies on the ecologist's knowledge, literature review and observation skills, and hence any assessment must be objective and justified.

## **4.0 Survey Results**

### **4.1. Overview of Site Vegetation Communities**

The vegetation on site predominantly consists of two main patches of regrowth dry sclerophyll forest with scattered paddock trees over introduced pasture. These remnants are highly modified due to grazing as demonstrated in photo 1.

The northeast drainage depression above the dam contains the vestigial remnants of what was probably swamp forest ie common sedges and herbs. The 3 dams in each of the drainage depression also contains wetland vegetation in these artificial habitats which may have colonised from former on-site populations, or more likely introduced via waterfowl.



**Photo 1: Area of disturbed open woodland in the north of the site.**



## 4.2. Threatened Ecological Communities and Populations

### 4.2.1. Study Area EECs

As summarised below, the study area contains areas of vegetation that appears likely to be qualify as an Endangered Ecological Community (EEC) listed under the TSCA 1995:

#### 4.2.1.1. Site Evaluation - Subtropical Coastal Floodplain Forest EEC

##### Final Determination Listing Criteria

“*Subtropical Coastal Floodplain Forest of the NSW North Coast bioregion*” is a characteristic ecological community 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).

##### a) Geomorphological Criteria:

Figure 3 shows that at the 1:25 000 scale, the southern and northeastern drainage depressions are mapped as containing alluvial soil landscapes (Troedson *et al* 2008). On-site soil tests have not been undertaken to verify this mapping (eg these soils could be colluvial), or that these soils dominate the root zone and hence influence the supporting vegetation. Hence in the absence of this site-specific



information, the Precautionary Principle applies and it is assumed that the soil horizon is dominated by alluvial soils.

Hence this key criterion is considered satisfied for these two areas.

b) Floristic Criteria:

There are two areas within the study area which have the floristic characteristics of the *Subtropical Coastal Floodplain of the NSW North Coast* EEC. These areas occur immediately outside the eastern site boundary directly east of the dam in the northeast drainage line, and immediately south of the site's southern boundary.

The assemblage of flora species which appear to occur on the alluvial soil landscape in these areas is considered to readily meet the floristic criteria of this EEC as listed under the Final Determination (see floristic list in Appendix 2). This includes dominance by the canopy/understorey species *Eucalyptus tereticornis* and *Corymbia intermedia*; along with understorey and groundcover species such as *Callistemon saligna*, *Breynia oblongifolia*, *Entolasia marginata*, *Echinopogon caespitosus*, *Notelaea longifolia* and *Lomandra longifolia*.

c) Conclusion:

Based on legal precedents and the Precautionary Principle (*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*, *NSWSC 2004a*), the open forest occurring on the outside of the eastern and southern site boundaries of the site on alluvial soils qualifies as part of the "*Subtropical Coastal Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions EEC*" as it matches the key floristic descriptors, soil type, habitat and ecological process indicators described by the NSW Scientific Committee's Final Determination (NSWSC 2004a).

This EEC is in poor condition however as a result of historical clearing, road construction and current agricultural practices. This has resulted in high edge effects and weed invasion of the understorey and groundcover



**Photo 2: *Subtropical Coastal Floodplain Forest* EEC in the eastern road reserve.**



**Photo 3: *Subtropical Coastal Floodplain Forest* EEC in the south of the study area.**





#### 4.2.1.2. Freshwater Wetlands on Coastal Floodplains of the NSW North Coast

##### Final Determination Listing Criteria

“*Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*” has been listed as an Endangered Ecological Community under the TSC Act 2004. This EEC is 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 ie habitats where flooding is periodic and standing fresh water persists for at least part of the year in most years. *Freshwater Wetlands on Coastal Floodplains* (FWCF) generally occur below 20m elevations, and the structure of the community varies from sedgeland 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).

##### a) Geomorphological and Habitat Criteria:

Figure 4 shows that at the 1:25 000 scale, the southern and northeastern drainage depressions are mapped as containing alluvial soil landscapes (Troedson *et al* 2008). On-site soil tests have not been undertaken to verify this mapping (eg the soils could be colluvial), or that these soils dominate the root zone. Hence in the absence of this site-specific information, the Precautionary Principle applies and it is assumed that the soil horizon is dominated by alluvial soils. The Final Determination also states that this EEC generally occurs below 20m elevation and in depressions: both criteria are met on site in these areas mapped as containing alluvial soils.

Dams occur on both drainage depressions mapped to contain alluvial soils. These have artificially created permanent water conditions. These do not form part of the EEC habitat as the Final Determination states “*artificial wetlands created on previously dry land specifically for purposes such as sewerage treatment, stormwater management, and farm production, are not regarded as part of the community*” (NSWSC 2004a). Dr David Keith, whose paper led to the Final Determinations for these EECs, confirmed via email that artificial dams on floodplains were encapsulated within this exclusion (Dr David Keith, pers. comm.).

##### b) Floristic Criteria:

The two dams in the foot of the on-site extent of the drainage depressions contain vegetation indicative of this EEC, but their habitat is excluded from the Final Determination. Hence the dam vegetation are not examples of this EEC.

The vegetation in the remainder of the drainage depressions have both been highly modified by pasture improvement, with native species completely displaced in the southern drainage line. Outside the dam, this area was also noted to be dry and hence not subject to waterlogging and hence conditions conducive to supporting vegetation indicative of this EEC. Hence ecological processes defining this EEC are considered ineffective, and no viable seedbank is likely to be present. The EEC is thus considered extinct site in this area.

Conversely, above the dam in the northeast drainage is a localised area of highly waterlogged soil. The site visit occurred after a relatively prolonged dry period (as indicated by low water levels in the dams),



yet this area was boggy. The soils were noted to be muddy, and while pasture species were co-dominant, several indicative wetland species (eg *Carex appressa*, *Ludwigia peploides*, *Persicaria lapathifolia*, *Persicaria strigosa*, *Philydrum lanuginosum*, and *Ranunculus inundatus*) listed in the Final Determination were present in localised abundance in this area. Given wide ranges in hydrological conditions are typical of Australian wetlands (as acknowledged in the Final Determination), the species assemblage of both native and pasture species here is expected to vary with conditions, hence actual diversity could vary. Legal precedents have also clarified that to qualify as an EEC, a given area does not have to contain a threshold proportion of the species listed: it needs only to demonstrate the underlying processes are active and that a viable seedbank is present (eg *Dazdon Pty Ltd v Ku-ring-gai Council [2009] NSWLEC 1147*, *Murlan Consulting Pty Limited v Ku-ring-gai Council [2007] NSWLEC 374*). This area is thus considered to be a degraded example of this EEC, subject to confirmation of soil geomorphological origins.

This area of EEC is probably the vestigial remnants of the original occurrence of the EEC – Subtropical Coastal Floodplain Forest, prior to clearing. This is evidenced by the dominance of several ground layer species in both EECs on site and in the study area; and that the Final Determinations accounts for such derivations.

c) Conclusion:

Based on legal precedents and the Precautionary Principle (*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*, *NSWSC 2004a*), a localised area above the dam in the northeast drainage depression qualifies as part of the “*Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*”, as it matches the key floristic descriptors, soil type, habitat and ecological process indicators described by the NSW Scientific Committee’s Final Determination (NSWSC 2004a)

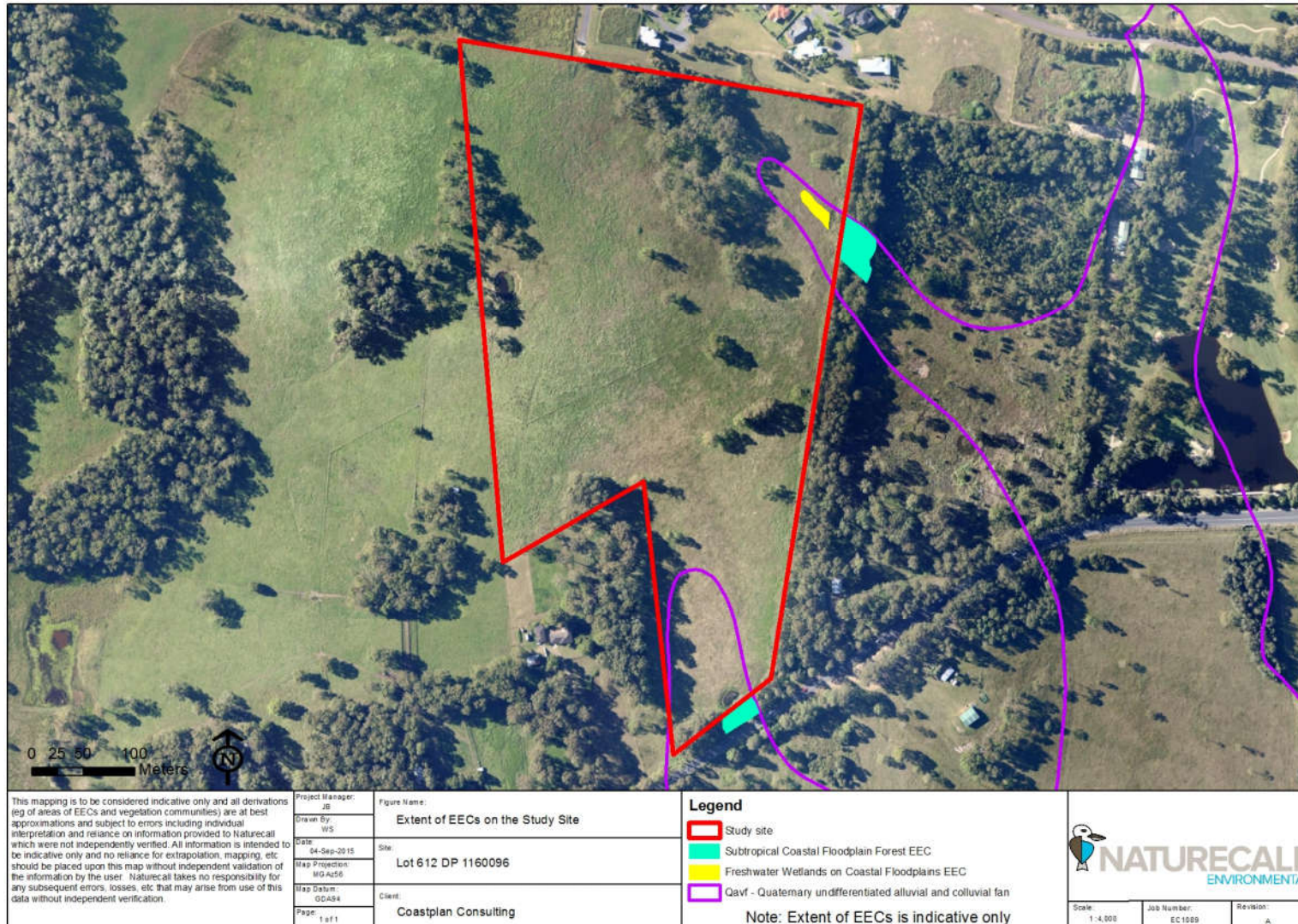


**Photo 4:** *Freshwater Wetland EEC* in the northeast of the site





Figure 4: EEC locations on site







#### 4.2.2. Other listed TECs and Endangered Populations

The following table reviews other TSCA and EPBCA listed TECs and Endangered Populations for occurrence:

**Table 2: Review of TECs and Endangered Populations**

Act	Literature Review	Significance
TSC Act	<p>“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 <i>Eucalyptus tereticornis</i>, <i>E. amplifolia</i>, <i>Angophora floribunda</i>, <i>A. subvelutina</i>, <i>E. saligna</i> and <i>E. grandis</i></p>	<p>Vegetation meeting the floristic and geomorphological criteria of this EEC does not occur on the site or in the study area.</p>
TSC Act	<p>“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 <i>Eucalyptus robusta</i> and <i>Melaleuca quinquenervia</i>.</p>	<p>Vegetation meeting the floristic and geomorphological criteria of this EEC does not occur on the site or in the study area</p>



Act	Literature Review	Significance
TSC Act	<p>“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 associated with coastal floodplains. Swamp Oak Floodplain Forest (SOFF) generally occurs below 20 m (rarely above 10 m) 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 (<i>Casuarina glauca</i>) is the dominant species. Other trees including <i>Acmena smithii</i>, <i>Glochidion</i> spp. and <i>Melaleuca</i> spp. may be present as subordinate species. The understorey is characterised by frequent occurrences of vines ie <i>Parsonsia straminea</i>, <i>Geitonoplesium cymosum</i> and <i>Stephania japonica</i> var. <i>discolor</i>, a sparse cover of shrubs, and a continuous groundcover of forbs, sedges, grasses and leaf litter.</p>	<p>Vegetation meeting the floristic and geomorphological criteria of this EEC does not occur on the site or in the study area.</p>
TSC Act	<p>“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 fauna. Tree species often present include Figs, (<i>Ficus</i> spp.), Palms (<i>Archontophoenix cunninghamiana</i>, <i>Livistona australis</i>), Lilly Pilly’s (<i>Syzygium</i> spp.) and vines (<i>Cissus</i> spp., <i>Pandorea pandorana</i>, <i>Flagellaria indica</i>).</p>	<p>Vegetation meeting the floristic and geomorphological criteria of this EEC does not occur on the site or in the study area.</p>
TSC Act	<p>“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.</p>	<p>Vegetation meeting the floristic criteria of this EEC does not occur on the site or in the study area.</p>



Act	Literature Review	Significance
EPBC Act	<p>“<i>Lowland Rainforest of Subtropical Australia</i>” is found from Maryborough to the Hunter. Predominantly occurs on basalt and alluvial soils, or enriched rhyolitic and metasediments. Generally occurs &lt;300m above sea level but may occur &gt;300m on north-facing slopes, and only in areas with annual rainfall &gt;1300mm. May intergrade with Littoral Rainforest and Coastal Vine Thickets but usually occurs &gt;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 &lt;30%. Emergents are typically figs, Hoop Pine and Brushbox.</p>	<p>Vegetation meeting the floristic criteria of this EEC does not occur on the site or in the study area.</p>
TSC Act	<p>“<i>Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions</i>” 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.</p>	<p>Vegetation meeting the floristic and geomorphological criteria of this EEC does not occur on the site or in the study area.</p>
EPBC Act	<p>“<i>Littoral Rainforest and Coastal Vine Thickets of Eastern Australia</i>” is a Critically Endangered Ecological Community listed under the EPBC Act 1999, which is generally identical to the TSC Act listing.</p>	<p>Vegetation meeting the floristic and geomorphological criteria of this EEC does not occur on the site or in the study area.</p>
TSC Act	<p>A localised population of a distinctive variation of <i>Glycine clandestina</i>, identified as <i>Glycine</i> sp. “Scotts Head”, has been listed as an Endangered Population. This population is restricted to part of the headland complex at Scotts Head.</p>	<p>The site is well beyond the range of this population.</p>
TSC Act	<p>“<i>Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregion</i>” 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: <i>Baumea juncea</i>, <i>Juncus kraussii</i>, <i>Sarcocornia quinqueflora</i>, <i>Sporobolus virginicus</i>, <i>Triglochin striata</i>, <i>Isolepis nodosa</i>, <i>Samolus repens</i>, <i>Selliera radicans</i>, <i>Suaeda australis</i>, <i>Zoysia macrantha</i>.</p>	<p>Vegetation meeting the floristic and geomorphological criteria of this EEC does not occur on the site or in the study area.</p>



Act	Literature Review	Significance
TSC Act	<p>“<i>White Box Yellow Box Blakely’s Red Gum Woodland</i>” 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.</p>	<p>The site does not meet the floristic requirements of this EEC, hence it does not occur.</p>
	<p>“<i>Hunter Lowland Red Gum Forest in the Sydney Basin and North Coast Bioregions</i>” 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.</p>	<p>The site vegetation does not meet the floristic criteria of this EEC and is located well beyond the range of this EEC.</p>
TSC Act	<p>The “<i>Population of Eucalyptus seeana in the Greater Taree Local Government Area</i>” has been listed as an Endangered Population.</p>	<p><i>E. seeana</i> does not occur on the site, and there are no records within 10km of the site.</p>
TSC Act	<p>“<i>White Gum Moist Forest in the NSW North Coast Bioregion</i>” is an ECC characteristically dominated by White Gum (<i>Eucalyptus dunnii</i>) either in pure stands or with <i>E. saligna</i>, <i>E. microcorys</i> and/or <i>Lophostemon confertus</i> (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.</p>	<p>White Gum does not occur on the site, thus the EEC does not occur.</p>
TSC Act	<p>“<i>Hunter Valley Vine Thicket in the NSW North Coast and Sydney Basin Bioregions</i>” 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 <i>Elaeodendron australe</i> (Red Olive Plum), <i>Geijera parviflora</i> (Wilga), <i>Notelaea microcarpa</i> var. <i>microcarpa</i> (Native olive), and <i>Alectryon oleifolius</i> subsp. <i>elongatus</i> (Western Rosewood). Emergent eucalypts are common and include <i>Eucalyptus albens</i> (White Box), <i>E. dawsonii</i> (Slaty Box), and <i>E. crebra</i> (Narrow-leaved Ironbark). Hunter Valley Vine Thicket has been recorded from the local government areas of Muswellbrook, Singleton, and Upper Hunter (NSWSC 2007b).</p>	<p>This community does not occur on the site which is located outside the prescribed range, thus the EEC does not occur.</p>



Act	Literature Review	Significance
TSC Act	<p>"<i>Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions</i>" 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).</p>	<p>This community does not occur on the site which is located outside the prescribed range, thus the EEC does not occur.</p>
TSC Act	<p>"<i>Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions</i>" is an that belongs to the Maritime Grasslands vegetation class of Keith (2004) and its structure is typically closed tussock grassland, but may be open shrubland or open heath with a grassy matrix between the shrubs.</p>	<p>Vegetation meeting the floristic and geomorphological criteria of this EEC does not occur on the site or in the study area.</p>
TSC Act	<p>"<i>Carex Sedgelands of the New England Tableland, Nandewar, Brigalow Belt South and NSW North Coast Bioregions</i>" is a preliminarily listed EEC in marshy regions dominated by sedges, grasses and semi-aquatic herbs. The species dominants are <i>Carex appressa</i>, <i>Stellaria angustifolia</i>, <i>Scirpus polystachyus</i>, <i>Carex gaudichaudiana</i>, <i>Carex sp. Bendemeer</i>, <i>Carex tereticaulis</i> and <i>Isachne globosa</i>, either as single species or in combinations. Other common species include <i>Geranium solanderi</i> var. <i>solanderi</i>, <i>Haloragis heterophylla</i>, <i>Lythrum salicaria</i>, <i>Epilobium billardierianum</i> subsp. <i>hydrophilum</i> and <i>Persicaria hydropiper</i> (Hunter and Bell 2009).</p>	<p>Vegetation meeting the floristic and location criteria of this EEC does not occur on site or in the study area.</p>
TSC Act	<p>'<i>Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions</i>' is an EEC that generally occurs on floodplains and on floodplains and associated floodplain rises along the Hunter River and tributaries.</p>	<p>This community does not occur on the site or in the study area, which is located outside the prescribed range, thus the EEC does not occur.</p>
TSC Act	<p>'<i>Coastal Cypress Pine Forest in the NSW North Coast Bioregion</i>' is a distinctive vegetation community dominated by Coastal Cypress Pine (<i>Callitris columellaris</i>) and is typically found on coastal sand plains, north from the Angourie area on the far north coast of NSW.</p>	<p>The site/study area is far beyond the known range of this EEC and the Coastal Pine does not occur, thus the EEC does not occur.</p>



## 4.3. Threatened Flora

### 4.3.1. Result of Threatened Flora Survey

No threatened plants were recorded on the study site during the survey.

### 4.3.2. Potential Occurrence Assessment

Searches of relevant literature and databases (OEH 2015a) found records of 5 threatened flora species in the locality. This and other species recorded in the region and/or in broadly similar habitats are reviewed for potential occurrence in Appendix 1.

In regards to potential occurrence of these and most threatened flora, it should be noted that threatened plants often occur in habitats with a precise mix of essential ecological requirements, and not randomly in the landscape or a broad structural form of vegetation (eg dry sclerophyll forest). Such essential requirements may be a complex nexus of position, soil type (which affects fertility, acidity, etc) and climate, but may also include specific (sometimes symbiotic) association with fungi and bacteria (eg Proteaceae), dispersal vectors (eg bats) and disturbance regimes eg *Acacia aprica* will not recruit without a suitable fire regime (Vallee *et al* 2004). Absence of such essential habitat variables or their modification (eg by disturbance such as frequent fire) can thus reduce or negate a site's potential for such plants to occur. These often poorly understood ecological factors are also a major contributor in the reason that many translocations of threatened plants fail (Vallee *et al* 2004).

A long history of disturbance within the study area (e.g. extensive clearing, underscrubbing, slashing, pastoralism etc.) has resulted in major habitat changes that may have effectively precluded threatened flora species from occurring due to competition, habitat changes, isolation, etc.

Given this and that no threatened flora species were detected during the survey or have been recorded in the Tallwoods estate by previous studies (eg Naturecall 2014, Travers 2014, 2004), it is considered highly unlikely that any such species would occur within the study area (see Appendix 1). Thus no threatened flora species are considered in the subsequent statutory assessments.



## 4.4. Fauna Survey Results

### 4.4.1. Habitat Evaluation

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

**Table 3: Habitat Evaluation Summary**

Habitat Attribute/Type	Site	Study Area	Potential Values to Threatened Species Occurrence
<b>Groundcover</b>	The site has been continuously grazed, hence current groundcover values are minimal. Composition ranges from native to exotic dominated areas and grasses are most common.	The area around the study site mostly consists of similar groundcover values to the west. East of the site there is a road reserve which was cleared approximately 20-30 years ago and has since been left to regenerate. Ground cover in this area is mainly typical of dry sclerophyll forest, with sedges locally dominant in the section of the drainage depression which crosses it. This habitat overall offers some	On site: Nil Study area: Insufficient extent, isolation and edge effects displaces potential occurrence of threatened small terrestrials eg Common Planigale.
<b>Leaf litter</b>	Very shallow patchy layer of leaf litter throughout two small patches of remnant forest.	Some leaf litter found in the road reserve to the east but no significant depth.	On Site: Nil. Study Area: Insufficient extent, isolation and edge effects displaces potential occurrence of threatened fauna which may use this habitat eg Three-toed Snake-toothed Skink.
<b>Logs and debris</b>	Only very small fallen timber with little habitat value ie no hollows.	Very limited – collected for firewood. No hollows.	On Site: Nil. Study Area: Nil



Habitat Attribute/Type	Site	Study Area	Potential Values to Threatened Species Occurrence
<p><b>Hollows</b></p>	<p>Only 2 hollow-bearing trees containing small hollows were identified on the site (eg Photo 6). See table in Appendix 3 for details and Figure 5 for location on site.</p>	<p>Few small hollows occur in a few trees in the road reserve to the east of the study site as limited age.</p>	<p>On Site: Limited potential to provide some limited habitat value for threatened species such as Yangochiropteran bats and small arboreal mammals. However, competition with common and woodland species would be high and a key limitation.</p> <p>Study Area: A small amount of marginal habitat exists for Yangochiropteran bat species and perhaps Squirrel Glider and Brushtailed Phascogale, however Insufficient extent, isolation and edge effects severely constrains potential occurrence.</p>
<p><b>Flowering canopy and understorey trees</b></p>	<p>A variety of myrtaceous tree species including Pink Bloodwood, Forest Red Gum, Tallowwood, Spotted Gum and Grey Ironbark, Several of these are winter-spring flowering, providing a diverse but still annually variable foraging resource for nectivorous bird species and arboreal mammals..</p>	<p>A variety of myrtaceous tree species including Pink Bloodwood, Forest Red Gum, Tallowwood, Spotted Gum and Grey Ironbark. Weeping Bottlebrush also present. Several of these are winter-spring flowering, providing a diverse but still annually variable foraging resource for nectivorous bird species and arboreal mammals.</p>	<p>On Site and Study Area: Grey-headed Flying Fox highly likely to use trees when flowering as part of local resource. Squirrel Glider unlikely due to Insufficient extent, isolation and edge effects.</p> <p>Likelihood of threatened birds using site trees very limited given competition with common woodland birds such as Noisy Miner and Rainbow Lorikeets, and other edge effects.</p> <p>Study Area: As for site and more abundant, Squirrel Glider unlikely due to Insufficient extent, isolation and edge effects.</p>





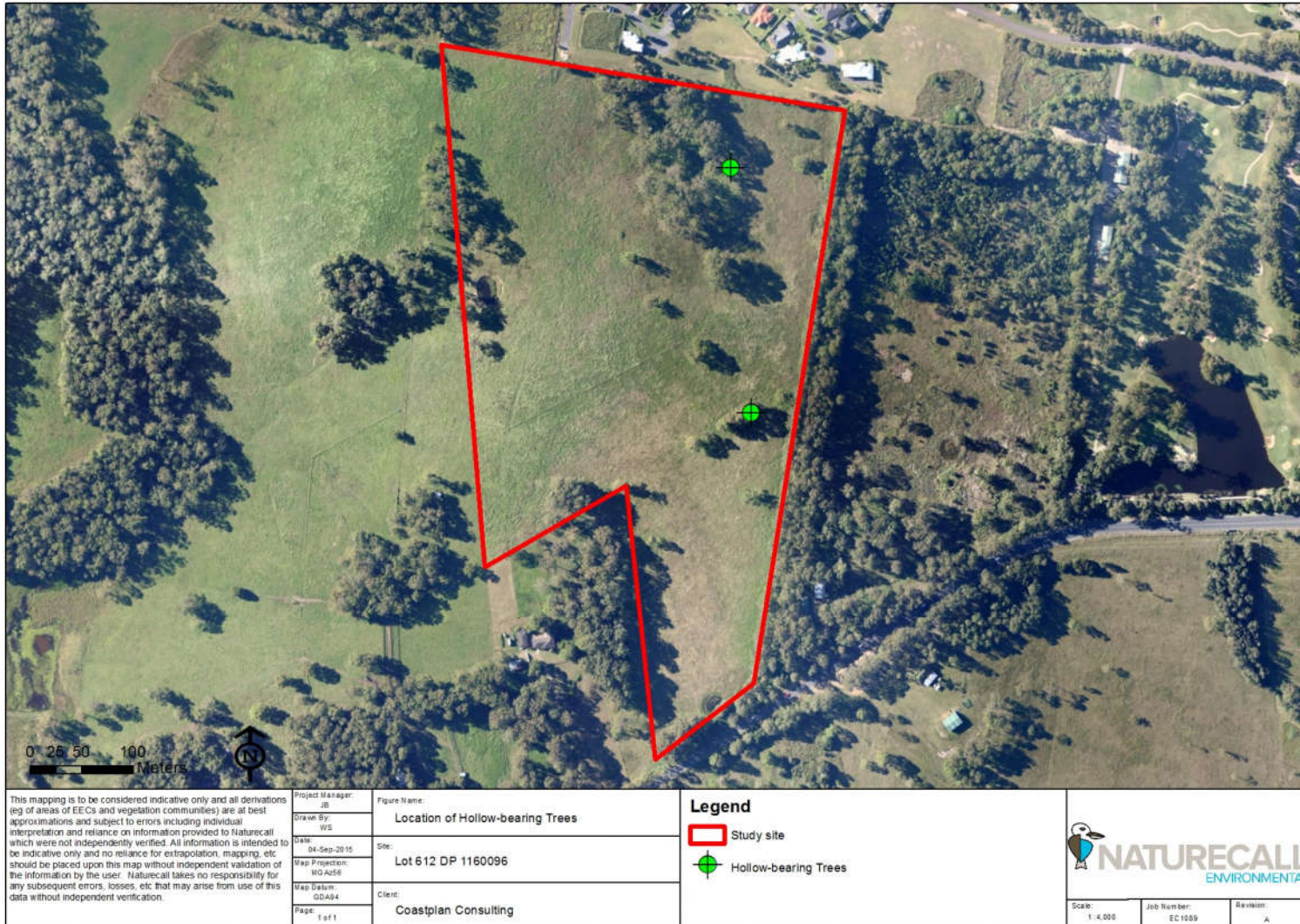
Habitat Attribute/Type	Site	Study Area	Potential Values to Threatened Species Occurrence
<b>Sap and gum sources</b>	Bloodwood, Small-fruited Grey Gum, Forest Red Gum, Grey Ironbark and less preferred Spotted Gum and Tallowwood are potential sap sources for Yellow Bellied Gliders (NPWS 2003a) and Squirrel Gliders.	As for site.	On Site and Study Area: A few small and quite old sap incisions noted. Isolation of site from forest precludes Yellow-bellied Glider; and edge effects (eg predator exposure), limited carrying capacity, poor connectivity and limited understorey are major limitations on the occurrence of Squirrel Glider.
<b>Primary preferred Koala browse trees</b>	Tallowwood, Forest Red Gum, and Small-fruited Grey Gum are preferred Koala food tree species (DECC 2008).	As for site.	On Site and Study Area: No evidence of the Koala was recorded on site. Site only provides minor foraging values due to its limited extent.
<b>Allocasuarinas</b>	No Allocasuarina or Casuarina species were found on site.	A number of Black Oak in the road reserve to the east of the site.	On Site: Nil Study Area: Potential to provide a minor foraging resource for the Glossy Black Cockatoo, however no evidence of foraging found during survey and is isolated from other habitat.
<b>Aquatic</b>	Three separate dams occur on site. The dams are relatively small in size, with the largest measuring approximately 0.3ha in the west, with the eastern and southern <0.1ha. All have good cover of aquatic vegetation including <i>Persicaria spp</i> , <i>Lomandra spp</i> , <i>Typha orientalis</i> , <i>Ludwigia peploides</i> etc.  Plague Minnow noted in two of the 3 dams (third too heavily vegetated).	Drainage depression was dry and lacked any defined scours or pools.	On Site: The on-site dams have no value for threatened frogs due to isolation from source habitat and non-breeding habitat.  The dams are not considered large enough to support even occasional foraging from the Black-necked Stalk.



Habitat Attribute/Type	Site	Study Area	Potential Values to Threatened Species Occurrence
<b>Fruiting species</b>	Absent.	Limited to Cheese Trees.	On Site: Nil. Study Area: No preferred forage species for threatened rainforest birds and no preferred sources for Grey-headed Flying Fox.
<b>Passerine bird habitat</b>	Poor habitat potential due to isolation, exposure, and lack of understorey and shrub layer. Area dominated by medium to large passerines typical of urban woodland habitats.	Some good structure but extreme edge to volume ratio and isolation from other habitat exposes nests and birds to extreme edge effects eg predation.	Poor prey potential for raptors dependant on smaller passerines. Very marginal to unsuitable for threatened passerines.
<b>Caves, cliffs, overhangs, culverts, bridges</b>	Absent.	Absent.	Nil
<b>Small terrestrial prey</b>	Minimal natural habitat for common terrestrial mammals, and very high predation risk (eg foxes).	Habitat potential in the road reserve to the east of the site is marginally better due to the presents of an understorey; however extreme edge to volume ratio and isolation from other habitat renders low diversity and abundance.	Minimal prey for forest owls, Quoll and diurnal raptors



Figure 5: Location of hollow-bearing trees on site





**Photo 5: Hollow-bearing tree in paddock**



**Photo 6: Hollow-bearing tree with old sap incisions in remnant forest**





## 4.4.2. Observed/Detected Fauna

### 4.4.2.1. Direct Sightings and Secondary Evidence

Only common medium small woodland birds were observed on and adjacent to the survey area. These included Laughing Kookaburra, Pied Butcherbird, Eastern Rosella, Magpie, Magpie Lark, Scaly-breasted Lorikeet and Noisy Miners.

The three dams on the site attracted common waterbirds such as the Wood Duck, and a Long-necked turtle was also observed in the larger western dam. These results were expected given the exposure of the site and high level of modification in the general area.

Only a small number of mammal species were opportunistically detected during the survey, a number of Red-necked wallabies, Eastern Grey Kangaroos and hares were observed during spotlighting.

A few small and old incisions indicative of gliders were observed on the Small-fruited Grey Gums on site. These were hypothesised to be from an old population of Sugar Gliders as no fresh marking were found and the low carrying capacity of the stand would exclude larger gliders.

### 4.4.2.2. Spotlighting and Stag Watching

In general, only a small number of common species were detected ie a number of Red-necked wallabies, Eastern Grey Kangaroos, hares and a number of sleeping birds. The Grey-headed Flying Fox was recorded as 3 animals foraging in flowering Grey Ironbarks in the road reserve.

### 4.4.2.3. Total Fauna Observed

The following table lists all fauna recorded by this survey

**Table 4: Fauna recorded on and adjacent to the site**

\* Indicates introduced species.

Observation Key: Obs – Observation; HC – heard calling

Group	Common Name	Species	Detection Method
Mammals	Red-necked Wallaby	<i>Macropus rufogriseus</i>	Obs, Scat
	Eastern Grey Kangaroo	<i>Macropus giganteus</i>	Obs, Scat
	European Hare*	<i>Lepus europaeus</i>	Obs, Scat
	Grey-headed Flying Fox	<i>Pteropus poliocephalus</i>	HC, Obs
Birds	Australian Raven	<i>Corvus coronoides</i>	Obs, HC
	Masked Lapwing	<i>Vanellus miles</i>	Obs
	Welcome Swallow	<i>Hirundo neoxena</i>	Obs
	Wood Duck	<i>Chenonetta jubata</i>	Obs
	Australian Magpie	<i>Cracticus tibicen</i>	Obs, HC



Group	Common Name	Species	Detection Method
	Magpie Lark	<i>Grallina cyanoleuca</i>	Obs
	Noisy Miner	<i>Manorina melanocephala</i>	Obs, HC
	Crested Pigeon	<i>Ocyphaps lophotes</i>	HC
	Rainbow Lorikeet	<i>Trichoglossus haematodus</i>	Obs, HC
	Scaly-breasted Lorikeet	<i>Trichoglossus chlorolepidotus</i>	Obs
	Southern Boobook	<i>Ninox boobook</i>	HC
	Galah	<i>Eolophus roseicapilla</i>	Obs
	Eastern Rosella	<i>Platycercus eximius</i>	Obs, HC
	Laughing Kookaburra	<i>Dacelo novaeguineae</i>	Obs
	Red Wattlebird	<i>Anthochaera carunculata</i>	Obs
	Willie Wagtail	<i>Rhipidura leucophrys</i>	Obs
Reptiles	Eastern long-necked turtle	<i>Chelodina longicollis</i>	Obs

## 4.5. Corridors and Key Habitats

Refer to Figure 6.

### 4.5.1. Regional and Sub-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). 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 and adjacent land within this section of the corridor are characterised by a mosaic of dry sclerophyll forest and cleared agricultural land. The western part of the site is currently mapped as part of a regional corridor and this section of land will be developed into residential dwellings and will retain very little to no value as a regional corridor post-development. While a negative effect, the section of corridor which the proposal will impact has very little value to the function of the overall corridor given:

- The small size of the land to be developed in comparison to the overall width of the corridor
- The lack of natural habitat within the corridor over the site overlap.



- The proposal does not create a barrier, restricting the movement of fauna along the overall corridor

Overall, the impacts which the proposed development will have on the Froggalla swamp, regional corridor are expected to be minimal.

#### 4.5.2. 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 (Lindenmayer and Fisher 2006). 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).

The study area falls within a highly fragmented landscape due to a history of pastoralism. In this context, the site has only marginal connectivity to the extensive forest to the northwest, broken by pasture. The main patch of forest in the north offers some low value as a stepping stone from the forested road reserve on the eastern boundary to the southern limit of the large body of forest to the northwest, but the gap is >100m of open ground. These distances are in the upper limits of the range in which Squirrel Gliders and Brushtailed Phascogales will travel across fragmented landscapes (Gleeson and Gleeson 2012, van der Ree *et al* 2008, Goldingay *et al* 2011, van der Ree *et al* 2001), however it is not unknown for Koala's to travel these distances for foraging and dispersal purposes albeit at risk of predation or dog attack (McAlpine *et al* 2006, Wilkes and Snowden 1998).

The forested road reserve provides some local linkage from similar linear remnants in Tallwoods and adjacent land to the partially wooded road reserve along Blackhead Rd, but edge effects and narrow width severely limit its functional effectiveness. Furthermore, it only links to similar small linear remnants with limited carrying capacity, hence has minimal potential to be a likely corridor for threatened arboreals other than the Koala.

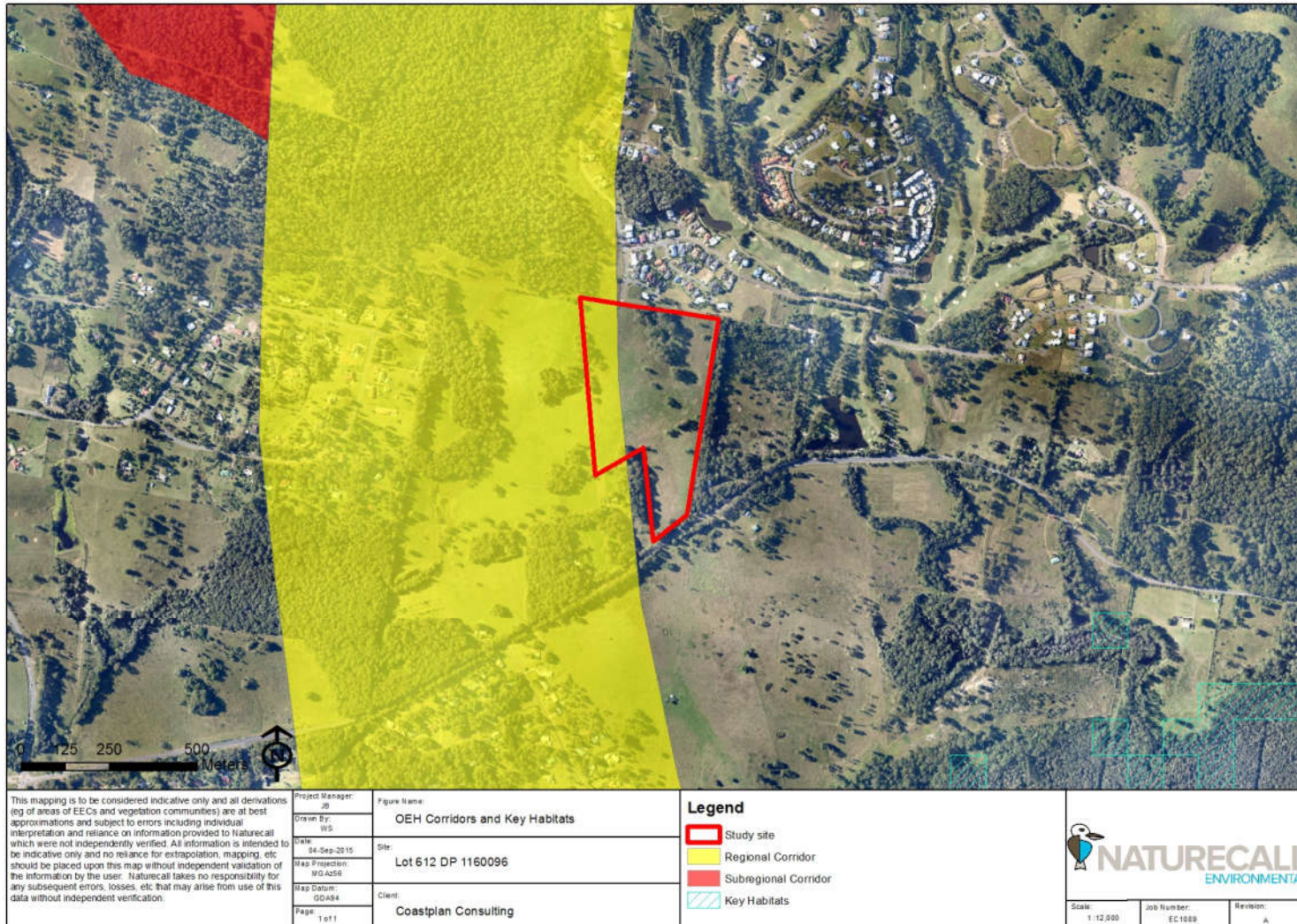
#### 4.5.3. Key Habitat

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 site is not mapped as Key Habitat.



Figure 6: OEH corridors and key habitats







## 4.6. Locally Recorded Threatened Fauna

The following table lists threatened species known to occur in the locality (OEH 2015a). 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.

**Table 5: Locally recorded threatened fauna**

Group	Common Name	Species	Legal Status	Distance from Study Site
Frogs	Wallum Froglet	<i>Crinia tinnula</i>	V-TSCA	Failford, Darawank, Nabiac sandplains, Hallidays Point
Birds	Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>	E-TSCA	Darawank Swamp, Rainbow Flat, Khappinghat Nature Reserve, Hallidays Point,
	Black Bittern	<i>Ixobrychus flavicollis</i>	V-TSCA	Failford
	Square-tailed Kite	<i>Lophoictinia isura</i>	V-TSCA	Tallwoods Drive, Diamond Beach, Khappinghat Nature Reserve
	Eastern Osprey	<i>Pandion cristatus</i>	V-TSCA	Saltwater National Park, Diamond Beach, Black Head
	Pied Oystercatcher	<i>Haematopus longirostris</i>	E-TSCA	Darawank Nature Reserve
	Little Tern	<i>Sternula albifrons</i>	E-TSCA	Diamond Beach
	Glossy Black Cockatoo	<i>Calyptorhynchus lathami</i>	V-TSCA	Diamond Beach, Kiwarrak State Forest
	Little Lorikeet	<i>Glossopsitta pusilla</i>	V-TSCA	Failford, Rainbow Flat, Wallabi Point
	Powerful Owl	<i>Ninox strenua</i>	V-TSCA	Tallwoods reservoir, Hallidays Point, Wallabi Point
	Masked Owl	<i>Tyto novaehollandiae</i>	V-TSCA	Tallwoods area, Old Soldiers Rd, Black Head, North of Tuncurry
	Sooty Owl	<i>Tyto tenebricosa</i>	V-TSCA	Kiwarrak State Forest
	Varied Sittella	<i>Daphoenositta chrysoptera</i>	V-TSCA	Failford, Rainbow Flat
Mammals	Spotted-tailed Quoll	<i>Dasyurus maculatus</i>	V-TSCA, E-EPBCA	Rainbow Flat, northeast of Nabiac, Talawahl Nature Reserve,
	Brush-tailed Phascogale	<i>Phascogale tapoatafa</i>	V-TSCA	North Tuncurry, Tallwoods reservoir, Rainbow Flat, Diamond Beach, Kiwarrak State Forest, Talawahl Nature Reserve
	New Holland Mouse	<i>Pseudomys novaehollandiae</i>	V-EPBCA	Kiwarrak State Forest, Talawahl Nature Reserve
	Squirrel Glider	<i>Petaurus norfolcensis</i>	V-TSCA	Possum Brush, Failford, North Tuncurry, Hallidays Point, Diamond Beach, Black Head



Group	Common Name	Species	Legal Status	Distance from Study Site
	Koala	<i>Phascolarctos cinereus</i>	V-TSCA, V-EPBCA	Tallwoods area, Red Head, Hallidays Point, Khappinghat Nature Reserve, Kiwarrak State Forest, Talawahl Nature Reserve
	Grey-headed Flying Fox	<i>Pteropus poliocephalus</i>	V-TSCA, V-EPBCA	Failford, Hallidays Point, Diamond Beach, Tallwoods area, Kiwarrak State Forest, Rainbow Flat
	Little Bentwing Bat	<i>Miniopterus australis</i>	V-TSCA	Hallidays Point, Black Head, Failford
	Eastern Bentwing Bat	<i>Miniopterus schreibersii oceanensis</i>	V-TSCA	Tallwoods, Failford, Nabiac, Black Head
	Southern Myotis	<i>Myotis macropus</i>	V-TSCA	Failford Rd, Joes Cutting Rd
	Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	V-TSCA	Failford, North Tuncurry
	East-coast Freetail Bat	<i>Mormopterus norfolcensis</i>	V-TSCA	Black Head, Failford, North Tuncurry, Hallidays Point,
	Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	V-TSCA	Failford

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

**Table 6: Regional threatened fauna potentially occurring in the locality**

\* listed under EPBC Act 1999.

Animal Group	Potentially Occurring Species
Mammals	Yellow-bellied Glider, Eastern Pygmy Possum, Common Planigale, Eastern Chestnut Mouse, *Long-nosed Potoroo, Rufous Bettong, *Dwyer's Bat, Eastern Cave Bat, Golden-tipped Bat, Yellow-bellied Sheath-tailed-bat, Common Blossom Bat.
Birds	*Red Goshawk, Barking Owl, Bush-stone Curlew, Barred Cuckoo Shrike, Rose-crowned Fruit Dove, Flame Robin, Scarlet Robin, Brown Treecreeper, Diamond Firetail, Grey-crowned Babbler, Hooded Robin, Speckled Warbler, *Australasian Bittern, Brolga, *Regent Honeyeater, Painted Honeyeater, *Eastern Bristlebird, Eastern Grass Owl, Wompoo Fruit Dove, Swift Parrot, Little Eagle.
Reptiles	*Three-toed Snake-tooth Skink, Pale Headed Snake, Stephens Banded Snake
Frogs	*Wallum Sedge Frog, *Giant Barred Frog, *Stuttering Frog, *Green and Golden Bell Frog, Green-thighed Frog

## 4.7. Potential Occurrence Assessment

### 4.7.1. New South Wales

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.



From this assessment, threatened species considered to potentially use the site (at best as a small part of a wider foraging range) are listed in the following table:

**Table 7: Threatened fauna potentially occurring on or near the site**

Species	Occurrence Type	Occurrence Likelihood
Powerful Owl	Minute portion of large foraging territory, no suitable nesting hollows present.	At best very low chance foraging in study area.
Masked Owl	Minute portion of large foraging territory, no suitable nesting hollows present.	Low chance foraging in study area. Recorded nearby to east.
Square-tailed Kite	Site offers some generic foraging opportunities as minute part of large foraging territory. Generic nest potential.	Moderate to high chance foraging over study area as small part of range. Historical records in study area from 2003.
Glossy Black Cockatoo	Small area of potential foraging habitat in road reserve adjacent to site. At most used as minute fraction of local range centred in larger remnants to northwest and beyond. No potential nest trees in study area.	Low as seasonal opportunist depending on fruit abundance.
Little Lorikeet	Potential seasonal nectar source and a few potential nesting hollows although subject to high competition.	Low to unlikely chance of occurrence on site as small part of foraging range.
Squirrel Glider	A few potential sap trees however lack of understorey over most of site, lack of hollows and isolation are key limitations. Small area of potential habitat in Crown road reserve may offer marginal dispersal linkage. Unlikely to be resident in study area due to edge effects and insufficient carrying capacity.	Very low to unlikely chance of occurrence. Recorded in loosely connected habitat to southeast.
Brushtailed Phascogale	Small area of potential habitat in Crown road reserve may offer marginal dispersal linkage. Unlikely to be resident in study area due to edge effects and insufficient carrying capacity.	Low to very low chance of occurrence. Recorded in loosely connected habitat to northeast.
Koala	Site offers some generic foraging opportunities as a minute part of a large foraging territory	Low chance of occurrence. Recorded immediately north of the site as well as in loosely connected habitat to the north east
Little Bentwing Bat, Eastern Bentwing Bat	Generic overfly and foraging as part of large range. Potential roost in hollow bearing trees	Moderate chance of foraging on site.
Greater Broad-nosed Bat	Potential foraging on site. Potential roosts in tree hollows.	Fair chance of foraging and roosting.
East-Coast Freetail Bat	Potential foraging in canopy and cleared grassland on site. Potential roosts in tree hollows.	Fair chance of foraging and roosting.
Yellow-bellied Sheath-tailed Bat	The woodland which is situated along the eastern site boundary provides a windbreak which would be favourable to the Yellow-bellied Sheath-tail Bat.	Low chance of foraging in study area.



#### 4.7.2. Commonwealth

The following species are considered by the DotE (2015a) 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.

##### Threatened Species:

The potential for these species to occur on the site is reviewed in Appendix 1.

**Table 8: 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 DotE website search.

Group	Common Name	Scientific Name	Listing Status	Recorded In Locality	Suitable Habitat On Site	Likelihood Of Occurrence On Site
Birds	*Regent Honeyeater	<i>Xanthomyza phrygia</i>	CE	N	Limited preferred forage species. Unlikely to occur.	Due to extreme rarity and lack of significant extent of preferred habitat, unlikely to occur.
	*Australian Painted Snipe	<i>Rostratula australis</i>	V	N	No suitable habitat.	Unlikely to occur.
	*Red Goshawk	<i>Erythroriorchis radiatus</i>	E	N	Generic potential habitat forming minute fraction of such habitat.	Unlikely as not seen south of Clarence River.
	*Eastern Bristlebird	<i>Dasyornis brachypterus</i>	E	N	No suitable habitat.	Unlikely to occur.
	*Australasian Bittern	<i>Botaurus poiciloptilus</i>	E	N	No suitable habitat.	Unlikely to occur.



Group	Common Name	Scientific Name	Listing Status	Recorded In Locality	Suitable Habitat On Site	Likelihood Of Occurrence On Site
	*Swift Parrot	<i>Lathamus discolor</i>	E	N	Limited preferred forage species. Unlikely to occur.	Due to extreme rarity and lack of significant extent of preferred habitat, unlikely to occur.
Mammals	*Long-nosed Potoroo	<i>Potorous tridactylus</i>	V	N	No suitable habitat.	Unlikely potential to occur – no local records and patchy coastal records throughout its distribution.
	*Koala	<i>Phascolarctos cinereus</i>	V	Y	Site and adjacent forest has some preferred forage species.	Low potential perhaps as transient.
	*Spotted-tail Quoll	<i>Dasyurus maculatus</i>	E	Y	Small area of potential habitat but surrounded by farmland. No proximate records.	Unlikely to occur.
	*Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	V	Y	Seasonally suitable for nectar foraging in study area.	<b>Recorded in study area</b>
	*Dwyer's/Large Pied Bat	<i>Chalinolobus dwyeri</i>	V	N	Generic forage habitat over forest. No potential roosts in study area.	Unlikely chance of occurrence.
	*Brushtailed Rock Wallaby	<i>Petrogale penicillata</i>	V	N	No suitable habitat in locality.	Extremely unlikely
	*New Holland Mouse	<i>Pseudomys novaehollandiae</i>	E	Y	Poor habitat on site due to disturbance.	Unlikely to occur.



Group	Common Name	Scientific Name	Listing Status	Recorded In Locality	Suitable Habitat On Site	Likelihood Of Occurrence On Site
Frogs	*Green and Golden Bell Frog	<i>Litoria aurea</i>	V	N	No potential habitat – dams too small and isolated from source habitat.	Unlikely to occur.
	*Stuttering Frog	<i>Mixophyes balbus</i>	V	N	No suitable habitat and no local records.	Unlikely to occur.
	Wallum Sedge Frog	<i>Litoria olongburensis</i>	V	N	No suitable habitat and no local records.	Unlikely to occur.
	*Giant Barred Frog	<i>M. iteratus</i>	E	N	No suitable habitat and no local records.	Unlikely to occur.

### Migratory Species

No EPBC Act 1999 migratory species were recorded on the site by the survey. A significant number of EPBC Act 1999 listed migratory bird species are known (OEH 2015a) or considered potential occurrences in the locality (DoE 2015a). 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 as detailed above.



**Table 9: EPBC Act migratory species potential occurrence assessment**

Common Name	Scientific Name	Predicted Type of Occurrence	Recorded In Locality (10km Radius)	Suitable Habitat On Site	Likelihood Of Occurrence On Site
*White-Bellied Sea-Eagle	<i>Haliaeetus benghalensis</i>	Species and/or habitat likely to occur within area	Y	No suitable foraging habitat on site	Unlikely
Osprey	<i>Pandion cristatus</i>	-	Y	As for White-Bellied Sea-Eagle.	As for Sea Eagle.
Latham's Snipe	<i>Gallinago hardwickii</i>	Species or habitat may occur in area	N	No suitable foraging habitat on site	Unlikely
Painted Snipe	<i>Rostratula benghalensis (australis)</i>	Species and/or habitat may occur in area	N	No suitable foraging habitat on site	Unlikely
Cattle Egret	<i>Egretta ibis</i>	Species/habitat may occur in area	Y	Some foraging habitat on site and stock present.	High
Great Egret	<i>Egretta alba</i>	Species/habitat may occur in area	Y	Very small area of foraging habitat in dams.	Low
Rainbow Bee-eater	<i>Merops ornatus</i>	Species/habitat may occur in area	Y	Suitable habitat in dry sclerophyll in reserve.	Low chance of occurrence
Regent Honeyeater	<i>Xanthomyza phrygia</i>	Species/habitat may occur in area	N	Limited preferred forage species. Unlikely to occur.	Due to extreme rarity and lack of significant extent of preferred habitat, unlikely to occur.



Common Name	Scientific Name	Predicted Type of Occurrence	Recorded In Locality (10km Radius)	Suitable Habitat On Site	Likelihood Of Occurrence On Site
Swift Parrot	<i>Lathumus discolor</i>	Species/habitat may occur in area	N	Limited preferred forage species.	Insufficient in study area – unlikely to occur.
Rufous Fantail	<i>Rhipidura rufifrons</i>	Breeding or breeding habitat may occur in area	N	Too open	Unlikely
Satin Flycatcher	<i>Myiagra cyanoleuca</i>	Breeding or breeding habitat likely in area	Y	Too open	Unlikely
Black Faced Monarch	<i>Monarcha melanopsis</i>	Breeding or breeding habitat may occur in area	Y	Too open	Unlikely
Spectacled Monarch	<i>M. trivirgatus</i>	Breeding or breeding habitat likely in area	Y	Too open	Unlikely
White-throated Needletail	<i>Hirundapus caudacutus</i>	Species/habitat likely to occur in area	Y	Yes as part of a broader area	Moderate-high, as transient
Fork-tailed Swift	<i>Apus pacificus</i>	Species/habitat may occur in area	Y	Yes as part of a broader area	Fair as transient





## 5.0 SEPP 44 - Koala Habitat Assessment

### 5.1. Potential Koala Habitat Assessment

#### 5.1.1. Introduction

The identification of an area of land as Potential Koala habitat is determined by the presence of Primary Preferred Koala Browse tree species. These species are listed under Schedule 2 of SEPP 44: *Koala Habitat Protection* (DoP 1995).

Potential Koala Habitat is defined as areas where the tree species listed under Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component. Primary preferred food species occurring in the Local Government Area (LGA) are: Tallowwood (*E. microcorys*), Scribbly Gum (*E. signata*), Grey Gum (*E. punctata*), Swamp Mahogany (*E. robusta*) and Forest Red Gum (*E. tereticornis*).

An area of land to which the policy applies to must be at least 1ha (and may include adjoining land in the same ownership).

#### 5.1.2. Assessment

The site is greater than 1ha in area, and Tallowwood, Forest Red Gum and Small-fruited Grey Gum comprises greater than 15% of the canopy trees over at least 1ha (eg the northern forest remnant). Thus the site meets the definition of Potential Koala Habitat and a Core Koala Habitat Assessment is required.

### 5.2. Core Koala Habitat Assessment

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.
- Failure to identify an Area of Major Activity.

Consequently, a Koala Plan of Management is not required.

## 6.0 Impact Assessment

### 6.1. Direct Impacts

As previously mentioned, the proposal is to eventually construct a residential estate over the entire site. A preliminary concept is provided in Figure 2.

As a minimum, the proposal will require the removal of all the remaining forest and woodland vegetation over the site, including up to 2 potential/actual hollow-bearing trees, and a number of primary preferred Koala browse species. Overall it is estimated that 2.4ha of disturbed open woodland as well as open pasture throughout the 16.5ha site will be removed. A road may also pass at least once through the eastern Crown road reserve, removing a small area of forest here.



The drainage depressions are to become drainage reserves, with stormwater directed to appropriate treatment facilities in these areas before offsite discharge. The existing dams may be retained here or form part of this system. The *Freshwater Wetland* EEC in the northeast drainage line is to be retained, rehabilitated and buffered within the drainage reserve in this area (see section 7.1.1).

The establishment of the development and associated services will have the following direct potential impacts:

- Reduction of the site's carrying capacity due to loss of forest vegetation which offers foraging habitat eg nectar sources.
- Partial loss of around 4.8ha of land mapped as a regional corridor for the Froggalla swamp regional corridor
- Loss of most if not all of the site's preferred Koala browse species (Tallowwoods, Forest Red Gum, Small-fruited Grey Gum)
- Loss of a number of potential sap species for gliders.
- Loss of 2 hollow-bearing trees including a termitaria.
- Permanent prevention of recovery of native vegetation.
- Drainage modification via landform changes and establishment of hard surfaces.

## 6.2. Indirect Impacts

The following is an assessment of indirect impacts typically associated with developments of this nature:

**Table 10: Indirect impacts of the proposal**

Threat	Literature Review	Assessment Of Proposal
<b>Direct mortality via clearing</b>	Animals within hollows and fallen logs, as well as dense vegetation and leaf litter may be killed during clearing of these structures. This risk increases during breeding seasons (generally spring to late autumn), and cooler season when mammals and reptiles enter torpor.	As detailed above, up to 2 actual/potential hollow bearing trees will be removed. Any fauna potentially within these hollows thus will be at risk of direct mortality during felling, or increased predation risk after felling until they can locate alternative shelter.  Appropriate hollow-bearing tree removal protocol and clearing supervision by an ecologist is recommended to be implemented to minimise this risk.
<b>Erosion and Sedimentation</b>	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 (eg 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 development footprint.  There is potential for the development to bring increased flow rates into the EEC habitat in the northeast due to the increase in hard surfaces. Unmitigated, this has the potential to damage the EECs found in the study area through erosion and sedimentation. This is to be mitigated via vegetated buffer zones, and standard erosion and stormwater management.



Threat	Literature Review	Assessment Of Proposal
<b>Fencing</b>	Fences have potential to obstruct the movement of threatened fauna across the site. 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).	Aside from EEC in the northeast drainage depression and dams in other reserves, no habitat is expected to remain on site to which any likely fencing may pose a barrier or injury risk. As these habitats will at most be separated via indicative fencing such as bollards, barriers to habitat or injury threats are unlikely to increase.
<b>Road Kills</b>	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 Snowden 1998, Connell Wagner 2000, Port Stephens Council 2001, Lunney et al 1999, DECC 2008, AKF 2007).	The proposal introduce road traffic to the area with the construction of over 100 new homes, as well as the potential construction of access roads from the east. Should access roads be developed through the Crown road reserve to the east of the site, it will further increase potential for wildlife-vehicle collisions. To minimise risk of this impact, it is recommended that low speed limits are encouraged through the use of engineering controls, combined with strategic lighting.
<b>Edge Effects</b>	The fragmentation and/or isolation of currently intact vegetation via partial/mosaic clearing and establishment of pastures, fences, buildings, trails, roads, etc, can have the following effects which are generally referred to as edge effects (Lindenmayer and Fisher 2006, Andrews 1990, Goosem 2002, May and Norton 1996, Catterall 2004, Dickman 1996, NPWS 2001, Kelly <i>et al</i> 2003, Cropper 1993, Downy 2003, Brown et al 2003):	Edge effects such as weed invasion and predation by cats and dogs have the potential to impact on retained EEC, but these effects are already a major threat to local biodiversity. Proposal will thus see an incremental increase in existing threats, and increase potential new ones eg weed invasion of the EEC due to elevated nutrients from runoff if stormwater is inadequately treated. This risk is proposed to be mitigated via appropriate stormwater management and a vegetated buffer zone.
<b>Alteration to Bushfire Regimes</b>	Altered fire frequency can also ultimately simplify or alter the character of vegetation communities by removing fire sensitive species (eg convert wet sclerophyll to dry, or eliminate Allocasuarinas), and even develop fire-prone communities (eg promote development of a grassy groundcover). This has consequences for the fauna assemblage as well as species dependant on specific resources eg Glossy Black Cockatoo, Common Planigale and Green Thighed Frog (NSWSC 2000d).	No change to current fire risk as forest on site will be removed, and road reserve is not likely to be perceived as fire threat needing regular burning.
<b>Eutrophication and pollution</b>	Eutrophication and pollution of waterbodies can occur at both the construction and establishment phases, from on site effluent for dwellings, and from exudates and residues on bitumen roads which contaminate soil and water. Contaminants and nutrients can escape via improper storage of petrochemicals and other chemicals, refuelling areas, surface runoff from on-site sewerage treatment areas and improper effluent disposal design, runoff from car washing and cement washdowns, and use of fertilisers	The construction over 100 dwellings will bring with it an increase in the amount of nutrient load from the site in stormwater. There will also be a dramatic decrease in the infiltration area of the site as a majority will contain roads, houses pavements etc. This has the potential to cause eutrophic conditions in the EEC's found in the study area, if stormwater controls are not adequate.



Threat	Literature Review	Assessment Of Proposal
	and herbicides on gardens.	
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.	Noise generated by the proposal is unlikely to disturb fauna occurring on the site, with species expected to have a substantial tolerance to the current level of anthropogenic noise in the area from roads, agricultural activities and adjacent residential areas.
Weed Invasion	Disturbance of soil provides the opportunity for weed invasion. Weeds may also be transported to the site from vehicle, people (eg on clothing), etc, who visit the development area, and via introduced fill material.	<p>Potential for weed propagules to be introduced on vehicles and earthmoving equipment. Exposed soil from earthworks will also be prone to weed invasion.</p> <p>This is not considered a significant risk given the current level of weed invasion throughout the site and conversion to a residential area.</p> <p>Remaining EEC and drainage reserves may be at risk of elevated weed inputs from additional nutrient-rich water flows and propagules from residential area. This is to be mitigated by rehabilitation of the onsite EEC, a vegetated buffer zone and adequate stormwater management.</p>

## 7.0 Recommendations

### 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. Protection and Rehabilitation of the Freshwater Coastal Wetland EEC

The final layout of the proposed development is to be designed to retain the small area of *Freshwater Wetland* EEC in the northeast drainage line within the designated drainage reserve. This area is the local occurrence of this EEC, hence its removal would require a Species Impact Statement.

This area is to be subject to rehabilitation under a Vegetation Management Plan to remove pasture weeds and increase biodiversity. Rehabilitation should also include planting of sedges, herbs, grasses, trees and shrubs (in areas with suitable edaphic conditions) indicative of the original EEC which is likely to have been *Subtropical Coastal Floodplain Forest* EEC. A vegetated buffer comprising an ecotone of the two EECs and the current nearby dry sclerophyll forest species should be planted and extend upslope for at least 30m either side and upstream of the EEC: exclusive of APZs, services and road infrastructure. This vegetation will provide a buffer to edge effects as well as a filter strip for runoff.

The extent of the EEC to be buffered should be that area on site which contains remnant species characteristics of a Coastal Floodplain EEC, falls within the 1:100 ARI of the drainage depression, and



occurs on alluvial soils ie the extent of EEC habitat. Further investigations may be required to determine the extent of this area, and hence the extent of the buffer zone.

Stormwater is to be filtered through appropriate engineered structures before discharge into the EEC area, but should not be completely directed around the area as this will adversely alter the hydrological regime.

The reserve containing the EEC may be used for passive recreation including elevated walkways, but the outer edges should be planted with pungent-leaved plants to discourage track making and other intrusions. Rear yards should also not adjoin the reserve directly to discourage impacts such as encroachment via lawn extensions; storage of trailers, boats and caravans; and dumping of green wastes.

### **7.1.2. Crown Road Reserve Crossing**

If roads are required to cross the Crown road reserve, the following is to be implemented:

- Engineering design is to include structures which reduce safe maximum speed to 40kph where the road passes through the vegetation to minimise risk of vehicle collision with wildlife.
- Artificial lighting is provided to maximise driver detection. Such lighting should include shielding to minimise light spillage into the adjacent vegetation and focus light direction to the crossing.

### **7.1.3. Tree Protection During Clearing**

Any trees/habitat to be retained is to be clearly marked prior to commencement of construction eg temporary fencing, flagging tape and/or spray paint to clearly identify what trees/habitat are to be retained.

This will be critical to ensure protection of the EEC in the northeast drainage line.

### **7.1.4. Pre-Clearing Survey and Clearing Monitoring**

The following ameliorative measures should be carried out to minimise the risk of injury or stress to Koalas and other fauna during clearing works on site.

1. The area of work is to be inspected for Koalas and other fauna by an approved ecologist immediately prior to commencement of any vegetation removal involving machinery and/or tree-felling.
2. If a Koala is present in an area subject to vegetation removal/modification, it is preferred works are suspended until the Koala moves along on its own volition. If the Koala is located in a position that a 25m buffer may be established, works may proceed outside this buffer.
3. Pre-clearing checks should be undertaken in the vegetation to be removed and include searches of habitat eg lifting and destruction of logs, searching of termitaria mounds, searches for bird nests, and raking of leaf litter. Other than Koalas, any detected fauna is to be relocated off-site to nearby suitable areas (preferably within their natural home range) prior to clearing commencement.
4. Until all ground habitat components and hollow-bearing trees are removed, the ecologist is to remain on site to supervise clearing to retrieve any fauna detected during works, undertake appropriate action (eg euthanize severely injured animals).



### 7.1.5. Hollow-bearing Tree Felling and Animal Welfare Protocol

The hollow-bearing trees proposed to be removed may 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.

In general, 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. Hollow-bearing trees should 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 undesirable 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 harvester head or similar 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, but limited in practicality to small to medium sized trees).
  - 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).
  - An arborist is to remove the tree via a top-down process. During this process, the arborist is to inspect the hollows for signs of fauna using a torch and/or snake-eye inspection camera. If fauna are present, the arborist is to follow the ecologist’s instructions to minimise risk of fauna mortality/stress.
2. An ecologist 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. euthanasia or transport animal to veterinary treatment (care at proponent’s cost) or care by FAWNA (with a donation by proponent to cover all carer and treatment costs).
3. 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.
4. 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.

The ecologist is to provide a brief report to GTCC within 14 days of works detailing the methods used, details of the hollows (aperture width, depth, evidence of use) and outcomes of any fauna rescue.



### 7.1.6. Replacement Nest Boxes

The hollows to be removed in the hollow-bearing trees removed for the proposal are to be offset with replacement nest boxes at a ratio of one per observed hollow (potential or actual). Nesting boxes specifically catering to gliders, small parrots and Yangochiropteran bats are recommended given current hollow size. These are recommended to be mounted in the patch of trees to remain in the southern drainage reserve.

The boxes are to be sourced by a reputable supplier and installed by an ecologist on retained mature trees before clearing commences.

### 7.1.7. Erosion and Sediment Control

Council's standard sediment and erosion control measures will be required during construction to ensure on site and nearby watercourses are not impacted upon, and most importantly the *Freshwater Wetland* EEC.

## 7.2. Secondary Recommendations

### 7.2.1. 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 strata and structural complexity), Yangochiropteran bats, and canopy species such as birds, arboreal mammals and Yinpterochiropteran bats (Catterall 2004).

Planting out of the southern drainage reserve with native species to offset the loss of Koala food trees and other habitat on site is encouraged provided it does not compromise water quality treatment facilities and objectives.



## 7.2.2. Artificial Lighting

To ensure anthropogenic impacts are minimised, it is recommended that artificial lighting 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.

# 8.0 Seven Part Test Assessment

## 8.1. General Overview

The 7 Part Test is 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 Part Test is 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 flora species were detected on site or are considered potential occurrences, hence none are subject to assessment.

A low quality example of probably derived *Freshwater Coastal Wetland* EEC occurs on site, and small remnants of the EEC - *Subtropical Floodplain Forest on Coastal Floodplains* also occur in the study area. Both of these EECs are to be assessed.

The Grey-headed Flying Fox was the only threatened species recorded by survey in the study area, and is automatically subject to assessment.

The following species are subject to the 7 Part Tests, as on the basis of habitat evaluation (see Appendix 1), they are conservatively considered likely to at least periodically use some habitat on the site or in the study area at some time (eg now or if they were to potentially recover and expand):

- **Mammals:** Brushtailed Phascogale, Squirrel Glider, Koala, Little Bentwing Bat, Eastern Bentwing Bat, East Coast Freetail Bat, Greater Broad-nosed Bat Yellow-bellied Sheathtailed Bat,
- **Birds:** Powerful Owl, Masked Owl, Square-tailed Kite, Little Lorikeet, Glossy Black Cockatoo.

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 Populations Occurrence

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 11: Definition of Local Population**

Species	Local Population
Forest Owls	Local pair of birds which may include site/study area as small portion of large foraging territory. Local population thus requires much more habitat that found within study area to meet lifecycle requirements.
Square-tailed Kite	The local breeding pair for which the study area may constitute a minute portion of larger potential foraging territory. Local population thus requires much more habitat that found within study area to meet lifecycle requirements.
Glossy Black Cockatoo	Local individual/ pair/ flight of bird/s which may include site/study area as small portion of large foraging territory due to the presents of Black Oak. Local population thus requires much more habitat that found within study area to meet lifecycle requirements.
Little Lorikeet	Any individuals potentially using habitat within the site/study area depending on flowering incidences and competition with common con-specifics. Local population requires much more habitat that found within study area to meet lifecycle requirements.
Koala	Any individual potentially using site/study area for occasional foraging or during dispersal from habitats outside the study area.
Squirrel Glider	All potentially occurring individuals, probably transient and dispersing from adjacent habitats outside the study area, given ecology of the species and habitat limitations of the site and study area.
Brushtailed Phascogale	All potentially occurring individuals potentially occurring in the study area, most likely as transients from habitats outside the study area, given ecology of the species and habitat limitations of the study area.



Species	Local Population
Yangochiropteran bats	Any individuals potentially using habitat within site/study area depending on lifecycle stage/seasonal range and time of year (ie season) and con-specific competition. Due to the ecology of these species, the local population requires much more habitat that found within study area to meet lifecycle requirements.
Grey-headed Flying Fox	Any individuals using foraging habitat within study area depending on seasonal flowering incidences. Local population thus requires much more habitat that found within study area to meet lifecycle requirements.

The local occurrence of the EECs as per the DECC (2007) definition is that within the study area. Due to extensive modification within the drainage depression on adjacent land, the local occurrence of the *Freshwater Wetlands* EEC appears to be restricted to the small area in the lower section of the northeast drainage line on site. The local occurrence of the *Subtropical Floodplain Forest on Coastal Floodplains* EEC in the study area appears to be limited to the two small patches just off site in the Crown road reserve to the east, and the Blackhead Road reserve to the south.

## 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:

- Part (a) is generally answered per species in a dedicated section if impacts are more acute and require more detailed evaluation. For less affected species, 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 answered per species or collectively depending on the nature of impacts. Part (b) deals with Endangered Populations Part (c) applies specifically to EECs, which is not relevant to this proposal. Part (e) deals with Critical Habitat, which is not relevant to the proposed works.

### 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,**

#### Yangochiropteran bats:

All of the subject bat species require home ranges or seasonably variable ranges that far exceed the site/study area at least seasonally depending on lifecycle stage or due to their ecology e.g. summer migrants in the south of the bioregion eg Dwyer 1966, 1968, OEH 2015b, ABS 2013, Smith *et al* 1995, Churchill 2009, etc). Hence ecologically, while an individual/s may use the site/study area for foraging or possibly roosting in tree hollows at some time, any potentially occurring local population of these species would extend well beyond the site/study area to meet all their full lifecycle requirements.



The site and study area provides only a relatively small area of potential foraging habitat for the subject Yangochiropteran bats (the frontage with the Crown road reserve provides the best structure for bats which forage along forest-pasture interfaces), with the presence of a few hollow-bearing trees offering potential roosts. The latter would however be subject to high competition with common species of birds, bats and other mammals (eg lorikeets, rosellas and common bats). Habitats in the study area are in a similar state of disturbance to those on site, however higher quality habitat exists within 1km of the site and tentative linkages occur to large expanses of State Forest and Nature Reserves to the north and south. Occurrence in the study area is thus likely to be short and term for non-critical lifecycle stages.

The proposal will require the removal of approximately 2.4ha of disturbed open woodland over the site including 2 hollow-bearing trees which may offer potential roosts. In the context of the extensive habitat available to these bats in the locality however, this only represents only a minor fraction of potential habitat and its loss is not likely to significantly impact on their foraging success or ability to raise young. Further, critical life stages are unlikely to occur on site due to exposure to edge effects (eg elevated predation and competition). Nest boxes are recommended to be installed to offset the loss of hollows on site.

Given the above, and that no new threat or barrier will be established, it is considered that the proposal has no potential to place a local viable population at risk of extinction.

### **Grey-headed Flying Fox**

The *Eucalyptus* and *Corymbia spp.* on site offer generic seasonal foraging habitat for this species, and the species was recorded during the surveys.

The site and study area are not suitable roosting habitat and the nearest known areas are at Diamond Beach and Khappinghat Nature Reserve to the north (OEH 2015a).

Due to the ecology of the species, the site/study area only has potential to form a small to minute part of a local breeding colony's seasonal range, and consequently, a local population needs to fulfil the majority of its lifecycle requirements well beyond the site/study area.

The proposal will result in the loss of up to 2.4ha of disturbed open woodland with some scattered trees over the site which offers a potential nectar source. This loss is only considered a very minor negative effect on the Grey-headed Flying Fox and is highly unlikely to impact this species given that no potential roosting habitat is affected and that extensive areas of higher quality habitat occur in the locality which would support the local population.

Overall, given the ecology of the species, that no barrier to connectivity will be created; and that the local population of the subject species would extend well beyond the confines of the site/study area to meet the majority of its 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 the local population of any of the subject species.

### **Square-tailed Kite and Forest Owls**

These species require very large territories that far exceed the site/study area (OEH 2015b, Debus 2012, DECC 2006). 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 site and study area.

The site and study area offers some low value generic potential foraging opportunities for these species but prey diversity and abundance is expected to be limited due to the fragmentation, low carrying capacity, and edge effects.

There are no nest trees for the owls, and the forest and woodland trees offer only generic nest sites for the Square-tailed Kite. No raptor nests were found, and the local landscape has an abundance of similar habitat.

The proposal will remove an estimated 2.4ha of disturbed open woodland which represents only a fraction of the habitat required by these species to fulfil their lifecycle requirements. Further, no new barriers will be created and the extent of higher quality habitat in the locality is relatively extensive.

Thus it is evident that the proposal will not result in a direct decline of the local population of these birds.

### **Glossy Black Cockatoo**

The Glossy Black Cockatoo was not recorded on site during the survey, with the nearest record approximately 2km south (OEH 2015a).

The Glossy Black Cockatoo feeds exclusively on Allocasuarinas such as *A. littoralis* and *A. torulosa* in the North Coast bioregion. Due to variable fruiting, it requires very large home ranges (Clout 1989, Smith *et al* 1995, OEH 2015b).

Allocasuarinas are scattered throughout the Crown road reserve along the site's eastern boundary, but insufficient to provide any more than a few days seasonal foraging. There are no potential nest sites in the study area. Hence a local population would need to fulfil its lifecycle requirements well beyond the site/study area.

The proposal has only very minor potential to impact this species due to the development of access roads to the east which may remove a few potential food trees. Increased human presence could potentially discourage the bird from foraging, but it has been recorded foraging in peri-urban remnants and rural-residential areas. Even if displaced, the Crown reserve road habitat is incapable of providing a significant proportion of the local population's sustenance, hence is highly unlikely to disrupt the bird's lifecycle.

Given this; that no new barriers or significant increases in secondary impacts to the species will be created; and that the local population would not be reliant on habitat in the study area to fulfil lifecycle 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 the local population of the Glossy Black Cockatoo.

### **Little Lorikeet:**

The proposal will see loss of up to an estimated 2.4ha of disturbed open woodland offering generic potential foraging resources for the Little Lorikeet. Associated with this is the potential loss of up to 2 hollow-bearing trees, although the hollows are considered to be used by the Little Lorikeet due to local competition from rosellas, bats, Sugar Gliders and lorikeets.



Given the ecology of the species, and limitations of the study area, the extent of loss in terms of local habitat extent is clearly minimal and foraging success of this bird is unlikely to be disrupted; and known or likely nesting habitat is not affected. Therefore it is considered that the impacts of the proposal are unlikely to compromise the viability of a local population

**Koala:**

The Koala was not recorded on site during the field surveys. Records occur within 100m and there is a known Koala population in the Halliday's Point area (AKF 2002).

Scat surveys as per Philips and Callaghan (2011) and AKF (2002) were conducted, with all potential browse species on site searched for any signs of Koalas in anticipation of applying the SAT method. However, no signs of Koalas were found on site and activity levels were recorded as 0. Hence it seems likely that any possible occurrence on site would at most be transient individuals dispersing throughout the landscape.

The proposal will result in the loss of approximately 2.4ha of disturbed open woodland which includes some Tallowwoods, Forest Red Gums and Small-fruited Grey Gums (preferred/primary browse species/secondary browse species). In context of habitat in the wider area and known records, this represents a minor contraction but also an incremental and cumulative contraction of the local potential foraging resource. While acknowledge as contributing to the primary cause of decline for this species, the potential impact on breeding and persistence of the local population of Koalas is expected to be significant given the following:

- The site does not constitute Core Koala Habitat;
- No area of activity was identified;
- Koalas are unlikely to permanently occupy the study site or breed there due to the limited extent of habitat, presence of higher quality habitat on surrounding lands and poor nutrient status of the site's soils; and
- No barrier is likely to be put in place to prevent access to the remaining vegetation in the study area and hence the study area should retain the capability to support occasional foraging or dispersing Koalas.

The potential for indirect impacts from vehicle strikes, dog attacks are expected to be moderately increased by the proposed works. The addition over 100 dwellings on the site will result in an increase in traffic and dogs in the area particularly if access roads are developed through the road reserve to the east of the site. As the Koala has only low potential to occur, this is considered a low threat. However, if roads pass through the Crown road reserve, artificial lighting and speed inhibition structures are to be provided to reduce safe effective speed to 40kph to minimise vehicle strike risk.

Overall it is considered that the impact on the local Koala population is only in terms of removal of potential forage and refuge trees, as well as an increase in indirect impacts through added traffic and dog pressure in an area which is not evidently significant to the local population. Given this, neither breeding nor foraging success of Koalas in the local population is likely to be significantly affected, and consequently the proposed development is unlikely to affect the life cycle such that a viable population of Koala is likely to be placed at risk of extinction.



### **Squirrel Glider and Brushtailed Phascogale:**

Neither of these species have been recorded in the study area, however records exist in tentatively interconnected habitat in the locality (OEH 2015a).

The habitat on site and more so in the Crown road reserve represents (in only very broad terms) generic potential foraging habitat for these species. The lack of a flowering understorey over most of the site and canopy gaps >100m from the nearest area of substantial forest is however a key limitation for the Squirrel Glider; and the Crown road reserve also offers only low quality habitat as it lacks preferred species and is subject to extreme edge effects, and does not directly interlink to any other significant habitat capable of independently supporting local viable populations.

Hollow-bearing trees are present on site only as 2 trees (one isolated in the paddock) with a few more in the adjacent road reserve, however these few potentially suitable hollows would be subject to very high competition with the Sugar Glider, lorikeets, etc. Given both species also require multiple hollows within their range (Gibbons and Lindenmayer 2002), this is a key limitation on their potential occurrence.

Overall thus, the site and Crown road reserve contains only a small remnant of low value habitat within a highly fragmented local landscape. Both are insufficient in extent to meet the full lifecycle requirements of a minimum breeding unit of either species, and hence would incur a reliance on nearby minor fragments, which are also low quality and poorly connected to any refuge habitat. This would predispose any animals in the study area to elevated risks of predation and other edge effects, and limit key lifecycle stages such as dispersal, as well as constrain fecundity (Lindenmayer and Fisher 2006).

Given the above, the subject species are considered highly unlikely to have a viable population in the study area, and occurrence would probably only at best be as rare incidental transients dispersing across the broader landscape from higher quality habitat to the northwest.

The proposal will mainly impact these species via a small but incremental and cumulative loss of potential carrying capacity as a number of trees offering nectar, sap and pollen sources and an insect foraging substrate will be removed. Given these trees form only a small portion of the local abundance of this resource, are concentrated within a relatively isolated and highly modified remnant, and are not currently or likely to form part of the home range of the local population: while a negative effect, this is not considered sufficient to undermine the local population's ability to obtain sufficient sustenance and raise young.

The likely loss of hollow-bearing trees on site is unlikely to impact these species given that they are likely to be occupied by common species and unlikely to be used due to their relative isolation. Notwithstanding, replacement nest boxes are proposed to be installed to offset any that are removed and measures are recommended to minimise mortality risk during tree felling.

The proposal may also impact these species via vehicle strikes and creation of a gap in the Crown road reserve. The gap will be at most 20m wide, and is considered crossable by the Squirrel Glider via gliding, and occurrence of Phascogales in rural-residential estates and rural isolates suggests capability to cross small gaps. With provision of engineering speed control and suitable lighting, this fragmentation thus should not prevent potential use of the Crown road reserve for dispersal.

The introduction of >100 dwellings will also elevate the local abundance of cats, which may potentially roam the Crown road reserve and increase predation risk. Given current extreme edge effects of the



area, while a negative effect, the current threat is already considered extreme by native and feral predators. Hence the current threat status of the study area are not expected to significantly change.

Overall thus, while the proposal will have a net negative impact on the current carrying capacity and habitat quality of the site/study area; the impact is not considered likely to be of sufficient order of magnitude to adversely affect the local population's life cycle to the point that it would be at significant risk of loss of viability.

**(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,**

A small, possibly derived and low quality example of the EEC – *Freshwater Wetlands on Coastal Floodplains* was found above the dam in the northeastern drainage line. This EEC appears likely to be the last vestiges of a formerly larger occurrence of the EEC – *Subtropical Floodplain Forest on Coastal Floodplains*, which now occurs as very small patch where the drainage line remains vegetated in the Crown road reserve; and similarly in the outer edge of the Blackhead Road reserve adjacent to the dam in the southern drainage depression. Habitat for both EECs occurs beyond these areas, but appears to have been effectively displaced by previous pastoralism, road construction and development. Hence both EECs now have a very limited local occurrence.

The proposal has been recommended to retain the EEC occurrence on site within a protected area which is to be rehabilitated and buffered by planted native vegetation. Stormwater management measures are also to be designed to ensure water discharged over the stormwater treatment chain to the area does not lead to degradation (eg eutrophication) or adverse alterations to the hydrological regime. The latter will also benefit the off-site occurrences of the EEC.

Given the above, the proposal is not likely to place the local extent of these EECs at risk of extinction.

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

- i. **the extent to which habitat is likely to be removed or modified as a result of the action proposed,**

The proposal will see removal of 2.4ha of modified dry sclerophyll forest, with the remainder being pasture with some scattered trees. The on-site EEC and all 3 dams are expected to be retained within drainage reserves.



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

The study area falls within a highly fragmented landscape with at best marginal connectivity to a large body of forest to the northwest, and some tentative local corridors which run along the bottom and eastern boundaries of the site. Further east north and south, cleared pastoral land and Tallwoods village pose major barriers to many fauna groups due to lack of forest connectivity.

The proposal will see the removal of the patch of disturbed woodland located in the north of the site. This patch of disturbed woodland is separated from habitat to the northwest by approximately 140m, and to marginal habitat to the east in the narrow Crown road reserve by approximately 100m. These distances are at the upper limits of the range in which Sugar Gliders and Brushtailed Phascogales will travel across open ground (eg Rhind 1996, van der Ree *et al* X, Smith and Murray 2003), however it is not unknown for Koala's to travel these distances for dispersal (AKF 2007, Wilkes and Snowden 1998).

The loss of the northern remnant will increase fragmentation by removing the stepping stone provided by modified woodland in the central north to the northwest, however given the minimal source habitat for forest fauna to the east and south, this is considered insignificant. The linkage provided by the Crown road reserve on the east will essentially remain, at most crossed by 1-2 roads which will have fauna crossing mitigation measures implemented ie speed reduction and lighting, and gap width limited to about 20m at most.

Thus the extent of fragmentation created by the proposal will be limited, and will not result in the isolation of any areas of habitat significantly greater than current isolation. As such, the proposal is highly unlikely to disrupt the current local movements of the subject species.

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

The vegetation on site and in the study area evidently has a significant disturbance history and has a number of major habitat limitations. For most of the subject species, the vegetation on the site only represents at best a minute area of generic potential foraging habitat and seasonal foraging resources eg flowering eucalypts.

Overall, the site is unlikely to constitute an important area of habitat for any of the subject species and none would be reliant on the habitat resources provided by the site or study area alone. The proposal will therefore not impact on the long term survival of any of the subject species 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 Forest Owls (DEC 2006), Grey-headed Flying Fox (DECCW 2009) and Koala (DECC 2008). Priority actions have been identified for all of the other species (OEH 2015b).

For these and all the other species: as the proposal will remove or modify habitat, and contribute to secondary impacts, it will not be considered strictly consistent with objectives of a recovery plan, threat abatement plan or priority action now or in the future, as it will slightly cumulatively contribute to the primary cause of the decline of these entities. However, as this habitat is of low value and common in the study area and locality, its loss will have minimal consequence for their viability in the short or long term.

**(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 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”.

The proposal will or may contribute (to varying extents) to the following Key Threatening Processes (KTP):

**Table 12: Contribution to Key Threatening Processes**

KTP	Extent/Manner Which Proposal Affects KTP
Human induced climate change (NSWSC 2000d).	Removal of vegetation and use of fossil-fuelled vehicles and machinery to carry out works. Relative to other sources, this incremental contribution is however minimal.
Clearing of native vegetation (NSWSC 2001).	Proposal will see removal of up to 2.4ha of modified forest/woodland. Some of this will be offset via rehabilitation of the EEC on site and establishment of a vegetated buffer.
Removal of dead trees and dead wood	Loss of minor woody debris in small patch of forest considered insignificant.
Loss of hollow-bearing trees (NSWSC 2007)	Up to 2 trees with hollows will be required to be removed. Protocol recommended to minimise risk of fauna mortality during clearing and replacement nest boxes proposed.
Aggressive exclusion of birds by noisy miners (NSWSC 2013)	Currently present and dominant. Future landscaping will also support this species.
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants	The increase in residences in in the study area may introduce new species of garden plants which have the potential to escape and become established.



## 9.0 EPBC Act - MNES Assessment

### 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) and Koala (Vulnerable) are known or considered potential occurrences on the site. As detailed in section 9.1 and 9.2, these species are not 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 the Environment (DotE) for approval under the EPBCA.

### 9.2. Koala Referral Assessment

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



**Table 13: Koala habitat assessment**

Attribute	Score*	Reason	
Koala occurrence	1	Desktop	OEH Bionet database shows a number of the species occurring within a 2km radius of the site. EPBCA PMST report identified the Koala as 'known to occur' in the study area/locality.
		On-ground	Diurnal search conducted on the site over two non-consecutive days. No signs of Koalas found.
Vegetation structure and composition	2	Desktop	AKF (2002) maps northern patch as Secondary Habitat (Class C)
		On-ground	Northern patch readily qualifies as Potential Koala Habitat.
Habitat connectivity	0	Site is not part of a contiguous landscape	
Key existing threats	1	Desktop	Koala road kill recorded in locality.
		On-ground	No evidence of Koala road kill. Generic risk of dog attack but very low risk.
Recovery value	0	Site has located in low value habitat with no evidence of a Koala population.	
Total	4	<b>Site does not qualify as critical habitat</b>	

\* Based upon criteria for Coastal Habitat Context.

As per the Koala habitat assessment tool, the site does not qualify as critical habitat. No further assessment is thus required, and the proposal does not require referral to the Minister.

## 9.3. Protected Species Assessments

### 9.3.1. Grey-headed Flying Fox (Vulnerable – EPBCA)

#### 9.3.1.1. Factors to Be Considered for Vulnerable Species

The guidelines to assessment of significance to this Matter, define an action 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.

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

The proposal will result in the loss of about 2.4ha of foraging habitat for the Grey-headed Flying Fox. While this will contribute incrementally and cumulatively to the threatening processes responsible for the decline of this species, it only represents a minute fraction of foraging resources available within the range of the subject species range (eg. Khappinghat Nature Reserve). Hence given that; the site has only low carrying capacity for the Grey-headed Flying Fox; the site is not breeding habitat; and considering the ecology of the species: the impact of the loss of vegetation on site is considered insignificant to the viability of the important population.

Thus the proposal will not lead to a long-term decrease in the size of an important population of the Grey-headed Flying Fox.

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

The proposal will not result in the loss of any Grey-headed Flying Fox roosting habitat, as the site is not known to be or likely to be suitable as a roost site. Foraging habitat of this species is measured in terms of hundreds of thousands of hectares (Eby 2000a, 2000b, OEH 2015b), hence the loss of the site vegetation is minimal relative to the area of occupancy.

##### **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. The proposal will offer no barrier to movement. Thus it will not fragment an existing important population.

Hence, the proposal will not fragment an important population.



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

“*Critical habitat*” refers to areas critical to the survival of a species or ecological community 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.

The vegetation on site is not considered critical habitat for the Grey-headed Flying Fox due to its limited extent, ecology of the species, and the massive extent of potential habitat in nearby State Forests and OEH estate. Post-development, the remainder of the adjacent vegetation will retain the potential to support local foraging, etc, of this species, hence helping support the viability of the local population.

**e) Disrupt the breeding cycle of an important population (Vulnerable) or population (Endangered or:**

The proposal is unlikely to disrupt the breeding cycle of an important population/population given that:

- The site does not represent potential breeding habitat for the subject species;
- These species have very large ranges which far exceed the site, or are unlikely to depend on the site for breeding.
- The potential for these species to occur within the study area will be retained post development; and
- 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 low value of the site and the degree of vegetation/habitat loss is not significant enough to affect the local population of the subject species to the point it could cause a decline of the species.

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

No new species that affects the Grey-headed Flying Fox is likely to be introduced as a direct result of the proposed works.

**h) Introduce disease that may cause a species to decline; or**

No disease that affects the subject species is likely to be introduced as a direct result of the proposed works.



### **i) Interferes substantially with the recovery of the species.**

Ideally, the goal in threatened species recovery is to increase the number and extent of the threatened species, so that it is not in risk of becoming extinct. As detailed previously, the proposal will result in the modification of a relatively minute area of potential foraging habitat that is not significant enough to interfere with the recovery of the subject species.

#### **9.3.1.3. Conclusion**

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

### **9.3.2. Migratory Species**

No migratory bird species were recorded during the survey. The habitats present across the site provide marginal potential habitat for a few listed migratory species such as the Cattle Egret, Great Egret, Satin Flycatcher, Rainbow Bee-eater, White-throated Needletail and Fork-tailed Swift.

These species are collectively assessed below.

#### **9.3.2.1. 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.

#### **9.3.2.2. 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. Additionally, similar habitat is known to occur both north and south of the LGA.
- 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 eg State Forest, conservation reserves, etc.

In regards to point (a): The proposal does not affect important habitat (as detailed above).

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, given they are currently known or likely to occur ie fox and feral cat.

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.
- No significant extent of potential or known nesting/breeding habitat is affected.
- No significant extent of potential or known foraging habitat will be affected.

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

## 10.0 Conclusion

This survey and assessment has identified that the site and wider study area is generally in a modified condition due a number of past disturbances, however still retains some known and potential values for a number threatened fauna species. These values are however limited by the condition of the site and study area habitats, and the high level of local fragmentation.

The latter is also evident in the current extent and status of EECs on site and the study area ie small remnants with low diversity due to historical clearing and pastoralism. These areas will be retained and protected within the final design of the future residential development, with appropriate stormwater treatment to minimise the risk of degradation.

The proposal will see loss of most of the habitat on site for potentially occurring threatened fauna, with habitat retained in most of the adjacent Crown road reserve and a small patch in the southern drainage reserve. Given the low value of this habitat, this is insignificant to the long term viability of any local population, and current connectivity will also largely remain as is.

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



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#### **Land and Environment Court Citations:**

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

Murlan Consulting Pty Limited v Ku-ring-gai Council [2007] NSWLEC 374





# 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:

- Recorded on-site;
- 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;
- 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 (eg sufficient to support an individual or the local population; comprises all of home range; forms part of larger territory, etc); quality (ie 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 (ie 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 (eg 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 eg 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 2014a) found records of 8 threatened flora species in the locality. 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 eligibility/requirement for Seven Part Test assessment.

**Table 14: Eligibility for Seven Part Test Assessment - Flora**

Species	TSC Act	EPBC Act	Habitat Requirement	No. of records	Likelihood of Occurrence and Impact Significance	7 Part Test Required?
<i>Allocasuarina defungens</i>	E	E	A straggly oak about 2m high with blue-green foliage found in heath on sand (sometimes clay and sandstone soils), and swamp sclerophyll forest margins. This plant has been recorded in at Limeburners Creek Nature Reserve. Recorded on Hastings LGA, Kempsey, Bare Point, Coffs Harbour, Greater Taree City Council LGA, Bulahdelah and Camden Haven databases	22	Recorded in the locality, however the site/study area did not contain suitable habitat for this species and it was not found. It is not considered a potential occurrence.	NO
<i>Asperula asthenes</i>	V	V	A herb found in damp sites along riverbanks and similar areas, typically from Taree to Bulahdelah, but has been recently found in the Kempsey LGA.	4	Recorded in the locality. Thorough search of dams failed to detect. Given habitat modification and disturbances, , however the site/study area did it is not considered a potential occurrence.	NO
<i>Cynanchum elegans</i>	E	E	A twiner occurring predominately in dry rainforest, littoral rainforest and the ecotone between dry rainforest and open forest, however it has been found in the Manning Valley and Hastings in Open Forest types on specific geologies eg limestone and serpentine respectively (Garry Germon pers. comm. 2004, personal observations). It occurs on a variety of lithology's and soil types. It has been found between the altitudinal ranges of 0 to 600 metres ASL and rainfall >760mm annually (NPWS 1999).	9	Recorded in the locality, however the site/study area did not contain suitable habitat for this species and it was not found. It is not considered a potential occurrence.	NO



Species	TSC Act	EPBC Act	Habitat Requirement	No. of records	Likelihood of Occurrence and Impact Significance	7 Part Test Required?
<i>Lindernia alsinoides</i>	E	-	Diffuse or erect annual herb to 15 cm high growing in swampy sites in sclerophyll forest and coastal heath. Distributed north from Bulahdelah. LGA records include Great Lakes, Taree, Coffs Harbour, Clarence Valley and Richmond Valley.	3	Recorded in the locality, however the site/study area did not contain suitable habitat for this species and it was not found. It is not considered a potential occurrence.	NO
<i>Senna acclinis</i>	E	-	Grows on the margins of subtropical, littoral and dry rainforests.	2	Recorded in the locality, however the site/study area did not contain suitable habitat for this species and it was not found. It is not considered a potential occurrence.	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 15: 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	<i>Acacia ruppia</i>	X	X	X
	<i>Ancistrachne maidenii</i>	X		X
	<i>Angophora inopina</i>	X		X
	<i>Angophora robur</i>	X		X
	<i>Babingtonia prominens</i>	X		X
	<i>Banksia conferta</i> subsp. <i>Conferta</i>	X		X
	<i>Bertya</i> sp.(Chambigne NR, M Fatemi 24)	X		X
	<i>Bertya ingramii</i>	X		X
	<i>Bertya</i> sp. <i>Cobar-Coolabah</i>	X		X
	<i>Boronia hapalophylla</i>	X		X
	<i>Caesia parviflora</i> var. <i>minor</i>	X	X	X
	<i>Chiloglottis anatriceps</i>	X		X
	<i>Diuris venosa</i>	X	X	X
	<i>Diuris disposita</i>	X		X



Preferred Habitat	Species	Site considered unsuitable habitat	Disturbance history likely to have excluded this species	Lack of local records
	<i>Diuris pedunculata</i>	X	X	X
	<i>Diuris praecox</i>	X	X	X
	<i>Dillwynia tenuiflora</i>		X	X
	<i>Eucalyptus glaucina</i>	X		X
	<i>Eucalyptus tetrapleura</i>	X	X	X
	<i>Grevillea banyabba</i>	X		X
	<i>Grevillea beadleana</i>	X		X
	<i>Grevillea caleyi</i>	X	X	X
	<i>Grevillea quadricuada</i>	X		X
	<i>Hakea trineura</i>	X		X
	<i>Hibbertia superans</i>	X		X
	<i>Leucopogon confertus</i>	X		X
	<i>Lindsaea incisa</i>	X		X
	<i>Macrozamia johnsonii</i>	X		X
	<i>Melichrus hirsutus</i>	X		X



Preferred Habitat	Species	Site considered unsuitable habitat	Disturbance history likely to have excluded this species	Lack of local records
Rainforest Wet Sclerophyll Forest Riparian	<i>Olax angulata</i>	X		X
	<i>Philotheca obovatifolia</i>	X		X
	<i>Polygala linariifolia</i>	X		X
	<i>Corybas dowlingii</i>	X		X
	<i>Dracophyllum macranthum</i>	X		X
	<i>Acacia chrysotricha</i>	X	X	X
	<i>Acronychia littoralis</i>	X		X
	<i>Acalypha eremorum</i>	X	X	X
	<i>Amorphospermum whitei</i>	X		X
	<i>Archidendron hendersonii</i>	X		X
	<i>Arthraxon hispidus</i>	X		X
	<i>Arthropteris palisotii</i>	X		X
	<i>Boronia umbellata</i>	X		X
	<i>Calophanoides hygrophiloides</i>	X		X
	<i>Corynocarpus rupestris</i> subsp. <i>rupestris</i>	X		X



Preferred Habitat	Species	Site considered unsuitable habitat	Disturbance history likely to have excluded this species	Lack of local records
	<i>Dendrocnide moroides</i>	X		X
	<i>Desmodium acanthocladum</i>	X		X
	<i>Diospyros mabacea</i>	X		X
	<i>Diploglottis cambelli</i>	X		X
	<i>Eidothea hardeniana</i>	X		X
	<i>Endiandra floydii</i>	X		X
	<i>Endiandra hayesii</i>	X		X
	<i>Eucalyptus tetrapleura</i>	X	X	X
	<i>Gingidia montana</i>	X		X
	<i>Grammitis stenophylla</i>	X		X
	<i>Grevillea guthrieana</i>	X	X	X
	<i>Haloragis exalata subsp. velutina.</i>	X		X
	<i>Harnieria hygrophiloides</i>	X		X
	<i>Lindsaea brachypoda</i>	X		X
	<i>Macadamia tetraphylla</i>	X		X





Preferred Habitat	Species	Site considered unsuitable habitat	Disturbance history likely to have excluded this species	Lack of local records	
	<i>Marsdenia longiloba</i>	X	X	X	
	<i>Melaleuca groveana</i>		X	X	
	<i>Olearia flocktoniae</i>	X	X	X	
	<i>Peristeranthus hillii</i>	X	X	X	
	<i>Phyllanthus microcladus</i>	X		X	
	<i>Plectranthus nitidus</i>	X		X	
	<i>Psilotum complanatum</i>	X		X	
	<i>Quassia sp. Moonee Creek</i>	X		X	
	<i>Sarcophilus dilatatus</i>	X		X	
	<i>Sarcophilus fitzgeraldii</i>	X		X	
	<i>Sarcophilus hartmannii</i>	X		X	
	<i>Siah's Backbone (Streblus pendulinus/brunonianus)</i>			X	X
	<i>Syzygium paniculatum</i>	X		X	
	<i>Tinospora smilacina</i>	X			X
	<i>Tinospora tinosporoides</i>	X			X



Preferred Habitat	Species	Site considered unsuitable habitat	Disturbance history likely to have excluded this species	Lack of local records	
	<i>Triplarina imbricata</i> (formerly <i>Baeckea camphorata</i> )	X	X	X	
Swamp Forest Aquatic Freshwater Wetland Estuarine	<i>Tylophora woolsii</i>	X		X	
	<i>Typhonium sp. aff. brownii</i>	X		X	
	<i>Oberonia titania</i>	X		X	
	<i>Dendrobium melaleucaphilum</i>	X	X	X	
	<i>Uromyrtus australis</i>	X		X	
	<i>Maundia triglochinosides</i>	X		X	
	<i>Alexfloydia repens</i>	X		X	
	<i>Cyperus aquatilis</i>	X		X	
	<i>Eleocharis tetraquetra</i>	X		X	
	<i>Melaleuca biconvexa</i>	X	X	X	
	<i>Melaleuca tamariscina ssp irbyana</i>	X		X	
	Heathland Shrubland Grasslands	<i>Sophora tomentosa</i> subsp. <i>australis</i>	X		X
		<i>Allocasuarina simulans</i>	X	X	



Preferred Habitat	Species	Site considered unsuitable habitat	Disturbance history likely to have excluded this species	Lack of local records
	<i>Babingtonia silvestris</i>	X		X
	<i>Centranthera cochinchinensis</i>	X		X
	<i>Chamaesyce psammogeton</i>	X		X
	<i>Diuris sp. aff. chrysantha</i>	X		X
	<i>Genoplesium littorale</i>	X	X	
	<i>Phaius australis</i>	X		X
	<i>Rotala tripartita</i>	X		X
	<i>Elyonurus citreus</i>	X		X
	<i>Eucalyptus approximans</i>	X		X
	<i>Glycine clandestina (Broad leaf form)</i>	X		X
	<i>Pimelea spicata</i>	X	X	X
	<i>Rutidosia heterogama</i>	X		X
	<i>Zieria prostrata</i>	X		X
Various Habitats, Miscellaneous, Other	<i>Pultenaea maritima</i>	X		X
	<i>Cryptostylis hunteriana</i>	X	X	



Preferred Habitat	Species	Site considered unsuitable habitat	Disturbance history likely to have excluded this species	Lack of local records
	<i>(Leafless Tongue Orchid)</i>			
	<i>Galium australe</i> <i>(Tangled Bedstraw)</i>	X	X	X
	<i>Zieria prostrata</i>	X		X
	<i>Hibbertia hexandra</i>		X	X
	<i>Neostelia spectabilis</i>	X		X
	<i>Zieria lasiocaulis</i>	X		X
	<i>Kennedia retrorsa</i>	X		X
	<i>Tetradlea juncea</i>	X	X	X
	<i>Prostanthera spinosa</i>	X		X
	<i>Senecio spathulatus</i>	X		X
	<i>Styphelia perileuca</i>	X		X



## A1.2 Fauna

As previously noted, a number of threatened fauna have been recorded in the locality, and a number of others are considered potential occurrences. 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 16: 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 ( <i>Calyptorhynchus lathamii</i> )	13	V-TSC Act	Dry sclerophyll forest and woodland containing Allocasuarina and Casuarina, and large tree hollows. Preferred regional forage species are <i>A. littoralis</i> and <i>A. torulosa</i> . Requires sufficient extent of forage within home range to support breeding. Breeds Mar-Aug, takes 90 days to hatch and fledge (Lindsey 1992).	No Allocasuarina onsite – limited in adjacent road reserve, offering only short term forage as minute part of local range which would be centred in larger forest remnants. Only low potential to occur for short term foraging – no potential to nest. No risk of significant impact, but could be deterred by human presence - <b>7 part test required</b> to evaluate.
	Brown Treecreeper ( <i>Climacteris picumnus</i> ) eastern subspecies	0	V-TSC Act	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,	Site and study habitat is largely unsuitable due fragmentation, and not recorded in locality. 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?
				Clarence, Richmond and Snowy River valleys, Coffs Harbour and Great Lakes Shire.	
	Powerful Owl <i>(Ninox strenua)</i>	5	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).	Site and adjacent land contains only very marginal potential foraging habitat limited to small area of woodland and forest with likely low potential prey species abundance and diversity, within a semi-urbanised context. No nesting hollows in study area. At best very low chance of occurrence in study area using as marginal fringe of territory based in large body of forest to the northwest, or moving across wider fragmented landscape.  Proposal unlikely to impact given limited habitat loss and extent of higher quality habitat in locality. No loss of potential nest trees or risk of prey impacts. <b>Seven Part Test undertaken</b> as low chance of occurrence.
	Masked Owl <i>(Tyto novaehollandiae)</i>	3	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. <b>Seven Part Test required.</b>
	Barking Owl <i>(Ninox connivens)</i>	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	Potential habitat in study area but not recorded locally, and very sparse distribution, hence 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?
				Magpies). Large territories. Nest in hollows.	
	Sooty Owl ( <i>Tyto tenebricosa</i> )	1	V-TSC Act	Rainforest and tall, moist, diverse eucalypt forest. Roosts in dense foliage, tree hollows & caves/overhangs. Nests in hollow in tall forest tree. Requires high diversity and abundance of medium-sized arboreal and/or terrestrial prey. Large territory.	Suitable habitat for this species does not occur in the study area. Recorded in the locality however unlikely to occur on site.  No risk of impact, hence 7 Part Test not required.
	Little Lorikeet ( <i>Glossopsitta pusilla</i> )	3	V-TSC Act	Gregarious, usually foraging in small flocks, often with other species of lorikeet feeding primarily on nectar and pollen in the tree canopy, particularly on profusely-flowering eucalypts, but also on a variety of other species including, melaleucas and mistletoes. Mostly occurs in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes.	The site and study area may offer some broadly suitable foraging habitat for the species, along with a couple of suitable nesting hollows. Considered at best low chance of occurrence as part of a wider foraging range, with competition for hollows likely to prevent breeding.  Proposal will see some removal of potential habitat and nesting hollows, however this loss is negligible in the context of the remaining higher quality habitat in the locality. <b>7 Part Test required</b> as potential to occur.
	Swift Parrot ( <i>Lathamus discolor</i> )	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 <i>E. robusta</i> , <i>Corymbia gummifera</i> , <i>E. globulus</i> , <i>E. sideroxylon</i> , <i>E. leucoxylon</i> , <i>E. labens</i> , <i>E.</i>	Some preferred forage species present but only single local record in locality. Considered unlikely chance of occurrence due to extreme rarity and competition with common and aggressive native conspecifics.  No risk of impact and unlikely to occur, hence 7 Part



Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
				<i>ovata</i> , <i>E. tereticornis</i> , <i>C. maculata</i> , <i>Banksia serrata</i> and <i>B. integrifolia</i> . 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.	Test not required
	Varied Sittella ( <i>Daphoenositta chrysoptera</i> )	2	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 decortivating 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.	Unlikely to occur due to isolation, lack of understorey cover and site exposure.  Proposal will not affect potential habitat in study area and species unlikely to occur on site. No risk of impact, hence 7 Part Test not required.
	Square-tailed Kite ( <i>Lophoictinia isura</i> )	4	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 <sup>2</sup> ). 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	Site and study offers some generic potential foraging habitat and potential nest trees. Considered moderate to high chance of occurrence foraging at some stage in study area as recorded within 1km.  Proposal will see given limited foraging habitat loss considered low significance given extent of higher





Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
				100days. Appears to be adapting to an abundance of passerines in well-vegetated outer fringes of cities. Probably migrates to northern Australia in winter. (Debus 1998, NSW NPWS 2000).	quality habitat in nearby forest. Impact clearly insignificant but <b>7 Part Test required as potential to occur.</b>
	Little Eagle ( <i>Hieraaetus morphnoides</i> )	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.	As for Square-tailed Kite however no records in the locality. Occurrence considered unlikely, or at best very low. Given minimal impacts on prey and no nest sites impacted, impact clearly incapable of being insignificant hence 7 part test not required to qualify.
	Spotted Harrier ( <i>Circus assimilis</i> )	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). 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	Some broadly generic potential habitat but low prey abundance and no local records – more likely to occur in upper hinterland. 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?
				in the nest for several months. Diet includes terrestrial mammals, birds and reptiles, occasionally large insects and rarely carrion (Marchant and Higgins 1993). 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).	
MAMMALS	Spotted-tail Quoll ( <i>Dasyurus maculatus</i> )	1	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.	Site and study area habitat too disturbed, fragmented and no potential denning habitat. Considered unlikely chance of occurrence. No risk of significant impact hence 7 Part Tests not undertaken.
	Brushtailed Phascogale ( <i>Phascogale tapoatafa</i> )	10	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 for nesting. (NPWS, 2000) Breeds May-July. Occupies territory of 20-100ha. Has been recorded in swamp forest.	Study area has some generically suitable habitat for this species however is highly exposed and isolated. Recorded in loosely connected habitat <1.5km east though and considered at best a low chance of occurrence foraging in study area.  Proposal has only limited impact however low potential to occur hence <b>Seven Part Test required.</b>
	Yellow-bellied Glider ( <i>Petaurus australis</i> )	0	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	Study area too modified and isolated from large stands of forest. No proximate records. Unlikely to occur 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?
				include: <i>E. propinqua</i> , <i>E. tereticornis</i> , <i>E. microcorys</i> , & <i>E. resinifera</i> (NPWS 2000). Home range of 30-65ha (NPWS 1999).	
	Squirrel Glider ( <i>P. norfolcensis</i> )	7	V-TSC Act	Dry, open forest and woodland, and occasionally wet eucalypt and rainforest. Most common in floriferous sub-coastal and coastal forests with winter flowering trees and shrubs and some smooth barked eucalypts. Most commonly recorded along the coastal margin where Banksias dominate the understorey. Home range 0.6-9ha, family groups of 2-10 (NSW NPWS 1999).	Study area has some generically suitable habitat for this species however is highly exposed and isolated. Lack of preferred understorey and poor local connectivity to source habitat. Recorded in loosely connected habitat to the southwest and considered at best a very low potential to occur on the site.  Proposal has only limited impact however low potential to occur and some further fragmentation, hence <b>Seven Part Test required</b> .
	Grey-headed Flying Fox ( <i>Pteropus poliocephalus</i> )	21	V-TSC Act, V-EPBC Act	Nomadic frugivore and nectivores on rainforest, eucalypt, <i>Melaleuca</i> and <i>Banksia</i> . Recorded flying up to 45km from roost (generally max. of 20km). Roosts colonially with short term individual or small groups. Spring or Summer roosts are maternity sites. Dependent on winter flowering species eg <i>E. robusta</i> and <i>E. tereticornis</i> .	Eucalypts and other trees on site offer generic foraging habitat. Very high change of occurrence.  Minor loss of habitat considered insignificant relative to range. No risk of significant impact, however <b>Seven Part Test required</b> as potential to occur.
	Yellow-bellied Sheath-tail Bat ( <i>Saccolaimus flaviventris</i> )	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	Site/study area has some generically suitable structure for foraging, but is somewhat isolated from larger tracts of forest and limited in extent. Not recorded in locality. Roosting would be limited by



Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
				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.	competition with conspecific bats and birds.  Proposal has only limited impact however low potential to occur and some further fragmentation, hence <b>Seven Part Test required</b> .
	Eastern False Pipistrelle ( <i>Falsistrellus tasmaniensis</i> )	1	V-TSC Act	Occupies sclerophyll forest from the Great Dividing Range to the coast, typically wet tall forest at high elevations and is more common in northern NSW. It may migrate to coastal areas in Winter. Roosts typically in tree hollows, but also in caves, buildings. Roosts as single sex colonies of 3-36 bats. Forages in and below tree canopy on moths, beetles, bugs, flies & ants, up to 12km from roost site. Breeds in Summer (Churchill 1998, Smith et al 1995).	Study area is not preferred habitat for this species – prefers more extensive tracts of forest. Only single record in locality.  Proposal will have negligible impact and unlikely to occur, hence 7 Part Tests not required.
	Eastern Cave Bat ( <i>Vespadelus troughtoni</i> )	0	V-TSC Act	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.	Study area contains some generic potentially suitable foraging habitat however not recorded locally and no potential roosting habitat in study area which is a key limitation. Unlikely chance of occurrence.  No risk of impact and unlikely to occur. Seven Part Test not required.
	Little Bent-wing Bat ( <i>Miniopterus</i> )	2	V-TSC Act	Forages above and below canopy of well-forested areas. Roosts in old buildings, caves, mines etc.	Site/study area may provide generic foraging habitat and non-breeding roosts in hollow-bearing trees. Moderate chance of occurrence most likely foraging



Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	<i>australis</i> )			Dependent on nursery caves and communal roosts.	as small part of local seasonal range.  Proposal has only limited impact however moderate potential to occur and some further fragmentation, hence <b>Seven Part Test required.</b>
	Eastern Bent-wing Bat ( <i>M. schreibersii oceanensis</i> )	4	V-TSC Act	Habitat generalist - forages above well-forested areas. Roosts in old buildings, caves, mines etc. Dependent on nursery caves and communal roosts.	As for Little Bent-wing Bat. <b>Seven Part Test required.</b>
	Greater Broad-nosed Bat ( <i>Scoteanax rueppellii</i> )	1	V-TSC Act	Forages over range of habitats including rainforests and moist forests, but prefers ecotones between riparian forest, woodland and cleared land. Requires sparse understorey and will forage over water. Roosts in tree hollows. Feeds on larger insects, small vertebrates and perhaps other bats.	Site and study area overall has generically suitable structure for foraging and suitable roosting habitats present in hollow trees. Considered fair potential occurrence foraging over site and study area as part of wider foraging range.  Proposal has only limited impact however fair potential to occur and some further fragmentation, hence <b>Seven Part Test required.</b>
	East-coast Freetail Bat ( <i>Micronomus norfolkensis</i> )	7	V-TSC Act	Specific habitat requirements of this species are poorly known. Has been recorded in habitats ranging from rainforest to dry sclerophyll and woodland, with most recorded in the latter (State Forests 1994). Roosts in small colonies under tree hollows and under loose bark; has been found under house eaves, in roofs and metal caps on telegraph poles. Recorded roosting in roof of	As for Greater Broad-nosed Bat and fair potential to occur. <b>Seven Part Test required.</b>



Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
				churches and schools. Probably forages above forest or woodland canopy, and in clearings adjacent to forest. Most records are of single individuals, and it is likely to occur at low densities over its range.	
	Southern Myotis ( <i>Myotis macropus</i> )	3	V-TSC Act	Tunnel, cave, bridges, old buildings, tree hollow and dense foliage roosting bat which prefers riparian habitat over 500m long with nearby roosting habitat. Key habitats are streams, rivers, creeks, lagoons, lakes and other water bodies. Feeds on aquatic insects and small fish. Has recently been observed foraging in small bodies of water.	Nearest records occur over 6km to the west. Dams on site too small and unlikely to be used for foraging. Unlikely to occur on site and no risk of significant impact hence 7 Part Tests not undertaken.

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 17: Fauna species unlikely to occur**

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 Forest/ Woodland	Hoary Bat ( <i>Chalinolobus nigrogriseus</i> )	X			X
	Regent Honeyeater ( <i>Xanthomyza phrygia</i> )	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
	Painted Honeyeater ( <i>Grantiella picta</i> )	X		X	X
	Black-chinned Honeyeater ( <i>Melithreptus gularis gularis</i> ) eastern subspecies				X
	Scarlet Robin ( <i>Petroica boodang</i> )	X		X	X
	Flame Robin ( <i>Petroica phoenicea</i> )	X		X	X
	Hooded Robin ( <i>Melanodryas cucullata cucullata</i> ) southeastern form	X			X
	Bush-stone Curlew ( <i>Burchinus grallaris</i> )	X			X
	Diamond Firetail ( <i>Stagonopleura guttata</i> )	X			X
	Grey-crowned Babbler ( <i>Pomatostomus temporalis temporalis</i> ) eastern subspecies	X		X	X
Rainforest/ Wet Sclerophyll Forest	White-eared Monarch ( <i>Carterornis leucotis</i> )	X		X	X
	Superb Fruit Dove ( <i>P. superbus</i> )	X			X
	Wompoo Fruit Dove ( <i>Ptilinopus magnificus</i> )	X			X
	Barred Cuckoo Shrike ( <i>Coracina lineata</i> )	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
	Parma Wallaby ( <i>Macropus parma</i> )	X	X	X	X
	Red-legged Pademelon ( <i>Thylogale stigmatica</i> )	X			X
	<b>Long-Nosed Potoroo</b> ( <i>Potorous tridactylus</i> )	X	X	X	X
	Olive Whistler ( <i>Pachycephala olivacea</i> )	X			X
	Three-toed Snake-tooth Skink ( <i>Coeranoscincus reticulatus</i> )	X		X	X
	Pale-Headed Snake ( <i>Hoplocephalus bitorquatus</i> )	X		X	X
	Stephen's Banded Snake ( <i>H. stephensii</i> )	X		X	X
	White-crowned Snake ( <i>Cacophis harriettae</i> )	X			X
Swamp/ Aquatic/ Freshwater Wetland/ Estuarine/ Marine	Osprey ( <i>Pandion haliaetus</i> )	X			X
	Blue-billed Duck ( <i>Oxyura australis</i> )	X			X
	Freckled Duck ( <i>Stictonetta naevosa</i> )	X			X
	Brolga ( <i>Grus rubicunda</i> )	X			X
	Magpie Goose ( <i>Anseranas semipalmata</i> )	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
	Black-necked Stork <i>(Ephippiorhynchus asiaticus)</i>	X			X
	Comb-crested Jacana <i>(Irediparra gallinacea)</i>	X			X
	Black Bittern <i>(Dupetor flavicollis)</i>	X		X	
	<b>Australasian Bittern</b> <b><i>(Botaurus poiciloptilus)</i></b>	X		X	X
	<b>Painted Snipe</b> <b><i>(Rostratula benghalensis)</i></b>	X		X	X
	White-fronted Chat <i>(Epthianura albifrons)</i>	X			X
	Wallum Froglet <i>(Crinia tinnula)</i>	X		X	
	Green and Golden Bell Frog <i>(Litoria aurea)</i>	X		X	X
	Olongburra Sedge Frog <i>(Litoria olongburensis)</i>	X		X	X
	Glandular Frog <i>(Litoria subglandulosa)</i>	X		X	X
	Booroolong Frog <i>(Litoria booroolongensis)</i>	X		X	X
	Pouched Frog <i>(Assa darlingtoni)</i>	X		X	X
	<b>Stuttering Frog</b> <b><i>(Mixophyes balbus)</i></b>	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
	<b>Giant barred Frog</b> <i>(Mixophyes iteratus)</i>	X			X
	Green-thighed Frog <i>(Litoria brevipalmata)</i>	X			X
Shrubland/Heathland/ Grassland	Sphagnum Frog <i>(Philoria sphagnicolus)</i>	X	X	X	X
	Eastern Pygmy Possum <i>(Certatetus nanus)</i>	X	X		X
	Common Planigale <i>(Planigale maculata)</i>	X	X	X	X
	Eastern Chestnut Mouse <i>(Pseudomys gracilicaudatus)</i>	X		X	X
	New Holland Mouse <i>(Pseudomys novaehollandiae)</i>	X	X	X	
	Eastern Blossom Bat <i>(Syconycteris australis)</i>	X			
	Grass Owl <i>(Tyto capensis)</i>	X			X
	Ground Parrot <i>(Pezoporus wallicus wallicus)</i>	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.

\* Denotes an introduced species

Common Name	Scientific Name	Frequency
<b>Canopy trees</b>		
Pink Bloodwood	<i>Corymbia intermedia</i>	O
Spotted Gum	<i>Corymbia maculata</i>	O
Tallowwood	<i>Eucalyptus microcorys</i>	D
Forest Red Gum	<i>Eucalyptus tereticornis</i>	O
Grey Ironbark	<i>Eucalyptus siderophloia</i>	D
Small-fruited Grey Gum	<i>Eucalyptus propinqua</i>	D
<b>Understorey trees</b>		
Prickly-leaved Paperbark	<i>Melaleuca stypheliodes</i>	O
Mock Olive	<i>Notelia longifolia</i>	O
<b>Shrubs</b>		
*Lantana	<i>Lantana camara</i>	O
Coffee Bush	<i>Breynia oblongifolia</i>	C
<b>Grasses</b>		
Threeawn Speargrass	<i>Aristida vagans</i>	U
Bushy Hedge-hog Grass	<i>Echinopogon caespitosus</i>	C
	<i>Entolasia marginata</i>	U
Blady Grass	<i>Imperata cylindrical</i>	D
Weeping Grass	<i>Microlaena stipoides</i>	O
Basket Grass	<i>Oplismenus aemulus</i>	C
	<i>Panicum simile</i>	O
Kangaroo Grass	<i>Themeda australis</i>	D
*Caratao Grass	<i>Axonopus fissifolius</i>	C



*Common Crab-grass	<i>Digitaria ciliaris</i>	C
*Panic Veld-grass	<i>Ehrharta erecta</i> ,	U
*Sticky Head Grass	<i>Paspalum dilatatum</i>	U
*Kikuyu	<i>Pennisetum clandestinum</i>	C
*Pigeon Grass	<i>Setaria sphacelata</i>	D
<b>Groundcovers</b>		
Kidney Weed	<i>Dichondra repens</i>	O
Twining Glycine	<i>Glycine clandestina</i>	O
Prickly Beard-heath	<i>Leucopogon juniperinus</i>	C
White-root	<i>Pratia purpurascens</i>	C
Bracken	<i>Pteridium esculentum</i>	O
*Farmers Friend	<i>Bidens pilosa</i>	O
*Flatweed	<i>Hypochoeris radicata</i>	C
*Lambs Tongue	<i>Plantago lanceolata lanceolata</i>	C
*Ragwort	<i>Senecio madagascariensis</i>	C
*Arrow-leaf Sida	<i>Sida rhombifolia</i>	C
*White Clover	<i>Trifolium repens</i>	D
<b>Lianas, Scramblers and Twiners</b>		
Monkey Rope	<i>Parsonsia straminea</i>	C
<b>Sedges, Rushes and Aquatics</b>		
Common Maidenhair	<i>Adiantum aethiopicum</i>	R
Bergalia Tussock	<i>Carex longebrachiata</i>	C
Water Velvet	<i>Azolla pinnata</i>	O
Tall Spike Rush	<i>Eleocharis sphacelata</i>	C
Common Enhydra	<i>Enhydra fluctuans</i>	O
Ground Fern	<i>Hypolepis muelleri</i>	C
Common Rush	<i>Juncus usitatus</i>	C
Creeping Water Pimrose	<i>Ludwigia peploides</i>	O
Swamp Lily	<i>Ottelia ovalifolia</i>	O
Pale Persicaria	<i>Persicaria lapathifolia</i>	O



Spotted Knot-weed	<i>Persicaria strigosa</i>	C
Frogmouth	<i>Philydrum lanuginosum</i>	O
River Buttercup	<i>Ranunculus inundatus</i>	U
Forest Buttercup	<i>Ranunculus plebius</i>	O
	<i>Ranunculus inundatus</i>	C
Rough-seed Bulrush	<i>Schoenoplectus mucronatus</i>	C
	<i>Sparganium subglobosum</i>	O
Cumbungi	<i>Typha orientalis</i>	U
Spiny-headed Matrush	<i>Lomandra longifolia</i>	C
-	<i>Lomandra sp.</i>	U
-	<i>Lepidosperma laterale</i>	O



## Appendix 3: Hollow Bearing Tree Data

Table 18: Hollow-bearing tree data

Number	Species	Height	DBH	Latitude	Longitude	Hollows					
						Trunk			Limbs		
						Small (<5cm)	Medium (5-15cm)	Large (>15cm)	Small (<5cm)	Medium (5-15cm)	Large (>15cm)
H1	Small-fruited Grey Gum	20-23	60	-32.05913	152.50122		1 (potential)				
H2	Small-fruited Grey Gum	18-20	75	32.06142	152.50188		1 (potential)				



## Appendix 4: Core Koala Habitat Assessment

### 1.0 Potential Koala Habitat Assessment

As detailed in section 5.1, the site contains Potential Koala Habitat, hence Part 2 of SEPP 44 applies.

### 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 *Cinnamomum 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 LGA:

**Table 19: Preferred Koala browse species in the LGA**

Source (DECC 2008)

Primary	Secondary	Tertiary
Tallowwood ( <i>E. microcorys</i> )	Small Fruited Grey Gum ( <i>E. propinqua</i> )	Thin-Leaved Stringybark ( <i>E. eugenioides</i> )
Forest Red Gum ( <i>E. tereticornis</i> )	Grey Gum ( <i>E. biturbinata</i> )	White Stringybark ( <i>E. globoidea</i> )
Swamp Mahogany ( <i>E. robusta</i> )	Narrow-Leaved Red Gum ( <i>E. seeana</i> )	Blue-Leaved Stringybark ( <i>E. agglomerata</i> )
Cabbage Gum ( <i>E. amplifolia</i> )	Red Mahogany ( <i>E. resinifera</i> )	
	Slaty Red Gum ( <i>E. glaucina</i> )	

In addition to this, the GTCC CKPOM (AKF 2002) has produced a list of Primary, Secondary and Tertiary preferred browse species for the shire:

**Table 20: Preferred Koala browse species in the LGA**

(Source: AKF 2002)

Primary	Secondary	Tertiary
Tallowwood ( <i>E. microcorys</i> )	Small Fruited Grey Gum ( <i>E. propinqua</i> )	Cabbage Gum ( <i>E. amplifolia</i> )
Forest Red Gum ( <i>E. tereticornis</i> )	Ironbark ( <i>E. siderophloia</i> )	Ribbon Gums ( <i>E. viminalis</i> / <i>E. nobilis</i> )
Swamp Mahogany ( <i>E. robusta</i> )	Grey Ironbark ( <i>E. placita</i> / <i>E. paniculata</i> )	Messmate Stringybark ( <i>E. obliqua</i> )
	Thin-Leaved Stringybark ( <i>E. eugenioides</i> )	

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. 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 are abundant, with 62 recorded in a 10km radius by the OEH Bionet/ Atlas of Wildlife (2015a). No Koalas records occur on the site, however there are several proximate records in the Tallwoods area directly to the north however these are from 2001 to 2006.

A cluster of records also occur nearby around Blackhead and Diamond Beach (OEH 2015a).



## 2.2.2 Field Survey

### 2.2.2.1 Methods

The site was surveyed for Koalas by the following methods:

- Intensive diurnal searches over 1 day
- Scat searches undertaken in accordance with the Spot Assessment Technique (SAT).
- Spotlighting for 1 night
- 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. The only smooth-barked trees on the site were Forest Red Gum



### 2.2.2.2 Results

#### Direct Observations and Secondary Evidence

No Koalas were directly observed during the survey.

#### SAT Surveys

No direct or indirect evidence of Koala's was observed during the field

A number of old animal scratches were found on the smooth-barked Grey Gums on site, however none were attributed to Koalas.

#### Spotlighting

No Koalas were observed during the spotlighting surveys.

## 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 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 survey, also no indirect evidence of Koala activity was found during the SAT survey. Thus, there is a possibility that Koala may have on association used the site, however it would only form a very small part of a single Koalas territory or be used as transitory habitat.

Despite the occurrence of Potential Koala Habitat on site, the lack of direct or indirect evidence of Koala activity suggests that there is only a low chance of occasional occurrence. This was not unexpected given the fragmented landscape and extent of habitat modification in the study area. As the site does qualify as an area of significant 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.