ASSESSMENT | PLANNING | MANAGEMENT

# Flora and Fauna Assessment

The Lakes Estate

Report prepared for:
Coomes Consulting

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## Executive Summary

Coomes Consulting is preparing a concept plan which forms part of a larger proposed residential release area for North Boambee Valley, Lakes Estate. An existing approved development, the first stage of the Lakes Estate development, is currently under construction adjacent to the study area.

Eco Logical Australia (ELA) has been engaged to undertake a constraints assessment to address the Director General's Environmental Assessment Requirements (DGEAR) issued by the Director General of Planning under section 75F of the *Environmental Planning and Assessment Act 1979*.

Lakes Estate is found on the south-west fringe of Coffs Harbour in an area known as North Boambee Valley (Figure 1). North Boambee Valley runs in an east west direction and is bounded by a steep escarpment along the northern boundary. The study area is approximately half covered by remnant vegetation. The majority of the surrounding land use is rural and rural residential, although the site is in close proximity to residential and commercial land to the east.

A literature review, database searches and preliminary field investigations were undertaken to identify the ecological constraints on the land to inform the urban design to minimise impacts on the environment.

Seven vegetation communities were identified and mapped within the study area. These include Tall Open Forest Type 1 – Flooded Gum – Tallowwood; Tall Open Forest Type 2 – Blackbutt – Tallowwood – Broad-leaved White Mahogany; Subtropical Lowland Rainforest (EEC); Pasture; Pastoral woodland – Swamp Mahogany; Disturbed or Regenerating; Wet Areas.

A total of 42 listed species were identified as potentially occurring on the site. Of these 5 are listed as vulnerable, 7 endangered and 5 migratory under the EPBC Act. During surveys 2 threatened species, the rusty plum (endangered under EPBC Act) and slender marsdenia (vulnerable under EPBC Act) and rainbow bee-eater (migratory under EPBC Act) were recorded. Of the total 42 species, 27 are listed as vulnerable, 10 listed as endangered and 1 listed EEC under the TSC Act. During surveys 3 threatened species (koala (vulnerable under TSC Act), rusty plum (vulnerable under TSC Act) and slender marsdenia (endangered under TSC Act)) and one Endangered Ecological Community (EEC) (Lowland Rainforest (EEC under TSC Act)) were recorded.

A large number of constraints were identified over much of the study area, predominately within the various forest and other remnant vegetation communities. These included koala habitat, corridors, EECs, threatened species, hollow bearing trees and stags and numerous statutory requirements.



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Conversely, few constraints to development were identified within the cleared and disturbed areas. A number of recommendations have been made that will deliver positive environmental outcomes, mitigate environmental impacts, and achieve a strategic design that meets the objectives of all statutory requirements.

The current subdivision plan avoids the majority of the forest communities within the study area, with any potential impacts being directed towards the cleared and disturbed parts of the site. As a consequence, any impacts are expected to be minor and insignificant.

To mitigate potential impacts to species likely to occur on the site a number of recommendations have been provided. Recommendations include the use of water sensitive urban design, design elements that achieve koala sensitive development solutions and the incorporation of revegetation and rehabilitation of strategic areas. If these recommendations are adopted then it is unlikely that that the proposal will have any significant impacts to any of the species assessed.



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# 1. Introduction

Coomes Consulting has engaged Eco Logical Australia (ELA) to undertake an Ecological Constraints Assessment to address the Director General's Environmental Assessment Requirements (DGEAR) issued under section 75F of the *Environmental Planning and Assessment Act 1979*. These DGEARs were provided in relation to the Lakes Estate Concept Plan, North Boambee Valley, Coffs Harbour.

## 1.1 Description of Proposal

The proposal involves a concept plan that forms part of a larger proposed residential release area for North Boambee Valley, Lakes Estate. The current proposal consists of 5 parcels of land covering an area of approximately 53.2ha. An existing approved development, the first stage of the Lakes Estate development, is currently under construction adjacent to the study area.

## 1.2 Study Area

Lakes Estate is found on the south-west fringe of Coffs Harbour in an area known as North Boambee Valley (Figure 1). North Boambee Valley runs in an east west direction and is bounded by a steep escarpment along the northern boundary. The subject site consists of the following land parcels that are outside of the existing approved development footprint:

- Part Lot 60 DP1070670
- Lot 2 DP607602
- Part Lot 4 DP 852521
- Lot 10 DP 1071628
- Closed Crown road DP 1089778

The study area is illustrated in Figure 1.

The study area is located 2km to east of Boambee State forest and 3.4km south of Ulidarra NP. It is approximately half covered by remnant vegetation. The majority of the surrounding land use is rural and rural residential, although the site is in close proximity to residential and commercial land to the east.

Within the study area, the subject site has been defined as the area of impact from the proposed subdivision based on the final layout provided in (Figure 10, Appendix 2).



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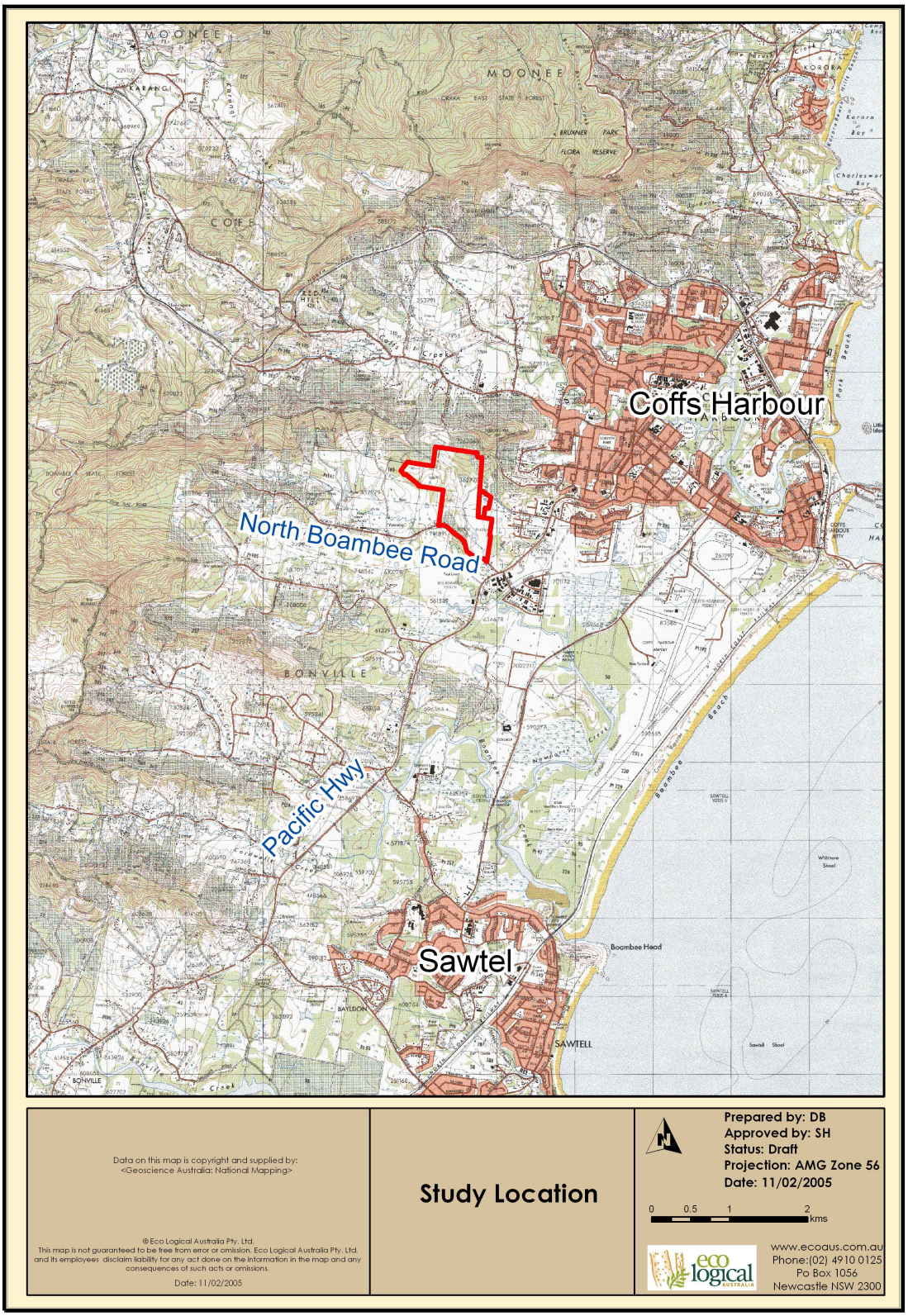


**Figure 1: Location of study**



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## 1.3 Legislative Requirements

### *1.3.1 Environmental Protection and Biodiversity Conservation Act 1999*

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a national scheme for protecting the environment and conserving biodiversity values.

Approval from the Commonwealth Environment Minister is required under the EPBC Act if the action (which can include a project, development, undertaking or activity) will, or is likely to, have a significant impact on matters considered to be of national environmental significance (NES matters).

NES matters relevant to the proposal include species and ecological communities that are listed under the Act. The EPBC Act does not define significant impact but identifies matters that are necessary to take into consideration. It is noted however, that where activities are deemed 'controlled actions' by the Department of the Environment and Water Resources (DEW), the Commonwealth and NSW governments have recently entered into a bilateral agreement relating to assessments under the EPBC Act. This agreement allows Commonwealth examination of environmental assessments prepared under NSW law.

A total of 17 species listed under EPBC Act (5 vulnerable, 7 endangered and 5 migratory) were identified as occurring or potentially occurring on the site (see Appendix 1). Of these, 1 endangered, 1 vulnerable and 1 migratory species were observed in the study area.

### *1.3.2 Environmental Planning and Assessment Act 1979*

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is the principal planning legislation for NSW, providing a framework for the overall environmental planning and assessment of development proposals. The proposed subdivision is to be assessed under Part 4 of the EP&A Act.

Section 5A of the EP&A Act relating to the seven part test for threatened species will also apply in regard to any threatened species, their predicted occurrence, endangered populations or endangered ecological communities that are present on the site (Appendix 1).

The EP&A Act places a duty on the determining authority to adequately address a range of environmental matters including maintenance of biodiversity and the likely impact to threatened species, populations or ecological communities (under the TSC Act – refer below).



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### *1.3.3 Threatened Species Conservation Act 1995*

The TSC Act aims to protect and encourage the recovery of threatened species, populations and communities listed under the Act. Obligations on Councils include consideration of threatened species, populations, ecological communities and recovery plans in fulfilling their statutory responsibilities in the development approvals process under the EP&A Act. The Act inserts provisions to the approvals process where there is likely to be a 'significant effect' requiring a Species Impact Statement (SIS) to be prepared.

The consent or determining authority must seek the concurrence of the Director-General of the Department of Environment and Climate Change (DECC) where there is likely to be a significant effect on threatened species, populations or endangered ecological communities, or their habitats or where the proposal impacts on identified critical habitat.

One listed endangered ecological communities (EEC), and a number of threatened species, are found in and around the study area. 27 vulnerable species and 10 endangered species have the potential to occur in the study area (Appendix 1). Of these, 2 vulnerable and 1 endangered species were observed and 1 EEC was recorded during surveys (Appendix 1).

### *1.3.4 Native Vegetation Act*

The NSW Native Vegetation Act 2003 (NV Act) aims to conserve and manage native vegetation through regulation of native vegetation clearing. It provides for the encouragement and promotion of the management of native vegetation on a regional basis in the social, economic and environmental interests of the state. Management of native vegetation must have regard to its contribution to water quality, biodiversity and land degradation. It also provides a mechanism to improve the condition of existing native vegetation. Under the Legislative exclusions, Section 25 (g) and (h) of the NV Act, clearing that is assessed under Part 5 of the EPA Act, and that complies with that part is not required to be assessed under the NV Act. However, the NV Act does provide guidance in regard to offsetting and the requirements under the 'improve or maintain' principle. The NV Act does not apply to land zoned residential, but does apply to land zoned as environmental protection.

### *1.3.5 SEPP 44 Koala Habitat*

Koalas are listed in the wildlife database atlas searches conducted in relation to the proposal (see Appendix 1) Koala food trees are found in the study site and 3 koalas were recorded on or adjacent to the study site. Coffs Harbour City Council is listed on Schedule 1 of the SEPP 44 and the site is greater than 1 ha, meaning the likelihood of koala habitat needs to be assessed as part of the environmental assessment process.



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Mapping of the koala habitat within Coffs Harbour LGA has been undertaken as part of the Coffs Harbour Koala Plan of Management (CHKPoM). Additional assessment of areas not mapped by the CHKPoM has been outlined in Section 2.2.

### *1.3.6 SEPP 71 – Coastal Protection*

SEPP 71 aims to foster a strategic and consistent approach to coastal planning and management and facilitate the assessment of development proposals on merit. The Policy achieves this by setting out matters for consideration by consent authorities, and developing a state-level review process for significant coastal development proposals. The SEPP deals with proposals in sensitive locations and seeks to ensure that particular types of subdivisions in the Coastal Zone are consistent with the SEPP's objectives by requiring a state-approved DCP.

SEPP 71 applies to the area declared as the NSW Coastal Zone under the Coastal Protection Act as mapped in the NSW Coastal Zone maps. The Lakes Estate study area is included within these area declared as NSW Coastal Zone. Director Generals Requirements from the Department of Planning have been issued for this proposal (see section 1.3.13).

The specific aims under Part 1 of the SEPP 71 that are applicable to the environment at Lakes Estate include:

(a) to protect and manage the natural, cultural, recreational and economic attributes of the New South Wales coast, and

(g) to protect and preserve native coastal vegetation, and

(j) to manage the coastal zone in accordance with the principles of ecologically sustainable development (within the meaning of section 6 (2) of the *Protection of the Environment Administration Act 1991*), and

(k) to ensure that the type, bulk, scale and size of development is appropriate for the location and protects and improves the natural scenic quality of the surrounding area, and

(l) to encourage a strategic approach to coastal management.

Matters for consideration by the consent authority under Part 2 of SEPP 71 that are applicable include:

(d) the suitability of development given its type, location and design and its relationship with the surrounding area,

(f) the scenic qualities of the New South Wales coast, and means to protect and improve these qualities,

(g) measures to conserve animals (within the meaning of the *Threatened Species Conservation Act 1995*) and plants (within the meaning of that Act), and their habitats,

(i) existing wildlife corridors and the impact of development on these corridors,

(m) likely impacts of development on the water quality of coastal waterbodies,



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### *1.3.7 Coffs Harbour City Council LEP 2000*

The aims of this LEP are to encourage sustainable economic growth and development within the LGA, and to recognise the need to provide for development within the City in an ecologically sustainable manner. The specific environmental objectives of this LEP are to identify areas for compatible development opportunities, and to protect environmentally sensitive areas.

The Lakes Estate study area is zoned 2A (Residential Low Density) and 7A (Environmental Protection – Habitat and Catchment).

The objectives of land zoned 2A are to enable housing development and other development that is compatible with a low density residential environment, and to provide for development that is within the environmental capacity of a low density residential environment and can be adequately serviced. Subdivision requires development consent.

The objectives of zone 7A are to protect habitat values and water quality and enable development which does not adversely impact upon these values, and to enable development that is within the environmental capacity of the land and can be adequately serviced. Subdivision requires development consent and allotment sizes must be greater than 40ha (LEP amendment 15).

### *1.3.8 'Our Living City' Settlement Strategy – Coffs Harbour City Council*

The Coffs Harbour Settlement Strategy has been developed in partnership with the community to provide a blueprint for a smart city with accessible and reliable transport, a strong regional economy, a vibrant community and a healthy natural environment. The Strategy is based on the "triple bottom line" objectives of environmental, economic and social sustainability, and it connects to the vision of a healthy, smart and cultural city. The Settlement Strategy is consistent with relevant State Environmental Planning Policies, the North Coast REP, ministerial directions and the NSW Coastal Policy.

The environmental objectives of the Strategy are to protect, maintain and improve our natural attributes and resources, to provide for settlement that enhances environmental values and is compatible with environmental constraints, to use resources efficiently and to devise innovative ways to minimise pollution and disposal of waste.

The Lakes Estate study area has been mapped as a combination of 'Urban Areas – Not Developed' and '7A LEP 2000 Zones (Environmental Protection)' within the Settlement Strategy.



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### *1.3.9 Draft Mid-North Coast Regional Strategy 2006-31*

The *Draft Mid-North Coast Regional Strategy 2006-31* aims to improve protection and enhancement of environmental assets, including biodiversity, wetlands, littoral rainforest, koala habitat, estuaries and landscape values and ensure the sustainable use of natural resources. The strategy recognises the importance of the region's natural environment, and its natural resources, to its economy, character, scenery and cultural values.

### *1.3.10 Coffs Harbour Koala Plan of Management*

This Comprehensive Koala Plan of Management (CKPoM) was prepared by the NSW National Parks and Wildlife Service (NPWS) in close consultation with Coffs Harbour City Council (CHCC) under the statutory provisions of State Environmental Planning Policy 44 - Koala Habitat Protection (SEPP 44). The adoption of a CKPoM which covers the whole Coffs Harbour Local Government Area (LGA) replaces the requirement under SEPP 44 for developments in Coffs Harbour LGA to address koala issues individually. It sets out a framework for conserving and managing koalas in Coffs Harbour LGA.

### *1.3.11 Coffs Harbour Vegetation Conservation DCP*

The Vegetation Management Strategy (CHCC 2003) provides a guiding document to the setting of priorities and targets for vegetation conservation, rehabilitation and vegetation clearing controls. Detailed clearing controls are provided in the Vegetation Conservation Development Control Plan for the NSW Coastal Area (as defined under SEPP 71), and these are discussed in further detail in section 4.8.

The controls in this DCP seek to complement Council's Local Vegetation Management Strategy. They provide a framework for vegetation management that achieves an outcome for vegetation conservation consistent with the Coffs Harbour Regional Vegetation Management Strategy. They also introduce vegetation removal controls to ensure vegetation values are protected in the urban, rural residential and future growth areas of the City. Finally, they seek to ensure development on land containing native vegetation or adjoining native vegetation is consistent with the principles of ecologically sustainable development.

Coffs Harbour City LEP 2000 provides that vegetation removal on land indicated in the maps or within an environmental protection zone shall not be undertaken without the consent of Council and consent shall not be granted to development (including vegetation removal) unless the development is in accordance with this DCP, and in accordance with any relevant koala plan of management (CHKPoM).

### *1.3.12 Tree Preservation Order*

The Coffs Harbour Council Tree Preservation Order aims to improve the protection of trees within the Coffs Harbour LGA. Ring barking, cutting down, topping, lopping,



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removal or wilful destruction of any tree is not permitted without development consent. The preservation order applies to all the land within the Lakes Estate study area with the following exception; within land zoned 2A where lots are less than 2000m$^2$.

The Tree Preservation Order applies to all Australian native vegetation that is either:

- a woody stemmed plant of greater than 3m in height or having a girth greater than 15cm
- any heathland, shrubland, sedgeland or rushland identified by Council's vegetation mapping (none identified on the study area)

The preservation order does not apply to certain activities including action required under the *Electricity Safety Act 1945* or the *Electricity Supply Act 1995*, plants declared to be noxious weeds under the *Noxious Weeds Act 1993* or trees identified for removal under a bushfire management plan available form the Council.

#### *1.3.13 Director Generals Requirements*

The Lakes Estate study area is included within the area declared as NSW Coastal Zone as indicated on the NSW Coastal Zone maps and therefore this policy is applicable. Director General's Requirements from the Department of Planning have been issued for this proposal. With regards to this report, relevant requirements include:

- Flora and Fauna: Outline measures for the conservation of animals and plants (within the meaning of the Threatened Species Conservation Act 1995 and Fisheries Management Act 1994) and their habitats, including existing wildlife corridor values and/or connective importance of any vegetation on the subject land; Koala habitat and vegetation identified as being of high and/or very high value ecological status;
- Proposed Conservation Areas: Outline long term ownership and management measures for conservation and open space areas;
- Liaison with relevant agencies;
- Consideration of relevant technical and policy guidelines.



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# 2. Methods

## 2.1 Information Review

Preliminary investigations on the study area involved gathering ecological information and data relevant to the site, including reviewing any literature or reports that have been undertaken on the study area and interrogating threatened species database records.

### *2.1.1 Literature Review*

No previous ecological studies have been undertaken in the study area. Other sources of information that were reviewed for this report include:

- Coffs Harbour Vegetation Management Strategy
- Coffs Harbour KPoM
- 'Our Living City' Settlement Strategy – Coffs Harbour City Council
- Relevant legislation
- Relevant literature pertaining to the species and environment of the area

### *2.1.2 Database review*

The DECC NSW Wildlife Atlas and Bionet were searched on the 30th October 2007 using a 10km radius centred on the site (-30° 18' 13" 153° 5' 10'') and the EPBC Protected Matters Search Tool was searched on the 30th of October 2007 using a 10km search radius centred on the study area (-30° 18' 13" 153° 5' 10'').

An assessment of likelihood of occurrence was made for threatened and migratory species identified from the database search. This assessment was based on database or other records, presence or absence of suitable habitat, features of the proposal site, results of the field investigations and professional judgement.

The results of these searches and analysis can be found in Appendix 1

## 2.2 Field Survey

Field investigations within the study area were conducted on the 16th and 17th November 2007 in order to identify significant vegetation communities (ie EEC's), potential habitat for threatened species and any opportunistic observations. Methods that were applied during the site investigation included:

Note that as the proponent is proposing to restrict development to mainly cleared areas within the study area, no systematic surveys were undertaken for this study, apart from along those areas, where targeted threatened flora searches were undertaken (see section 2.2.3). Literature review, data audit, validation of vegetation communities and habitat assessment are considered adequate to understand the level of ecological importance of the site, and to formulate recommendations for avoidance of key values, minimisation of effects, and mitigation of potential impacts from adjoining development.



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### *2.2.1 Vegetation Community Validation*

Ground truthing during the site inspection was used to distinguish and map vegetation associations or units across the study area using aerial photo interpretation and Global Positioning System (GPS). This method also involved delineating the boundaries of EEC's, where they occurred within the study area.

### *2.2.2 Habitat Assessment*

Seven habitat assessments were applied across the study area in a 20 x 50 metre quadrat that was a representative sample of each vegetation community or patch remnant assessed. Structural and resource attributes were collected that contributed to assessing which fauna species were likely to occur. Attributes that were recorded included:

- Date and weather conditions
- vegetation community and type;
- forage resources (ie koala primary browse trees, sap feed trees, flowering trees and shrubs);
- topography, slope and aspect;
- percentage cover for canopy, understorey and ground-layer habitat present (separated into categories of 'litter', 'rocks' and 'bare ground');
- number of trees with hollows, the number of hollows under or over 5 centimetres in diameter;
- the total length of any fallen logs;
- the number and extent of any rock outcrops;
- number and extent of any standing or flowing water bodies; and
- disturbance history.

### *2.2.3 Targeted Threatened Flora Surveys*

Targeted threatened flora surveys were undertaken on the 6th of December 2007 for a total of four person hours. Surveys were along a meandering traverse targeting potential habitat for likely species. Habitats that were targeted included cleared areas close to the edges of the forests and through the wet areas.

### *2.2.4 Opportunistic Observations*

While traversing each of the sites, key opportunistic and secondary evidence observations were recorded. This primarily involved recording evidence that indicated the presence of threatened species, such as calling activity (ie for frogs), identification of scats uncovered while conducting other survey methods (ie koala, gliders), identification of scratches on trees, glider sap incisions, owl regurgitation pellets and nests.

### *2.2.5 Consultation with Relevant agencies*

Telephone discussions were held with DECC regarding the proposal and particularly with regards to the values identified on the site and the level of survey effort that would be required. DECC advised that:

- Consideration should be given to appropriate buffer distances to vegetation communities on the site;



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- Consideration should be given to the potential for threatened flora species within the cleared or paddock areas to occur – namely the hairy joint grass (spp)
- Reporting would need to demonstrate and justify that literature review, data audit, validation of vegetation communities and habitat assessment are considered adequate to understand the level of ecological importance of the site and that systematic survey would not be required.

Telephone discussions were held with Coffs Harbour Council regarding the proposal. Council advised that the proponent should consider:

- Coffs Harbour KPoM objectives and controls
- Draft Vegetation Strategy (CHVS) and Vegetation Conservation Development Control Plan (VCDCP and associated mapping
- Listed EEC's and Threatened species in the LGA.
- Draft offsetting guidelines– These are not yet publicly available, but again the proposal may be conditioned on this. These guidelines include offsetting provisions for Koala habitat (Primary and Secondary habitat 1 to 5, tertiary habitat 1 to 3)

Council also advised that No DCP applies to this land, however Council may 'condition in' DCPs across relevant boundaries. Such DCPs may have requirements such as:

- Require provisions of a VMP. VMP's may require offsetting for removal of indigenous vegetation
- 5 year maintenance requirements



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# 3. Results

## 3.1 Vegetation Communities and habitat assessment

Seven vegetation communities were identified and mapped (Appendix 1, Figure 2) within the study area. Vegetation communities that were mapped corresponded to several of the mapped Tall Open Forest communities from the Coffs Harbour Council vegetation mapping and included:

| Mapped Vegetation Community | Coffs Harbour Council Vegetation Mapping |
|---|---|
| Tall Open Forest Type 1 – Flooded Gum - Tallowwood | • Tall Open Forest – *Eucalyptus grandis*<br>• Tall Open Forest – *E. microcorys, E. grandis, Lophostemon confertus*<br>• Tall Open Forest – *E. pilularis, E. microcorys* |
| Tall Open Forest Type 2 – Blackbutt – Tallowwood – Broad-leaved White Mahogany | • Tall Open Forest – *E. grandis*<br>• Tall Open Forest – *E. pilularis, E. microcorys*<br>• Tall Open Forest – *E. pilularis, E. microcorys* |
| Subtropical Lowland Rainforest | • Tall Open Forest – *E. grandis*<br>• Tall Open Forest – *E. pilularis, E. microcorys* |
| Pasture | • Nothing |
| Pastoral woodland – Swamp Mahogany | • Nothing |
| Disturbed or Regenerating | • Nothing |
| Wet Areas | • Tall Open Forest – *E. grandis* |

### *3.1.1 Tall Open Forest Type 1 – Flooded Gum - Tallowwood*

This association occupies approximately 4ha of the study area and occurs in sheltered areas, often within and on the edges of gullies and ecotones with Lowland Rainforest. The canopy was up to 45m high and provided up to 50% projective cover. Canopy species included flooded gum (*Eucalyptus grandis*), tallowwood (*E. microcorys*), brush box (*Lophostemon confertus*) and turpentine (*Syncarpia glomulifera*). The understorey provided approximately 30% cover and species included black oak (*Allocasuarina littoralis*), blue lilly pilly (*Syzygium oleosum*), and *Cryptocarya sp*. The ground cover was relatively open and dominated by gristle fern (*Blechnum cartilagineum*) and other ferns. Lantana (*Lantana camara*) and camphor laurell (*Cinnamonum camphora*) were the most commonly encountered exotic species.

The results of the habitat assessment indicate that this Tall Open Forest contains relatively few hollow bearing trees, with the exception of occasional stags. Fallen logs were common and leaf litter covered up to 95% of the ground. Seasonal forage resources included winter flowering canopy species (ie tallowwood and flooded gum), rainforest fruiting species and *Allocasuarina* fruit. Tree stumps and similar aged canopy trees suggest that logging has occurred in this association within the last 20-30 years.

One koala scat tree was found within this community and many of the canopy species are considered preferred feed trees such as tallowwood and flooded gum. This community is considered valuable habitat for the koala. Threatened species considered likely to utilise this vegetation association have been compiled in Table 2 of Section 3.3.



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*3.1.2 Tall Open Forest Type 2 – Blackbutt – Tallowwood – Broad-leaved White Mahogany*

Approximately 8.7ha of this Tall Open Forest type occupies the study area and generally occurs in more elevated and exposed areas. The canopy was up to 35m high and provided up to 35% projective cover. Canopy species included blackbutt (*Eucalyptus pilularis*), tallowwood, pink bloodwood (*Corymbia intermedia*), grey ironbark (*E. siderophloia*) and flooded gum. The understorey provided approximately 30% cover and species included black oak (*Allocasuarina littoralis*) and scattered shrubs including hairy rosewood (*Dysoxylum rufum*), scrub turpentine (*Rhodamnia rubescens*) and guioa (*Guioa semiglauca*). The ground cover was open and dominated by ferns such as bracken fern (*Pteridium esculentum*). Weeds were uncommon.

The results of the habitat assessment indicate that this Tall Open Forest type contains relatively few hollow bearing trees, though occasional stags contained hollows greater than 15cm diameter. Fallen logs were common and leaf litter covered up to 90% of the ground. Seasonal forage resources included winter flowering canopy species (ie tallowwood, grey ironbark and flooded gum), few rainforest fruiting species, possible sap resources (ie blackbutt and grey ironbark, though very few incisions were observed) and *Allocasuarina* fruit. Tree stumps and similar aged canopy trees suggest that logging has occurred in this association within the last 20-30 years and low intensity grazing is currently occurring on the study area.

Three koala scat trees were found within this community and many of the canopy species are considered preferred feed trees such as blackbutt, flooded gum and tallowwood. This community is considered valuable habitat for this species. Threatened species considered likely to utilise this vegetation association have been compiled in Table 2 of Section 3.3.

*3.1.3 Subtropical Lowland Rainforest – Flooded Gum – Blue Lilly Pilly – Bangalow Palm*

Approximately 8.2ha of Lowland Rainforest, considered to constitute *Lowland Rainforest in NSW North Coast and Sydney Basin Bioregion* EEC, occupies the drainage depression flowing from the northwest corner of the study area to the east and some other small remnants occur on the site. The canopy height varied from occasional emergent flooded gum up to 45m to a lower closed canopy (up to 85% cover) of bangalow palm (*Archontophoenix cunninghamiana*), brushbox, Moreton Bay fig (*Ficus macrophylla*) and native tamarind (*Diploglottis australis*). Vines were common within this association and often strangled the low closed canopy. kangaroo grape (*Cissus antarctica*) was the most common vine, water vine (*Cissus hypoglauca*), *Smilax australis*, snake vine (*Stephania japonica*) also occurred. Understorey and shrub species included blue lilly pilly, hairy rosewood, sassafras (*Doryphora sassafras*), black wattle (*Callicoma serratifolia*), scrub turpentine, palm lilly (Cordyline *stricta*) and muttonwood (*Rapanea howittiana*). Lantana and emergent camphor laurel also occurred.

The results of the habitat assessment indicate that Subtropical Lowland Rainforest contains few hollow bearing trees. Fallen logs occurred but were uncommon and leaf litter covered up to 90% of the ground. Seasonal forage resources included occasional winter flowering canopy species (ie flooded gum) and rainforest fruiting



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species were common. Two freshwater streams occupied the Subtropical Lowland Rainforest, a broad north to south flowing drainage depression in the western portion of the site and a northwest to southeast stream flowing form the northwest corner of the site. Despite habitat fragmentation and impacts from previous landuse on adjoining lands (ie banana plantations), both these streams offer marginal habitat potential for threatened frogs (ie barred frogs and green-thighed frog). Targeted threatened flora surveys recorded rusty plum (*Amorphospermum whitei*) and slender marsdenia (*Marsdenia longiloba*) along the track edges within this community (Figure 2). Other threatened species considered likely to utilise this vegetation association have been compiled in Table 2 of Section 3.3.

### *3.1.4 Pasture*

This association comprised most of the cleared areas where pastoral grasses dominate. Some scattered emergent paddock trees occurred, including camphor laurel and isolated eucalypts. Grasses included blady grass (*Imperata cylindrica*) and paspalum (*Paspalum dilatatum*).

The habitat assessment indicates that areas of pasture offer limited ecological value for most of the threatened species considered likely to use the study area, with limited structural and floristic diversity. Five areas of aquatic habitat occur on the site, the north to south flowing drainage depression in the western portion of the site, a low lying soak in the central east of the site and three dams. Although the cleared pasture areas offer the greatest potential for development, if development is to occur on the site, allowance for hazard free movement corridors between vegetation remnants needs to be considered, especially for koalas which are known to traverse open ground. Threatened species considered likely to utilise this vegetation association have been compiled in Table 2 of Section 3.3.

### *3.1.5 Pastoral Woodland* – Swamp Mahogany

Approximately 0.8ha of Pastoral Woodland – Swamp Mahogany occupies a small area in the eastern additional area of the study area. The canopy was up to 30m and provided open <5% projective cover. Swamp mahogany (*Eucalyptus robusta*) and swamp oak (*Casuarina glauca*) were the main emergent species that occurred. The understorey was absent due to clearing. Shrubs were comprised of regenerating broad-leaved paperbark (*Melaleuca quinquenervia*) and ground covers included *Juncus continuous*, *J. usitatis* and *Cyperus sp*.

The habitat assessment indicates that Pastoral Woodland had no hollow bearing trees, fallen logs were rare, leaf litter was limited and seasonal and perennial forage resources comprised swamp mahogany (winter flowering and koala primary browse). Prior to clearing, this association is likely to have represented *Swamp Sclerophyll Forest on Coastal Floodplains in NSW North Coast and Sydney Basin Bioregion* EEC; however, the clearing has resulted in simplified forest structure and floristics to a point where this community is not recognised as the EEC. Despite this, natural regeneration of the Pastoral Woodland – Swamp Mahogany was observed, with numerous broad-leaved paperbark seedlings emerging in the period since last disturbance. Threatened species considered likely to utilise this vegetation association have been compiled in Table 2 of Section 3.3.



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*3.1.6 Disturbed or Regenerating*

Disturbed Scrub occupied approximately 2.7ha at the top of the northern facing slope in the northwest portion of the site and in the central areas of the site. Canopy species comprised occasional emergent tallowwood and wattles, up to 15m high with <10% cover. The understorey and shrub layer merged, with lantana dominating these strata.

The habitat assessment indicates that Disturbed Scrub had no hollow bearing trees, fallen logs were absent and leaf litter was high, with up to 85% cover. Seasonal forage resources were limited to lantana fruit and eucalypt and wattle inflorescence. This association is a result of clearing, possibly for Banana or agricultural purposes, and has regenerated with weeds and pioneer species. Threatened species considered likely to utilise this vegetation association have been compiled in Table 2 of Section 3.3.

*3.1.7 Wet Areas – Dams – Wetland Soak*

This association comprised four dams, an ephemeral wetland soak and the western drainage line. The four dams were located in the eastern additional lot, two in the central portion of the study area near the northwest to southeast flowing drainage line and one small dam in the west at the southern portion of the north to south flowing drainage line. The dams contained standing water with fringing emergent aquatic vegetation and some floating macrophytes. All the dams were artificial and have been used for grazing purposes. Dams are considered to offer habitat for amphibian species, predominately common species, and retaining water quality within the dams is important.

The ephemeral wetland soak was located in the broad depression at the base of the northwest to southeast flowing drainage line. This area contains emergent sedges and rushes and contained ephemeral water to a depth of 0.2m deep. The area has been modified through dams, clearing and cattle grazing and as a result has lost some habitat value. The area is considered to offer suitable habitat possibly for *Eleocharis tetraquetra* and habitat for more common amphibian species and retaining water quality in the area is important.

The north to south flowing drainage line in the western portion of the study area contains ephemeral flows and limited standing water was observed. However, soils along the drainage line were wet and moisture tolerant plants such as *Juncus* spp were observed along this drainage line. The drainage line has been cleared for pastoral purposes and as a result is fringed with pastoral grasses. The drainage line offers habitat for more common amphibian species and is an important area of connectivity for amphibians. Retaining water quality in the area is also important. Threatened species considered likely to utilise these habitats have been compiled in Table 2 of Section 3.3.

## 3.2 Opportunistic fauna observations

Table 1 below lists the fauna species observed opportunistically while undertaking other field methods.



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**Table 1: Opportunistic observations.**

| SCIENTIFIC NAME | COMMON NAME | TSC Act | EPBC Act |
|---|---|---|---|
| **Amphibians** | | | |
| *Adelotus brevis* | Tusked Frog | – | – |
| *Crinia signifera* | Common Eastern Froglet | – | – |
| *Litoria dentata* | Bleating Tree Frog | – | – |
| *Litoria pearsoniana* | Pearson's Green Tree Frog | – | – |
| **Aves** | | | |
| *Alectura lathami* | Australian Brush-turkey | – | – |
| *Anas superciliosa* | Pacific Black Duck | – | – |
| *Ardea alba* | Great Egret | – | – |
| *Centropus phasianinus* | Pheasant Coucal | – | – |
| *Colluricincla harmonica* | Grey Shrike-thrush | – | – |
| *Columba leucomela* | White-headed Pigeon | – | – |
| *Coracina novaehollandiae* | Black-faced Cuckoo-shrike | – | – |
| *Cormobates leucophaea* | White-throated Treecreeper | – | – |
| *Coturnix ypsilophora* | Brown Quail | – | – |
| *Dacelo novaeguineae* | Laughing Kookaburra | – | – |
| *Dicaeum hirundinaceum* | Mistletoebird | – | – |
| *Dicrurus bracteatus* | Spangled Drongo | – | – |
| *Elanus axillaris* | Black-shouldered Kite | – | – |
| *Eolophus roseicapillus* | Galah | – | – |
| *Eopsaltria australis* | Eastern Yellow Robin | – | – |
| *Eurystomus orientalis pacificus* | Dollarbird | – | – |
| *Gerygone mouki* | Brown Gerygone | – | – |
| *Gymnorhina tibicen* | Australian Magpie | – | – |
| *Isoodon macrourus* | Northern Brown Bandicoot | – | – |
| *Macropygia amboinensis* | Brown Cuckoo-Dove | – | – |
| *Malurus cyaneus* | Superb Fairy-wren | – | – |
| *Malurus melanocephalus* | Red-backed Fairy-wren | – | – |
| *Meliphaga lewinii* | Lewin's Honeyeater | – | – |
| ***Merops ornatus*** | **Rainbow Bee-eater** | – | **M** |
| *Oriolus sagittatus* | Olive-backed Oriole | – | – |
| *Pachycephala pectoralis* | Golden Whistler | – | – |
| *Psophodes olivaceus* | Eastern Whipbird | – | – |
| *Rhipidura albiscapa* | Grey Fantail | – | – |
| *Scythrops novaehollandiae* | Channel-billed Cuckoo | – | – |
| *Sericulus chrysocephalus* | Regent Bowerbird | – | – |
| *Sphecotheres vieilloti* | Australasian Figbird | – | – |
| *Threskiornis molucca* | Australian White Ibis | – | – |
| *Todiramphus macleayii* | Forest Kingfisher | – | – |
| *Trichoglossus haematodus* | Rainbow Lorikeet | – | – |
| **Reptiles** | | | |
| *Egernia major* | Land Mullet | – | – |
| **Mammals** | | | |
| *Felis catus* | Cat | – | – |
| ***Phascolarctos cinereus*** | **Koala** | **V** | – |
| *Tachyglossus aculeatus* | Short-beaked Echidna | – | – |
| *Wallabia bicolor* | Swamp Wallaby | – | – |

V = Vulnerable, M = Migratory



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### 3.3 Threatened species, Endangered Ecological Communities and Migratory Species

Four listed species were identified during the field investigations. These species included:

- Koala (*Phascolarctos cinereus*)
- Rusty plum (*Amorphospermum whitei*)
- Slender marsdenia (*Marsdenia longiloba*)
- Rainbow bee-eater (*Merops ornatus*)

The status of these species and the vegetation communities found in the study area that constitute habitat for these species are listed in Table 2 below.

The likelihood of occurrence table in Appendix 1 lists those species that have been either recorded or considered potential occurrences within a 10km radius of the study area, as determined by field survey or the database review. These species were assessed for their likelihood to occur in the study area, based on local records and the availability of suitable habitat within the site. Threatened species, EEC's and Migratory species recorded or considered likely to occur on the site have been compiled in Table 2 below.

**Table 2: List of species recorded or considered likely to occur within the study area based on the likelihood of occurrence table in Appendix 1 and the corresponding important vegetation association likely to be used by the species**

| SCIENTIFIC NAME | COMMON NAME | TSC Act | EPBC Act | Important Vegetation Association |
|---|---|---|---|---|
| **EEC** | | | | |
| ***Lowland Rainforest in NSW North Coast and Sydney Basin Bioregion* EEC** | | **EEC** | **–** | **Subtropical Lowland Rainforest** |
| **Flora** | | | | |
| ***Amorphospermum whitei*** | **Rusty Plum** | **V** | **E** | **Subtropical Lowland Rainforest** |
| *Arthraxon hispidus* | Hairy Jointgrass | V | V | Pasture; Subtropical Lowland Rainforest; forest edges in shaded moist areas. |
| *Eleocharis tetraquetra* | Square-stemmed Spike Rush | E | – | Wet areas – Dams – Wetland Soak |
| *Lindsaea incisa* | Slender Screw Fern | E | — | Subtropical Lowland Rainforest |
| ***Marsdenia longiloba*** | **Slender Marsdenia** | **E** | **V** | **Subtropical Lowland Rainforest** |
| *Parsonsia dorrigoensis* | | V | E | Subtropical Lowland Rainforest |
| *Phaius australis* | Swamp Orchid | E | E | Subtropical Lowland Rainforest |
| *Senna acclinis* | Rainforest Cassia | E | — | Subtropical Lowland Rainforest |
| *Tylophora woollsii* | Cryptic Forest Twiner | E | E | Subtropical Lowland Rainforest |
| **Amphibians** | | | | |
| *Litoria brevipalmata* | Green Thighed Frog | V | — | Subtropical Lowland Rainforest; Wet areas – |



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| SCIENTIFIC NAME | COMMON NAME | TSC Act | EPBC Act | Important Vegetation Association |
|---|---|---|---|---|
| | | | | Dams – Wetland Soak; Tall Open Forest |
| *Mixophyes balbus* | Stuttering Frog | E | V | Subtropical Lowland Rainforest |
| *Mixophyes iteratus* | Giant Barred Frog | E | E | Subtropical Lowland Rainforest |
| **Aves** | | | | |
| *Calyptorhynchus lathami* | Glossy Black-Cockatoo | V | — | Tall Open Forest types |
| *Coracina lineata* | Barred Cuckoo-shrike | V | — | Subtropical Lowland Rainforest |
| *Cyclopsitta diophthalma coxeni* | Coxen's Double-eyed Fig-Parrot | E | E | Subtropical Lowland Rainforest |
| *Lophoictinia isura* | Square-tailed Kite | V | — | All |
| *Ptilinopus magnificus* | Wompoo Fruit-Dove | V | — | Subtropical Lowland Rainforest |
| *Ptilinopus regina* | Rose-crowned Fruit-Dove | V | — | Subtropical Lowland Rainforest |
| *Ninox strenua* | Powerful Owl | V | — | All |
| *Tyto novaehollandiae* | Masked Owl | V | — | All |
| *Tyto tenebricosa* | Sooty Owl | V | — | Subtropical Lowland Rainforest |
| *Hirundapus caudacutus* | White-throated Needletail | — | M | All |
| ***Merops ornatus*** | **Rainbow Bee-eater** | **—** | **M** | **All** |
| *Monarcha melanopsis* | Black-faced Monarch | — | M | Subtropical Lowland Rainforest |
| *Rhipidura rufifrons* | Rufous Fantail | — | M | Subtropical Lowland Rainforest; Tall Open Forest |
| *Ardea ibis* | Cattle Egret | — | M | Pasture and Wet areas – Dams – Wetland Soak |
| **Mammals** | | | | |
| *Dasyurus maculatus* | Spotted-tailed Quoll | V | — | All |
| *Petaurus australis* | Yellow-bellied Glider | V | — | Tall Open Forest |
| *Petaurus norfolcensis* | Squirrel Glider | V | — | Tall Open Forest |
| ***Phascolarctos cinereus*** | **Koala** | **V** | **—** | **Tall Open Forest; Pastoral Woodland – Swamp Mahogany; paddock trees** |
| *Potorous tridactylus* | Long-nosed Potoroo | V | — | Subtropical Lowland Rainforest; Tall Open Forest |
| *Chalinolobus nigrogriseus* | Hoary Bat | V | — | All |



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| SCIENTIFIC NAME | COMMON NAME | TSC Act | EPBC Act | Important Vegetation Association |
|---|---|---|---|---|
| *Chalinolobus dwyeri* | Large-eared Pied Bat | V | V | All |
| *Kerivoula papuensis* | Golden-tipped Bat | V | — | Subtropical Lowland Rainforest; Tall Open Forest |
| *Miniopterus australis* | Little Bent-wing Bat | V | — | All |
| *Miniopterus schreibersii oceanensis* | Eastern Bent-wing Bat | V | — | All |
| *Mormopterus norfolkensis* | East Coast Freetail Bat | V | — | All |
| *Myotis adversus* | Large-footed Myotis | V | — | Pasture and Wet areas – Dams – Wetland Soak |
| *Pteropus poliocephalus* | Grey-headed Flying-Fox | V | V | Tall Open Forest types; Subtropical Lowland Rainforest; Pastoral Woodland – Swamp Mahogany |
| *Saccolaimus flaviventris* | Yellow-bellied Sheathtail-bat | V | — | All |
| *Scoteanax rueppellii* | Greater Broad-nosed Bat | V | — | All |
| **Invertebrates** | | | | |
| *Phyllodes imperalis* (Southern subspecies) | A moth | E | E | Subtropical Lowland Rainforest |

E = Endangered, V = Vulnerable, M = Migratory
Those in **BOLD** were recorded on site during the current study


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# 4. Ecological Constraints

There are a large number of ecological constraints on the study area. These were koala habitat, corridors, EECs, wet areas, hollow bearing trees and high value vegetation.

The ecological constraints were identified following the field investigation and represent the significant environmental values that were identified in the study area. The locations of these constraints are each mapped separately in Appendix 2.

## 4.1 Approach to constraints assessment

The methodology used to identify and assess the constraints was as follows:

1. Field investigations (sections 2 & 3)
2. Identify ecological values (section 3)
3. List ecological constraints and planning requirements (this section)
4. Identify conservation planning principles (section 5)

Each ecological constraint is discussed separately in the sections following and each discussion describes the relevant ecological constraint in relation to the potential impacts from residential development and any planning requirements.

The section following (section 5) outlines planning principles for design that will address these constraints, achieve good environmental outcomes, reduce additional environmental impact assessment and achieve a strategic design that meets the objectives of the statutory components.

It should be noted that the constraints are focused predominately within the various remnant vegetation communities. If development within these areas is avoided and development close to these remnants is designed to be sensitive to the environmental values of the area, then potential environmental impacts to are expected to be minimised.

## 4.2 Koala Habitat

The study area contains vegetation mapped as Primary and Secondary Habitat and is part of a Regionally Significant Corridor under the Coffs Harbour Koala Plan of Management (NSW NPWS 1999). As described in the results section, 3 koalas were observed on or adjacent to the site and a number of scat trees were found on the site (Appendix 2 Figure 3). Appendix 2, Figure 3 also indicates those areas mapped as koala habitat. In total there is approximately 9ha of Primary koala habitat, 9.6ha of Secondary koala habitat and 1.3ha of additional koala habitat not mapped under the CHKPoM.

Objectives and controls for land identified as Primary, Secondary and Corridor Habitat are provided within the Coffs Harbour Koala Plan of Management (CHKPoM). These are outlined below in the context of this proposal.



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*4.2.1 Development on Primary Koala Habitat*

Objective: To prevent further clearing, disturbance, fragmentation or isolation of existing primary koala habitat, and where appropriate, restore habitat and encourage sympathetic management to ensure the maintenance of koalas.

Control: The consent authority shall not grant consent to the carrying out of development on areas identified as Primary Koala Habitat, whether zoned 7(A) or otherwise, which will remove the following tree species: tallowwood *Eucalyptus microcorys*, swamp mahogany *E. robusta*, broad-leaved paperbark *Melaleuca quinquenervia,* flooded gum *E. grandis*, Blackbutt *E. pilularis*, forest red gum *E. tereticornis*, small-fruited grey gum *E. propinqua*, or forest oak *Allocasuarina torulosa,* unless the development will not destroy, damage or compromise the values of the land as koala habitat. In assessing an application the consent authority shall take into consideration:

- that there should be zero net loss of Primary Koala Habitat;
- the threats to koalas which may result from the development;
- the likely impacts to adjacent or nearby Primary Koala Habitat and existing or potential koala movement corridors;
- all other options for preventing or ameliorating impacts from the development on koalas;
- • whether the land is accredited under the *Timber Plantation (Harvest Guarantee) Act1995*

*4.2.2 Development Adjacent to Primary Koala Habitat*

Objective: To minimise impacts on Primary Koala Habitat from development proposed on adjoining lands, particularly where such areas may contain scattered preferred koala trees, and to maintain opportunities for free movement of koalas between areas of habitat.

Control: Development on land adjoining Primary Koala Habitat shall not be carried out unless it can be demonstrated that:

- The proposal will not result in barriers to movement;
- boundary fencing does not prevent the free movement of koalas;
- lighting and koala exclusion fencing is provided where appropriate on roadways adjacent to koala habitat;
- tree species listed for Primary Habitat are retained where possible;
- new local roads are designed to reduce traffic speed to 40km/hr in potential koala "blackspots";
- preferred koala trees are used in landscaping where suitable;
- threats to koalas have been minimised (ie banning of dogs or confined to koala proof yards);
- fire protection zones, including fuel reduced zones and radiation zones, are provided outside the area of Primary Koala Habitat;



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*4.2.3 Development in Secondary Koala Habitat*

Objective: To minimise further loss, fragmentation or isolation of existing secondary koala habitat and the creation of barriers to koala movement and, where appropriate, to encourage restoration of koala habitat.

Control: The consent authority shall not grant consent to the carrying out of development on areas identified as Secondary Koala Habitat which will remove the following tree species: tallowwood *Eucalyptus microcorys,* swamp mahogany *E. robusta,* flooded gum *E. grandis* (except when part of a forest plantation), forest red gum *E. tereticornis*, or small-fruited grey gum *E. propinqua*, unless the development will not significantly destroy, damage or compromise the values of the land as koala habitat.

In assessing an application the consent authority shall take into consideration:

- that there will be minimal net loss of Secondary Koala Habitat;
- the level of significance to koalas of the trees proposed to be removed;
- the number of trees proposed to be removed in relationship to the extent and quality of adjacent or nearby Primary and/or Secondary Koala Habitat;
- the threats to koalas which may result from the development;
- all other options for protecting koala trees as listed above; and,
- the impacts to existing or potential koala movement corridors;
- whether the land is accredited under the *Timber Plantation (Harvest Guarantee) Act 1995*

The consent authority shall not grant consent to the carrying out of development in areas identified as Secondary Koala Habitat unless it is satisfied that:

1. The proposal will not result in significant barriers to koala movement;
2. boundary fencing does not prevent the free movement of koalas;
3. lighting and koala exclusion fencing is provided where appropriate on roadways adjacent to koala habitat;
4. tree species listed for Secondary Koala Habitat are retained, where possible;
5. new local roads are designed to reduce traffic speed to 40 kph in potential koala blackspots;
6. preferred koala trees are used in landscaping where suitable;
7. threats to koalas by dogs have been minimised ie. banning of dogs or confining of dogs to koala proof yards;
8. fire protection zones, including fuel reduced zones and radiation zones, are provided generally outside of Secondary Koala Habitat.

*4.2.4 Development in Regionally Significant Habitat Links*

Objective: To ensure that forested areas, whether continuous or not, which provide corridor links for movement of koalas between areas of identified koala habitat are recognised and protected, particularly where such areas are important to the



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functioning of amelioration measures for roads constructed and/or proposed by the RTA and Council.

Regionally significant links provide for wider dispersal from larger habitat areas and the opportunity for re-establishment of koalas in areas where local extinction may have occurred. The opportunity for immigration on a regional level also buffers against potential loss of genetic diversity. The study area is identified in the CHKPoM as part of a regionally significant link.

Control: The consent authority shall not grant consent to development in all areas which function as koala habitat link areas, unless it is satisfied that:

- the proposal will not reduce the effectiveness of the area in acting as a koala habitat link between areas of secondary and/or primary koala habitats;
- the significance of the area in contributing to the functioning of amelioration measures constructed and/or proposed by the RTA or Council for roadways has been considered; and,
- enhancement planting of preferred koala trees has been included in the proposal.

### 4.3 Connectivity

To achieve the goals of ecological sustainable development there is a need to plan for species and ecological processes, and in doing so incorporate a landscape focus. Linking large core areas, buffers and providing landscape connectivity are essential elements in the broader context of an integrated approach to regional conservation (Scotts 2003).

A number of habitat corridors have been identified on site and much of the western and northern portion of the study area is identified as *sub-regional habitat corridors* in Scotts (2003) (Appendix 2, Figure 4). Aims for sub-regional corridors are to promote multiple use, in cognisance of the conservation values to be maintained or enhanced (Scotts 2003).

The functionality of corridors depends on the species that will use them and their sensitivity to disturbance. In fragmented habitat one of the main disturbances is the impact of edge effects. Edge effects include impacts from weeds, domestic and feral animals, human disturbance and changed microclimates which can in turn alter vegetation composition. To combat these edge effects, corridors should be as wide as possible and include buffers and measures to minimise human disturbance.

The species of most concern within the study area (from Table 2) in regards to habitat connectivity are the koala, squirrel glider, yellow-bellied glider, long-nosed potoroo and various frog species. In managing corridors and connectivity for these species, functionality of these corridors for many other species will be met.



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### 4.4 Endangered Ecological Communities

The endangered ecological community *Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion* has been identified on site (Appendix 2, Figure 5). This community is listed as an EEC under the TSC Act and occupies approximately 8.5ha of the study area. Significant threats to this community include: clearing and fragmentation of habitat for development and agriculture, invasion of community by introduced weeds, particularly exotic vines and lantana, degradation of habitat by fire, degradation of habitat by grazing stock and dumping of rubbish within rainforest remnants.

Significant impacts to this EEC resulting from the exacerbation of these threats listed above will be likely to require the preparation of a Species Impact Statement. Exacerbation of threats may result from clearing for development or consequential impacts from development close to the EEC such as invasion of exotic plants, changes in water quality including both surface runoff and ground water and changes in fire regimes.

Along with the value of this community as an EEC, this lowland rainforest provides habitat for 2 threatened species listed on both the TSC Act and EPBC Act, rusty plum and slender marsdenia and has the potential to provide habitat for a further 18 threatened species listed under either the TSC Act or EPBC Act and 2 species listed as migratory under the EPBC Act that have the potential to occur on the site (Table 2).

### 4.5 Wet areas

The wet areas within the study area (Appendix 2, Figure 6), have been identified as having value for 5 threatened species identified in Table 2. Much of these areas are considered to be potential habitat for *Eleocharis tetraquetra*, large-footed myotis, green-thighed frog, stuttering frog and the giant barred frog which are listed as threatened species under the TSC Act and or the EPBC Act (Table 2), although formal surveys for these species have not been undertaken.

The constraints brought about by the wet areas on site include impacts to water quality and threatened species habitat. Threats to these species include modification and loss of habitat, impacts to water quality and predation of eggs and tadpoles by introduced fish species. These impacts would be increased by clearing, changes to the hydrological regime of the area and increased pollution from urban runoff. Development near theses areas should incorporate buffers, minimise access to these environments and be developed utilising water sensitive urban design.

### 4.6 Hollow bearing trees and stags

The site supports a very low density of hollow bearing trees within the forested communities. Stags are present throughout the forested areas on the site, many of



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which contain small hollows and some with larger hollows. These hollow bearing trees and stags provide roosting and den habitat for various threatened species such as the squirrel glider, yellow-bellied glider, owl species and the many bats predicted to occur on the site (Table 2). Impacts or removal of these hollow bearing trees and stags and the forest communities has the potential to impact on these threatened species and would require further impact assessment. Protection of these forested areas and mapped trees (Appendix 2, Figure 7) will be critical to reducing impact to these species.

### 4.7 Threatened Flora Species

Two threatened species were recorded in the study area during targeted surveys. These were the rusty plum and slender marsdenia (Figure 2) which are both listed on the TSC Act and the EPBC Act. Both of these species were recorded along track edges through the Lowland Rainforest community which provides significant habitat for these species. Significant threats to these species include; loss and fragmentation of habitat through land clearing for agriculture and urban development; invasion of habitat by introduced weeds; grazing and trampling of plants by cattle.

Exacerbation of threats may result from clearing tracks within their habitat which cattle can access, clearing for development or consequential impacts from development close to their habitat such as invasion of exotic plants and changes in water quality including both surface runoff and ground water. Any significant increases in these threats may require the preparation of a SIS. Impacts to these species and their habitat can be minimised through avoidance of any impacts to the lowland rainforest and tall open forest (Type 1) communities.

### 4.8 Coffs Harbour Council Vegetation Conservation DCP

The study site falls under Council's draft Vegetation Strategy (CHVS) and Vegetation Conservation Development Control Plan (VCDCP). The draft Coffs Harbour VCDCP (CHCC 2003) has mapped vegetation value where this DCP applies using a "12 point test" to assess the conservation value of a site's vegetation. The majority of the vegetation on the site falls under two categories, 'very high value vegetation' and 'high value vegetation'. Vegetation on the site is summarised in the table below and in Figure 8.

| DCP Vegetation Category | Vegetation on site |
|---|---|
| Very High Value | Primary koala habitat, Lowland Rainforest EEC |
| High Value | Secondary koala habitat and all other intact forest |
| Low | Regrowth and disturbed vegetation |

There is some displacement error within the Council vegetation value maps and in such cases where vegetation value is unclear due to mapping limitations, application of the 12 point test has been used to assess vegetation value.



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The DCP recommends that subdivision layout should be set out to avoid the need to remove any very high or high value vegetation for the purposes of APZs or building envelopes. Although, within all the vegetation categories, the limitation to management actions is that developments need to be subject to community based social and economic sustainability considerations. Furthermore, in the event that a triple bottom line assessment leads to the loss of vegetation, compensatory planting and protection will be required at the following rates (referring to area):

- Very High Value Vegetation: 5 to 1
- High Value Vegetation: 4 to 1
- Low Value Vegetation: 1 to 1

#### *4.8.1 Management Actions*

*Very High Value Vegetation*

Objective: To prevent further clearing, disturbance, fragmentation or isolation of very high value vegetation, and where appropriate recreate vegetation connections between areas of very high value vegetation.

Management actions:

- vegetation removal within areas of very high value vegetation for the purpose of establishing a timber plantation is prohibited;
- funding of conservation measures are to give first priority to securing the long-term conservation of very high value vegetation;
- the number of land parcels over which very high value vegetation is spread should be minimised through consolidation of lots;
- applications for vegetation removal within areas of very high value vegetation shall be accompanied by a detailed assessment of the impact of the removal, taking into account the local and regional implications and the possible cumulative impacts of the removal;
- applications for vegetation removal within areas of very high value vegetation are to be referred to NPWS and DIPNR for advice, to assist Council's assessment of the application;
- consultation with DIPNR is required in respect to land identified as protected land (riparian or steep);
- development of land is to be designed to avoid the loss of very high value vegetation and the land containing the very high value vegetation be considered for public ownership or conservation management through VCAs or registered property agreements; and
- development includes any area required for the provision of asset protection zones for bushfire hazard management.

*High Value Vegetation*

Objective: To minimise, or where possible, prevent further clearing, disturbance, fragmentation or isolation of high value vegetation, and where appropriate, recreate vegetation connections between areas of high value vegetation and between high and highest value vegetation.

Management actions:

- vegetation removal within areas of high value vegetation for the purpose of establishing a timber plantation is prohibited;



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- funding of conservation measures are to give second priority to securing the longterm conservation of high value vegetation;
- the number of land parcels over which high value vegetation is spread should be minimised through consolidation of lots where possible;
- applications for vegetation removal within areas of high value vegetation shall be accompanied by a detailed assessment of the impact of the removal, taking into account the local and regional implications and the possible cumulative impacts of the removal;
- applications for vegetation removal within areas of high value vegetation are to be referred to NPWS and DIPNR for advice, to assist Council's assessment of the application; and
- development of land should be designed to avoid the loss of high value vegetation and the land containing the high value vegetation be considered for public ownership or conservation management through VCAs, registered property agreements or community titles subdivision.

*Low Value Vegetation*
Objective: To limit, where possible, further clearing, disturbance, fragmentation or isolation of low value vegetation.

Management actions:
- clearing of other vegetation for the purpose of establishing a timber plantation requires consent;
- funding of conservation measures are to give fourth priority to securing the long-term conservation of other vegetation;
- the number of land parcels over which other vegetation is spread may be minimised through consolidation of lots where possible if appropriate;
- applications for vegetation removal within areas of low value vegetation shall be accompanied by an assessment under Section 5A of the Environmental Planning and Assessment Act to determine if the development is likely to cause a significant effect on threatened species, populations or ecological communities, or their habitats; and
- development design, where possible, should seek to limit the loss of low value vegetation.

### 4.9 Tree Preservation Order

No trees are to be removed without development consent on residential lots zoned 2A that are greater than 2000m$^2$ and on all land zoned 7A. The overarching objective is to retain as many trees as possible.


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# 5. Environmental Planning Recommendations

This study has identified a number of constraints to development across much of the study area, predominately within the various forest and remnant vegetation communities. Conversely, few constraints to development have been identified within the cleared and disturbed areas. Appendix 2, Figure 9 identifies all the areas that are environmentally constrained. Many of the constraints have similar planning principles for design that will achieve good environmental outcomes, reduce additional environmental impact assessment and achieve a strategic design that meets the objectives of all the statutory components.

The following recommendations (see Table 3) were proposed to address the various environmental constraints on site (eg koala habitat, corridors, EECs, threatened species and hollow bearing trees and stags). They also support the objectives of SEPP 71, Coffs Harbour Koala PoM and the Coffs Harbour Vegetation Conservation DCP.

**Table 3: Planning recommendations to address environmental constraints**

| Planning Recommendations | Relevant Ecological Constraint |
|---|---|
| 1. Development lots including, roads and infrastructure are to be excluded from Primary and Secondary Koala habitat, identified corridors and remnant vegetation including where isolated clumps of trees occur. | Koala habitat, corridors, EEC, wet areas, tree preservation order, general threatened species management, Vegetation Conservation DCP. |
| 2. APZ requirements should be located outside of remnant vegetation. | Koala, corridors, EECs, wet areas, hollow bearing trees, general threatened species management, Vegetation Conservation DCP |
| 3. Zero net loss of Primary Koala Habitat and minimise net loss of Secondary Koala Habitat. Retain primary browse species. | Koala habitat, tree preservation order, Vegetation Conservation DCP |
| 4. Road footprints are to be minimised and narrowed to reduce speed. | Koala habitat |
| 5. Koala proof fenced yards and fenced yards on subdivision lots are not to contain primary koala browse trees. | Koala habitat |
| 6. Pet and dog protocol: - dogs are to be kept on leashes and in control when walked outside of yards;<br>- cats are not to be allowed outside of yards, unless controlled.<br>- All pets are to be registered with Council<br>-Signage and educational programs informing residence are advised. | Koala habitat, general threatened species management |
| 7. Roads that intersect corridors, secondary and primary habitat are to be minimised. Traffic calming measures, such as speed humps, chicanes, road narrowing, downward facing lighting and signage should be implemented. Traffic speed is to be reduced to 40km/hr in these areas. Visibility of potential koala movement at these intersections is to be maximised (ie reduce blind spots). | Koala habitat, corridors, general threatened species management |
| 8. Where roads intersect corridors and secondary and primary koala habitat, koala proof fencing is to be used parallel to the road to guide koalas to the managed | Koala habitat, corridors |



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| | |
|---|---|
| corridor crossing point, as per Coffs Harbour KPoM - Management Strategies for Koala Road Risk (Part A p22 – 29) | |
| 9. Development lots and lot boundary fences are not to obstruct free koala movement. | Koala habitat |
| 10. Preferred koala feed trees are used in landscape plantings where suitable. However, plantings are to be strategically positioned in areas outside of fenced yards, and not in areas that would direct koalas into areas of high risk (ie such as busy roads). | Koala habitat |
| 11. The effectiveness of corridors and koala habitat links is to be improved through strategic plantings. | Koala habitat, corridors |
| 12. Strategic tree planting is to use the Coffs Harbour KPoM - Guidelines For Planting Koala Trees In Coffs Harbour LGA (Part A p19). | Koala habitat, tree preservation order |
| 13. Sufficient road underpasses (ie box culverts) are to be provided where roads intersect drainage lines to allow for safe of movement amphibians, reptiles and small mammals. | Corridors, wet areas, general threatened species management |
| 14. Adequate buffers for drainage lines, wetland soaks, Lowland Rainforest EEC and corridors are to be implemented. | Corridors, general threatened species management |
| 15. Development is to be excluded from the Lowland Rainforest EEC. Bush regeneration measures are to be implemented to regenerate areas that have been cleared (ie tracks) or disturbed and access is to be minimised to areas of Lowland Rainforest. | EEC, general threatened species management tree preservation order, hollow bearing trees, Vegetation Conservation DCP |
| 16. Avoid development within and minimise access to wet areas and wetland soaks. | Wet areas |
| 17. Incorporated water sensitive urban design to manage stormwater and impacts to water quality. | Wet areas, Coffs Harbour Settlement Strategy, EEC, general threatened species management |
| 18. Strict enforcement of sediment erosion measures at subdivision & allotment levels. | Wet areas, Coffs Harbour Settlement Strategy |
| 19. All hollow bearing trees are to be retained including a suitable buffer around these trees so that post-development hollow bearing tree removal (ie due to safety hazards) is not required. | Hollow bearing trees, general threatened species management |
| 20. Any vegetation removed should be offset by compensatory planting or protection according to Vegetation Conservation DCP ratio (see section 4.8) | Vegetation Conservation DCP |



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# 6. Impact Assessment

The proposed layout for the Lakes Estate subdivision (Figure 10, Appendix 2) was prepared so as to respond to the identified on-site constraints, and to reflect the planning recommendations outlined above.

Following the finalisation of the subdivision layout, the list of threatened and migratory species with potential to be impacted by the proposal was refined. Ann assessment of potential impact was then prepared for these species and communities (Appendix 3).

A number of species that were either observed or predicted within the study area are not expected to occur within the subject site (ie the area proposed to be directly affected by the proposal). Consequently, these species are not included within the impact assessment of the subdivision. These are listed below.

Species from Table 2 that are expected to occur only within the large remnant area of subtropical lowland rainforest that is to be retained as part of the proposal and are not part of the impact assessment include:

- Rusty Plum (*Amorphospermum whitei*)
- Slender Screw Fern (*Lindsaea incias*)
- Slender Marsdenia (*Marsdenia longiloba*)
- *Parsonsia dorrigoensis*
- Swamp Orchid (*Phaius australis*)
- Rainforest Cassia (*Senna acclinis*)
- Cryptic Forest Twiner (*Tylophora woollsii*)
- Stuttering Frog (*Mixophyes balbus*)
- Giant Barred Frog (*Mixophyes iteratus*)
- Barred Cuckoo-shrike (*Caracina lineata*)
- Coxen's Double-eyed Fig-parrot (*Cyclopsitta diophthalma coxeni*)
- Wompoo Fruit-dove (*Ptilinopus magnificus*)
- Rose-crowned Fruit-dove (*Ptilinopus regina*)
- Sooty Owl (*Tyto tenebricosa*)
- Black-faced Monach (*Monarcha melanopsis*)
- Rufous Fantail (*Rhipidura rufifrons*)
- Long-nosed Potoroo (*Potorous tridactylus*)
- Large-eared Pied Bat (*Chalinolobus dwyeri*)
- Golden-tipped Bat (*Kerivoula papuensis*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- *Phyllodes imperalis* (a moth)



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Species from Table 2 that are expected to occur only within the wet areas that are to be avoided as part of the proposal and are not part of the impact assessment include the:

- Square-stemmed Spike Rush (*Eleocharis tetraquetra*)
- Cattle Egret (*Ardea ibis*)
- Large-footed Myotis (*Myotis adversus*)

Highly mobile species from Table 2 that are expected to occur only within the tall open forest areas that are to be retained as part of the proposal and are not part of the impact assessment include the:

- Glossy Black-cockatoo (*Calyptorhynchus lathami*)
- Powerful Owl (*Ninox strenua*)
- Masked Owl (*Tyto novaehollandiae*)

The remaining vegetation community and species from Table 2 are part of the impact assessment provided in Appendix 3 as they have the potential to be impacted by the proposal. They are:

- Lowland Rainforest in NSW North Coast and Sydney Basin Bioregion
- Hairy Joint Grass (*Arthraxon hispidus*)
- Green-thighed Frog (*Litoria brevipalmata*)
- Square-tailed Kite (*Lophoictinia isura*)
- White-throated Needletail (*Hirundapus caudacutus*)
- Rainbow Bee-eater (*Merops ornatus*)
- Spotted-tail Quoll (*Dasyurus maculata*)
- Yellow-bellied Glider (*Petaurus australis*)
- Squirrel Glider (*Petaurus norfolcensis*)
- Koala (*Phascolarctos cinereus*)
- Hoary Bat (*Chalinolobus nigrogriseus*)
- Little Bent-wing Bat (*Miniopterus australis*)
- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*)
- East Coast Freetail Bat (*Mormopterus norfolkensis*)
- Yellow-bellied Sheathtail-bat (*Saccolaimu flaviventris*)

The current subdivision plan avoids the majority of the forest communities within the study area with impacts being focused towards the cleared and disturbed parts of the site. Consequently, the majority of species are expected to face only minimal potential impacts.

To mitigate potential impacts to the species likely to occur on the site, a number of recommendations have been provided (refer Section 7).



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Recommendations include the use of water sensitive urban design, design elements that achieve koala sensitive development solutions and the incorporation of revegetation and rehabilitation of strategic areas.

If these recommendations are adopted then, it is considered unlikely that that the proposal will have significant impacts on any of the species assessed. Similarly, threatened and migratory species listed on the EPBC Act are not considered to be impacted and referral under the EPBC Act is not recommended.



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# 7. Recommendations

This section of the report provides recommendations in relation to the final proposed layout of the Lakes Estate subdivision (Figure 10, Appendix 2). These reflect the need of the proposal to address identified on-site constraints, and to adopt the planning recommendations outlined for the site above.

In general, the final subdivision plan takes into consideration the planning recommendations made in the sections above.

Some discrepancies do exist, nevertheless, and these are identified in Figure 10, Appendix 2.

The recommendations provided below, are in addition to the planning recommendations outlined in section 5, and are provided to mitigate further any potential impacts from the proposal

**R1.** The loss of primary koala habitat at location `1' (Figure 10, Appendix 2) can be offset in line with the CHKPoM, and the vegetation DCP, through the planting of primary koala feed trees (see pg 23 and guidelines in CHKPoM). This should be targeted to provide support for existing koala habitat on the site in line with planning principle 12 (section 5) and at ratios outlined in section 4.8.

**R2.** The loss of primary koala habitat at location `4' (Figure 10, Appendix 2) can be reduced through the strategic location of building envelopes to avoid removal of primary koala browse trees (pg 23 and CHKPoM) within lots 143, 144, 153 – 156. These lots will require the application of planning recommendations 3, 5, 6 and 9 (section 5).

**R3.** In location `3' the inclusion of narrowed road widths with traffic calming measures and guiding fences are required in line with planning recommendations 4, 7 and 8 (section 5).

**R4.** Compensatory planting for the loss of very high value and high value vegetation will need to be undertaken in line with the ratios provided within the Coffs Harbour Vegetation Conservation DCP. These are reproduced in section 4.8 of this report. It is recommended that these plantings be undertaken in conjunction with the plantings required to compensate for the removal of koala habitat. They should also be targeted to rehabilitate the degraded tracks within the retained area of EEC.

**R5.** Water sensitive urban design systems should be used in all areas where there is potential for urban run-off into bushland.



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# 8. Conclusion

Seven vegetation communities were identified and mapped within the study area. These include Tall Open Forest Type 1 – Flooded Gum – Tallowwood; Tall Open Forest Type 2 – Blackbutt – Tallowwood – Broad-leaved White Mahogany; Subtropical Lowland Rainforest (EEC); Pasture; Pastoral woodland – Swamp Mahogany; Disturbed or Regenerating; Wet Areas.

A total of 42 listed species were identified as potentially occurring on the site. Of these 5 are listed as vulnerable, 7 endangered and 5 migratory under the EPBC Act. During surveys 2 threatened species, the rusty plum (endangered under EPBC Act) and slender marsdenia (vulnerable under EPBC Act) and rainbow bee-eater (migratory under EPBC Act) were recorded. Of the total 42 species, 27 are listed as vulnerable, 10 listed as endangered and 1 listed EEC under the TSC Act. During surveys 3 threatened species, koala (vulnerable under TSC Act), rusty plum (vulnerable under TSC Act) and slender marsdenia (endangered under TSC Act) and Lowland Rainforest (EEC under TSC Act) were recorded.

A large number of constraints were identified over much of the study area, predominately within the various forest and remnant vegetation communities. These included koala habitat, corridors, EECs, threatened species, hollow bearing trees and stags and numerous statutory requirements.

Conversely, there few constraints to development were identified within the cleared and disturbed areas. A number of environmental planning recommendations have been made that will deliver positive environmental outcomes, mitigate environmental impacts, and deliver a plan for the site that addresses all statutory requirements.

The current subdivision plan avoids the majority of the forest communities within the study area, with any impacts being focused towards the cleared and disturbed parts of the site. As a result potential impacts from the proposal are considered to be minor and insignificant.

To mitigate potential impacts a number of recommendations have been provided. Recommendations include the use of water sensitive urban design, design elements that achieve koala sensitive development solutions and the incorporation of revegetation and rehabilitation actions within strategically important areas.

If these recommendations are adopted then it is considered unlikely that that the proposal will have any significant impacts on species and vegetation communities assessed.



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# 9. References

Coffs Harbour City Council (2007) Our Living City: A Settlement Strategy for Coffs City to 2031.

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# Appendix 1 – Likelihood Table

**Summary of initial assessment to determine the likelihood of occurrence of threatened species, populations and ecological communities in the proposal site.**

An assessment of likelihood of occurrence was made for threatened and migratory species identified from the database search. Five terms for the likelihood of occurrence of species are used in this report. This assessment was based on database or other records, presence or absence of suitable habitat, features of the proposal site, results of the field survey and professional judgement. The terms for likelihood of occurrence are defined below:

- "yes" = the species was or has been observed on the site
- "likely" = a medium to high probability that a species uses the site
- "potential" = suitable habitat for a species occurs on the site, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur
- "unlikely" = a very low to low probability that a species uses the site
- "no" = habitat on site and in the vicinity is unsuitable for the species.

**FAUNA**

**Table : Assessment of Likelihood of Occurrence of Threatened Fauna Species**

| Scientific Name | Common Name | Conservation Significance | | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| | | TSC Act | EPBC Act | | |
| **FROGS** | | | | | |
| *Crinia tinnula* | Wallum Froglet | V | — | Wallum swamps and associated low land meandering watercourses on coastal plains (Ehmann 1997). Occurs in elevations up to around 50m and is closely related to freshwater habitats in the coastal zone (DECC 2007). Found most commonly in wallum wetlands characterised by low nutrients, highly acidic, tanin-stained waters that are typically dominated by paperbarks and tea-trees. Also found in sedgeland and wet heathland (DECC 2007) | **No**. no suitable habitat. |



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| Table : Assessment of Likelihood of Occurrence of Threatened Fauna Species | | | | | |
|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **Conservation Significance** | | **Habitat Associations** | **Likelihood of Occurrence** |
| | | **TSC Act** | **EPBC Act** | | |
| *Litoria aurea* | Green and Golden Bell Frog | E | V | This species has been observed utilising a variety of natural and man-made waterbodies (Pyke & White 1996) such as coastal swamps, marshes, dune swales, lagoons, lakes, other estuary wetlands, riverine floodplain wetlands and billabongs, stormwater detention basins, farm dams, bunded areas, drains, ditches and any other structure capable of storing water (DECC 2007). Fast flowing streams are not utilised for breeding purposes by this species (Mahony 1999). Preferable habitat for this species includes attributes such as shallow, still or slow flowing, permanent and/or widely fluctuating water bodies that are unpolluted and without heavy shading (DECC 2007). Large permanent swamps and ponds exhibiting well-established fringing vegetation (especially bulrushes–Typha sp. and spikerushes–Eleocharis sp.) adjacent to open grassland areas for foraging are preferable (Ehmann 1997; Robinson 1993). Ponds that are typically inhabited tend to be free from predatory fish such as Mosquito Fish (Gambusia holbrooki) (DECC 2007). | **No**. Paucity of local records and no suitable habitat. |



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| Table : Assessment of Likelihood of Occurrence of Threatened Fauna Species | | | | | |
|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **Conservation Significance** | | **Habitat Associations** | **Likelihood of Occurrence** |
| | | **TSC Act** | **EPBC Act** | | |
| *Litoria brevipalmata* | Green Thighed Frog | V | — | Wet sclerophyll forest along the northern coast of NSW to Ourimbah (Anstis 2002). Also in a variety of habitats including dry to wet sclerophyll forest, rainforests and shrubland with a healthy understorey (DECC 2007).). Breeding aggregations occur in still water habitats such as grassy temporary to semi-permanent ponds and flooded ditches in late spring and summer (Cogger 2000; Anstis 2002; DECC 2007). | **Potential in subject site**. The Lowland Rainforest offers some habitat potential for this species, though habitat fragmentation and adjoining historic landuse presents some limitation. |
| *Mixophyes balbus* | Stuttering Frog | E | V | A variety of forest habitats from rainforest through wet and moist sclerophyll forest to riparian habitat in dry sclerophyll forest (DECC 2007).) that are generally characterised by deep leaf litter or thick cover from understorey vegetation (Ehmann 1997). Breeding habitats are streams and occasionally springs. Not known from streams disturbed by humans (Ehmann 1997) or still water environments (DECC 2007).. | **Potential in study area but not subject site**. The Lowland Rainforest offers some habitat potential for this species, though habitat fragmentation and adjoining historic landuse presents some limitation. |
| *Mixophyes iteratus* | Giant Barred Frog | E | E | Found on forested slopes of the escarpment and adjacent ranges in riparian vegetation, subtropical and dry rainforest, wet sclerophyll forests and swamp sclerophyll forest (DECC 2007; Ehmann 1997). This species is associated with flowing streams with high water quality, though habitats may contain weed species (Ehmann 1997). This species is not known from riparian vegetation disturbed by humans (DECC 2007). During breeding eggs are kicked up onto an overhanging bank or the streams edge (DECC 2007). | **Potential in study area but not subject site**. The Lowland Rainforest offers some habitat potential for this species, though habitat fragmentation and adjoining historic landuse presents some limitation. |
| **REPTILES** | | | | | |



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| Table : Assessment of Likelihood of Occurrence of Threatened Fauna Species | | | | | |
|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **Conservation Significance** | | **Habitat Associations** | **Likelihood of Occurrence** |
| | | **TSC Act** | **EPBC Act** | | |
| *Emydura signata*<br>*Emydura macquarii* | Bellinger River Emydura | –<br>V | V<br>– | The Bellinger River Emydura is restricted to the upper Bellinger River above Thora. It prefers long, deep pools in broad reaches of the upper Bellinger River. | **No**. site is outside of the known range of the species. |
| *Hoplocephalus stephensii* | Stephen's Banded Snake | V | — | Found in a variety of habitats from rainforest through wet and moist sclerophyll forests to dry sclerophyll forests (DECC 2007). However it is most commonly found in wet to moist forests with rocky outcrops, cliffs or ridges and tends to favour ecotones between wet and dry forests (DECC 2007). It most frequestly uses gaps in the peeling bark of large senecsent or dead trees for daytime shelter (DECC 2007). However it can use hollow trunks, limbs, epiphytes, vine thickets, rock crevices or rock slabs (DECC 2007).. | **Potential in study area but not subject site**. The Lowland Rainforest offers some habitat potential for this species, though habitat fragmentation and adjoining historic landuse presents some limitation. |
| **DIURNAL BIRDS** | | | | | |
| *Calyptorhynchus lathami* | Glossy Black-Cockatoo | V | — | Associated with a variety of forest types containing Allocasuarina species, usually reflecting the poor nutrient status of underlying soils (Environment Australia 2000; DECC 2007). Intact drier forest types with less rugged landscapes are preferred (DECC 2007). Nests in large trees with large hollows (Environment Australia 2000). | **Potential in study area but not subject site**. Forage habitat is available and records nearby. No evidence of foraging was observed. |
| *Coracina lineata* | Barred Cuckoo-shrike | V | — | It is associated with subtropical, dry and littorial rainforests and is restricted to below 500m elevation (DECC 2007). | **Potential in study area but not subject site**. The Lowland Rainforest offers some habitat potential for this species. |



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| Table : Assessment of Likelihood of Occurrence of Threatened Fauna Species | | | | | |
|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **Conservation Significance** | | **Habitat Associations** | **Likelihood of Occurrence** |
| | | **TSC Act** | **EPBC Act** | | |
| *Cyclopsitta diophthalma coxeni* | Coxen's Double-eyed Fig-Parrot | E | E | Associated with upland (to 1200masl) to lowland rainforests, tropical semi-deciduous vine thickets and gallery forests, usually containing fig trees (Marchant & Higgins 1993). Probably prefer subtropical lowland rainforest (Holmes 1994). Usually in large tracks of forests, particularly near edges, rarely in partly cleared or fragmented rainforest (Marchant & Higgins 1993). | **Potential in study area but not subject site**. The Lowland Rainforest offers some habitat potential for this species. |
| *Ephippiorhynchus asiaticus* | Black-necked Stork | E | — | Associated with tropical and warm temperate terrestrial wetlands, estuarine and littoral habitats, and occasionally woodlands and grasslands floodplains (Marchant & Higgins 1993). Forages in fresh or saline waters up to 0.5m deep, mainly in open fresh waters, extensive sheets of shallow water over grasslands or sedgeland, mangroves, mudflats, shallow swamps with short emergent vegetation and permanent billabongs and pools on floodplains (Marchant & Higgins 1993; DECC 2007). | **Potential in study area but not subject site**. The dams and wetland soak offers some suitable forage habitat during the transient lifecycle of the species. |
| *Esacus neglectus* | Beach Stone-curlew | E | — | Beaches, mudflats, reefs and especially islands (Blakers et al. 1984). Open undisturbed beaches, islands, reefs, intertidal sand and mudflats, preferably with estuaries or mangroves nearby (DECC 2007). | **No**. No suitable habitat |
| *Grantiella picta* | Painted Honeyeater | V | — | A nomadic species that typically inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests with abundant mistletoe (DEC 2007). It is a specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias, preferring *Amyema* sp mistletoe (DEC 2007). | **No**. No suitable habitat |



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| | | **TSC Act** | **EPBC Act** | | |
| *Ixobrychus flavicollis* | Black Bittern | V | — | Occurs in both terrestrial and estuarine wetlands generally in areas of permanent water and dense vegetation (NPWS 1999g). In areas with permanent water it may occur in flooded grassland, forest, woodland, rainforest and mangroves (DECC 2007). | **No**. No suitable habitat |
| *Lathamus discolor* | Swift Parrot | E | E | Breeds in Tasmania between September and January. Migrates to mainland in autumn, where it forages on profuse flowering Eucalypts (Blakers et al. 1984; Schodde and Tidemann 1986; Forshaw and Cooper 1981). Hence, in this region, autumn and winter flowering eucalypts are important for this species. Favoured feed trees include winter flowering species such as Swamp Mahogany (Eucalyptus robusta), Spotted Gum (Corymbia maculata), Red Bloodwood (C. gummifera), Mugga Ironbark (E. sideroxylon), and White Box (E. albens) (DECC 2007). | **Unlikely**. Very limited favoured winter season flowering eucalypts and few local records. |
| *Lophoictinia isura* | Square-tailed Kite | V | — | In coastal areas associated tropical and temperate forests and woodlands on fertile soils with an abundance of passerine birds (Marchant & Higgins 1993, DECC 2007). May be recorded inland along timbered watercourses (NPWS 1999h). In NSW it is commonly associated with ridge or gully forests dominated by Woollybutt (Eucalyptus logifloria), Spotted Gum (E. maculata), or Peppermint Gum (E. elata, E. smithii) (DECC 2007). | **Likely across study area including subject site**. Recorded near Sawtell and given the large home range of the species, the site is considered to offer a portion of the species forage habitat. |



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| *Pandion haliaetus* | Osprey | V | — | Associated with waterbodies including coastal waters, inlets, lakes, estuaries, beaches, offshore islands and sometimes along inland rivers (Schodde and Tidemann 1986; Clancy 1991; Olsen 1995). Osprey may nest on the ground, on sea cliffs or in trees (Olsen 1995). Osprey generally prefer emergent trees, often dead or partly dead with a broken off crown (Olsen 1995). | **Unlikely**. No suitable forage habitat. |
| *Ptilinopus magnificus* | Wompoo Fruit-Dove | V | — | Associated with large, undisturbed patches of tall tropical or subtropical rainforest, at all altitudes, preferrably with a diversity of fruit (Marchant and Higgins 1999; DECC 2007). Occasionally located in patches of monsoon rainforest, closed gallery forest, wet sclerophyll forest, tall open forest, open woodland or vine thickets near rainforest (Marchant and Higgins 1999; DECC 2007). | **Potential in study area but not subject site**. Lowland Rainforest offers suitable rainforest fruiting trees, shrubs and vines and records nearby. |
| *Ptilinopus regina* | Rose-crowned Fruit-Dove | V | — | Tall tropical and subtropical, evergreen or semi-deciduous rainforests, especially with a dense growth of vines trees (Marchant and Higgins 1999). Also located in closed wet sclerophyll forest, gallery forests or sclerophyll woodlands with abundant fruiting trees, near or next to rainforest (DECC 2007). Is thought to prefer large areas of vegetation, but has been located in patches and occasionally in parks and gardens with fruiting trees (Marchant and Higgins 1999). | **Potential in study area but not subject site**. Lowland Rainforest offers suitable rainforest fruiting trees, shrubs and vines and records nearby. |



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| *Rostratula benghalensis australis* | Painted Snipe (Australian subspecies) | E | E | Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber (DECC 2007). Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds (*ibid.*). Breeding is often in response to local conditions; generally occurs from September to December (DEC 2007). Roosts during the day in dense vegetation (NSW Scientific Committee 2004a). Forages nocturnally on mud-flats and in shallow water (DECC 2007). Feeds on worms, molluscs, insects and some plant-matter (*ibid.*). | **No**. no habitat |
| *Todiramphus chloris* | Collared Kingfisher | V | — | In NSW it is most commonly observed in the Tweed River estuary, where it breeds (DECC, 2007). It appears to be an irregular visitor further south (DECC, 2007). Collared Kingfishers are virtually restricted to mangroves and other estuarine habitats and mainly occur about the mouths of the larger coastal rivers (DECC, 2007). Nests are usually in a hollow in a mangrove tree or drilled into termite nests in a large eucalypt or paperbark adjacent to mangroves (DECC, 2007). | **No**. no habitat |



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| *Turnix melanogaster* | Black-breasted Button-quail | E | V | Dry rainforests, vine scrub or lantana thickets (Marchant & Higgins 1993). In NSW the species inhabits dry or subtropical forests which contain Brigalow, Belah, Bottletrees, Hoop Pine, Lantana, Ironbark, Wattle, Spotted Gum, Wallaby Grass or Rhodes Grass (Bennett 1985; Hughes & Hughes 1991). Observations in Lantana thickets and hoop pine plantations indicate this species may be able to utilise human modified (Blakers et al. 1984). | **Unlikely**. Not preferred habitat |
| *Xanthomyza phrygia* | Regent Honeyeater | E | E, M | Associated with temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts, and riparian forests of River Oak (Casuarina cunninghamiana) (Garnett 1993). Areas containing Swamp Mahogany (Eucalyptus robusta) in coastal areas have been observed to be utilised (DECC 2007). The Regent Honeyeater primarily feeds on nectar from box and ironbark eucalypts and occasionally from banksias and mistletoes (DECC 2007). As such it is reliant on locally abundant nectar sources with different flowering times to provide reliable supply of nectar (Environment Australia 2000). | **Unlikely**. Very limited favoured winter season flowering eucalypts and few local records. |



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| | | **TSC Act** | **EPBC Act** | | |
| **NOCTURNAL BIRDS** | | | | | |
| *Ninox connivens* | Barking Owl | V | — | Associated with a variety of habitats such as savanna woodland, open eucalypt forests, wetland and riverine forest. The habitat is typically dominated by Eucalypts (often Redgum species), however often dominated by Melaleuca species in the tropics (DECC 2007). It usually roosts in dense foliage in large trees such as River She-oak (Allocasuarina cunninghamiana), other Casuarina and Allocasuarina, eucalypts, Angophora, Acacia and rainforest species from streamside gallery forests (DECC 2007). It usually nests near watercourses or wetlands (DECC 2007).in large tree hollows with entrances averaging 2-29 metres above ground, depending on the forest or woodland structure and the canopy height (Debus 1997). | **Unlikely**. No local records. |
| *Ninox strenua* | Powerful Owl | V | — | Powerful Owls are associated with a wide range of wet and dry forest types with a high density of prey, such as arboreal mammals, large birds and flying foxes (Environment Australia 2000, Debus & Chafer 1994). Large trees with hollows at least 0.5m deep are required for shelter and breeding (Environment Australia 2000). | **Likely in study area but not subject site**. Potential habitat and records nearby. |



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| | | **TSC Act** | **EPBC Act** | | |
| *Tyto capensis* | Grass Owl | V | — | Reported habitats include tall grass, swampy, sometimes tidal areas, mangrove fringes, grassy plains, coastal heaths, grassy woodland, cane grass, lignum, sedges, cumbungi, cane fields and grain stubble (Pizzey and Knight, 1997). The Grass Owl nests on the ground within dense tall grass, sedges, reeds and even sugarcane plantations (Pizzey and Knight, 1997). The Grass Owl primarily feeds on rodents, hunting on the wing over heathland, grassland and sedgeland, as well as along the edge of sugar cane, crops and pastureland (Pizzey and Knight, 1997). | **Unlikely**. No suitable habitat. |
| *Tyto novaehollandiae* | Masked Owl | V | — | Associated with forest with sparse, open, understorey, typically dry sclerophyll forest and woodland (DECC 2007) and especially the ecotone between wet and dry forest, and non forest habitat (Environment Australia 2000). Known to utilise forest margins and isolated stands of trees within agricultural land (Hyem 1979) and heavily disturbed forest where its prey of small and medium sized mammals can be readily obtained (Kavanagh & Peake 1993). | **Likely in study area but not subject site**. Potential habitat and records nearby. |



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| *Tyto tenebricosa* | Sooty Owl | V | — | Sooty Owls are associated with tall wet old growth forest on fertile soil with a dense understorey and emergent tall Eucalyptus species (Environment Australia 2000, Debus 1994). Pairs roost in the daytime amongst dense vegetation, in tree hollows and sometimes in caves. The Sooty Owl is typically associated with an abundant and diverse supply of prey items and a selection of large tree hollows (Debus 1994, Garnett 1993, Hyem 1979). | **Likely in study area but not subject site**. Potential habitat and records nearby. |
| **MAMMALS** (EXCLUDING BATS) | | | | | |
| *Aepyprymnus rufescens* | Rufous Bettong | V | — | Prefer forests with a grassy to sparse understorey including coastal forest, tall wet sclerophyll forest and dry forests west of GDR (DECC 2007). It is most commonly found on sites derived from sedimentary rock and in north eastern NSW in forests characterised by Spotted Gum (Corymbia maculata and C. henryi) (DECC 2007). It has been known to feed on introduced pasture species (DECC 2007). | **Unlikely**. Few local records and suitable habitat is fragmented. |



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| *Dasyurus maculatus*<br><br>*Dasyurus maculatus maculatus* | Spotted-tailed Quoll<br><br>Spotted-tailed Quoll (SE Mainland Population) | V<br><br>— | —<br><br>E | The Spotted-tailed Quoll inhabits a range of forest communities including wet and dry sclerophyll forests, coastal heathlands and rainforests (Mansergh 1984; DECC 2007), more frequently recorded near the ecotones of closed and open forest. This species requires habitat features such as maternal den sites, an abundance of food (birds and small mammals) and large areas of relatively intact vegetation to forage in (DECC 2007). Maternal den sites are logs with cryptic entrances; rock outcrops; windrows; burrows (Environment Australia 2000). | **Likely across study area including subject site**. Several records occur in the area and suitable forage and possibly den habitat within the Lowland Rainforest is available. |
| *Petaurus australis* | Yellow-bellied Glider | V | — | This species is restricted to tall mature forests, preferring productive tall open sclerophyll forests with a mosaic of tree species including some that flower in winter (Environment Australia 2000, Braithwaite 1984, Davey 1984, Kavanagh 1984; NPWS 1999k). Large hollows within mature trees are required for shelter, nesting and breeding (Henry and Craig 1984; DECC 2007). | **Potential across study area including subject site**. Suitably sized hollows and forage resources are available. No evidence of the species was identified on the site and the fragmented nature of the site reduces the likelihood to occur. |
| *Petaurus norfolcensis* | Squirrel Glider | V | — | Associated with dry hardwood forest and woodlands (Menkhorst et al. 1988; Quin 1995). Habitats typically include gum barked and high nectar producing species, including winter flower species (Menkhorst et al. 1988). The presence of hollow bearing eucalypts is a critical habitat value (Quin 1995). | **Potential across study area including subject site**. Suitably sized hollows and forage resources are available. No evidence of the species was identified on the site and the fragmented nature of the site reduces the likelihood to occur. |



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| *Petrogale penicillata* | Brush-tailed Rock-wallaby | E | V | Rocky areas in a variety of habitats, typically north facing sites with numerous ledges, caves and crevices (Strahan 1995). | **No.** |
| *Phascogale tapoatafa* | Brush-tailed Phascogale | V | — | Preferred habitat is Dry Open forest with a sparse open understorey, however, has been located in heath, swamps and rainforest and wet sclerophyll forest (DECC 2007). | **Unlikely**. Some marginal habitat potential, though few local records. |
| *Phascolarctos cinereus* | Koala | V | — | Associated with both wet and dry Eucalypt forest and woodland that contains a canopy cover of approximately 10 to 70% (Reed et al. 1990), with acceptable Eucalypt food trees. Some preferred Eucalyptus species are: Eucalyptus tereticornis, E. punctata, E. cypellocarpa, E. viminalis | **Yes**. Three Koalas observed and scats identified across the site. |
| *Planigale maculata* | Common Planigale | V | — | Subtropical to dry rainforest, dry sclerophyll forest, heathland and grassland up to 400m elevation (NPWS 2005o; Strahan 1998). Habitat selection is dependant on surface cover (DECC 2007). | **Unlikely**. Marginal suitable habitat and no local records. |
| *Potorous tridactylus*<br>*Potorous tridactylus tridactylus* | Long-nosed Potoroo<br>Long-nosed Potoroo (SE Mainland Population) | V<br>— | —<br>V | Associated with dry coastal heath and dry and wet sclerophyll forests (Strahan 1998) with dense cover for shelter and adjacent more open areas for foraging (Menkhorst & Knight 2004). | **Potential in study area but not in subject site**. Recorded within 10 km of the study area. The Lowland Rainforest offers some potential habitat for this species. |
| **MAMMALS** (BATS) | | | | | |



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| | | **TSC Act** | **EPBC Act** | | |
| *Chalinolobus nigrogriseus* | Hoary Bat | V | — | The preferred habitat of this species appears to be variable, with dry open forest, woodland, vine thickets, coastal scrub, sand dunes, grasslands and floodplains recorded (Churchill 1998). This species often forages along watercourses, swampy areas and over farm dams. In NSW, this species has been recorded in Spotted Gum (Corymbia maculata), Grey Box (Eucalyptus moluccana) and Northern Ironbark (E. siderophloia) and woodland characterised by Scribbly Gums (E. signata) and Pink Bloodwood (C. intermedia) and sites dominated by the Blackbutt (E. pilularis) (Churchill 1998). Roost sites have been identified as tree hollows, rock crevices and the roofs of buildings (Churchill 1998). | **Potential within study area and subject site.** The Lowland Rainforest offers suitable habitat for this species. |
| *Chalinolobus dwyeri* | Large-eared Pied Bat | V | V | The Large-eared Pied Bat has been recorded in a variety of habitats, including dry sclerophyll forests, woodland, sub-alpine woodland, edges of rainforests and wet sclerophyll forests (Churchill 1998; NPWS 2005p). This species roosts in caves, rock overhangs and disused mine shafts and as such is usually associated with rock outcrops and cliff faces (Churchill 1998; DECC 2007). | **Likely in study area but not in subject site**. Suitable forage habitat available |



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| | | **TSC Act** | **EPBC Act** | | |
| *Kerivoula papuensis* | Golden-tipped Bat | V | — | The most favoured habitat for this species is moist closed forests often with a rainforest influence, however, some captures have been made in dry forests some distance from any rainforest (Lunney et. al. 1986; Parnaby and Mills, 1994). It has been suggested that the amount of vines and complex tree layers allows for increased numbers of spiders and webs and such areas are sought by the Golden-tipped Bat (Schulz & Eyre 2000). This species is often caught over streams within rainforest are known to frequently roost within the pendulous nests of Yellow-throated and Large-billed Scrub Wrens and Brown Gerygone in such areas (Schulz & Eyre 2000). | **Likely in study area but not in subject site**. Suitable forage habitat and possibly roost habitat available. |
| *Miniopterus australis* | Little Bent-wing Bat | V | — | Prefers well-timbered areas including rainforest, wet and dry sclerophyll forests, Melaleuca swamps and coastal forests (Churchill 1998). This species shelter in a range of structures including culverts, drains, mines and caves (Environment Australia 2000). Relatively large areas of dense vegetation of either wet sclerophyll forest, rainforest or dense coastal banksia scrub are usually found adjacent to caves in which this species is found (NPWS 2005q). Breeding occurs in caves, usually in association with M. schreibersii (Environment Australia 2000, DECC 2007). | **Likely across study area including subject site**. Suitable forage habitat available |



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| *Miniopterus schreibersii oceanensis* | Eastern Bent-wing Bat | V | — | Associated with a range of habitats such as rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland (Churchill 1998). It forages above and below the tree canopy on small insects (AMBS 1995, Dwyer 1995, Dwyer 1981). Will utilise caves, old mines, and stormwater channels, under bridges and occasionally buildings for shelter (Environment Australia 2000, Dwyer 1995). | **Likely across study area including subject site**. Suitable forage habitat available |
| *Mormopterus norfolkensis* | East Coast Freetail Bat | V | — | Most records of this species are from dry eucalypt forest and woodland east of the Great Dividing Range (Churchill 1998). Individuals have, however, been recorded flying low over a rocky river in rainforest and wet sclerophyll forest and foraging in clearings at forest edges (Environment Australia 2000; Allison & Hoye 1998). Primarily roosts in hollows or behind loose bark in mature eucalypts, but have been observed roosting in the roof of a hut (Environment Australia 2000; Allison & Hoye 1998). | **Likely across study area including subject site**. Suitable forage habitat available |



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| *Myotis adversus* | Large-footed Myotis | V | — | Will occupy most habitat types such as mangroves, paperbark swamps, riverine monsoon forest, rainforest, wet and dry sclerophyll forest, open woodland and River Red Gum woodland, as long as they are close to water (Churchill 1998). While roosting is most commonly associated with caves, this species has been observed to roost in tree hollows, amongst vegetation, in clumps of Pandanus, under bridges, in mines, tunnels and stormwater drains (Churchill 1998). However the species apparently has specific roost requirements, and only a small percentage of available caves, mines, tunnels and culverts are used (Richards 1998). | **Potential in study area but not in subject site**. Dams and water bodies offer some suitable forage habitat and suitable roosts are available |
| *Pteropus poliocephalus* | Grey-headed Flying-Fox | V | V | Inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas (Churchill 1998, Eby 1998). Camps are often located in gullies, typically close to water, in vegetation with a dense canopy (Churchill 1998). | **Likely in study area but not in subject site**. Suitable forage habitat available. |



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| *Saccolaimus flaviventris* | Yellow-bellied Sheathtail-bat | V | — | Found in almost all habitats, from wet and dry sclerophyll forest, open woodland (Churchill 1998), open country, mallee, rainforests, heathland and waterbodies (SFNSW 1995). Roosts in tree hollows; may also use caves; has also been recorded in a tree hollow in a paddock (Environment Australia 2000) and in abandoned sugar glider nests (Churchill 1998). The Yellow-bellied Sheathtail-bat is dependent on suitable hollow-bearing trees to provide roost sites, which may be a limiting factor on populations in cleared or fragmented habitats (Environment Australia 2000). | **Likely across study area including subject site**. Suitable forage habitat available |
| *Scoteanax rueppellii* | Greater Broad-nosed Bat | V | — | Associated with moist gullies in mature coastal forest, or rainforest, east of the Great Dividing Range (Churchill, 1998), tending to be more frequently located in more productive forests (Hoye & Richards 1998). Within denser vegetation types use is made of natural and man made openings such as roads, creeks and small rivers, where it hawks backwards and forwards for prey (Hoye & Richards 1998). | **Likely in study area but not in subject site**. Suitable forage habitat and suitable roosts are available |
| *Syconycteris australis* | Common Blossom-bat | V | — | The combination of heathland and coastal rainforest is essential for this species (Churchill 1998). Breeding and sheltering habitats are in subtropical and littoral rainforests and a diverse range of nectar producing plant communities are required year round; it will occasionally eat some rainforest fruits (Churchill 1998; Environment Australia 2000). | **Unlikely**. No suitable forage habitat. Marginal roost habitat, though more likely to roost in coastal rainforest. |



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| **INVERTEBRATES** | | | | | |
| *Phyllodes imperalis* (Southern subspecies) | A moth | E | E | Lower montane rainforests from QLD to NSW, where larvae appear to be dependent on the vine Carronia multisepalea (NSW Scientific Committee 2004). Breeding habitat is considered to be restricted to undisturbed old growth subtropical rainforest below 600m altitude (NSW Scientific Committee 2004) | **Potential in study area but not in subject site**. Lowland Rainforest offers some suitable habitat. |
| **MIGRATORY TERRESTRIAL SPECIES LISTED UNDER EPBC ACT** | | | | | |
| *Haliaeetus leucogaster* | White-bellied Sea-Eagle | — | M | Forages over large open fresh or saline waterbodies, coastal seas and open terrestrial areas (Marchant & Higgins 1993, Simpson & Day 1999). Breeding habitat consists of tall trees, mangroves, cliffs, rocky outcrops, silts, caves and crevices and is located along the coast or major rivers. Breeding habitat is usually in or close to water, but may occur up to a kilometre away (Marchant & Higgins 1993). | **No**. |
| *Hirundapus caudacutus* | White-throated Needletail | — | M | Forages aerially over a variety of habitats usually over coastal and mountain areas, most likely with a preference for wooded areas (Marchant & Higgins 1993; Simpson & Day 1999). Has been observed roosting in dense foliage of canopy trees, and may seek refuge in tree hollows in inclement weather (Marchant & Higgins 1993). | **Likely across study area**. Likely to fly over the site. |



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| Table : Assessment of Likelihood of Occurrence of Threatened Fauna Species | | | | | |
|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **Conservation Significance** | | **Habitat Associations** | **Likelihood of Occurrence** |
| | | **TSC Act** | **EPBC Act** | | |
| *Merops ornatus* | Rainbow Bee-eater | — | M | Resident in coastal and subcoastal northern Australia; regular breeding migrant in southern Australia, arriving September to October, departing February to March, some occasionally present April to May (Pizzey and Doyle 1988). Occurs in open country, chiefly at suitable breeding places in areas of sandy or loamy soil: sand-ridges, riverbanks, road-cuttings, sand-pits, occasionally coastal cliffs (*ibid*). Nest is a chamber a the end of a burrow, up to 1.6 m long, tunnelled in flat or sloping ground, sandy back or cutting (*ibid*). | **Yes**. Observed on site. |
| *Monarcha melanopsis* | Black-faced Monarch | — | M | Rainforest and eucalypt forests, feeding in tangled understorey (Blakers et al. 1984). | **Potential in study area but not in subject site**. May utilise the Lowland Rainforest on the site. |
| *Monarcha trivirgatus* | Spectacled Monarch | — | M | Wet forests, mangroves (Simpson and Day 1999). | **Unlikely**. Limited suitable habitat. |
| *Myiagra cyanoleuca* | Satin Flycatcher | — | M | Associated with drier eucalypt forests, absent from rainforests (Blakers et al. 1984), open forests, often at height (Simpson & Day 1999). | **Unlikely**. Limited suitable habitat. |
| *Rhipidura rufifrons* | Rufous Fantail | — | M | The Rufous Fantail is a summer breeding migrant to southeastern Australia (Morcombe, 2004). The Rufous Fantail is found in rainforest, dense wet eucalypt and monsoon forests, paperbark and mangrove swamps and riverside vegetation (Morcombe, 2004). Open country may be used by the Rufous Fantail during migration (Morcombe, 2004). | **Potential in study area but not in subject site**. May utilise the Lowland Rainforest and other forest communities on the site. |
| *Xanthomyza phrygia* | Regent Honeyeater | E | E, M | SEE DIURNAL BIRDS ABOVE | SEE DIURNAL BIRDS ABOVE |



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|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **Conservation Significance** | | **Habitat Associations** | **Likelihood of Occurrence** |
| | | **TSC Act** | **EPBC Act** | | |
| **MIGRATORY WETLAND SPECIES LISTED UNDER EPBC ACT** | | | | | |
| *Ardea alba* | Great Egret | — | M | The Great Egret is common and widespread in Australia (McKilligan, 2005). It forages in a wide range of wet and dry habitats including permanent and ephemeral freshwaters, wet pasture and estuarine mangroves and mudflats (McKilligan, 2005). | **Unlikely**. Limited suitable habitat. |
| *Ardea ibis* | Cattle Egret | — | M | Cattle Egrets forage on pasture, marsh, grassy road verges, rain puddles and croplands, but not usually in the open water of streams or lakes and they avoid marine environments (McKilligan, 2005). Some individuals stay close to the natal heronry from one nesting season to the next, but the majority leave the district in autumn and return the next spring. Cattle Egrets are likely to spend the winter dispersed along the coastal plain and only a small number have been recovered west of the Great Dividing Range (McKilligan, 2005). | **Likely in study area but not in subject site.** Likely to utilise the site intermittently |



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|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **Conservation Significance** | | **Habitat Associations** | **Likelihood of Occurrence** |
| | | **TSC Act** | **EPBC Act** | | |
| *Gallinago hardwickii* | Latham's Snipe | — | M | A variety of permanent and ephemeral wetlands, preferring open fresh water wetlands with nearby cover (Marchant and Higgins 1999). Occupies a variety of vegetation around wetlands (Marchant and Higgins 1999) including wetland grasses and open wooded swamps (Simpson and Day 1999). | **Unlikely**. Limited suitable habitat. |
| *Rostratula benghalensis s. lat.* | Painted Snipe | — | M | Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber (DECC 2007). Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds (*ibid.*). Breeding is often in response to local conditions; generally occurs from September to December (DECC 2007). Roosts during the day in dense vegetation (DECC 2007). Forages nocturnally on mud-flats and in shallow water (DECC 2007). Feeds on worms, molluscs, insects and some plant-matter (*ibid.*). | **Unlikely**. Limited suitable habitat. |
| Disclaimer: Data extracted from the Atlas of NSW Wildlife and DEW Protected Matters Report are only indicative and cannot be considered a comprehensive inventory. In recognising this, a literature review complemented by appropriate field survey has been undertaken that targets a larger number of species than is listed in this table. 'Migratory marine species' and 'listed marine species' listed on the EPBC Act (and listed on the DEW protected matters report) have not been included in this table, since they are considered unlikely to occur within the study area due to the absence of marine habitat. | | | | | |

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## FLORA

**Table : Assessment of Likelihood of Occurrence of Threatened Flora Species**

| Scientific Name | Common Name | Conservation Significance | | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| | | TSC Act | EPBC Act | | |
| Acronychia littoralis | Scented Acronychia | E | E | Coastal dune and littoral rainforest | **No**. |
| *Alexfloydia repens* | | E | – | Recorded in the understorey of *Casuarina glauca* forest and along the uppermost fringe of mangroves (DECC 2007). | **No**. |
| *Amorphospermum whitei* | Rusty Plum | V | E | Typical habitat consists of gully rainforest or wet sclerophyll with a well-developed rainforest understorey growing on medium fertility soils formed on metasediment or rhyolite (Floyd 1989). The altitudinal range of this species is from near sea level to 600 m (Floyd 1989). | **Yes in study area but not in subject site**. The Lowland Rainforest association and edges offers suitable habitat for this species. |
| *Arthraxon hispidus* | Hairy Jointgrass | V | V | Moisture and shade-loving grass, found in or on the edges of rainforest and in wet eucalypt forest, often near creeks or swamps (DECC, 2007). | **Likely in subject site**. Open areas along forest edges, particularly adjoining rainforest remnants, offers suitable habitat for this species. |



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|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **Conservation Significance** | | **Habitat Associations** | **Likelihood of Occurrence** |
| | | **TSC Act** | **EPBC Act** | | |
| *Cynanchum elegans* | | E | E | Climber or twiner with a variable form (DECC 2007). It occurs in dry rainforest gullies, scrub and scree slopes (DECC 2007). However has been found in littoral rainforest; *Leptospermum laevigatum – Banksia integrifolia* subsp *integrifolia* coastal scrub; *Eucalyptus tereticornis* aligned open forest/ woodland; *E. maculata* aligned open forest/woodland; and *Melaleuca armillaris* scrub to open scrub (DECC 2007). Flowers between August and May, peaking in November (DECC 2007). Seeds are unlikely to persist in the seedbank (DECC 2007). | **Unlikely**. Not recorded in locality and paucity of records in north coast region. |
| *Eleocharis tetraquetra* | Square-stemmed Spike Rush | E | – | Thought to be extinct in NSW until it was rediscovered in 1997 at Boambee near Coffs Harbour (DECC 2007). It has since been found in other north coast localities near Grafton and Murwillumbah (DECC 2007). Found in damp locations on stream edges and in and on the margins of freshwater swamps (DECC 2007). | **Potential in study area but not in subject site**. The ephemeral wetland areas offer some suitable habitat for this poorly known species. |
| *Lindsaea incisa* | Slender Screw Fern | E | — | In NSW it is known only from a few locations between Woombah and just south of Coffs Harbour (DECC 2007). Dry eucalypt forest on sandstone and moist shrubby eucalypt forest on metasediments (DECC 2007). It is usually found in waterlogged or poorly drained sites along creeks, where ferns, sedges and shrubs grow thickly (DECC 2007). | **Potential in study area but not in subject site**. The stream side and parts of the site offers some suitable habitat. |



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|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **Conservation Significance** | | **Habitat Associations** | **Likelihood of Occurrence** |
| | | **TSC Act** | **EPBC Act** | | |
| *Marsdenia longiloba* | Slender Marsdenia | E | V | Subtropical and warm temperate rainforest, lowland moist eucalypt forest adjoining rainforest and, sometimes, in areas with rock outcrops (DECC 2007). Moist open forest with a fern-grass understorey and occasional small rainforest trees, often on hillslopes adjacent to gully rainforest (Ecos Environmental Pty Ltd, 2005). It appears to prefer soils of medium fertility formed on substrates such as metasediment (Ecos Environmental Pty Ltd, 2005). | **Yes in study area but not in subject site**. The Lowland Rainforest association and edges offers suitable habitat for this species. |
| *Parsonsia dorrigoensis* | | V | E | Scattered populations in the north coast region between Kendall and Woolgoolga (DECC 2007). Found in subtropical and warm-temperature rainforest, on rainforest margins, and in moist eucalypt forest up to 800 m, on brown clay soils (DECC 2007). Flowers in summer (DECC 2007). | **Likely in study area but not in subject site**. The Lowland Rainforest association and edges offers suitable habitat for this species. |
| *Persicaria elatior* | Tall Knotweed | V | V | This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance (DECC 2007). | **Unlikely**. Not recorded in locality and paucity of records in north coast region. |
| *Phaius australis* | Swamp Orchid | E | E | Swampy grassland or swampy forest including rainforest, eucalypt or paperbark forest, mostly in coastal areas (DECC 2007). | **Potential in study area but not in subject site**. Some marginal habitat suitability within the Lowland Rainforest and in ephemeral wetland areas. |
| *Pultenaea maritima* | | V | – | The species occurs in grasslands, shrublands and heath on exposed coastal headlands (DECC 2007) | **No.** |



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|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **Conservation Significance** | | **Habitat Associations** | **Likelihood of Occurrence** |
| | | **TSC Act** | **EPBC Act** | | |
| *Quassia* sp.1 | 'Mooney Creek' Quassia | E | E | The habitat of the Moonee Quassia at Moonee and other coastal sites is wet sclerophyll forest, typically comprising canopy species such as *Eucalyptus microcorys* (Tallowwood), *Lophostemon confertus* (Brushbox), *Syncarpia glomulifera* (Turpentine), and *Allocasuarina torulosa* (Forest Oak) (DECC 2007). This wet forest habitat usually supports a varying density and diversity of rainforest understorey species (DECC 2007). The habitat of populations in the Grafton district consists of tall dry Eucalypt forests of *Eucalyptus planchoniana* (Needlebark Stringybark)/ *Eucalyptus pyrocarpa* (Large-fruited Blackbutt) above a well developed shrub layer (DECC 2007). | **Unlikely**. Population is centred in areas north of Moonee Beach. |
| *Sarcochilus fitzgeraldii* | Ravine Orchid | V | V | North-east NSW, north of the Macleay River, to Maleny in south-east Queensland (DECC 2007). The Ravine Orchid grows mainly on rocks, amongst organic matter, in cool, moist, shady ravines, gorges and on cliff faces in dense subtropical rainforest at altitudes between 500 and 700 m (DECC 2007). Occasional clumps are found on the bases of fibrous-barked trees (DECC 2007). | **No** |
| *Sarcochilus hartmannii* | | V | V | Associated with cliff faces on steep narrow ridges supporting sclerophyll forest, growing in clefts on volcanic rock, occasionally epiphytic on grass trees at altitudes of 500 to 1000masl (Bishop 1996). | **No** |



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|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **Conservation Significance** | | **Habitat Associations** | **Likelihood of Occurrence** |
| | | **TSC Act** | **EPBC Act** | | |
| *Senna acclinis* | Rainforest Cassia | E | — | Grows in or on the edges of subtropical and dry rainforest (DECC 2007). | **Potential in study area but not in subject site**. Few local records, but Lowland Rainforest offers some suitable habitat. |
| *Thesium australe* | Austral Toadflax | V | V | Occurs in grassland or grassy woodland (DECC 2007). Often found in damp sites in association with Kangaroo Grass (*Themeda australis*) DECC 2007). | **No**. |
| *Tylophora woollsii* | Cryptic Forest Twiner | E | E | It is found from the NSW north coast and New England Tablelands to southern Queensland, but is very rare within that range (DECC 2007). Known on the Tablelands from the Bald Rock and Boonoo Boonoo areas north of Tenterfield (DECC 2007). Grows in moist eucalypt forest, moist sites in dry eucalypt forest and rainforest margins (DECC 2007). Flowering occurs in summer and autumn, usually between January and March but sometimes as late as November (DECC 2007). | **Likely in study area but not in subject site**. The Lowland Rainforest association and edges offers suitable habitat for this species. |
| *Zieria prostrata* | Headland Zieria | E | E | Restricted to four coastal headlands in the Coffs Harbour area of north-east NSW (DECC 2007). Low grassy heath on exposed sites and wind-pruned open to sparse shrubland on more sheltered aspects (DECC 2007). | **No** |
| *Zieria smithii* | Low growing form of *Z. smithii,* Diggers Head population | E | – | Known only from Diggers Head at Coffs Harbour. Closely related forms occur on eight to ten headlands north to Byron Bay. Occurs in low heath with Kangaroo Grass (Themeda australis) on a coastal headland (DECC 2007) | **No** |



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| **Scientific Name** | **Common Name** | **Conservation Significance** | | **Habitat Associations** | **Likelihood of Occurrence** |
| | | **TSC Act** | **EPBC Act** | | |
| Disclaimer: Data extracted from the Atlas of NSW Wildlife and EPBC Act Protected Matters Report are only indicative and cannot be considered a comprehensive inventory. In recognising this, a literature review complemented by appropriate field survey has been undertaken that targets a larger number of species than is listed in this table. | | | | | |

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# Appendix 2 – Ecological Constraints Maps



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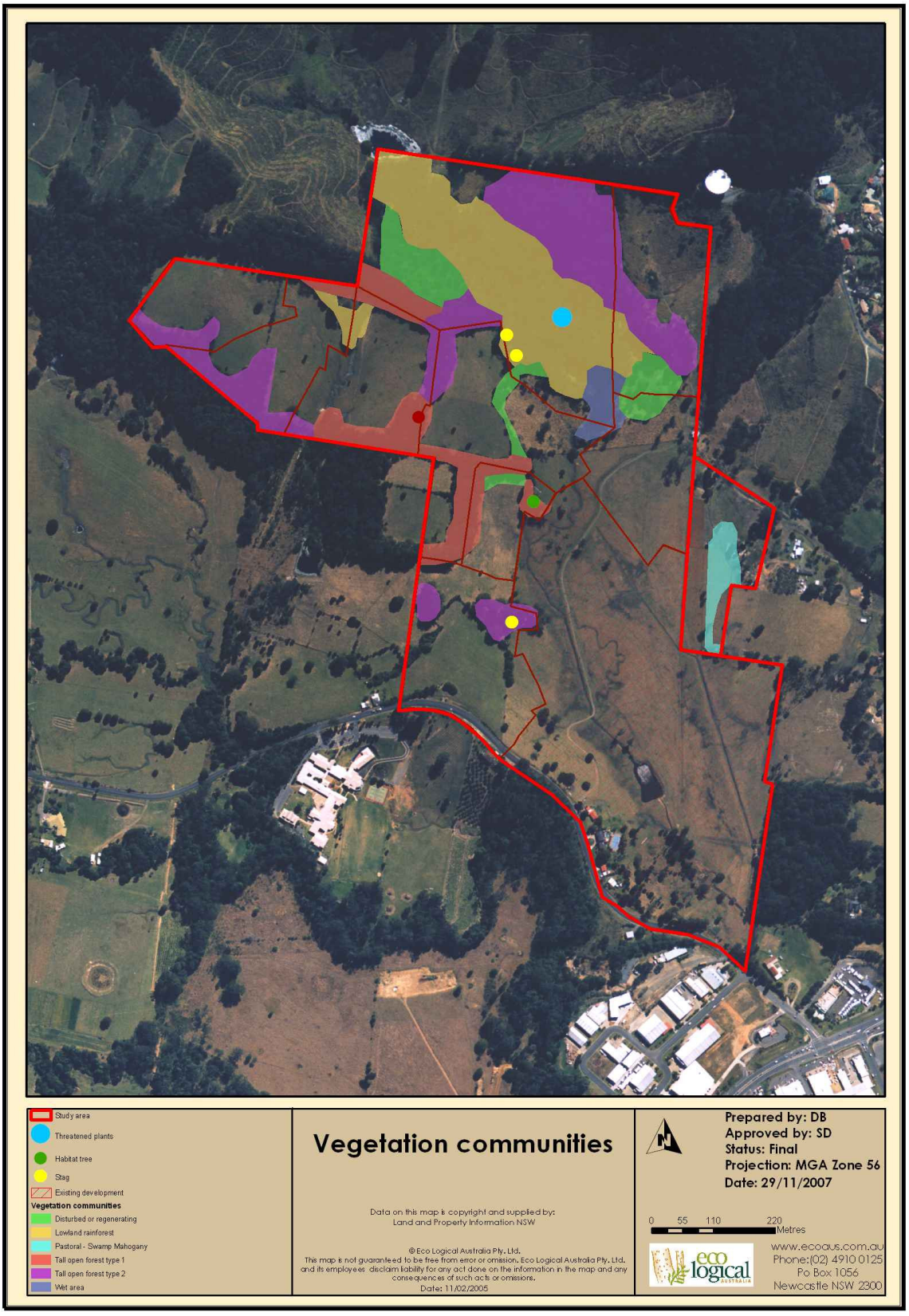


**Figure 2**



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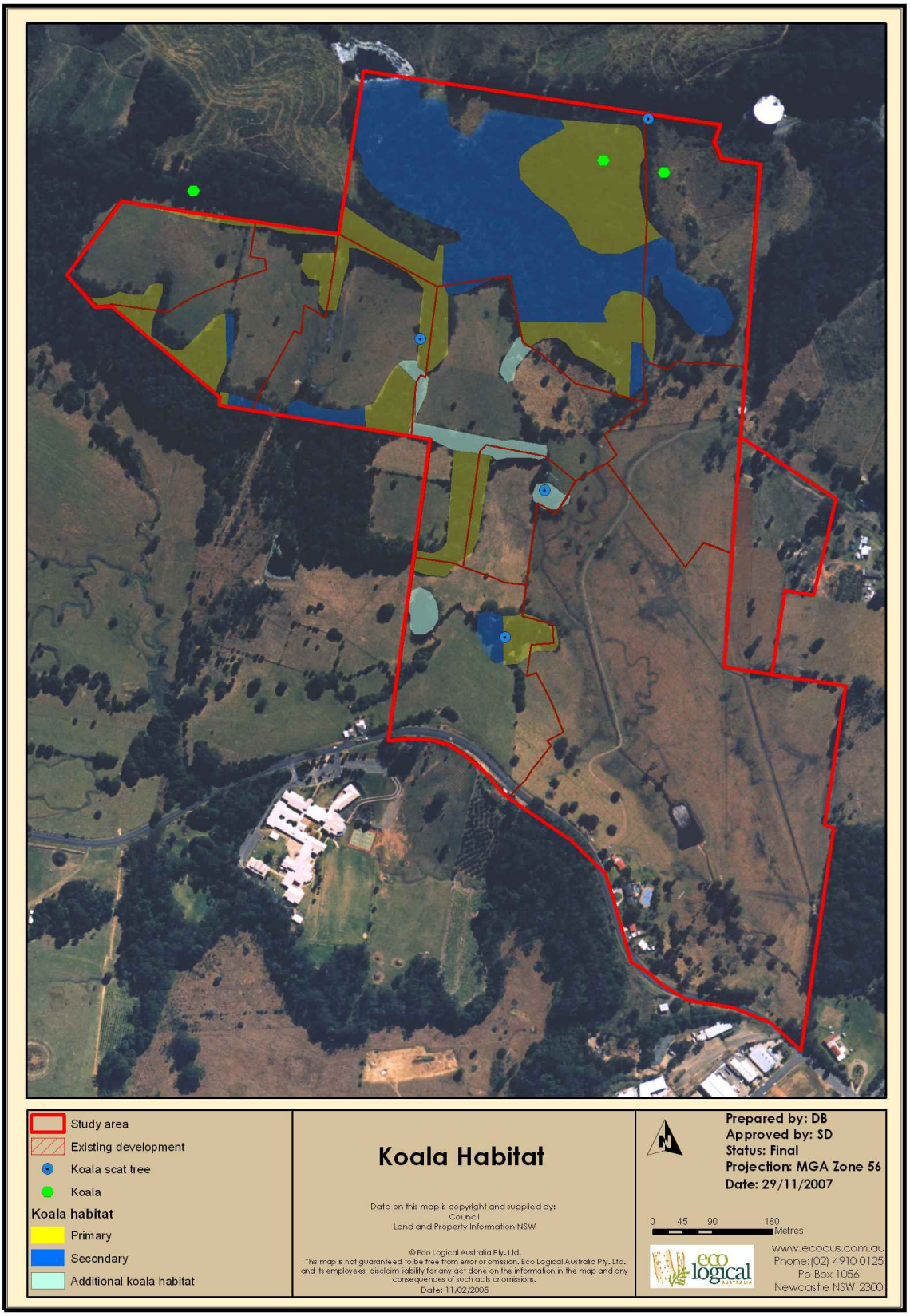


**Figure 3**



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**Figure 4**



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**Figure 5**



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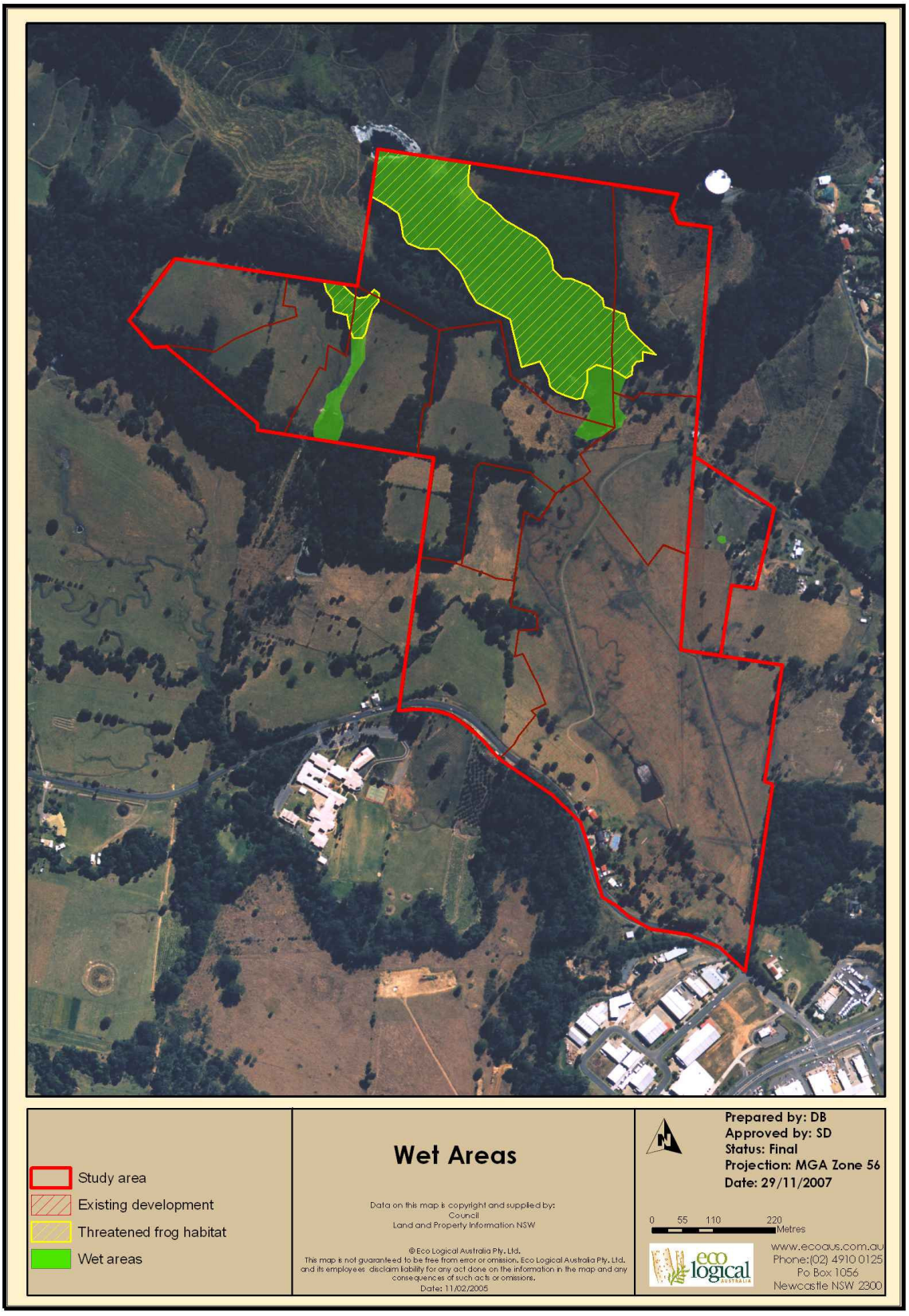


**Figure 6**



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**Figure 7**



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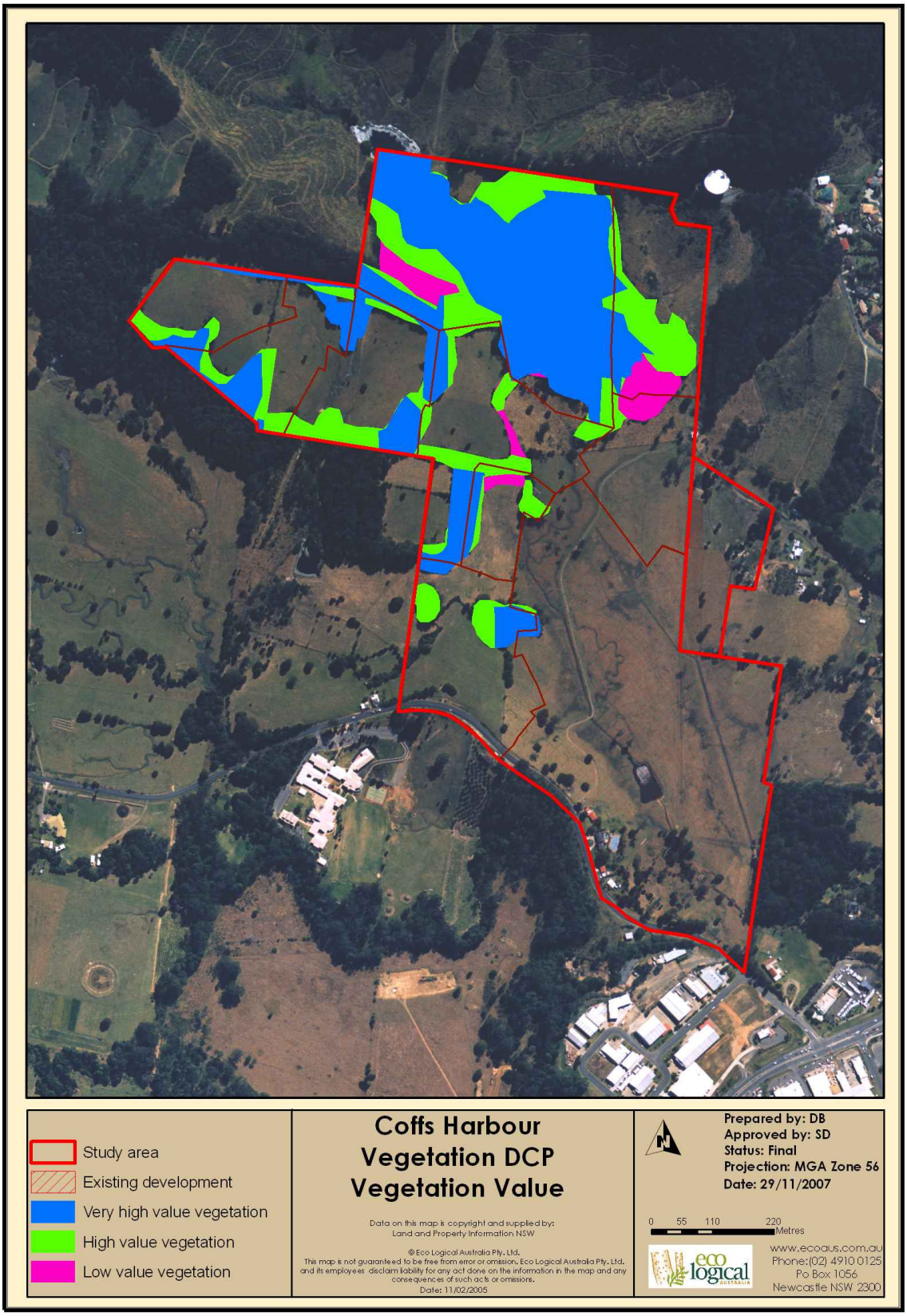


**Figure 8**



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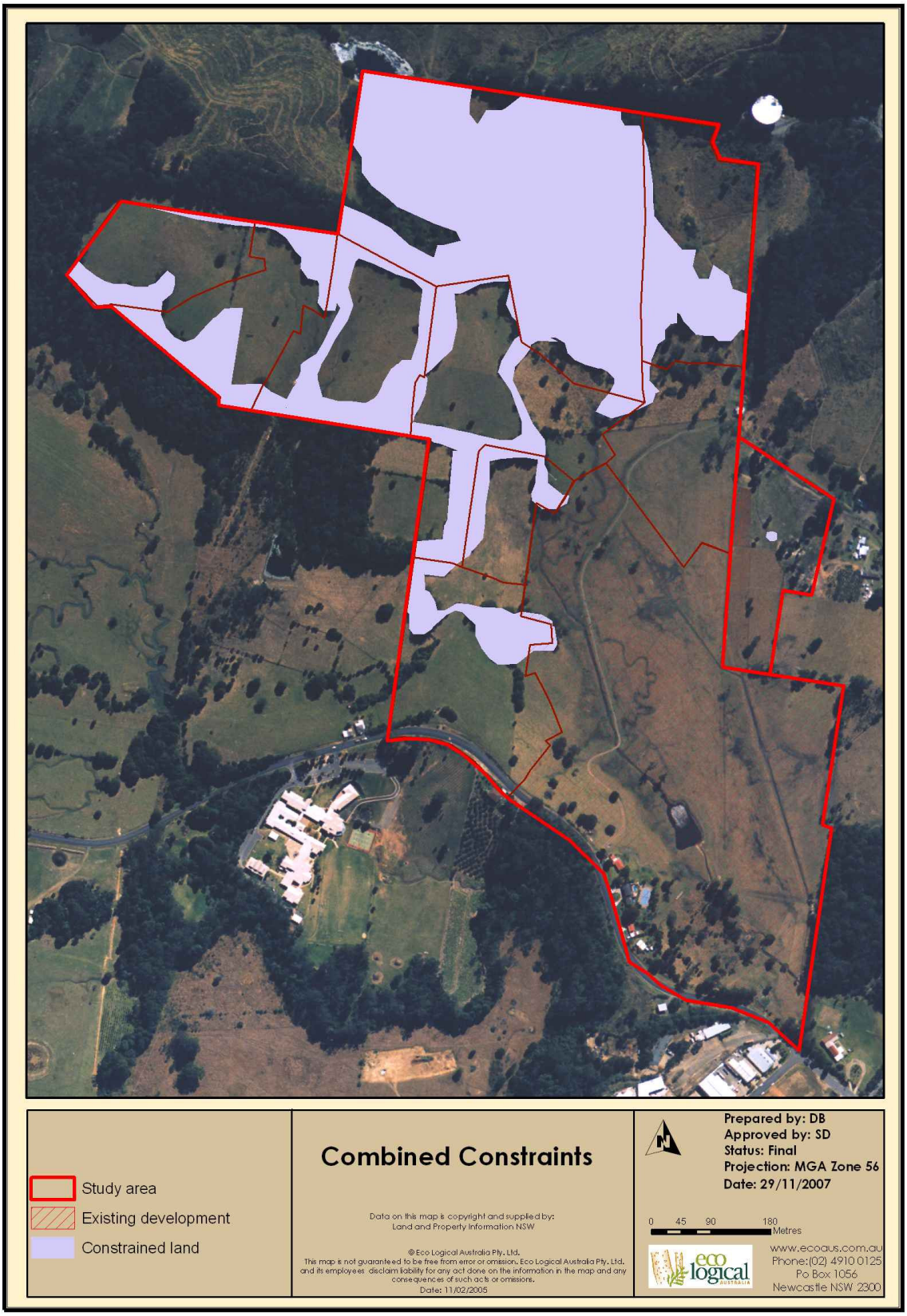


**Figure 9**



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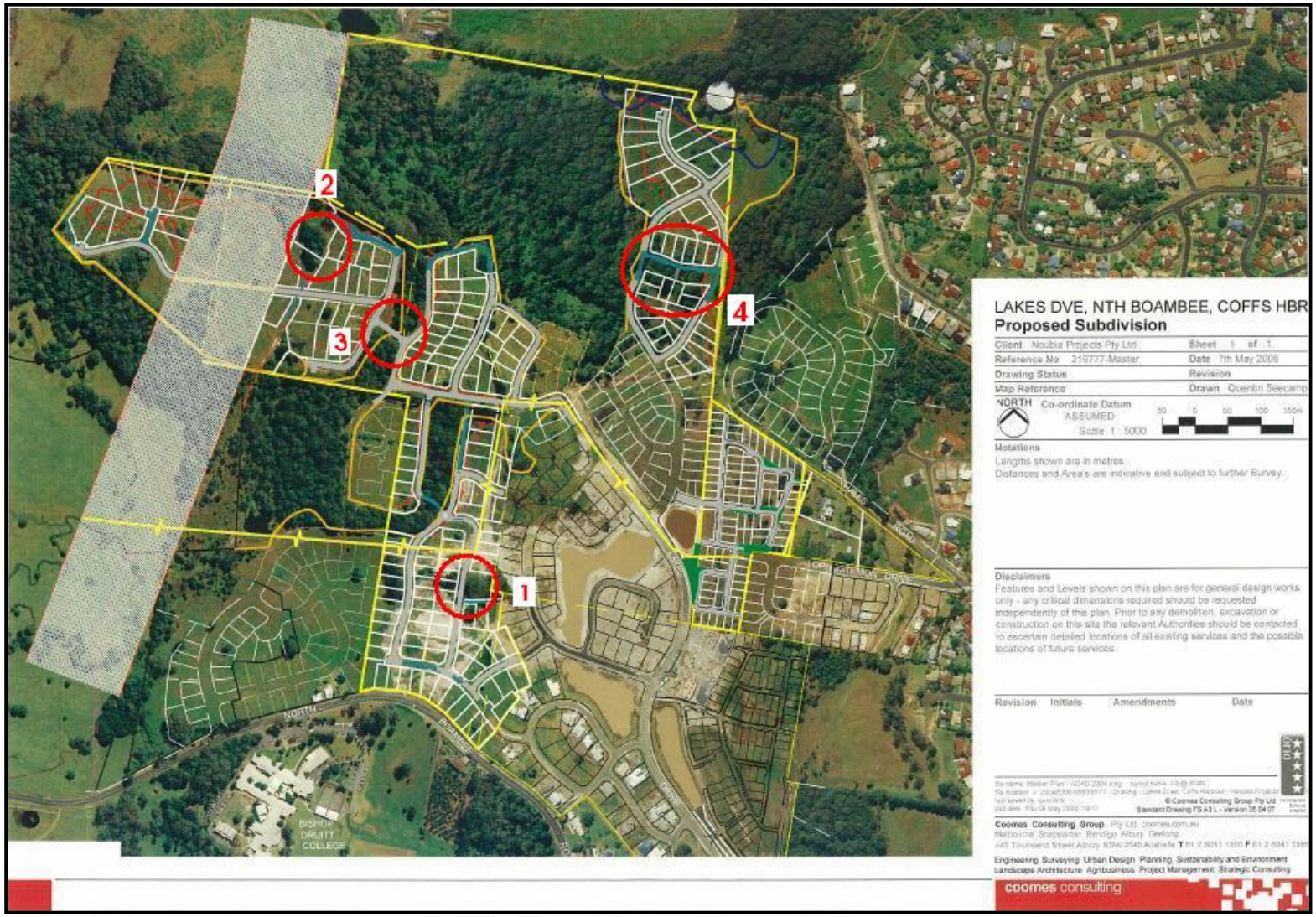


**Figure 10: Current subdivision layout. Numbers are referred to in text, blue roads indicate managed areas for fauna.**



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# Appendix 3 – Impact Assessment

**EP&A Act Assessment of Significance (7-Part Test)**

*Framework for Assessment of Significance*

The Assessment of Significance (7-part test) is applied to species, populations and ecological communities listed on Schedules 1, 1A and 2 of the TSC Act and Schedules 4, 4A and 5 of the Fisheries Management Act. The assessment sets out 7 factors, which when considered, allow proponents to undertake a qualitative analysis of the likely impacts of an action and to determine whether further assessment is required via a Species Impact Statement (SIS). All factors must be considered and an overall conclusion made based on all factors in combination. An SIS is required if, through application of the 7-part test, an action is considered likely to have a significant impact on a threatened species, population or ecological community.

Threatened species, populations and ecological communities which may be directly or indirectly affected by the current proposal include:

- Lowland Rainforest in NSW North Coast and Sydney Basin Bioregion
- Hairy Joint Grass (*Arthraxon hispidus*)
- Green-thighed Frog (*Litoria brevipalmata*)
- Square-tailed Kite (*Lophoictinia isura*)
- Spotted-tail Quoll (*Dasyurus maculata*)
- Yellow-bellied Glider (*Petaurus australis*)
- Squirrel Glider (*Petaurus norfolcensis*)
- Koala (*Phascolarctos cinereus*)
- Hoary Bat (*Chalinolobus nigrogriseus*)
- Little Bent-wing Bat (*Miniopterus australis*)
- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*)
- East Coast Freetail Bat (*Mormopterus norfolkensis*)
- Yellow-bellied Sheathtail-bat (*Saccolaimu flaviventris*)

## Lowland Rainforest in NSW North Coast Bioregion

Lowland Rainforest is a rainforest community which now occurs only as small remnants in scattered localities on the NSW north coast, with less than 1000ha in total thought to remain. Larger stands of the community typically have a dense canopy, which blocks most light from reaching the ground, creating cool, moist conditions within. Lowland Rainforest on Floodplain supports a rich diversity of plants and animals.

**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 the risk of extinction.**

This is not a threatened species



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**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**

There are no endangered populations relevant to this 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**

The vast majority of the lowland rainforest on the site will be preserved within the lands zoned for environmental protection. A small fragment of approximately 0.75ha and some disturbed fringes of the main remnant will be removed as part of this proposal. This loss, in light of the area to be conserved of approximately 7ha, is not considered to place the local remnant at risk of extinction.

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

The proposed subdivision will place new pressures on the lowland rainforest remnant from the proximity of residential development. However, the use of water sensitive urban design and a caveat on many of the residential lots preventing the keeping of domestic cats and dogs will help to reduce these indirect impacts. Additionally, recommendations within this report provide guidance on targeting any rehabilitation works in the disturbed areas of this community. If all these design and management actions are undertaken then the local occurrence of this community will not be placed 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, and**

The proposal will result in the loss of approximately 1ha of lowland rainforest. 0.75ha of this is already highly disturbed through significant weed encroachment and fragmentation.

**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 proposal will not result in the further fragmentation of this community. The proposal will remove the most fragmented part of this community.

**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 area of this community that will be removed is not considered to constitute an important part of the remaining remnant. The areas removed are fragmented from



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the main remnant or are a small area on the periphery of the remnant where it intergrades with the tall eucalypt forest.

**e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),**
There is not critical habitat within the subject site.

**f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,**
There is currently no recovery plan for this community. However, DECC have detailed several actions that land holders can undertake to recover the species, including:

- Support a local Landcare group or bush regeneration team.
- Plant local rainforest species in gardens.
- Avoid burning edges of rainforest remnants.
- Fence remnant areas to protect from grazing stock.
- Assist with the control and removal of introduced weeds.
- Protect remaining areas of rainforest from clearing or development. Even small stands have conservation values

Some of these actions do not apply to this proposal, although the protection of the main community remnant and targeting of revegetation activities in the disturbed areas of this community as recommended in this report are consistent with these actions.

**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 proposal will result in the removal of some of the lowland rainforest, which is considered to represent a contribution to the Key Threatening Process: 'clearing of native vegetation'. However, this is being restricted to the disturbed areas of this community and when incorporated with the planting of native vegetation is not considered to increase the impact of this threatening process.

Several other Key Threatening Processes may influence the study area, including 'invasion of native plant communities by exotic perennial grasses' and 'invasion, establishment and spread of Lantana camara'. These processes are of concern to this community. However, the community remnant is already highly invaded by exotic species including perennial grasses and lantana and this action is not considered to increase the impact of this threatening process on this community.

### Hairy Joint Grass (*Arthraxon hispidus*)

Moisture and shade-loving grass, found in or on the edges of rainforest and in wet eucalypt forest, often near creeks or swamps.



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**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 the risk of extinction.**

The proposed action avoids the majority of the potential habitat for this species which is within the remnant lowland rainforest community. A small amount of this community will be removed although the majority of habitat for this species will be retained. As the majority of the habitat on the site for this species will be retained it is considered unlikely that there will be any significant impacts such that a viable local population is likely to be put at risk of extinction.

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

There are no endangered populations relevant to this 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**

This is not an endangered ecological community.

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.**

This is not an endangered ecological community.

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

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

The proposal will result in the loss of approximately 1ha of habitat for this species. 0.75ha of this is already highly disturbed through significant weed encroachment and fragmentation.

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 area of this community that will be removed is not considered to constitute an important part of the remaining remnant. The areas removed are fragmented from the main remnant or are a small area on the periphery of the remnant and highly disturbed.

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 isolated fragment of habitat to be removed is unlikely to be of significant importance to the long term survival of the species.



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**e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),**
There is not critical habitat within the subject site.

**f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,**
There is currently no recovery plan for this species. However, DECC have detailed several actions that land holders can undertake to recover the species, including:

- Protect habitat from frequent fire.
- Avoid slashing or mowing around rainforest edges.
- Fence habitat remnants to protect from stock.
- Control introduced grasses in areas with known populations.
- Protect areas of rainforest, wet eucalypt forest and swamp from clearing and development

Most of these actions do not apply to this proposal as the majority of the habitat for this species will be retained within an environmental protection area.

**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 proposal will result in the removal of some of the lowland rainforest, which is considered to represent a contribution to the Key Threatening Process: 'clearing of native vegetation'. However, this is being restricted to the disturbed areas of this community and when incorporated with the recommended planting of native vegetation is not considered to increase the impact of this threatening process.

Several other Key Threatening Processes may influence the study area, including 'invasion of native plant communities by exotic perennial grasses' and 'invasion, establishment and spread of Lantana camara'. These processes are of concern to this species. However, the community remnant is already highly invaded by exotic species including perennial grasses and lantana and this action is not considered to increase the impact of this threatening process on this community.

## Green-thighed Frog (*Litoria brevipalmata*)

This species prefers wet sclerophyll forest down the northern coast of NSW to Ourimbah. It is also found in a variety of habitats including dry to wet sclerophyll forest, rainforests and shrubland with a healthy understorey. Breeding aggregations occur in still water habitats such as grassy temporary to semi-permanent ponds and flooded ditches in late spring and summer.

**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 the risk of extinction.**
The proposed action avoids the majority of the potential habitat for this species which is within the remnant lowland rainforest community. A small isolated patch of


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this community will be removed although the majority of habitat for this species will be retained. Flood prone grassy breeding habitat is found in the south west of the large lowland rainforest remnant which will be retained as part of the current plan. Further potential breeding habitat will be lost to the south of the isolated rainforest remnant that will be removed. As the majority of the habitat on the site for this species is to be retained it is considered unlikely that there will be any significant impacts such that a viable local population is likely to be put at risk of extinction.

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

There are no endangered populations relevant to this 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**

This is not an endangered ecological community.

**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.**

This is not an endangered ecological community.

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

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

The proposal will result in the loss of approximately 1ha of habitat for this species, including potential breeding habitat. 0.75ha of this is already highly disturbed through significant weed encroachment and fragmentation.

**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 area of this community that will be removed is not considered to constitute an important part of the remaining remnant. The areas removed are fragmented from the main remnant or are a small area on the periphery of the remnant and highly disturbed. The potential breeding habitat found on site will be retained in the current plan.

**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 isolated fragment of habitat to be removed is unlikely to be of significant importance to the long term survival of the species. The potential breeding habitat found on site will be retained in the current plan.



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**e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),**
There is not critical habitat within the subject site.

**f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,**
There is currently no recovery plan for this species. However, DECC have detailed several actions that land holders can undertake to recover the species, including:

- Avoid burning off in moist grassy habitats between December and April.
- Maintain vegetation and leaf litter around ponds, dams, drainage lines and other moist areas.
- Conserve natural patterns of local flooding.
- Protect water bodies from pollution.
- Fence off suitable habitat to protect it from grazing.
- Exclude logging around breeding habitat

Most of these actions do not apply to this proposal. However, the retention of the lowland rainforest and some of the surrounding wet grassy areas along with the use of recommended water sensitive urban design is in alignment with these actions.

**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 proposal will result in the removal of some of the lowland rainforest, which is considered to represent a contribution to the Key Threatening Process: 'clearing of native vegetation'. However, this is being restricted to the disturbed areas of this community and when incorporated with the recommended planting of native vegetation is not considered to increase the impact of this threatening process.

Several other Key Threatening Processes may influence the study area, including 'invasion of native plant communities by exotic perennial grasses' and 'invasion, establishment and spread of Lantana camara'. These processes are of concern to this species. However, the community remnant is already highly invaded by exotic species including perennial grasses and lantana and this action is not considered to increase the impact of these threatening processes on this species.

### Square-tailed Kite (*Lophoictinia isura*)

In coastal areas it is associated tropical and temperate forests and woodlands on fertile soils with an abundance of passerine birds. May be recorded inland along timbered watercourses. In NSW it is commonly associated with ridge or gully forests dominated by Woollybutt (Eucalyptus longifloria), Spotted Gum (E. maculata), or Peppermint Gum (E. elata, E. smithii).

**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 the risk of extinction.**


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The square-tailed kite is likely to visit the site and forage over much of the area. It is considered most likely to be found over and around the retained forested areas of the study area, although foraging activities may extend into the cleared areas of the subject site. The loss of foraging opportunities as a result of the development of the subject site is not considered to be significant due to the retention of the species primary habitat within the study area, the forested areas. Additionally this species is highly mobile and the site is considered to only be of value to a very small number of individuals. As such, the proposal is not considered to have a significant impact on the lifecycle of the species such that a viable local population will be put at risk of extinction.

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

There are no endangered populations relevant to this 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**

This is not an endangered ecological community.

**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.**

This is not an endangered ecological community.

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

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

The proposal will result in the loss of approximately 1ha of good quality habitat, 0.75ha of which is already highly disturbed through significant weed encroachment and fragmentation. Approximately a further 18ha of potential marginal foraging habitat will also be lost.

**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 square-tailed kite is highly mobile and the proposal will not result in the fragmentation or isolation of habitat for this 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 areas of habitat that will be removed are unlikely to be of significant importance to the long term survival of the species. The most important habitat found on site will be retained as part of the current plan.



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**e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),**
There is not critical habitat within the subject site.

**f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,**
There is currently no recovery plan for this species. However, DECC have detailed several actions that land holders can undertake to recover the species, including:

- Protect known habitat from fires of a frequency greater than that recommended for the retention of biodiversity.
- Retain and protect nesting and foraging habitat, particularly along watercourses.
- Report suspected illegal bird shooting and egg-collecting to DEC

Most of these actions do not apply to this proposal. However, the retention of the major forested areas in the study area is in alignment with these actions.

**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 proposal will result in the removal of a small portion of the lowland rainforest, which is considered to represent a contribution to the Key Threatening Process: `clearing of native vegetation'. However, this is being restricted to the disturbed areas of this community and when incorporated with the recommended planting of native vegetation is not considered to increase the impact of this threatening process.

Several other Key Threatening Processes may influence the study area, including `invasion of native plant communities by exotic perennial grasses' and `invasion, establishment and spread of Lantana camara'. These processes are of not of concern to this species and may actually benefit it by promoting suitable habitat for small birds.

## Spotted-tail Quoll (*Dasyurus maculata*)

The Spotted-tailed Quoll inhabits a range of forest communities including wet and dry sclerophyll forests, coastal heathlands and rainforests, more frequently recorded near the ecotones of closed and open forest. This species requires habitat features such as maternal den sites, an abundance of food (birds and small mammals) and large areas of relatively intact vegetation to forage in. Maternal den sites are logs with cryptic entrances, rock outcrops, windrows and burrows.

**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 the risk of extinction.**
The spotted-tail quoll is considered a potential occurrence within the study area, based on local records and suitable habitat. All forest types within the study area are considered to offer potential forage habitat for this species and suitable hollows


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and logs suggest that this species may also utilise hollows for dens within the study area.

The proposal will not result in the loss of any large areas of forest and corridors connecting the retained forest areas are to be maintained. These actions will preserve the current connectivity and available hollow logs within the study area. As such, it is unlikely that the proposal would have an adverse effect on the lifecycle of the spotted-tail quoll.

**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**

There are no endangered populations relevant to this 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**

This is not an endangered ecological community.

**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.**

This is not an endangered ecological community.

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

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

The proposal will result in the loss of approximately 1ha of habitat for this species. 0.75ha of this is already highly disturbed through significant weed encroachment and fragmentation.

**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 main areas of connectivity across the site, although only tenuously connected, will be retained. As such, areas of habitat are not considered to become isolated or fragmented as a result of this proposal.

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

The areas of habitat that will be removed are unlikely to be of significant importance to the long term survival of the species. The most important habitat found on site will be retained as part of the current plan.

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



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There is not critical habitat within the subject site.

**f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,**
Several actions have been identified by DECC that need to be undertaken to recover this species, including:

- Consult with DECC if Spotted-tailed Quolls are raiding poultry, rather than taking direct action.
- Undertake cat and fox control using poison-baiting techniques least likely to affect quolls.
- Consult with DECC if any poison baiting is to be conducted in and immediately adjacent to areas where Spotted-tailed Quolls are known or likely to occur.
- Retain and protect large, forested areas with hollow logs and rocky outcrops, particularly areas with thick understorey or dense vegetation along drainage lines.

Not all these actions are relevant to the proposal, however, the retention of the forested areas of habitat on the site are considered to be consistent with the above actions.

**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 proposal will result in the removal of some of the lowland rainforest, which is considered to represent a contribution to the Key Threatening Process: 'clearing of native vegetation'. However, this is being restricted to the disturbed areas of this community and when incorporated with the recommended planting of native vegetation is not considered to increase the impact of this threatening process.

Several other Key Threatening Processes may influence the study area, including 'invasion of native plant communities by exotic perennial grasses' and 'invasion, establishment and spread of Lantana camara'. These processes are of concern to this species. However, the community remnant is already highly invaded by exotic species including perennial grasses and lantana and this action is not considered to increase the impact of these threatening processes on this species.

'Predation by the European Red Fox *Vulpes Vulpes*' and the 'Predation by the Feral Cat, *Felis catus*' are listed Key Threatening Processes that are likely to exist in the study area. These species are considered likely occurrences within the subject site and locality. However, cats were recorded on the study area and foxes are considered highly likely to occur given the surrounding rural, rural residential and urban land uses. The proposal is likely to cause a marginal contribution to this process.


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### Yellow-bellied Glider (*Petaurus australis*)

This species is restricted to tall mature forests, preferring productive tall open sclerophyll forests with a mosaic of tree species including some that flower in winter. Large hollows within mature trees are required for shelter, nesting and breeding.

**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 the risk of extinction.**

The yellow-bellied glider is considered a potential occurrence within the study area, based on local records and suitable habitat. All forest types within the study area are considered to offer potential forage habitat for this species and suitable hollow bearing trees suggest that this species may also utilise these resources for dens within the study area.

The proposal will not result in the loss of any large areas of forest and corridors connecting the retained forest areas are to be maintained. Hollow bearing trees outside of this retained vegetation have been identified and recommended for protection These actions will preserve the current connectivity and available den trees within the study area. As such, it is unlikely that the proposal would have an adverse effect on the lifecycle of the yellow-bellied glider.

**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**

There are no endangered populations relevant to this 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**

This is not an endangered ecological community.

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.**

This is not an endangered ecological community.

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

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

The proposal will result in the loss of approximately 1ha of habitat for this species. 0.75ha of this is already highly disturbed through significant weed encroachment and fragmentation.

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**



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The main areas of connectivity across the site, although only tenuously connected, will be retained. As such, areas of habitat are not considered to become isolated or fragmented as a result of this proposal.

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

The areas of habitat that will be removed are unlikely to be of significant importance to the long term survival of the species. The most important habitat found on site will be retained as part of the current plan.

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

There is not critical habitat within the subject site.

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

A Recovery Plan has been formulated for yellow-bellied glider (NPWS 2003), the actions of which are detailed in Table 3, below.

**Table 4: Yellow-bellied glider recovery objectives, actions and relevance to the proposal.**

| Objective | Recovery Action | Relevance to Proposal |
|---|---|---|
| 1. To co-ordinate the recovery of the Yellow-bellied Glider in NSW | The NPWS will co-ordinate the implementation of the actions outlined in this Recovery Plan. | NPWS responsibility. Not relevant to the proposal. |
| | The NPWS will integrate recovery actions of the Yellow-bellied Glider with those of other threatened species, populations and ecological communities. | NPWS responsibility. Not relevant to the proposal. |
| 2. To encourage and assist in improving the protection and management of the Yellow-bellied Glider and its habitat. | The NPWS will develop standard survey and environmental impact assessment guidelines for the Yellow-bellied Glider and distribute them to all relevant consent authorities. | NPWS responsibility. Not relevant to the proposal. |
| | The NPWS will provide for Yellow-bellied Glider populations in reserve management and planning. | NPWS responsibility. Not relevant to the proposal. |
| | The NPWS will encourage State government agencies and local governments to consider the inclusion of regional-based Yellow-bellied Glider habitat types, sap trees and sap tree species in planning instruments. | NPWS responsibility. Not relevant to the proposal |



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| Objective | Recovery Action | Relevance to Proposal |
|---|---|---|
| | The NPWS will encourage Catchment Management Boards (CMBs), RVCs and Bush Fire Management Committees (BFMCs) to consider regionally significant Yellow-bellied Glider habitat types, sap trees and sap tree species in Catchment Management Blueprints, Regional Vegetation Management Plans, Bush Fire Risk Management Plans and Plans of Operations. | NPWS responsibility. Not relevant to the proposal |
| | The NPWS will liaise with DLWC to achieve retention of Yellow-bellied Glider sap trees, sap tree species den trees and a mosaic of forest types when assessing private native forest logging and vegetation clearance applications. | NPWS responsibility. Not relevant to the proposal |
| | The NPWS will liaise with relevant government agencies and utility providers to ensure that appropriate consideration is given to the isolation of Yellow-bellied Glider habitat in design of roads, easement corridors and other linear clearings (including access and maintenance trails). | NPWS responsibility. Not relevant to the proposal |
| | The NPWS will consolidate survey results and records, including existing records that do not appear in the NPWS Atlas of NSW Wildlife, to identify the status of the Yellow-bellied Glider on privately-owned and public forested land. | NPWS responsibility. Not relevant to the proposal |
| 3. To identify and monitor significant populations of the species | The NPWS will, on a NPWS directorate basis, identify significant Yellow-bellied Glider populations and the specific management issues associated with them. The NPWS will support monitoring of these populations and, where possible, implement appropriate management. | NPWS responsibility. Not relevant to the proposal |
| 4. To facilitate strategic research into the ecology of the Yellow-bellied Glider that is relevant to its conservation | The NPWS will liaise with research institutes, tertiary institutions, State government agencies and other public authorities to facilitate strategic ecological research that is relevant to the conservation of the Yellow-bellied Glider. | NPWS responsibility. Not relevant to the proposal |



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| Objective | Recovery Action | Relevance to Proposal |
|---|---|---|
| 5. To increase community awareness of the Yellow-bellied Glider and encourage community involvement in its conservation | The NPWS will develop and distribute an information package to provide guidance to CMBs, RVCs, BFMCs, local governments,<br>Landcare groups and individuals to assist in the identification of Yellow-bellied Glider habitat, sap trees, protection strategies and habitat enhancement as part of conservation and revegetation programs. | NPWS responsibility. Not relevant to the proposal |
| | The NPWS will develop and distribute information on the Yellow-bellied Glider to the general community. | NPWS responsibility. Not relevant to the proposal |

Not all these actions are relevant to the proposal, however, the retention of the forested habitat on site is considered to be consistent with the above actions.

**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 proposal will result in the removal of some of the lowland rainforest, which is considered to represent a contribution to the Key Threatening Process: `clearing of native vegetation'. However, this is being restricted to the disturbed areas of this community and when incorporated with the recommended planting of native vegetation is not considered to increase the impact of this threatening process.

Several other Key Threatening Processes may influence the study area, including `invasion of native plant communities by exotic perennial grasses' and `invasion, establishment and spread of Lantana camara'. These processes are of concern to this species. However, the community remnant is already highly invaded by exotic species including perennial grasses and lantana and this action is not considered to increase the impact of these threatening processes on this species.

`Predation by the European Red Fox *Vulpes Vulpes*' and the 'Predation by the Feral Cat, *Felis catus*' are listed Key Threatening Processes that are likely to exist in the study area. These species are considered likely occurrences within the subject site and locality. However, cats were recorded on the study area and foxes are considered highly likely to occur given the surrounding rural, rural residential and urban land uses. The proposal is likely to cause a marginal contribution to this process.

### Squirrel Glider (*Petaurus norfolcensis*)

Associated with dry hardwood forest and woodlands. Habitats typically include gum barked and high nectar producing species, including winter flower species. The presence of hollow bearing eucalypts is a critical habitat value.



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**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 the risk of extinction.**

The squirrel glider is considered a potential occurrence within the study area, based on local records and suitable habitat. All forest types within the study area are considered to offer potential forage habitat for this species and suitable hollow bearing trees suggest that this species may also utilise these resources for dens within the study area.

The proposal will not result in the loss of any large areas of forest and corridors connecting the retained forest areas are to be maintained. Hollow bearing trees outside of this retained vegetation have been identified and recommended for protection These actions will preserve the current connectivity and available den trees within the study area. As such, it is unlikely that the proposal would have an adverse effect on the lifecycle of the squirrel glider.

**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**

There are no endangered populations relevant to this 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**

This is not an endangered ecological community.

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.**

This is not an endangered ecological community.

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

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

The proposal will result in the loss of approximately 1ha of habitat for this species. 0.75ha of this is already highly disturbed through significant weed encroachment and fragmentation.

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 main areas of connectivity across the site, although only tenuously connected, will be retained. As such, areas of habitat are not considered to become isolated or fragmented as a result of this proposal.



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**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 areas of habitat that will be removed are unlikely to be of significant importance to the long term survival of the species. The most important habitat found on site will be retained as part of the current plan.

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

There is not critical habitat within the subject site.

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

There is currently no recovery plan for this species. However, DECC have detailed several actions that land holders can undertake to recover the species, including:

- Retain den trees and recruitment trees (future hollow-bearing trees).
- Retain food resources, particularly sap-feeding trees and understorey feed species such as Acacias and banksias.
- Replace top one or two strands of barbed wire on fences with regular wire in and adjacent to habitat.
- Retain and protect areas of habitat, particularly mature or old growth forest containing hollow-bearing trees and sap-feeding trees.
- In urban and rural areas retain and rehabilitate habitat to maintain or increase the total area of habitat available, reduce edge effects, minimise foraging distances and increase the types of resources available

Many of these actions do not apply to this proposal. However, the retention of the forest communities and the hollow bearing trees on the site is in alignment with these actions.

**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 proposal will result in the removal of some of the lowland rainforest, which is considered to represent a contribution to the Key Threatening Process: `clearing of native vegetation'. However, this is being restricted to the disturbed areas of this community and when incorporated with the recommended planting of native vegetation is not considered to increase the impact of this threatening process.

Several other Key Threatening Processes may influence the study area, including `invasion of native plant communities by exotic perennial grasses' and `invasion, establishment and spread of Lantana camara'. These processes are of concern to this species. However, the community remnant is already highly invaded by exotic species including perennial grasses and lantana and this action is not considered to increase the impact of these threatening processes on this species.



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'Predation by the European Red Fox *Vulpes Vulpes*' and the 'Predation by the Feral Cat, *Felis catus*' are listed Key Threatening Processes that are likely to exist in the study area. These species are considered likely occurrences within the subject site and locality. However, cats were recorded on the study area and foxes are considered highly likely to occur given the surrounding rural, rural residential and urban land uses. The proposal is likely to cause a marginal contribution to this process.

**Koala (*Phascolarctos cinereus*)**

Associated with both wet and dry Eucalypt forest and woodland that contains a canopy cover ranging from approximately 10 to 70%, with acceptable Eucalypt food trees. Some preferred Eucalyptus species are: *Eucalyptus tereticornis, E. punctata, E. cypellocarpa, E. viminalis* and *E. gradis*.

**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 the risk of extinction.**

The koala was observed within the study area. All forest types within the study area are considered to offer potential forage habitat for this species with preferred feed trees common across the site. The proposal will not result in the loss of any large areas of forest and corridors connecting the retained forest areas are to be maintained in accordance with the CHKPoM. Additionally recommendations have been made to incorporate koala sensitive road design in the vicinity of koala habitat along with koala sensitive design of lots These actions will largely preserve the current connectivity and available feed trees within the study area and allow koala activity around the proposal. If these recommendations are adopted, it is unlikely that the proposal would have an adverse effect on the lifecycle of the koala such that a local population will be placed at risk of extinction.

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

There are no endangered populations relevant to this 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**

This is not an endangered ecological community.

**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.**

This is not an endangered ecological community.

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



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

The proposal will result in the loss of approximately 1.5ha of habitat for this species. 0.75ha of this is already highly disturbed through significant weed encroachment and fragmentation.

**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 main areas of connectivity across the site, although only tenuously connected, will be retained. Recommendations have been provided to enhance the available connectivity in accordance with the CHKPoM. As such, areas of habitat are not considered to become isolated or fragmented as a result of this proposal.

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

The areas of habitat that will be removed are unlikely to be of significant importance to the long term survival of the species. The most important habitat found on site will be retained as part of the current plan.

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

There is not critical habitat within the subject site.

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

A Recovery Plan has been formulated for koala (NPWS 2003a), the actions of which are detailed in Table 4, below.

| Objective | Specific Objective | Relevance to Proposal |
|---|---|---|
| 1. To conserve koalas in their existing habitat | Identification and conservation of habitat important for koala conservation | NPWS responsibility. Not relevant to the proposal |
| | Integration of koala conservation into local and state government planning processes | NPWS responsibility. Not relevant to the proposal |
| | Development of appropriate road design in koala habitat. | Undertaken in this study as part of the CHKPoM |
| | Implementation of strategies which minimise the impacts of dogs on koala populations | NPWS responsibility. Not relevant to the proposal |
| | Integration of koala conservation into local and state government planning processes | NPWS responsibility. Not relevant to the proposal |



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| Objective | Specific Objective | Relevance to Proposal |
|---|---|---|
| 2. To rehabilitate and restore koala habitat and populations | Revegetation and rehabilitation of selected sites | NPWS responsibility. Not relevant to the proposal |
| | Appropriate use of Translocation | NPWS responsibility. Not relevant to the proposal |
| 3. To develop a better understanding of the conservation biology of koalas | Establishing research priorities | NPWS responsibility. Not relevant to the proposal |
| | Surveys of koala distribution and habitat requirements | NPWS responsibility. Not relevant to the proposal |
| | Use of recognised census techniques | Undertaken in this study |
| | Establishment of a Monitoring Program | NPWS responsibility. Not relevant to the proposal |
| 4. To ensure that the community has access to factual information about the distribution, conservation and management of koalas at a national, State and local level. | Preparation and distribution of educational material and involvement of the community in koala conservation. | NPWS responsibility. Not relevant to the proposal |
| | To understand the cultural significance of koalas to indigenous Australians in NSW. | NPWS responsibility. Not relevant to the proposal |
| 5. To manage captive, sick or injured koalas and orphaned wild koalas to ensure consistent and high standards of care | | NPWS responsibility. Not relevant to the proposal |
| 6. To manage over-browsing to prevent both koala starvation and ecosystem damage in discreet patches of habitat. | | NPWS responsibility. Not relevant to the proposal |
| 7. To co-ordinate the implementation of the Koala Recovery Plan across NSW | | NPWS responsibility. Not relevant to the proposal |

Not all these actions are relevant to the proposal, however, the retention of the forested habitat on site is considered to be consistent with the above actions.

**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.**



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The proposal will result in the removal of some of the lowland rainforest, which is considered to represent a contribution to the Key Threatening Process: 'clearing of native vegetation'. However, this is being restricted to the disturbed areas of this community and when incorporated with the recommended planting of native vegetation is not considered to increase the impact of this threatening process.

Several other Key Threatening Processes may influence the study area, including 'invasion of native plant communities by exotic perennial grasses' and 'invasion, establishment and spread of Lantana camara'. These processes are of concern to this species. However, the community remnant is already highly invaded by exotic species including perennial grasses and lantana and this action is not considered to increase the impact of these threatening processes on this species.

'Predation by the European Red Fox *Vulpes Vulpes*' and the 'Predation by the Feral Cat, *Felis catus*' are listed Key Threatening Processes that are likely to exist in the study area. These species are considered likely occurrences within the subject site and locality. However, cats were recorded on the study area and foxes are considered highly likely to occur given the surrounding rural, rural residential and urban land uses. The proposal is likely to cause a marginal contribution to this process.

**Hoary Bat (*Chalinolobus nigrogriseus*)**

The preferred habitat of this species appears to be variable, with dry open forest, woodland, vine thickets, coastal scrub, sand dunes, grasslands and floodplains recorded (Churchill 1998). This species often forages along watercourses, swampy areas and over farm dams. In NSW, this species has been recorded in Spotted Gum (*Corymbia maculata*), Grey Box (*Eucalyptus moluccana*) and Northern Ironbark (*E. siderophloia*) and woodland characterised by Scribbly Gums (*E. signata*) and Pink Bloodwood (*C. intermedia*) and sites dominated by the Blackbutt (*E. pilularis*). Roost sites have been identified as tree hollows, rock crevices and the roofs of buildings.

**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 the risk of extinction.**

The hoary bat is considered a potential occurrence within the study area, based on local records and suitable habitat. All lowland rainforest, stream and dams within the study area are considered to offer potential forage habitat for this species and suitable hollow bearing trees suggest that this species may also utilise these resources for roosting within the study area.

The proposal will not result in the loss of any large areas of forest and the majority of the stream and dams within the study area will be retained. Hollow bearing trees outside of this retained vegetation have also been identified and recommended for protection. These actions will preserve the current habitat and available roost trees within the study area. As such, it is unlikely that the proposal would have an adverse effect on the lifecycle of the hoary bat.



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**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**

There are no endangered populations relevant to this 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**

This is not an endangered ecological community.

**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.**

This is not an endangered ecological community.

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

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

The proposal will result in the loss of approximately 1.5ha of habitat for this species. 0.75ha of this is already highly disturbed through significant weed encroachment and fragmentation.

**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**

This species is highly mobile and the proposal will not result in the fragmentation or isolation of habitat for this bat.

**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 areas of habitat that will be removed are unlikely to be of significant importance to the long term survival of the species. The most important habitat found on site will be retained as part of the current plan.

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

There is not critical habitat within the subject site.

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

There is currently no recovery plan for this species. However, DECC have detailed several actions that land holders can undertake to recover the species, including:

- Reduce the frequency of burning in dry eucalypt forests used for timber production and grazing.
- Reduce use of insecticides and consider alternatives where available.



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- Protect individual hollow-bearing trees in all habitats as well as large mature trees which will provide hollows in the future.
- Protect areas of dry, low-elevation, old-growth eucalypt forest, particularly those dominated by Spotted Gum, boxes and ironbarks, from clearing or fragmentation

Most of these actions do not apply to this proposal. However, the retention of the lowland rainforest and the accompanying hollow bearing trees is in alignment with these actions.

**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 proposal will result in the removal of some of the lowland rainforest, which is considered to represent a contribution to the Key Threatening Process: `clearing of native vegetation'. However, this is being restricted to the disturbed areas of this community and when incorporated with the recommended planting of native vegetation is not considered to increase the impact of this threatening process.

Several other Key Threatening Processes may influence the study area, including `invasion of native plant communities by exotic perennial grasses' and `invasion, establishment and spread of Lantana camara'. These processes are of concern to this species. However, the community remnant is already highly invaded by exotic species including perennial grasses and lantana and this action is not considered to increase the impact of these threatening processes on this species.

`Predation by the European Red Fox *Vulpes Vulpes*' and the 'Predation by the Feral Cat, *Felis catus*' are listed Key Threatening Processes that are likely to exist in the study area. These species are considered likely occurrences within the subject site and locality. However, cats were recorded on the study area and foxes are considered highly likely to occur given the surrounding rural, rural residential and urban land uses. The proposal is likely to cause a marginal contribution to this process.

### Little Bent-wing Bat (*Miniopterus australis*)

The little bent-wing bat is associated with a range of habitats, typically well-timbered areas where it forages above and below the tree canopy on small insects (AMBS 1995; Dwyer 1995, 1981). Generally, the common bent-wing bat utilises caves, old mines, and stormwater channels, under bridges and occasionally buildings for shelter (Environment Australia 2000, Dwyer 1988).

Breeding for the little bent-wing bat is confined to caves with suitable temperature, humidity and physical dimensions to permit breeding (Reardon and Flavel 1987). The dependence of the common bent-wing bat upon relatively few nursery caves suggests that threats to the existence or structural integrity of these may place widespread populations in jeopardy (Dwyer 1995).


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The Little Bent-Wing Bat generally forages above and beneath the canopy of tropical rainforest, warm temperate rainforest, tall open forest, riparian forest and dry sclerophyll forest, and in/on the edge of clearings adjacent to forest (Dwyer 1991, Smith et al 1995, Berrigan 2001d). The little bent-wing bat are often recorded flying along tracks under canopy or forest edge.

**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 the risk of extinction.**

The little bent wing bat is considered a potential occurrence within the study area during foraging activities, based on local records and suitable habitat. All lowland rainforest and the stream within the rainforest are considered to offer potential forage habitat for this species, along with the cleared open areas.

The proposal will not result in the loss of any large areas of forest and the majority of the stream within the study area will be unchanged. The cleared open areas will be lost as foraging habitat through the urban development although these are not considered as important as the forested habitats. These actions will preserve a substantial portion of the current foraging habitat within the study area. As such, it is unlikely that the proposal would have an adverse effect on the lifecycle of the little bent wing bat.

**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**

There are no endangered populations relevant to this 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**

This is not an endangered ecological community.

**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.**

This is not an endangered ecological community.

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

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

The proposal will result in the loss of approximately 1.5ha of habitat for this species. 0.75ha of this is already highly disturbed through significant weed encroachment and fragmentation.

**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**



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This species is highly mobile and the proposal will not result in the fragmentation or isolation of habitat for this bat.

**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 areas of habitat that will be removed are unlikely to be of significant importance to the long term survival of the species. The most important habitat found on site will be retained as part of the current plan.

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

There is not critical habitat within the subject site.

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

There is currently no recovery plan for this species. However, DECC have detailed several actions that land holders can undertake to recover the species, outlined in the table below:

| Recovery Actions | Relevance to Proposal |
|---|---|
| **Little Bent-wing Bat** | |
| • Retain stands of native vegetation<br>• Reduce the use of pesticides<br>• Protect known roosting and nursery sites and surrounding forest<br>• Protect from recreational caving | The proposal is in line with these recovery actions. |

**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 proposal will result in the removal of some of the lowland rainforest, which is considered to represent a contribution to the Key Threatening Process: 'clearing of native vegetation'. However, this is being restricted to the disturbed areas of this community and when incorporated with the recommended planting of native vegetation is not considered to increase the impact of this threatening process.

Several other Key Threatening Processes may influence the study area, including 'invasion of native plant communities by exotic perennial grasses' and 'invasion, establishment and spread of Lantana camara'. These processes are of concern to this species. However, the community remnant is already highly invaded by exotic species including perennial grasses and lantana and this action is not considered to increase the impact of these threatening processes on this species.

'Predation by the European Red Fox *Vulpes Vulpes*' and the 'Predation by the Feral Cat, *Felis catus*' are listed Key Threatening Processes that are likely to exist in the study area. These species are considered likely occurrences within the subject site and locality. However, cats were recorded on the study area and foxes are



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considered highly likely to occur given the surrounding rural, rural residential and urban land uses. The proposal is likely to cause a marginal contribution to this process.

**Eastern Bent-wing bat (*Miniopterus schreibersii oceanensis*)**
The eastern bent-wing bat is associated with a range of habitats, typically well-timbered areas where it forages above and below the tree canopy on small insects. Generally, the eastern bent-wing bat utilises caves, old mines, and stormwater channels, under bridges and occasionally buildings for shelter.

The eastern bent-wing bat has also been recorded using a tree hollow roost, which is more likely to be an opportunistic roost. The eastern bent-wing bat has been reported utilising bushland remnants in urban areas and is estimated to forage within a 20 km radius in a single night. Predators include owls, green tree frog (*Litoria caerulea*), pythons, feral cats and foxes.

Breeding for the little and eastern bent-wing bats is confined to caves with suitable temperature, humidity and physical dimensions to permit breeding (Reardon and Flavel 1987). The dependence of the common bent-wing bat upon relatively few nursery caves suggests that threats to the existence or structural integrity of these may place widespread populations in jeopardy (Dwyer 1995). Limestone cave systems within the Macleay valley support a known large nursery colony of eastern bent-wing bat (Dwyer 1991, 1968; Smith *et al* 1995). Another maternity cave of the eastern bent-wing bat occurs near Riverton (western tablelands) (Dwyer 1966). Long migrations of eastern bent-wing bat between roost sites, according to seasonal needs or reproductive status, have been recorded (ie up to 60-70km in one night)(Dwyer 1995a).

**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 the risk of extinction.**
The eastern bent wing bat is considered a potential occurrence within the study area during foraging activities, based on local records and suitable habitat. All lowland rainforest and the stream within the rainforest are considered to offer potential forage habitat for this species, along with the cleared open areas.

The proposal will not result in the loss of any large areas of forest and the majority of the stream within the study area will be unchanged. The cleared open areas will be lost as foraging habitat through the urban development although these are not considered as important as the forested habitats. These actions will preserve a substantial portion of the current foraging habitat within the study area. As such, it is unlikely that the proposal would have an adverse effect on the lifecycle of the eastern bent wing bat.

**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**


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There are no endangered populations relevant to this 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**

This is not an endangered ecological community.

**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.**

This is not an endangered ecological community.

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

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

The proposal will not result in the loss of any important habitat

**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 proposal will not result in the fragmentation of habitat on the site. Additionally, this species is highly mobile and this proposal will not increase the fragmentation of habitat across the species range.

**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 proposal will not result in the removal of any important habitat and will not impact on the long-term survival of the species in this locality.

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

There is not critical habitat within the subject site.

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

There is currently no recovery plan for this species. However, DECC have detailed several actions that land holders can undertake to recover the species, outlined in the table below:

**Recovery actions for threatened microchiropteran bats**

| Recovery Actions | Relevance to Proposal |
|---|---|
| **Common Bent-wing Bat** | |
| • Control foxes and feral cats around roost sites<br>• Retain native vegetation around roost sites<br>• Minimise the use of pesticides in foraging areas<br>• Protect roosting sites from lakeage or disturbance | The proposal is in line with these recovery actions. |



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**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 proposal will result in the removal of some of the lowland rainforest, which is considered to represent a contribution to the Key Threatening Process: `clearing of native vegetation'. However, this is being restricted to the disturbed areas of this community and when incorporated with the recommended planting of native vegetation is not considered to increase the impact of this threatening process.

Several other Key Threatening Processes may influence the study area, including `invasion of native plant communities by exotic perennial grasses' and `invasion, establishment and spread of Lantana camara'. These processes are of concern to this species. However, the community remnant is already highly invaded by exotic species including perennial grasses and lantana and this action is not considered to increase the impact of these threatening processes on this species.

`Predation by the European Red Fox *Vulpes Vulpes*' and the 'Predation by the Feral Cat, *Felis catus*' are listed Key Threatening Processes that are likely to exist in the study area. These species are considered likely occurrences within the subject site and locality. However, cats were recorded on the study area and foxes are considered highly likely to occur given the surrounding rural, rural residential and urban land uses. The proposal is likely to cause a marginal contribution to this process.

### East Coast Freetail Bat (*Mormopterus norfolkensis*)

Most records of this species are from dry eucalypt forest and woodland east of the Great Dividing Range. Individuals have, however, been recorded flying low over a rocky river in rainforest and wet sclerophyll forest and foraging in clearings at forest edges. Primarily roosts in hollows or behind loose bark in mature eucalypts, but have been observed roosting in the roof of a hut.

**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 the risk of extinction.**
The east coast freetail bat is considered a potential occurrence within the study area, based on local records and suitable habitat. All lowland rainforest, stream and adjacent cleared areas within the study area are considered to offer potential forage habitat for this species and suitable hollow bearing trees suggest that this species may also utilise these resources for roosting within the study area.

The proposal will not result in the loss of any large areas of forest and the majority of the stream within the study area will be retained. Hollow bearing trees outside of this retained vegetation have also been identified and recommended for protection. These actions will preserve the current habitat and available roost trees within the study area. As such, it is unlikely that the proposal would have an adverse effect on the lifecycle of the east coast freetail bat.


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**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**

There are no endangered populations relevant to this 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**

This is not an endangered ecological community.

**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.**

This is not an endangered ecological community.

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

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

The proposal will result in the loss of approximately 1.5ha of habitat for this species. 0.75ha of this is already highly disturbed through significant weed encroachment and fragmentation.

**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**

This species is highly mobile and the proposal will not result in the fragmentation or isolation of habitat for this bat.

**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 areas of habitat that will be removed are unlikely to be of significant importance to the long term survival of the species. The most important habitat found on site will be retained as part of the current plan.

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

There is not critical habitat within the subject site.

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

There is currently no recovery plan for this species. However, DECC have detailed several actions that land holders can undertake to recover the species, including:

- Retain hollow-bearing trees and provide for hollow tree recruitment.
- Retain foraging habitat.
- Minimise the use of pesticides in foraging areas



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Most of these actions do not apply to this proposal. However, the retention of the lowland rainforest and the accompanying hollow bearing trees is in alignment with these actions.

**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 proposal will result in the removal of some of the lowland rainforest, which is considered to represent a contribution to the Key Threatening Process: 'clearing of native vegetation'. However, this is being restricted to the disturbed areas of this community and when incorporated with the recommended planting of native vegetation is not considered to increase the impact of this threatening process.

Several other Key Threatening Processes may influence the study area, including 'invasion of native plant communities by exotic perennial grasses' and 'invasion, establishment and spread of Lantana camara'. These processes are of concern to this species. However, the community remnant is already highly invaded by exotic species including perennial grasses and lantana and this action is not considered to increase the impact of these threatening processes on this species.

'Predation by the European Red Fox *Vulpes Vulpes*' and the 'Predation by the Feral Cat, *Felis catus*' are listed Key Threatening Processes that are likely to exist in the study area. These species are considered likely occurrences within the subject site and locality. However, cats were recorded on the study area and foxes are considered highly likely to occur given the surrounding rural, rural residential and urban land uses. The proposal is likely to cause a marginal contribution to this process.

### Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)

Found in almost all habitats, from wet and dry sclerophyll forest, open woodland, open country, mallee, rainforests, heathland and waterbodies. Roosts in tree hollows; may also use caves; has also been recorded in a tree hollow in a paddock and in abandoned sugar glider nests. The Yellow-bellied Sheathtail-bat is dependent on suitable hollow-bearing trees to provide roost sites, which may be a limiting factor on populations in cleared or fragmented habitats.

**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 the risk of extinction.**
The yellow-bellied sheathtail-bat is considered a potential occurrence within the study area, based on local records and suitable habitat. All lowland rainforest, stream and dams within the study area are considered to offer potential forage habitat for this species and suitable hollow bearing trees suggest that this species may also utilise these resources for roosting within the study area.

The proposal will not result in the loss of any large areas of forest and the majority of the stream and dams within the study area will be retained. Hollow bearing trees


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outside of this retained vegetation have also been identified and recommended for protection These actions will preserve the current habitat and available roost trees within the study area. As such, it is unlikely that the proposal would have an adverse effect on the lifecycle of the yellow-bellied sheathtail-bat.

**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**

This is not an endangered ecological population.

**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**

This is not an endangered ecological community.

**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.**

This is not an endangered ecological community.

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

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

The proposal will result in the loss of approximately 1.5ha of habitat for this species. 0.75ha of this is already highly disturbed through significant weed encroachment and fragmentation.

**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**

This species is highly mobile and the proposal will not result in the fragmentation or isolation of habitat for this bat.

**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 areas of habitat that will be removed are unlikely to be of significant importance to the long term survival of the species. The most important habitat found on site will be retained as part of the current plan.

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

There is not critical habitat within the subject site.



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

There is currently no recovery plan for this species. However, DECC have detailed several actions that land holders can undertake to recover the species, including:

- Raise landowners' awareness about the presence of the species and provide information on how their management actions will affect the species' survival.
- Conduct searches for the species in suitable habitat in proposed development areas.
- DEC should be consulted when planning development/s to minimise impact/s on populations.
- Retain stands of native vegetation, especially those with hollow-bearing trees (including dead trees), and retain other structures containing bats.
- Retain a buffer of vegetation around roost sites in vegetated areas.
- Protect hollow-bearing trees for breeding sites, including those on farmland; younger mature trees should also be retained to provide replacements for the older trees as they die and fall over.
- Reduce the use of pesticides in the environment.
- Encourage regeneration and replanting of local flora species to maintain bat foraging habitat.
- Assess the site's importance to the species' survival, including linkages provided between ecological resources across the broader landscape.
- Mark known sites and potential habitat onto maps used for planned poison-spraying activities

Most of these actions do not apply to this proposal. However, the retention of the lowland rainforest and the accompanying hollow bearing trees is in alignment with these actions.

**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 proposal will result in the removal of some of the lowland rainforest, which is considered to represent a contribution to the Key Threatening Process: `clearing of native vegetation'. However, this is being restricted to the disturbed areas of this community and when incorporated with the recommended planting of native vegetation is not considered to increase the impact of this threatening process.

Several other Key Threatening Processes may influence the study area, including `invasion of native plant communities by exotic perennial grasses' and `invasion, establishment and spread of Lantana camara'. These processes are of concern to this species. However, the community remnant is already highly invaded by exotic species including perennial grasses and lantana and this action is not considered to increase the impact of these threatening processes on this species.

`Predation by the European Red Fox *Vulpes Vulpes*' and the 'Predation by the Feral Cat, *Felis catus*' are listed Key Threatening Processes that are likely to exist in the



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study area. These species are considered likely occurrences within the subject site and locality. However, cats were recorded on the study area and foxes are considered highly likely to occur given the surrounding rural, rural residential and urban land uses. The proposal is likely to cause a marginal contribution to this process.

*Conclusion of 7 Part Tests*

The current subdivision plan aims to avoid the majority of the forest communities within the study area with impacts being concentrated in the cleared and disturbed parts of the site. Recommendations include the use of water sensitive urban design, design elements that achieve koala sensitive development solutions and the incorporation of revegetation and rehabilitation of strategic areas. If these recommendations are taken on board then based on the assessments provided above, for those threatened species that have been recorded within the subject site, are potential occurrences or may be indirectly affected by the proposal, it is considered unlikely that that the proposal will have significant impacts to any of the species assessed.



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**EPBC Act Assessment of Significance**

The EPBC Act Administrative Guidelines on Significance set out **'Significant Impact Criteria'** that are to be used to assist in determining whether a proposed action is likely to have a significant impact on matters of national environmental significance. Matters listed under the EPBC Act as being of national environmental significance include:

- Listed threatened species and ecological communities
- Listed Migratory species
- Wetlands of International Importance
- The Commonwealth marine environment
- World Heritage properties
- National Heritage places
- Nuclear actions

Specific **'Significant Impact Criteria'** are provided for each matter of national environmental significance except for threatened species and ecological communities in which case separate criteria are provided for species listed as endangered and vulnerable under the EPBC Act.

Threatened and migratory species listed under the EPBC Act that are considered likely or potentially to occur within the study area are given in Appendix 2 of the Report. The relevant Significant Impact Criteria have been applied to these threatened and migratory species to determine the significance of impact of the project.

- Hairy Joint Grass (*Arthraxon hispidus*) (vulnerable)
- Spotted-tail Quoll (*Dasyurus maculatus*) (endangered)
- White-throated Needletail (*Hirundapus caudacutus*) (migratory)
- Rainbow Bee-eater (*Merops ornatus*) (migratory)

| Matters to be addressed | Impact (Commonwealth Legislation) |
|---|---|
| (a) any environmental impact on a World Heritage Property; | No |
| (b) any environmental impact on Wetlands of International Importance; | The proposal will not affect any part of RAMSAR wetland. |
| (c) any impact on Commonwealth Listed Critically Endangered or Endangered Species; | Yes. One Commonwealth listed endangered species, spotted-tail quoll (*Dasyurus maculatus*) is considered likely to occur in the study area.<br><br>The significant impact criteria in terms of the endangered species; spotted-tail quoll, are discussed below:<br><br>*a. lead to a long-term decrease in the size of a population,*<br>The proposal will retain the available habitat for the species and is not |



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| Matters to be addressed | Impact (Commonwealth Legislation) |
|---|---|
| | considered to decrease the size of a population.<br><br>*b. reduce the area of occupancy of the species,*<br>The proposal will retain the available habitat and much of the connectivity for the species and is not considered to reduce the area of occupancy of the species.<br><br>*c. fragment an existing population into two or more population,*<br>The proposal will retain much of the connectivity presently on the site. Some of this connectivity will be reduced through the proximity to urban development, however this is not expected to cause a fragmentation of a population.<br><br>*d. adversely affect habitat critical to the survival of the species,*<br>The most significant area of habitat on the site will be retained. The small area of habitat to be lost is not considered to be critical to the survival of the species.<br><br>*e. disrupt the breeding cycle of a population,*<br>As the proposal will largely protect the remaining habitat and connectivity available for the spotted-tail quoll it is not expected to disrupt the breeding cycle of a population.<br><br>*f. modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline,*<br>The proposal will largely protect the available habitat for this species and it is not expected to cause a decline in the species in this area.<br><br>*g. result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species habitat,*<br>The proposal may increase the prevalence of cats and foxes in the study area due to the proximity to urban development. However, cats were recorded on the site and foxes are highly likely to be established already. As such, the proposal will not result in the establishment of these species.<br><br>*h. introduce disease that may cause the species to decline,*<br>The proposal places restriction on pets and cats are already present on the site. It is considered highly unlikely that the proposal will result in the introduction of harmful diseases.<br><br>*i. interfere with the recovery of the species,*<br>The proposal is occurring in fragmented habitat on the periphery of Coffs Harbour. It is unlikely that any impacts caused will interfere with the recovery of the spotted-tail quoll. |
| (d) any impact on Commonwealth Listed vulnerable Species; | Yes. One Commonwealth listed vulnerable species, hairy joint grass (*Arthraxon hispidus*) is considered likely to occur in the study area.<br><br>The significant impact criteria in terms of the vulnerable species; hairy joint grass, are discussed below:<br><br>*a. lead to a long-term decrease in the size of an important population of a species,*<br>The proposed action avoids the majority of the potential habitat for this species which is within the remnant lowland rainforest community. A small amount of this community will be removed although the majority of habitat for this species will be retained. As the majority of the habitat on the site for this species will be retained it is considered unlikely that the proposal will lead to a long-term decrease in the size of an important population. |



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| Matters to be addressed | Impact (Commonwealth Legislation) |
|---|---|
| | *b. reduce the area of occupancy of an important population*<br>The loss of habitat for this species is not considered to represent a reduction in the area of occupancy of an important population.<br><br>*c. fragment an existing important population into two or more populations*<br>The area of habitat that will be removed as part of this proposal is currently isolated and as such, its removal will not result in the further fragmentation of an existing population.<br><br>*d. adversely affect habitat critical to the survival of a species*<br>The habitat that is to be removed is not considered to be critical to the survival of the species.<br><br>*e. disrupt the breeding cycle of an important population*<br>The proposal is not considered to disrupt the breeding cycle of hairy joint grass which is most likely to be found in the remnant rainforest that will be retained.<br><br>*f. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*<br>The majority of the habitat for this species on the site will be retained within environmental protection lands. The loss of an isolated and degraded portion of habitat is not considered likely to cause a decline in the species.<br><br>*g. result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*<br>The existing habitat that is to be retained as part of this proposal already has invasive species established within it. The proposal is unlikely to result in the further establishment of invasive species.<br><br>*h. interferes substantially with the recovery of the species.*<br>The proposal will not substantially interfere with the recovery of hairy joint grass. |
| (e) any environmental impact on Commonwealth Listed Migratory Species; | Yes. Two Commonwealth listed migratory species are considered likely to occur at the study area:<br>• White-throated Needletail<br>• Rainbow Bee-eater<br><br>The guidelines in terms of the migratory species are discussed below:<br><br>*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*<br>The proposal will not substantially modify, destroy or isolate an area of important habitat for the white-throated needletail or rainbow bee-eater as:<br>• The proposal does not involve the modification or removal of any potential habitat for these species.<br>• All these species are capable of flying large distances and thus the proposed fragmentation will not isolate habitat for these species.<br>• Mitigative measures such as water sensitive urban design will help to prevent impact to habitat for these species.<br><br>*b. result in invasive species that is harmful to the migratory species becoming established in an area of important habitat of the migratory species*<br>The proposal will not introduce or facilitate an invasive species that is harmful to the white-throated needletail or rainbow bee-eater in an area of important habitat or otherwise.<br><br>*c. seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the* |



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| Matters to be addressed | Impact (Commonwealth Legislation) |
|---|---|
| | *species.*<br>The proposal is unlikely to disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species for the following reasons:<br>• The proposal involves minor potential impacts to the area of potential habitat, that offers variable and in some cases marginal habitat suitability.<br>• The white-throated needletail is a non-breeding migrant in Australia, with breeding taking place in northern Asia from May to August.<br>• There are no suitable nesting areas for the rainbow bee-eater. |
| (f) does any part of the Proposal involve a Nuclear Action; | No. The project does not include a Nuclear Action. |
| (g) any environmental impact on a Commonwealth Marine Area; | No. There are no Commonwealth Marine Areas within the study area. |
| (h) In addition, any direct or indirect impact on Commonwealth lands | No. The project does not directly or indirectly affect Commonwealth land. |

*Conclusion of EPBC Act Assessment*

It is unlikely that the development will significantly impact on the threatened or migratory species listed on the EPBC Act, particularly as the site only provides marginal habitat for highly mobile migratory species and that the most significant area of habitat for the spotted-tail quoll and hairy joint grass will be retained as part of the proposal. If recommendations within the report, such as water sensitive urban design, planting of vegetation and rehabilitation within the retained remnant are undertaken then referral under the EPBC Act would not be recommended.



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