JAMES WARREN & Associates Pty Ltd

ENVIRONMENTAL CONSULTANTS

# RISE ESTATE
# BILAMBIL HEIGHTS WEST TWEED
# MP 08-0234

## VOLUME 1 – ECOLOGICAL ASSESSMENT

APRIL 2009

REPORT PREPARED FOR
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# 1. INTRODUCTION

## 1.1 Background

James Warren and Associates (JWA) have been engaged by Terranora Group Management Pty Ltd to complete an Ecological Assessment for land at Bilambil Heights, NSW. The Minister for Planning has authorised a Concept Plan for the area contained within the Far North Coast Regional Strategy for Urban Expansion, plus the proposed Sports Park and sections the proposed Rise residential community at Bilambil Heights. The Director General's has subsequently issued Environmental Assessment Requirements (DGEAR's) to the Terranora Group Management Pty Ltd.

The Ecological Assessment (Volume 1) and associated documents (i.e. Volumes 2 – 3) have been prepared in response to the DGEAR's.

## 1.2 Locality

### *1.2.1 Introduction*

The Locality is defined as the area within a 10km radius of the Subject site. The Locality therefore extends from Duranbah in the south to Palm Beach in the north and from Upper Currumbin in the west to Fingal Head in the east (**FIGURE 1**).

Prominent features in the locality include the southern suburbs of the Gold Coast as far north as Palm Beach, the townships of Coolangatta, Tweed Heads, Tumbulgum, Kingscliff, Banora Point and Terranora and the villages of Chinderah, Glengarrie and Piggabeen. Major water bodies include the Tweed River and its tributaries, Cobaki Broadwater and Terranora Broadwater.

Dominant habitat types are eucalypt forest, rainforest, degraded farmland and intertidal communities. Land uses within the locality include forestry, conservation, tourism, residential, commercial, grazing and agriculture.

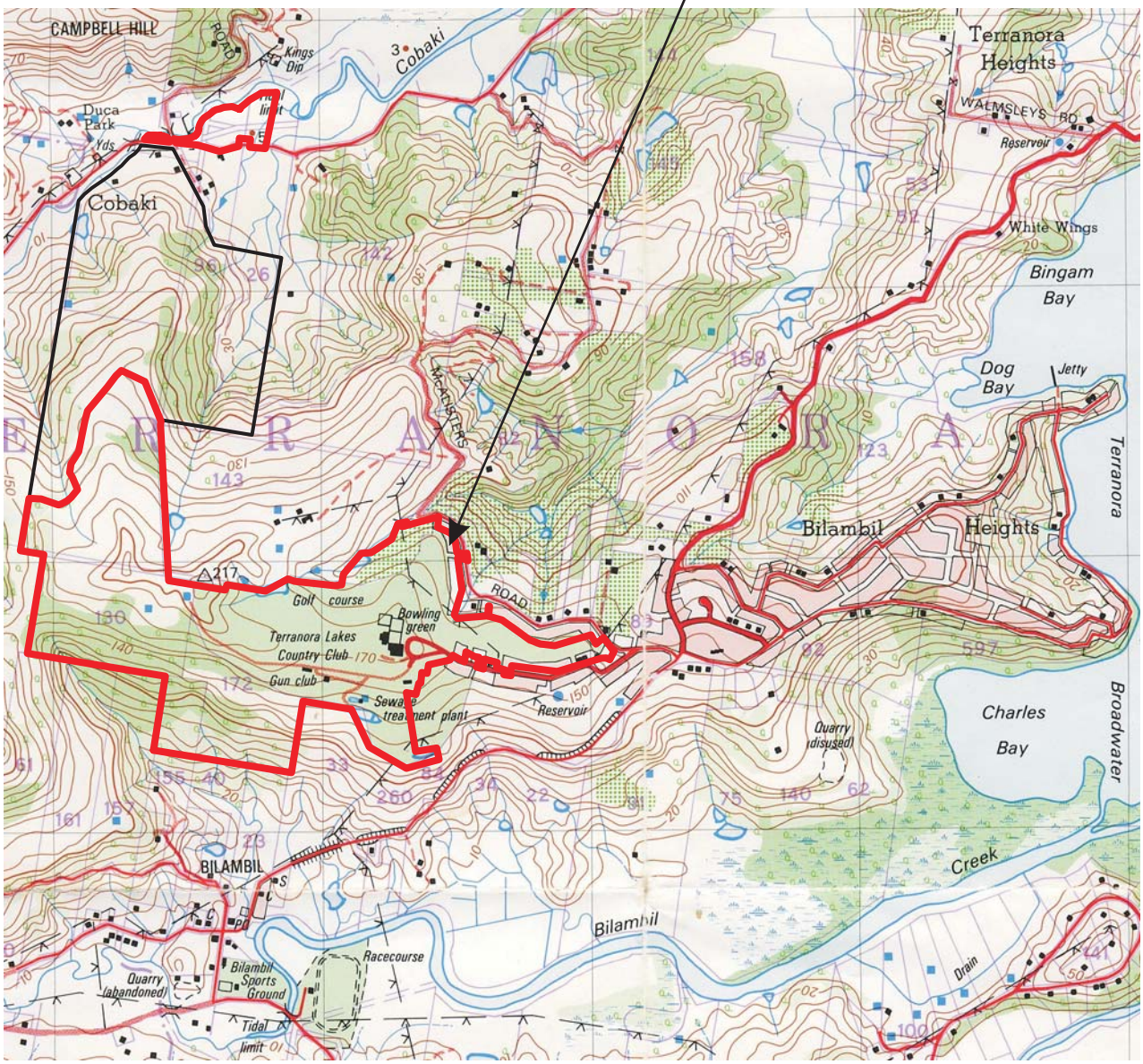
### *1.2.2 Conservation Reserves/Ecologically significant areas in the locality*

There are five (5) dedicated conservation reserves in the locality:

- Nicoll Scrub National Park, an area of 27 hectares to the North of the Subject site;
- Currumbin Hill Conservation Park, an area of 4 hectares to the North of the Subject site;
- Stotts Island Nature Reserve, an area of 142 hectares to the south of the Subject site;
- Tweed Estuary Nature Reserve, an area of 59 hectares to the east of the Subject site; and
- Ukerebagh Nature Reserve, an area of 150 hectares to the east of the Subject site.


SUBJECT SITE

N




0 1000m

| | | | |
|---|---|---|---|
| SOURCE: Currumbin Topographic Map<br>SCALE: 1 : 25 000 @ A4<br>JAMES WARREN & ASSOCIATES PTY LIMITED<br>Ecological Consultants | CLIENT<br>Terranora Group Management Pty Ltd<br>PROJECT<br>Ecological Assessment<br>Rise Estate<br>Bilambil Heights, West Tweed, NSW<br>Shire of Tweed | **VOLUME 1**<br>**FIGURE 1**<br>PREPARED: BW<br>DATE: 27 April 2009<br>FILE: N01051_EA_Locality.cdr | TITLE<br>**LOCALITY PLAN** |

State Wetlands numbers 1 - 42 occur within 10km of the locality, and are shown in **FIGURE 2**. These wetlands are protected by State Environmental Planning Policy No. 14 – Coastal Wetlands (SEPP 14).

SEPP 26 Littoral Rainforests numbers 2a, 2b and 2c occur within the locality and are shown in **FIGURE 3**. These areas of rainforest are protected by State Environmental Planning Policy No. 26 – Littoral Rainforest (SEPP 26).

## 1.3 The Subject Site

### *1.3.1 Description*

The Subject site consists of the Terranora Golf Resort (disused) and associated grazing land and covers a total area of approximately 184ha. The portion of the site that relates to the development application MP08-0234 covers a total area of approximately 129ha. While much of the land is cleared or has been substantially modified, patches of regrowth native vegetation occur covering approximately 68.4ha of the total 184ha site area. The majority of native vegetation on the site however is heavily infested with weeds including Camphor laurel and Privet. An aerial photograph of the subject site is shown in **FIGURE 4**.

The site undulates from 3m AHD in the low-lying northern portion (proposed Sports Park) to 216m AHD in the central and southern portions of the site and includes steeply sloping land.

### *1.3.2 Landuse Zones*

#### 1.3.2.1 Tweed LEP (2000)

Under the Tweed LEP (2000) various zonings cover the MP08-0234 portion of the site. These include:

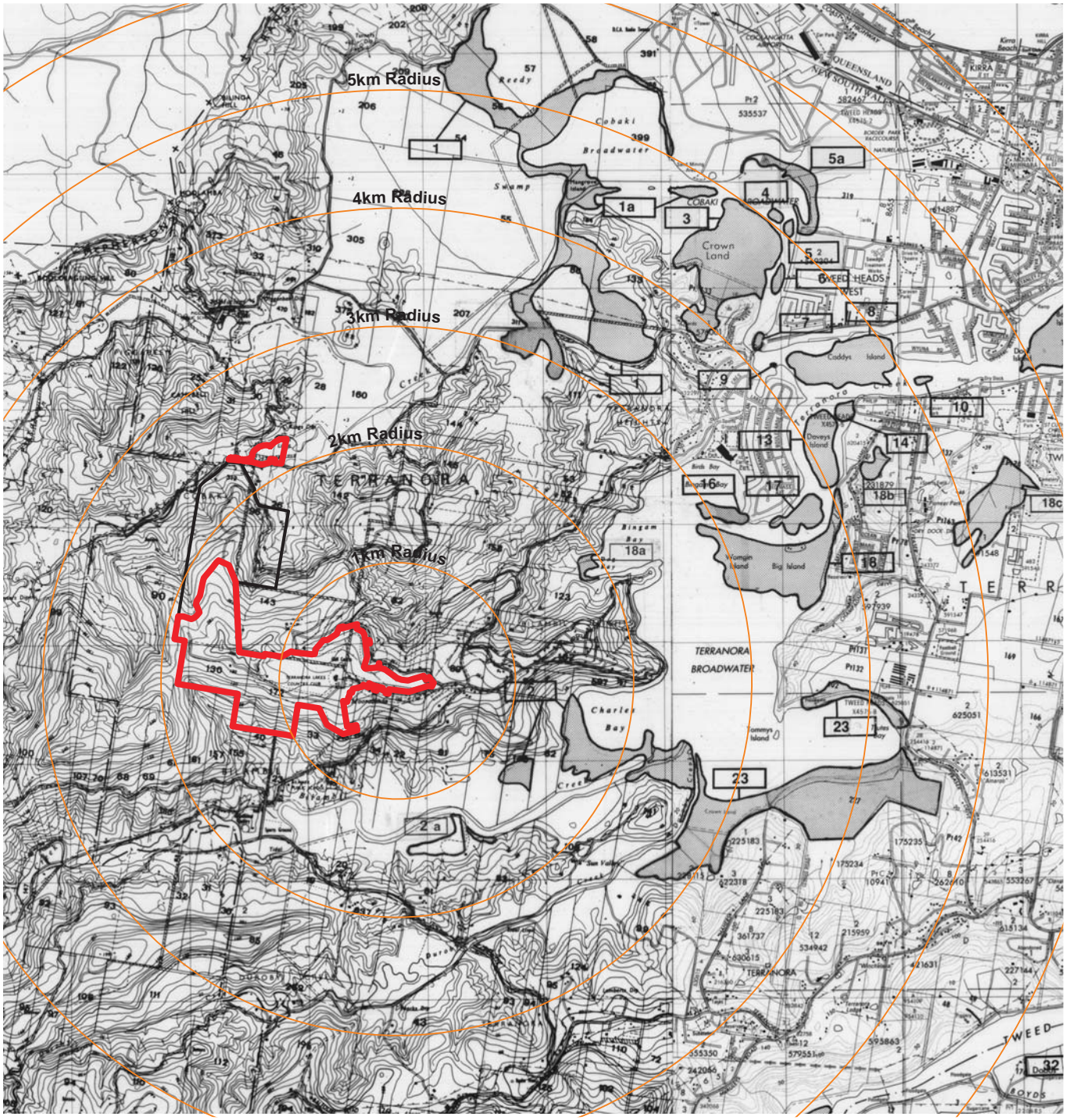
- 1(a) – Rural (an area of 5.98 ha)
- 2(c) – Urban expansion (an area of 40.47ha)
- 5(a) – Special use (an area 0.08ha)
- 6(b) - Recreation (a total area of 64.60ha)
- 7(d) - Environmental (Scenic escarpment) (a total area of 11.31 ha)

Current zonings for the site are shown in **FIGURE 5**.

#### 1.3.2.2 DRAFT Amended Tweed LEP (2008)

It is worth noting that amendments are proposed to the landuse zones currently occurring on the subject site. The Draft Amended Tweed LEP (**FIGURE 6**) shows the following landuse zones over the subject site:

- E2 – Environmental conservation (an area of 31.52 ha);
- R1 – General residential (an area of 40.63 ha);
- RE2 – Private recreation(an area of 44.61 ha); and




**LEGEND**

Area subject to SEPP No. 14 (with index number)

Site Outline

N

0 1500m

SOURCE: State Env. Planning Policy No. 14
Coastal Wetlands Map 1 Amend. No. 14

SCALE: 1 : 50 000 @ A4

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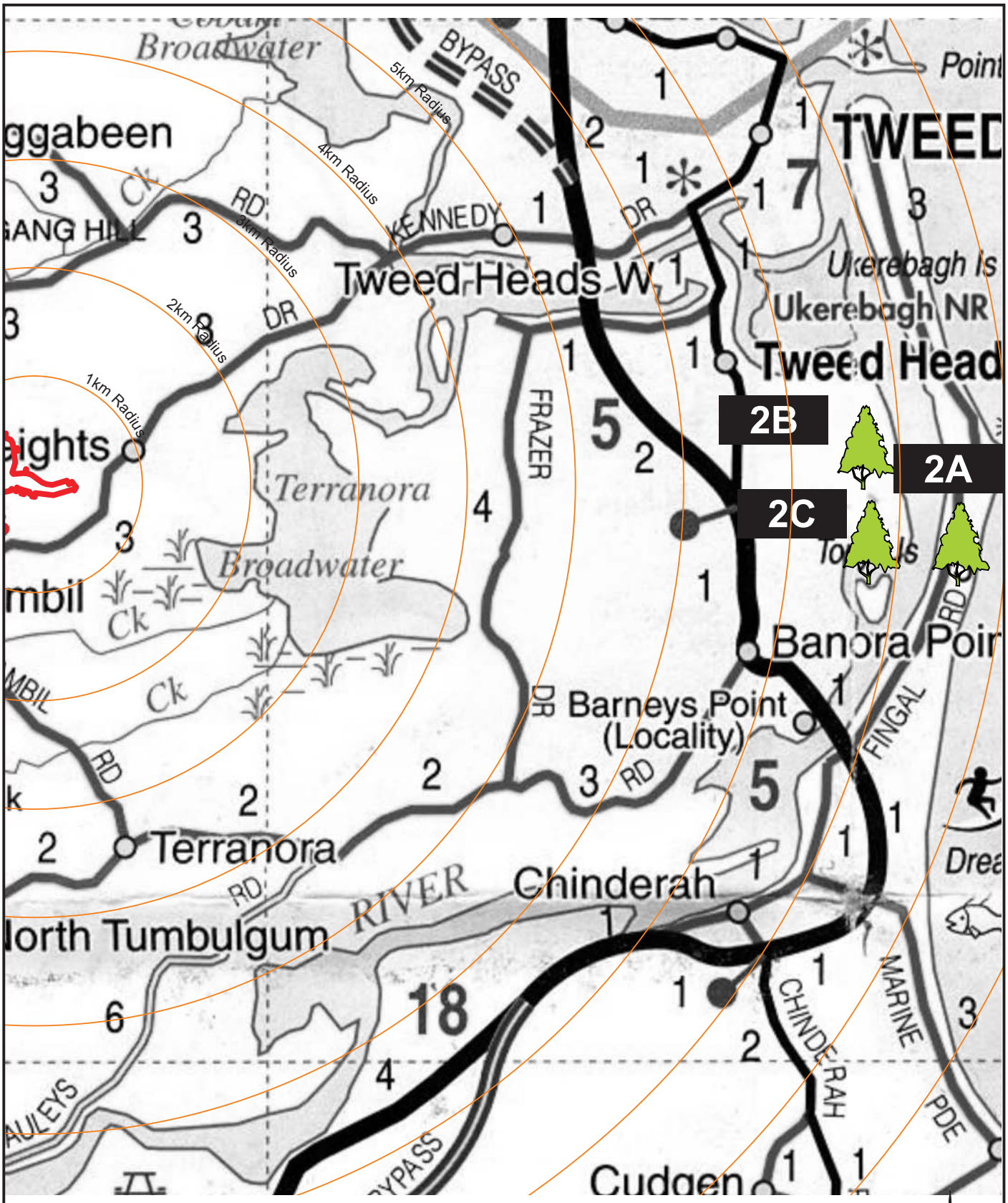
**VOLUME 1**
**FIGURE 2**

PREPARED: VJA/BW
DATE: 27 April 2009
FILE: 01051_EA_SEPP14.cdr

TITLE

**SEPP No. 14 COASTAL WETLANDS**




**LEGEND**

Area subject to SEPP No. 26 (with index number)

Site Outline

0 1500m

N

SOURCE: State Env. Planning Policy No. 26 Littoral Rainforests Map 1 Amend. No. 1

SCALE: 1 : 50 000 @ A4

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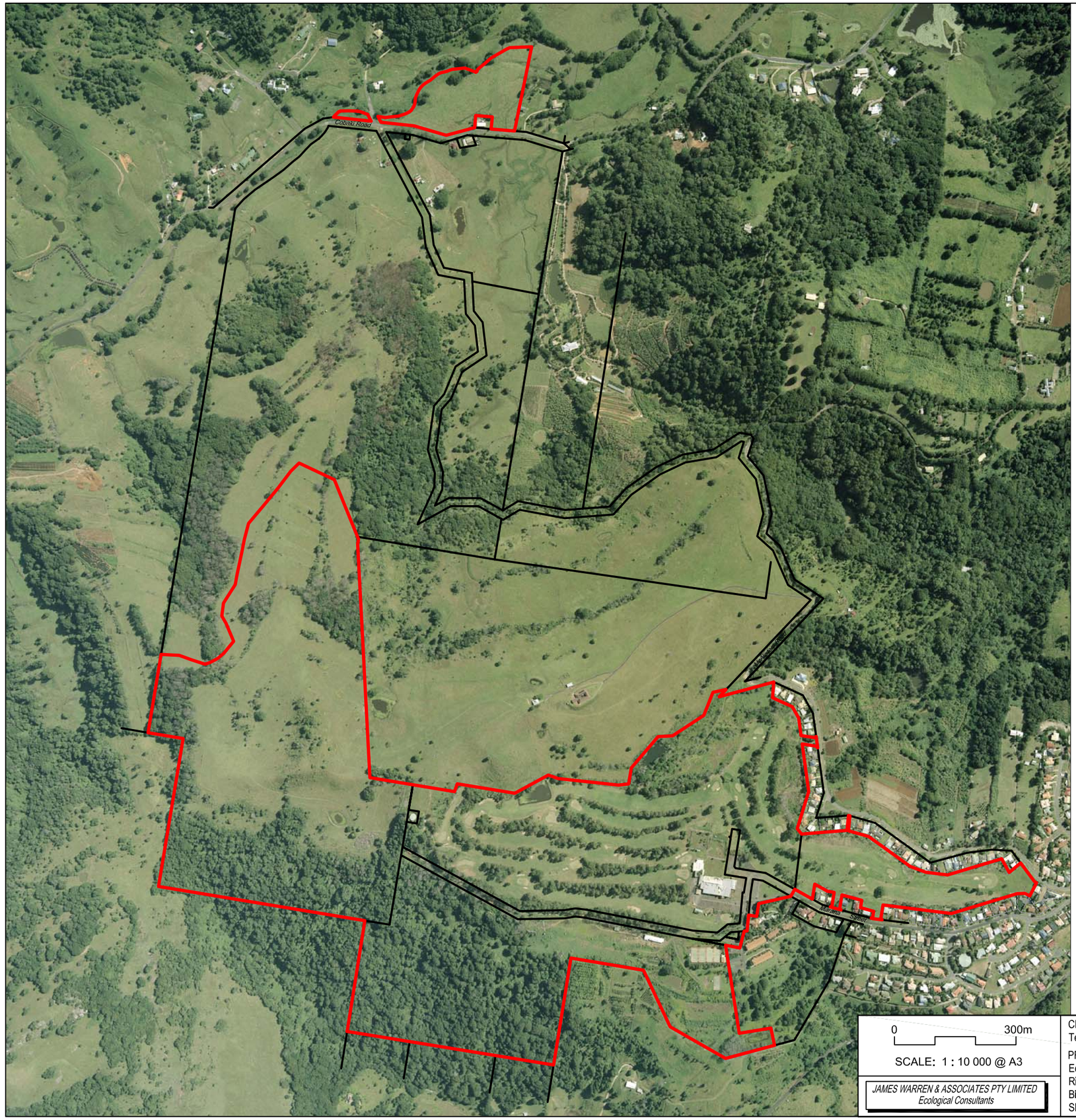
**FIGURE 3**

PREPARED: VJA/BW
DATE: 27 April 2009
FILE: 01051_EA_SEPP26.cdr

TITLE

**SEPP No. 26 LITTORAL RAINFORESTS**




**LEGEND**

Site Outline

N

SOURCE:
Aerial Photograph - Michel Group Services taken 2006 (Ref: bilambil_heights_2006-reduced.jpeg)

0 300m

SCALE: 1 : 10 000 @ A3

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FIGURE 4

PREPARED: BW
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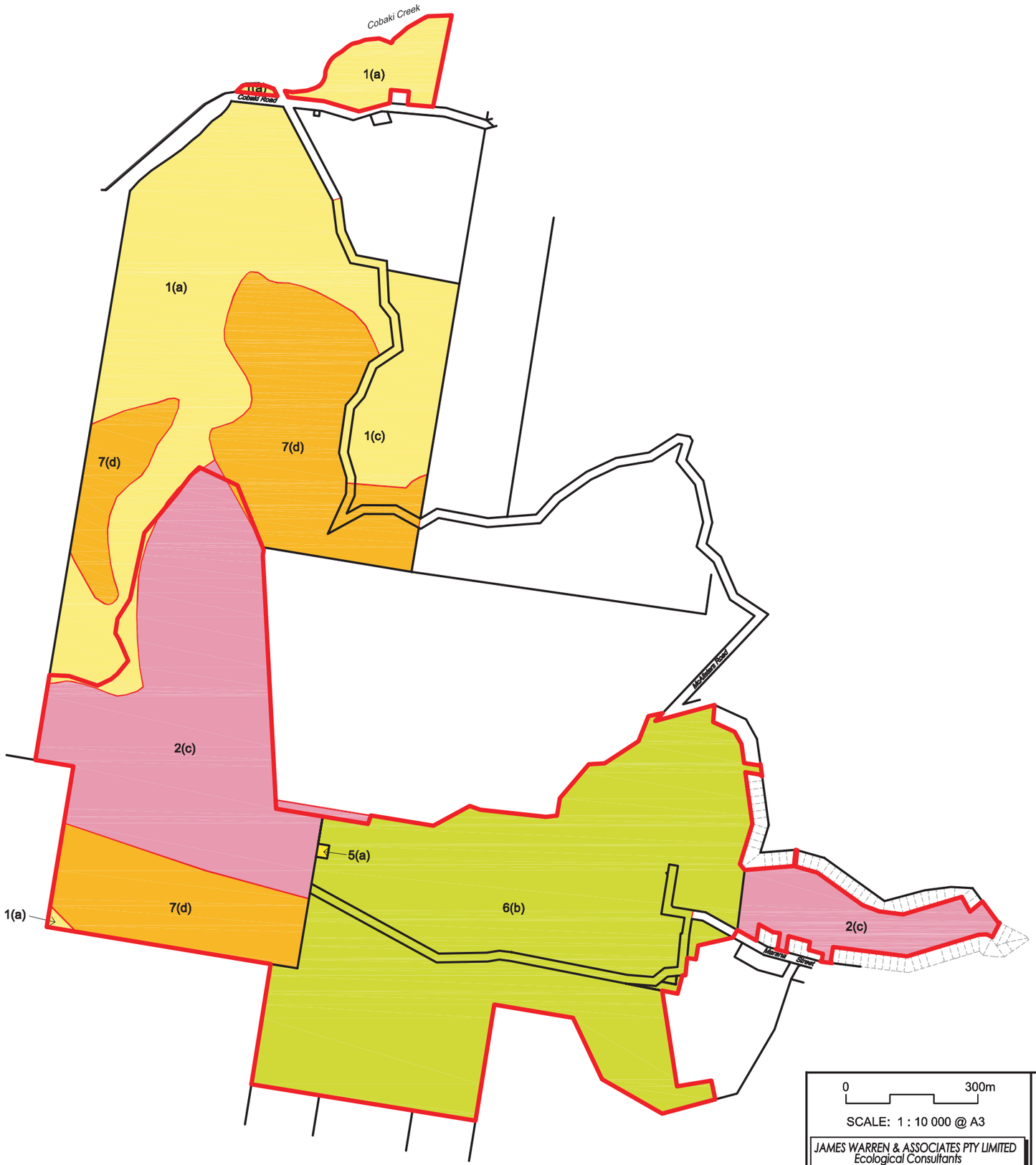
FILE: N01051_EA_Base.dwg

TITLE

AERIAL PHOTOGRAPH




## LEGEND

Rural

- 1(a) Rural
- 1(b) Rural Living

Residential

- 2(c) Urban Expansion

Special Use

- 5(a)

Open Space

- 6(b) Recreation

Environmental Protection

- 7(d) Scenic/Escarpment
- Site Outline

SOURCE:
Zoning - Michel Group Services (Ref: 8715-21E.pdf)

0 300m

SCALE: 1 : 10 000 @ A3

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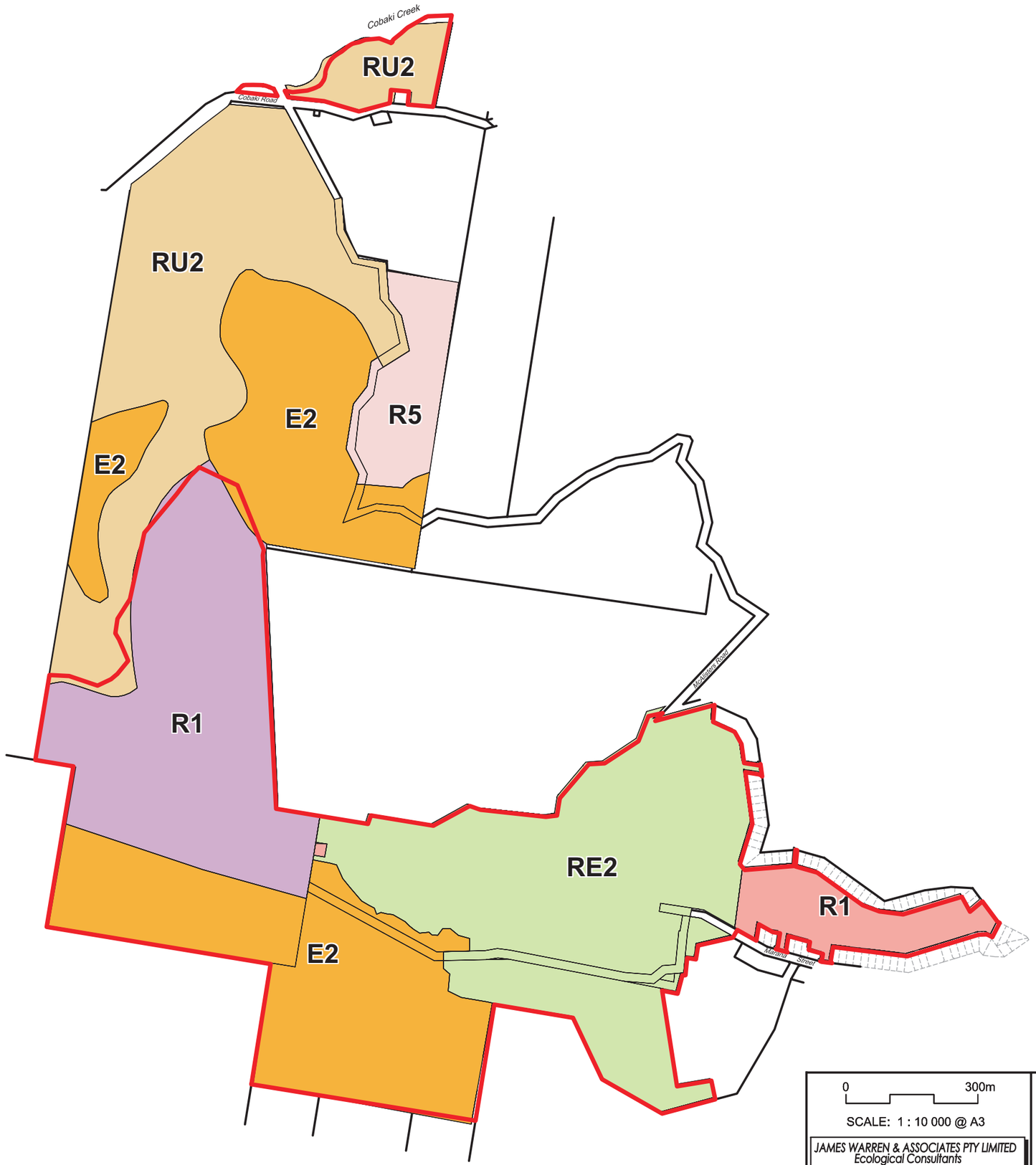
**VOLUME 1**
**FIGURE 5**

PREPARED: BW
DATE: 27 April 2009
FILE: N01051_EA_Zoning.cdr

TITLE

# TWEED SHIRE COUNCIL ZONING LEP 2000




N

## LEGEND

- E2 Environmental Conservation
- R1 General Residential
- R5 Large Lot Residential
- RE2 Private Recreation
- RU2 Rural Landscape
- Site Outline

SOURCE:
Proposed Zoning - Tweed Shire Council - Pacific Highlands / Bilambil Heights Draft Local Environmental Plan 2008 (Map LEP08)

0 300m

SCALE: 1 : 10 000 @ A3

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**FIGURE 6**

PREPARED: BW
DATE: 27 April 2009
FILE:N01051_EA_Draft Zoning.cdr

TITLE

**TWEED SHIRE COUNCIL ZONING DRAFT LEP 2008**

- RU2 – Rural landscape (an area of 5.51 ha).

Under the amended zoning for the site approximately 31.52ha of the MP08-0234 development area is designated for conservation, an increase of 20.35ha from the current zonings for the site (i.e. LEP 2000).

1.3.2.3 Proposed zoning under the MP08-0234 application

It should be noted that the proposed development layout proposes amendments to the current zoning based on the results of the numerous environmental assessments completed over the site. Under the proposed development layout, environmental protection areas would increase from approximately 11.31ha within the subject area (i.e. 7(d) zoned land) to 28.19ha (**FIGURE 7**), a gain of 17.02ha.

A summary of the current and proposed zoning for the MP08-0234 development area is shown in **TABLE 1.**

**TABLE 1**
**COMPARISON OF ZONING OVER MP08-0234 DEVELOPMENT AREA**

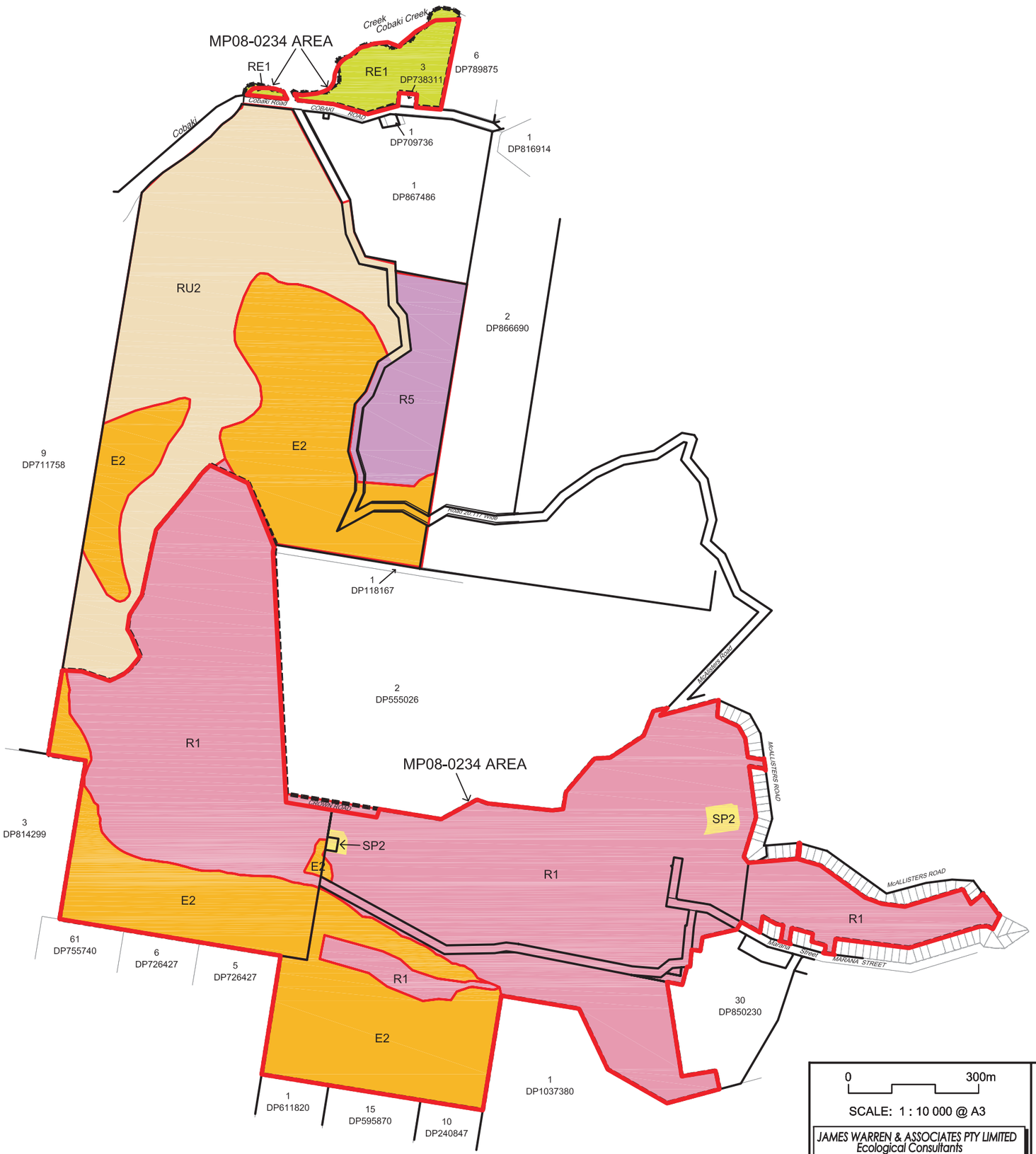
| Zone type | Current* (Tweed LEP 2000) | DRAFT Amended (Tweed LEP 2008) | Proposed (MP08-0234 Concept Plan) |
|---|---|---|---|
| **RU2 – Rural Landscape** | 4.677ha | 5.51ha | **-** |
| **R1 - General Residential** | 41.15ha | 40.63ha | **89.62ha** |
| **SP2 - Infrastructure** | 0.08ha | - | **0.71ha** |
| **RE1 – Public Recreation** | - | - | **4.51ha** |
| **RE2 – Private Recreation** | 64.6ha | 44.61ha | **-** |
| **E2 - Environmental Conservation** | 11.17ha | 31.52ha | **28.19ha** |

*** Zone types as described in section 1.3.2.1 have been replaced with corresponding titles from the DRAFT Tweed LEP (2008) for purposes of comparison within this table.**

### *1.3.3 Site History*

Terranora Group Management Pty Ltd (TGM) has owned the subject site since 1996 and during that time cattle grazing has been the dominant landuse on the farmland portions of the site. The Golf Course and associated Clubhouse are no longer commercially used full time for and both have fallen into disrepair.

In 1997 TGM gained Development Approval for a major 27 hole resort golf course and 994 resort dwellings, as well as substantial resort and Golf Club facility buildings. This DA acknowledged that removal of sections of existing rainforest vegetation would occur, along with approval to carry out one million $m^3$ of earthworks across the site. The approval also acknowledged that TGM had planned to restore approximately 50ha of environmental land as part of the resort development.




## LEGEND

- RU2 Rural Landscape
- R1 General Residential
- SP2 Infrastructure
- RE1 Public Recreation
- RE2 Private Recreation
- E2 Environmental Conservation
- Site Outline

SOURCE:
Zoning - Michel Group Services (Ref: 8715-47A.pdf)

0 300m

SCALE: 1 : 10 000 @ A3

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**FIGURE 7**

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DATE: 27 April 2009
FILE:N01051_EA_Proposedzone.cdr

TITLE

**PROPOSED ZONING**

During the past five (5) years TGM has undertaken a program of Camphor laurel removal in an attempt to control the spread of this noxious weed, and to assist the restoration of native flora communities and species, including Threatened species.

Subsequent to the commencement of the Camphor laurel management program JWA completed numerous detailed flora surveys to locate and GPS all Threatened plant species on the site.

In 2007 the Department of Environment & Climate Change (DECC) completed an intensive program to locate and map Threatened plant species on the site as part of an investigation into the alleged losses of significant plant species during the Camphor laurel management program. Data collected by DECC was not available during the completion of this assessment.

## 1.4 Structure of this Assessment

The Ecological Assessment (**VOLUME 1**) and associated documents have been prepared in response to the DGEAR's.

Accompanying Volumes of this assessment are as follows:

**VOLUME 2** – Appendices to the Ecological Assessment;

**VOLUME 3** – Site Regeneration, Revegetation and Pest Management Plan

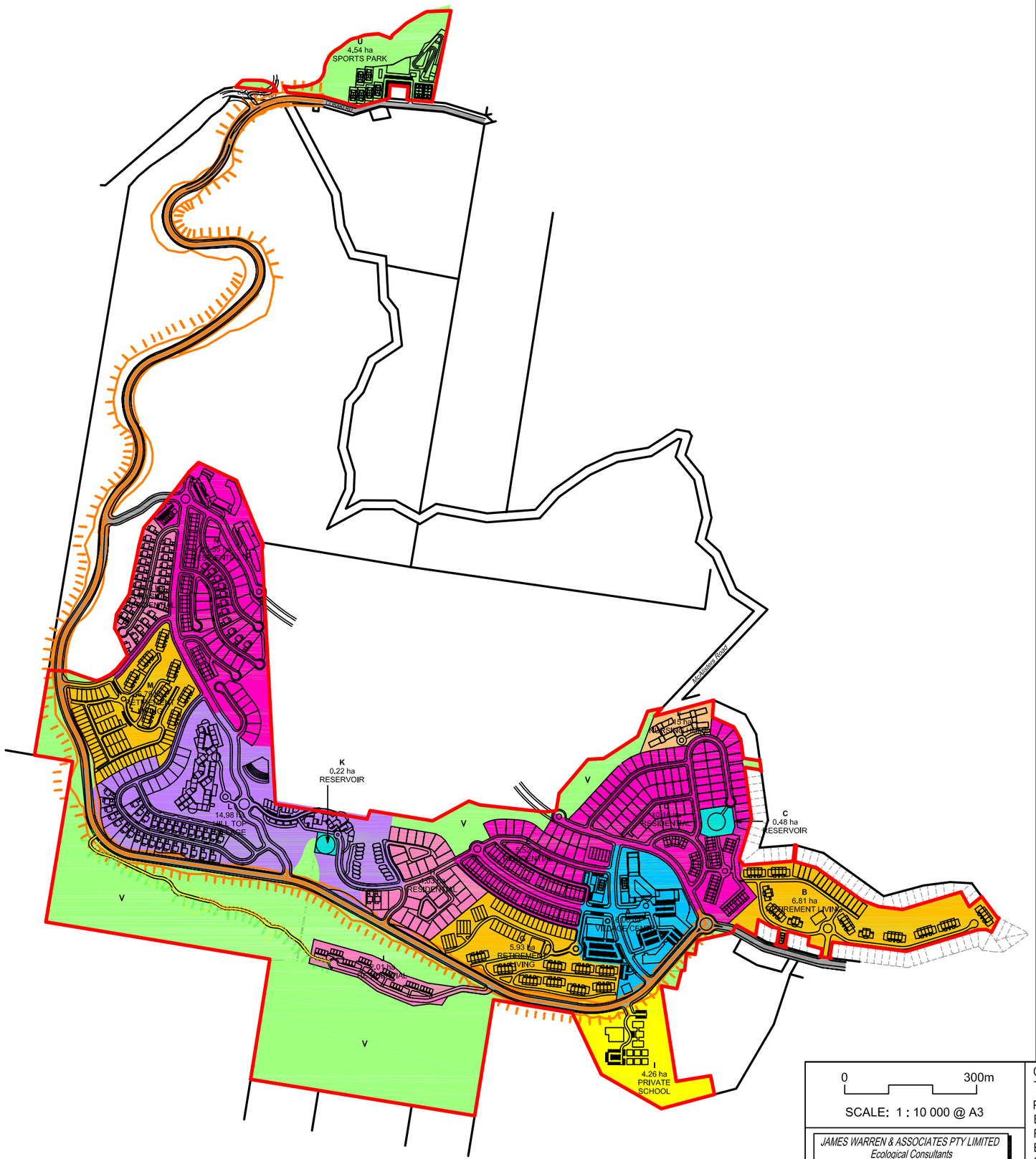
# 2. PROPOSED MP08-0234 DEVELOPMENT

The site is proposed to be developed into a master planned residential community in two (2) stages. A concept plan for the first stage of the development (i.e. the subject of the application) is shown as **FIGURE 8**. The MP08-0234 stage of the proposed development will include the following:

- Precinct A - Village centre (6.0 hectares);
- Precinct B – Retirement living (6.81 hectares);
- Precinct C – Existing water reservoir (0.48 hectares);
- Precinct D – Low density housing (10.18 hectares);
- Precinct E – Low density housing (5.52 hectares);
- Precinct F – Nursing home (1.15 hectares);
- Precinct G – Retirement living (5.93 hectares);
- Precinct H – Medium density housing (4.03 hectares);
- Precinct I – Private schools (4.26 hectares);
- Precinct J – Residential (2.01 hectares);
- Precinct K – Reservoir (0.2 hectares);
- Precinct L – Hilltop village (14.98 hectares);
- Precinct M – Retirement living (5.79 hectares);
- Precinct N – Residential (11.55 hectares);
- Precinct O – Hillside residential (2.35 hectares);
- Precinct U – Unstructured Sports Park(4.54 hectares); and
- Precinct V – Open Space and Conservation (37.12 hectares).

These works will create an estimated, 1804 dwellings and will also include the construction of the 'Spine Road' which will link the elevated southern portion of the development site with the lower lying Cobaki Road to the north.

The second stage of the project will be developed at a future date and will be the subject of a separate application.




## LEGEND

| | | |
|---|---|---|
| | A | Village Centre |
| | B | Retirement Living |
| | C | Reservoir |
| | D | Low Density Housing |
| | E | Low Density Housing |
| | F | Nursing Home |
| | G | Retirement Living |
| | H | Medium Density Housing |
| | I | Private Schools |
| | J | Residential |
| | K | Reservoir |
| | L | Hilltop Village |
| | M | Retirement Living |
| | N | Residential |
| | O | Hillside Residential |
| | U | Unstructured Sports Fields |
| | V | Open Space & Conservation |
| | | Site Outline |

SOURCE:
Layout - ML Designs (Ref: A-MP-01-16B.dwg & A-MP-01-18B.dwg)
Bushfire Track - Cardno (Ref: 510038-03-SK01 Layout Plan.dwg)

0 300m

SCALE: 1 : 10 000 @ A3

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FIGURE 8

PREPARED: BW
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FILE: N01051_EA_Base.dwg

TITLE
PROPOSED DEVELOPMENT LAYOUT

# 3. LITERATURE REVIEW

## 3.1 Introduction

A number of Flora and Fauna Reports and other sources of information were reviewed in the course of this assessment. These include:

- NPWS Atlas of NSW Wildlife & EPBC Protected Maters Database
- Tweed Vegetation Management Strategy (2004)
- Tweed Coast Koala Atlas (1996)
- WBM Oceanics (1996) Terranora Golf Project – Flora and Fauna Report
- JWA (2004a) 38 McAllisters Road - Flora and Fauna Assessment
- Tweed Shire Council (2002) Rare and Significant trees Register.
- JWA (2004b) Lot 5 DP 822786 Marana Street Bilambil Heights - Flora and Fauna Assessment.

These documents contain flora and fauna data relevant to the ecological analysis of the Subject site.

## 3.2 Flora

### *3.2.1 NPWS Atlas of NSW Wildlife & EPBC Protected Maters Database*

Searches of the NPWS and EPBC databases were completed to find records of Threatened flora species[1] within 10km of the Subject site. These searches revealed thirty-three (33) significant flora species within 10km of the Subject site. These species are shown in **TABLE 2**.

**TABLE 2**
**RECORDS OF SIGNIFICANT FLORA SPECIES WITHIN 10 KM OF THE SUBJECT SITE**

| Common name | Botanical name | Status | |
|---|---|---|---|
| | | TSC Act* | EPBC Act# |
| Arrow-head vine | *Tinospora tinosporoides* | V | V |
| Axe breaker | *Geijera paniculata* | E | - |
| Ball nut | *Floydia praealta* | V | V |
| Bopple nut | *Hicksbeachia pinnatifolia* | V | V |
| Brush cassia | *Cassia brewsteri var. marksiana* | E | - |
| Clear milkvine | *Marsdenia longiloba* | E | V |
| Coolamon | *Syzygium moorei* | V | V |
| Corokia | *Corokia whiteana* | V | V |
| Crystal Creek walnut | *Endiandra floydii* | E | E |
| Davidson's plum | *Davidsonia jerseyana* | E | E |
| Fine-leaved tuckeroo | *Lepiderema pulchella* | V | - |
| Hairy-joint grass | *Arthraxon hispidus* | V | V |
| Jointed baloghia | *Baloghia marmorata* | V | V |
| Marblewood | *Acacia bakeri* | V | - |
| Queensland xylosma | *Xylosma terrae-reginae* | E | - |

[1] As listed within schedules of the TSC Act (1995) and EPBC Act (1999).

| | | | |
|---|---|---|---|
| Red lilly pilly | *Syzygium hodgkinsoniae* | V | V |
| Red-fruited ebony | *Diospyros mabacea* | E | E |
| Rough-shelled bush nut | *Macadamia tetraphylla* | V | V |
| Rusty plum | *Amorphospermum whitei* | V | - |
| Rusty rose walnut | *Endiandra hayesii* | V | V |
| Scented acronychia | *Acronychia littoralis* | E | E |
| Small-leaved hazelwood | *Symplocos baeuerlenii* | V | V |
| Small-leaved tamarind | *Diploglottis campbellii* | E | E |
| Smooth Davidson's Plum | *Davidsonia johnsonii* | E | E |
| Southern fontainea | *Fontainea australis* | V | V |
| Sothern ochrosia | *Ochrosia moorei* | E | E |
| Spiny gardenia | *Randia moorei* | E | E |
| Stinking cryptocarya | *Cryptocarya foetida* | V | V |
| Swamp orchid | *Phaius australis* | E | E |
| Sweet myrtle | *Gossia fragrantissima* | E | E |
| Thorny pea | *Desmodium acanthocladum* | V | V |
| Yellow satinheart | *Bosistoa transversa* | V | V |
| Yiel yiel | *Grevillea hilliana* | E | - |

* E or V is Endangered or Vulnerable under the TSC Act 1995.
# E, V or R is Endangered, Vulnerable or Rare under the EPBC Act 1999.

### *3.2.2 Tweed Vegetation Management Strategy (2004)*

The Tweed Vegetation Management Strategy (TVMS) (2004) maps the southern portion of vegetation on the site as Subtropical rainforest (containing 9 Threatened flora records), while all vegetation in the northern portion of the site has been mapped as Camphor laurel (**FIGURE 9**). The disused golf course in the east of the site, and grazing land in the central and northern portions of the site has been found not to contain any vegetation of significance.

The ecological values on the site as mapped by the TVMS (2004) are shown in **FIGURE 10.** The following ecological values are mapped:

- the southern portion of vegetation on the site contains Threatened flora and fauna records and is mapped as having a high ecological sensitivity value, and a medium ecological status;
- scattered vegetation in the northern portion of the site has been mapped as having a low ecological sensitivity value, and a low ecological status, however scattered occurrences of Threatened flora species are mapped;
- the ecological sensitivity and status of the disused golf course in the east of the site, and grazing land in the central and northern portions of the site has not been determined, however a single record of a Threatened flora species occurs on the northern boundary of the golf course.

The degree of Camphor laurel presence on the site has also been mapped under the TVMS (**FIGURE 11)**. This mapping shows Camphor laurel as the dominant species within vegetation in the northern portion of the site. The southern portion of vegetation on the site is mapped as containing occasional/patchy/edges Camphor laurel. The level of Camphor laurel infestation within the disused golf course has not been determined.


**LEGEND**

Rainforest and Riparian Communities

102 - Sub-tropical / Warm Temperate Rainforest on Bedrock Substrates

Sclerophyll Open Forests on Bedrock Substrate

207 - Brush Box Open Forest

Miscellaneous Map Units

903 - Open Water

998 - Not Assessed

Highly Modified / Disturbed

1004 - Camphor Laurel Dominant Closed to Open Forest

Site Outline

SOURCE:
Tweed Shire Council - Vegetation Management Strategy Map 2

0 300m

SCALE: 1 : 10 000 @ A3

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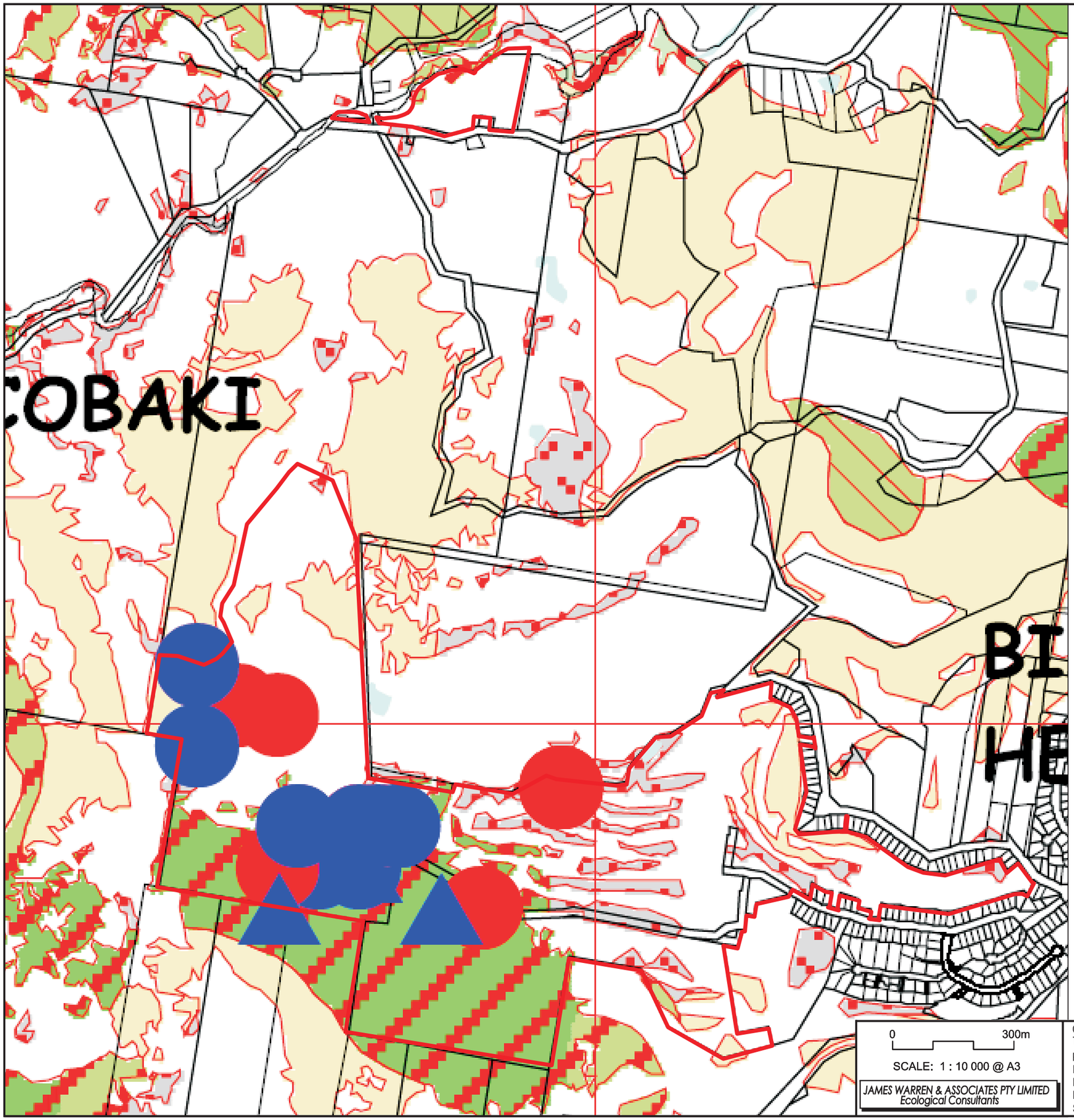
**FIGURE 9**

PREPARED: BW
DATE: 27 April 2009
FILE: N01051_EA_tweedveg.cdr

TITLE

**TSC VEGETATION TYPE**




## LEGEND

Threatened Fauna (NPWS Atlas to July 2004)

- Endangered
- Vulnerable

Threatened Flora (NPWS Atlas to July 2004)

- Endangered
- Vulnerable

Ecological Senstivity

- 1 - High
- 2 - Moderate
- 3 - Low
- 4 - Not Determined

Ecological Status

- 1 - Very High
- 2 - High
- 3 - Medium
- 4 - Low
- 5 - Not Determined
- Site Outline

SOURCE:
Tweed Shire Council - Vegetation Management Strategy Map 4

0 300m

SCALE: 1 : 10 000 @ A3

JAMES WARREN & ASSOCIATES PTY LIMITED
Ecological Consultants

CLIENT
Terranora Group Management Pty Ltd

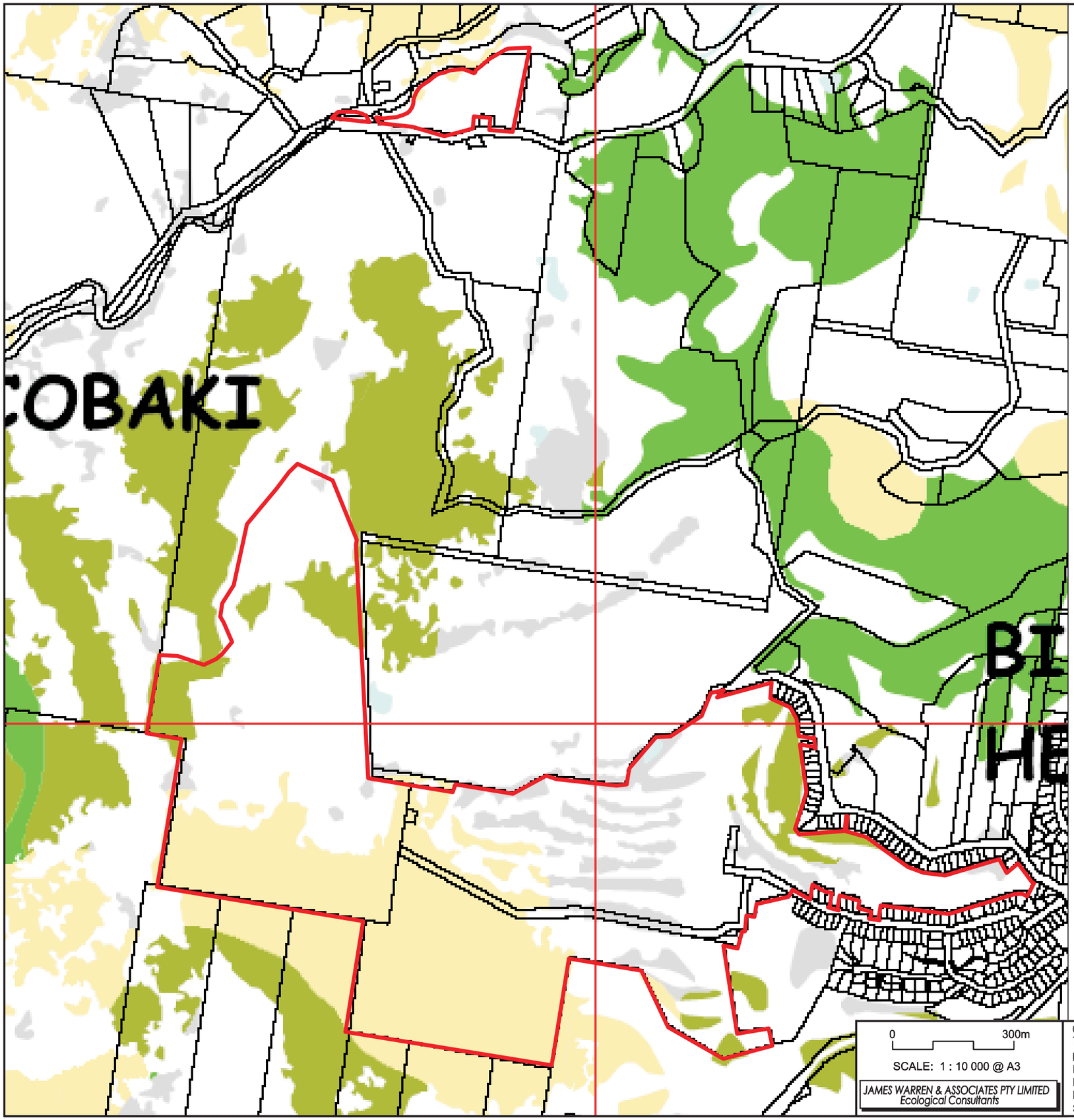
PROJECT
Ecological Assessment
Rise Estate
Bilambil Heights, West Tweed, NSW
Shire of Tweed

**VOLUME 1**
**FIGURE 10**

PREPARED: BW
DATE: 27 April 2009
FILE: N01051_EA_tweedvalue.cdr

TITLE

**TSC ECOLOGICAL VALUES**




**LEGEND**

- Dominant
- Co-dominant
- Occasional, Patchy or Edges
- Not Detected from API
- Not Determined
- Site Outline

SOURCE:
Tweed Shire Council - Vegetation Management Strategy Map 3

0 300m

SCALE: 1 : 10 000 @ A3

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**VOLUME 1**
**FIGURE 11**

PREPARED: BW
DATE: 27 April 2009
FILE: N01051_EA_camphor.cdr

TITLE

**TSC**
**CAMPHOR LAUREL**
**ABUNDANCE**

### *3.2.3 WBM Oceanics (1996) Terranora Golf Project – Flora and Fauna Report*

A comprehensive Flora and Fauna assessment was completed over the entire Terranora golf course site by WBM Oceanics in 1996. This assessment recorded thirteen (13) Threatened flora species, mostly within a large area of remnant rainforest in the south-west of the site. Threatened flora recorded included:

- Sweet myrtle (*Gossia fragrantissima*)
- Small-leaved tamarind (*Diploglottis campbellii*)
- Spiny gardenia (*Randia moorei*)
- Yellow satinheart (*Bosistoa transversa*)
- Stinking laurel (*Cryptocarya foetida*)
- Rough-shelled bush nut (*Macadamia tetraphylla*)
- Fine-leaved tuckeroo (*Lepiderema pulchella*)
- Marblewood (*Acacia bakeri*)
- White laceflower (*Archidendron hendersonii*)
- Yiel yiel (*Grevillea hilliana*)
- Rusty rose walnut (*Endiandra hayesii*)
- Southern ochrosia (*Ochrosia moorei*)
- Coolamon (*Syzygium moorei*)

### *3.2.4 JWA (2004a) 38 McAllisters Road - Flora and Fauna Assessment*

A flora and fauna assessment was completed by JWA (2004) for a nearby site within the locality of the subject site. The threatened species Fine-leaved tuckeroo (*Lepiderema pulchella*) and the ROTAP (Rare or Threatened Australian Plant) species Smooth Scrub Turpentine (*Rhodamnia maideniana*) were recorded from this assessment of a site in McAllisters Road, which occurs adjacent to the Subject site.

### *3.2.5 Tweed Shire Council (2002) Rare and Significant trees Register.*

The Tweed Shire Council Recreation Services Rare and Significant Tree Register does not record any rare or significant trees on the Subject site.

### *3.2.6 JWA (2004b) Lot 5 DP 822786 Marana Street Bilambil Heights – Flora and Fauna Assessment*

One (1) Threatened species was recorded - Small-leaved tamarind (*Diploglottis campbellii*). Two (2) of these trees occur on the site, and another occurs just outside the site in Lot 1453, however these are planted trees and have little ecological significance. The 2 Small-leaved tamarind on the site were planted in 1979, and their provenance is unknown (Bill Clark – Head groundskeeper *pers. comm*. April 2005).

This site now forms part of the proposed MP08-0234 development.

## 3.3 Fauna

### *3.3.1 NPWS Atlas of NSW Wildlife & EPBC Protected Maters Database*

Searches of the NPWS and EPBC databases were completed to find records of Threatened flora species[2] within 10km of the Subject site. These searches revealed records of fifty-nine (59) significant fauna species, and one (1) significant fauna population, within 10km of the Subject site (**TABLE 3**). Oceanic and coastal species have been omitted from the results as they will not occur on the subject site.

**TABLE 3**
**RECORDS OF SIGNIFICANT FAUNA WITHIN 10 KM OF THE SUBJECT SITE**

| Common Name | Scientific Name | Status | |
|---|---|---|---|
| | | TSC Act (1995)* | EPBC Act (1999)# |
| **INVERTEBRATES** | | | |
| Imperial moth | *Phyllodes imperialis* | E[1] | E |
| Mitchell's rainforest snail | *Thersites mitchellae* | E[1] | CE |
| **AMPHIBIANS** | | | |
| Giant barred frog | *Mixophyes iteratus* | E[1] | E |
| Green-thighed frog | *Litoria brevipalmata* | V | - |
| Pouched frog | *Assa darlingtoni* | V | - |
| Wallum froglet | *Crinia tinnula* | V | - |
| Wallum sedge frog | *Litoria olongburensis* | V | V |
| **REPTILES** | | | |
| Three-toed snake-toothed skink | *Coeranoscincus reticulatus* | V | V |
| **BIRDS** | | | |
| Albert's lyrebird | *Menura alberti* | V | - |
| Australian cotton pygmy-goose | *Nettapus coromandelianus albipennis* | E | M |
| Australian painted snipe | *Rostratula australis* | E[1] | V, M |
| Barking owl | *Ninox connivens* | V | - |
| Barred cuckoo-shrike | *Coracina lineata* | V | - |
| Black bittern | *Ixobrychus flavicollis* | V | - |
| Black-breasted button-quail | *Turnix melanogaster* | E[1] | V |
| Black-faced monarch | *Monarcha melanopsis* | - | M |
| Black-necked stork | *Ephippiorhynchus asiaticus* | E[1] | - |
| Black-throated finch | *Peophila cincta cincta* | E[1] | E |
| Bush-hen | *Amaurornis olivaceus* | V | - |
| Bush-stone curlew | *Burhinus grallarius* | E[1] | - |
| Cattle egret | *Ardea ibis* | - | M |
| Collared kingfisher | *Todiramphus chloris* | V | - |
| Comb-crested jacana | *Irediparra gallinacea* | V | - |
| Coxen's fig parrot | *Cyclopsitta diophthalma coxeni* | E[1] | E, M |
| Glossy black-cockatoo | *Calyptorhynchus lathami* | V | - |

[2] As listed within schedules of the TSC Act (1995) and EPBC Act (1999).

| Common Name | Scientific Name | Status | |
|---|---|---|---|
| Grass owl | *Tyto capensis* | V | - |
| Great egret | *Ardea alba* | - | M |
| Latham's snipe | *Gallinago hardwickii* | - | M |
| Magpie goose | *Anseranas semipalmata* | V | - |
| Mangrove honeyeater | *Lichenostomus fasciogularis* | V | - |
| Masked owl | *Tyto novaehollandiae* | V | - |
| Osprey | *Pandion haliaetus* | V | - |
| Rainbow bee-eater | *Merops ornatus* | - | M |
| Regent honeyeater | *Xanthomyza phrygia* | $E^1$ | E, M |
| Rose-crowned fruit-dove | *Ptilinopus regina* | V | - |
| Rufous fantail | *Rhipidura rufifrons* | - | M |
| Satin flycatcher | *Myiagra cyanoleuca* | - | M |
| Sooty owl | *Tyto tenebricosa* | V | - |
| Spectacled monarch | *Monarcha trivirgatus* | - | M |
| Square-tailed kite | *Lophoictinia isura* | V | - |
| Swift parrot | *Lathamus discolor* | $E^1$ | E |
| White-bellied sea-eagle | *Haliaeetus leucogaster* | - | M |
| White-eared monarch | *Monarcha leucotis* | V | - |
| Wompoo fruit-dove | *Ptilinopus magnificus* | V | - |
| **MAMMALS** | | | |
| Beccari's freetail-bat | *Mormopterus beccarii* | V | - |
| Cobaki Lakes and Tweed Heads West population of the Long-nosed potoroo | *Potorous tridactylus* | $E^2$ | - |
| Common blossom-bat | *Syconycteris australis* | V | - |
| Common planigale | *Planigale maculata* | V | - |
| Eastern bentwing bat | *Miniopterus schreibersii oceanensis* | V | - |
| Eastern long-eared bat | *Nyctophilus bifax* | V | - |
| Eastern pygmy possum | *Cercartetus nanus* | V | - |
| False water rat | *Xeromys myoides* | - | V |
| Grey-headed flying-fox | *Pteropus poliocephalus* | V | V |
| Koala | *Phascolarctos cinereus* | V | - |
| Large-eared pied bat | *Chalinolobus dwyeri* | V | V |
| Large-footed myotis | *Myotis adversus* | V | - |
| Little bentwing bat | *Miniopterus australis* | V | - |
| Long-nosed potoroo | *Potorous tridactylus* | V | V |
| Spotted-tail quoll | *Dasyurus maculatus maculatus* | V | E |
| Yellow-bellied sheathtail bat | *Saccolaimus flaviventris* | V | - |

* V, $E^1$ & $E^2$ is Vulnerable, Endangered or an Endangered Population under the TSC Act 1995; # CE, E, V & M is Critically Endangered, Endangered, Vulnerable & Migratory under the EPBC Act 1999.

### *3.3.2 Tweed Coast Koala Atlas (1996)*

The Tweed Coast Koala Atlas maps the site and surrounds as 'mainly cleared', although a small area of Secondary Class B habitat occurs to the east of the site near the Terranora Broadwater.

### *3.3.3 WBM Oceanics (1996) Terranora Golf Project – Flora and Fauna Report*

A comprehensive literature review and detailed fauna survey was completed by WBM Oceanics (1996) for the entire Terranora golf resort. This review used a number of sources to identify records of Threatened species in the locality.

Threatened species recorded in the WBM Oceanics Study (1996) of Terranora Golf Resort include:

- Rose-crowned fruit dove (*Ptilinopus regina*); and
- White-eared monarch (*Monarcha leucotis*).

### *3.3.4 JWA (2004a) 38 McAllisters Road - Flora and Fauna Assessment*

The Flora and Fauna Assessment on this site did not record any Threatened fauna species.

### *3.3.5 JWA (2004b) Lot 5 DP 822786 Marana Street Bilambil Heights – Flora and Fauna Assessment*

Two (2) Threatened species were recorded from incidental observations:

- Koala – recorded from very old scratchings on several Grey gums on the site. No scats were recorded.
- Grey-headed flying-fox – observed flying overhead approximately five (5) kilometres from the site. Discarded mango seeds from old Mango trees (since removed from the site) were also found on the site, which are likely to have been as a result of feeding by this species.

This site now forms part of the proposed MP08-0234 development.

# 4. DIRECTOR GENERAL'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS (DGEAR'S)

## 4.1 DGEAR's Relevant to the Flora & Fauna Assessment

A concept plan for the proposed Rise residential community at Bilambil Heights was authorised by the Minister for Planning in October 2008 and subsequently, the Director-general's Environmental Assessment Requirements (DGEAR's) have been outlined in a letter from the NSW Governments Department of Planning.

The seven (7) flora and fauna requirements that the Director-general has listed for environmental assessment are as follows:

1. *Address the impact of the development on existing native flora and fauna and their habitats, including identified threatened species, having regard to the Threatened Species Assessment Guidelines and recommend offset measures to avoid or mitigate impacts on threatened species and their habitat.*

Compliance with the *Threatened Species Assessment Guidelines* will be discussed in more detail in Section 4.2.

2. *Address the Management of threatened species and natural open space areas.*
3. *Assess impacts of native vegetation clearing and provide details of any offset strategy or suitable mitigation measures.*
4. *Outline the management arrangements for ongoing control of weeds and pests.*
5. *Discuss as relevant the development of ecological corridors to link flora and fauna corridors both on and adjoining the site, as well as ecological buffers between land uses such as asset protection zones.*
6. *Assess any potential impact on surrounding waterways in terms of water quality and aquatic ecosystems. This should include but not be limited to:*
    - *(a) Onsite pollution such as accidental spills and sewer overflows;*
    - *(b) Stormwater management and treatment;*
    - *(c) Risks such as weed invasion, encroachment and litter; and*
    - *(d) Vegetated buffer zones.*
7. *Detailed plan for the control of environmental weeds and pest animal species.*

## 4.2 Compliance with the Threatened Species Assessment Guidelines

The NSW *Threatened Species Conservation Act 1995* (TSC Act 1995) requires that the planning and development approval process for development and other activities have regard to the potential for adverse impacts on Threatened flora and fauna species and their habitats.

The Minister for Planning has determined that the proposed development is a 'Major Project' under section 3A of the *Environmental Planning & Assessment Act 1979* (EPA Act 1979). In July 2005 the NSW Department of Environment and Conservation (DEC) and NSW Department of Primary Industries (DPI) drafted Guidelines for Threatened Species Assessment. These guidelines identify factors that must be considered when assessing potential impacts on Threatened species, populations, or ecological communities, or their habitats for Major Project Applications assessed under part 3A of the EPA Act 1979.

This assessment has been completed in accordance with the DEC & DPI (February 2008) revised guidelines. **APPENDIX 1** of the guidelines includes recommendations for the structure and content of the threatened species assessment. A summary of compliance with the guidelines is contained in **TABLE 4** below.

**TABLE 4**
**COMPLIANCE WITH THE GUIDELINES FOR THREATENED SPECIES ASSESSMENT**

| Section | Purpose | Compliance |
|---|---|---|
| Introduction | Sets the scene of the study | • The author of the study and who it was commissioned by is included in **SECTION 1.1.**<br>• The regional context, location, disturbance history and other relevant information relating to stratification requirements is provided in **SECTION 1.2.**<br>• A detailed description of the proposal is in included in **SECTION 2.** |

| Section | Purpose | Compliance |
|---|---|---|
| Methods | Details the desktop and field survey methods employed. The technical information should be sufficiently detailed to enable the field survey to be replicated. The choice of field methods and extent of survey should be justified, and any constraints noted. | • The methods utilised in this assessment are contained in **VOLUME 2.**<br>• Descriptions of vegetation types in terms of structure and floristics, and a list of the dominant plant species in each growth stratum (trees, midstorey and groundcover) is included in **VOLUME 2.**<br>• An assessment of the suitability of the site as habitat for species, populations and ecological communities of conservation significance has been completed in **VOLUME 2.**<br>• Descriptions of survey techniques utilised during the flora assessment are contained in **VOLUME 2**, and during the fauna assessment in **VOLUME 2.**<br>• The type and number of traps, a description and map of their layout, details of the bait used, and the number of survey nights for each technique in included in **VOLUME 2.** |
| Results | Displays the findings of the study | • A list of all flora species recorded from the subject site is contained in **VOLUME 2.**<br>• A list of all fauna species recorded is contained in **VOLUME 2.**<br>• A list of all Threatened species, populations, and ecological communities recorded or known to occur in the locality is provided in **SECTION 5.1.1.**<br>• Maps of survey method locations are included in **VOLUME 2.**<br>• Maps of environmental features, vegetation types and habitat types are provided (**FIGURES 12 – 14 & 18**).<br>• Maps showing the location of Threatened species records are provided (**FIGURES 14(a) – (e) & 18**). |

| Section | Purpose | Compliance |
|---|---|---|
| Impact Evaluation | Describe context and intensity of impacts | • The potential impacts of the proposed development on the following ecological characteristics has been discussed:<br>o Threatened flora species & their habitats (**SECTION 5.1.2.2**);<br>o Endangered Ecological Communities (**SECTION 5.1.2.4**);<br>o Threatened fauna species and their habitats (**SECTION 5.1.2.6**); and<br>o Native vegetation communities (**SECTION 5.3.2**). |
| Mitigation | Discuss measures to minimise impacts | • Amelioration measures to minimise potential impacts of the proposed development on the following ecological characteristics has been discussed:<br>o Threatened flora species & their habitats (**SECTION 5.1.2.3**);<br>o Endangered Ecological Communities (**SECTION 5.1.2.5**);<br>o Threatened fauna species and their habitats (**SECTION 5.1.2.6**); and<br>o Native vegetation communities (**SECTION 5.3.3**). |
| Conclusion | Discuss the results | Statements on the likely presence/absence of threatened biodiversity, and the general habitat value of the study area is provided in **SECTION 5.** This section also includes statements as to the likely impacts on key population thresholds. Potential impacts on threatened biodiversity and the proposed mitigation measures and offsets are summarised in **SECTION 6**. |
| References | Cites publications used in the report | A list of references is provided on **Page 73.** |
| Appendices | Collates detailed information in the back of the report and allows the main body of the report to be concise | Appendices and supporting documentation to the main report are included in **VOLUMES 2 & 3.** |

# 5. RESPONSE TO DGEAR'S

## 5.1 Address the impact of the development on existing native flora and fauna and their habitats, including identified threatened species, having regard to the Threatened Species Assessment Guidelines and recommend offset measures to avoid or mitigate impacts on threatened species and their habitat.

### *5.1.1 Introduction*

The Threatened Species Assessment Guidelines requires the description and justification of measures to mitigate any adverse effects. Consideration is to be given to measures to avoid or minimise the impacts. Where measures to avoid and mitigate are not possible, then offset strategies need to be considered. These may include offset or local area proposals that contribute to the long-term conservation of the Threatened species.

The following discussion of impacts and amelioration for Threatened species and EEC's at the MP08-0234 development site will include an assessment of:

- Impacts
- Avoidance of Impacts
- Mitigation
- Offsets

### *5.1.2 Summary of existing flora and fauna values*

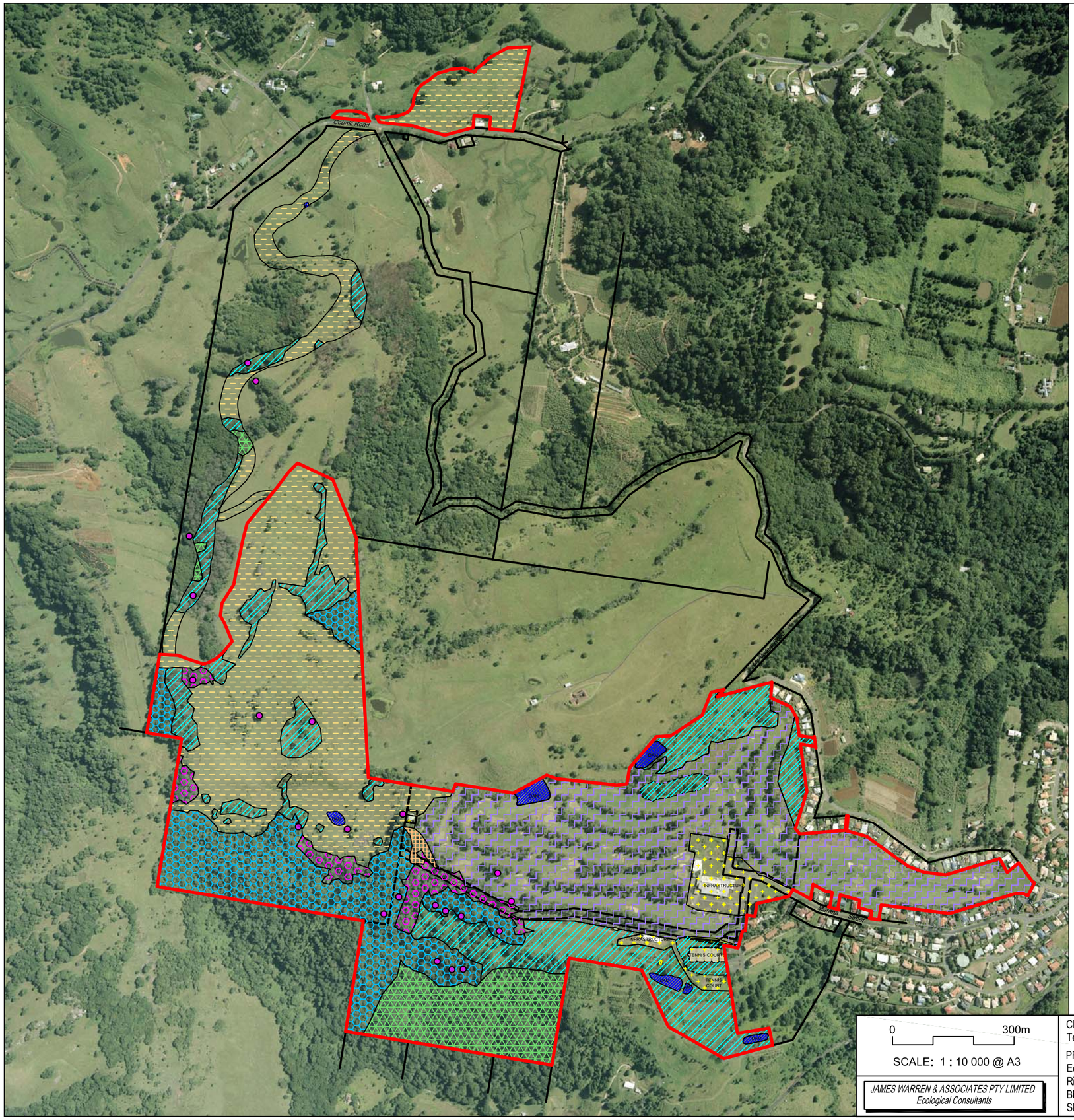
#### 5.1.2.1 Flora values

A detailed flora assessment of the entire site which discusses the methods used in the vegetation assessment and provides a description of the location, composition and extent of the vegetation communities on the Subject site is provided within **VOLUME 2 (APPENDIX 1).** The flora assessment recorded seven (7) vegetation communities (**FIGURE 12**).

One (1) Endangered Ecological Community (EEC) – Lowland rainforest – occurs on the subject site. The locations of the EEC are shown in **FIGURE 13.** Better quality rainforest in the south of the site and some patches in the northern portion of the site are considered to represent the EEC Lowland rainforest. Additionally, several areas that have been subject to Camphor laurel poisoning practices are regenerating into this rainforest EEC.

The Scientific Committee Final Determination notes that Lowland rainforest includes subtropical rainforest and some related structurally forms of dry rainforest and states:

> *"Lowland rainforest may be associated with a range of high-nutrient geological substrates, notably basalts and fine-grained sedimentary rocks, on coastal plains*




## LEGEND

- Community 1 - Tall closed forest (*Cinnamomum camphora* +/- mixed species)
- Community 2 - Tall closed forest (Mixed species)
- Community 3 - Tall closed forest (*Lophostemon confertus*)
- Community 4 - Regenerating closed forest (Mixed species)
- Community 5 - Landscape plantings (Disused golf courses)
- Community 6 - Disturbed land
- Community 7 - Grassland with scattered trees
- Dams
- Existing Infrastructure
- Location of Figs (*Ficus* sp.)
- Site Outline

N

SOURCE:
Vegetation - James Warren & Associates GPS Survey Feb/March 2006, April 2009
Aerial Photograph - Michel Group Services taken 2006 (Ref: bilambil_heights_2006-reduced.jpeg)

0 300m

SCALE: 1 : 10 000 @ A3

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VOLUME 1
FIGURE 12

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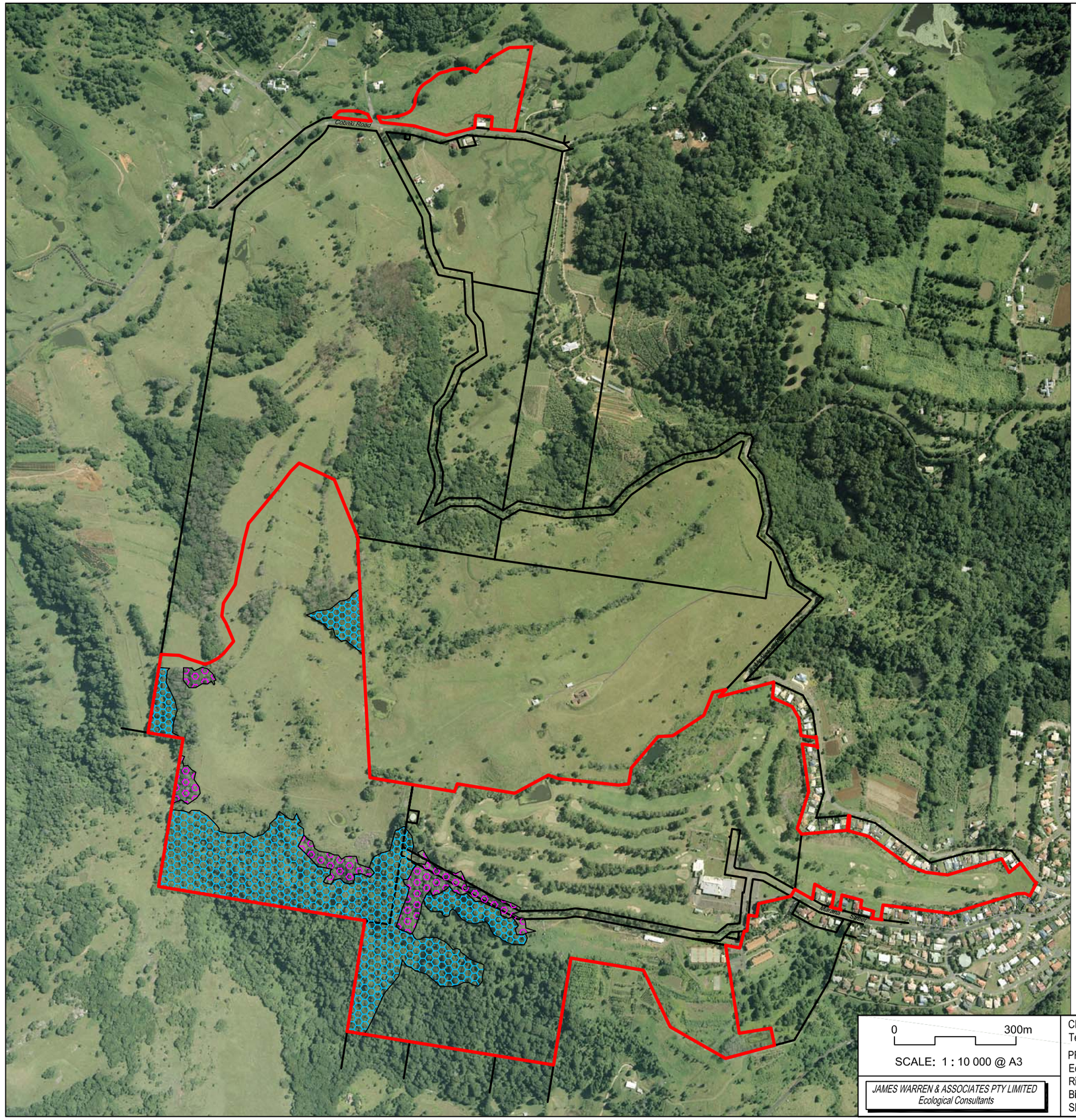
DATE: 27 April 2009
FILE: N01051_EA_Base.dwg

TITLE

# EXISTING SITE VEGETATION




**LEGEND**

- Lowland rainforest EEC
- Regenerating Lowland rainforest EEC
- Site Outline

N

SOURCE:
EEC's - James Warren & Associates GPS Survey Feb/March 2006, April 2009
Aerial Photograph - Michel Group Services taken 2006 (Ref: bilambil_heights_2006-reduced.jpeg)

0 300m

SCALE: 1 : 10 000 @ A3

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VOLUME 1
FIGURE 13

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DATE: 27 April 2009
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TITLE

# ENDANGERED ECOLOGICAL COMMUNITIES (EEC'S)

*and plateau, footslopes and foothills. In the north of its range, Lowland Rainforest is found up to 600 metres above sea level…"*

Depauperate rainforest vegetation over large portions of the site has been degraded by regenerating Camphor laurel and Large-leaved privet saplings subsequent to removal of mature Camphor laurel and is not considered to adequately represent this EEC.

In total, three hundred and ninety-one (391) flora species have been recorded at the subject site. A complete list of flora species recorded from the site is provided in **VOLUME 2 (APPENDIX 1).** A total of seventeen (17) threatened flora species have been recorded on the subject site to date. These are listed in **TABLE 5** below.

**TABLE 5**
**THREATENED FLORA RECORDED ON THE SITE**

| Common name | Botanical name | TSC Act (1995) | EPBC Act (1999) |
|---|---|---|---|
| Axe breaker | *Geijera paniculata* | E | - |
| Ball nut | *Floydia praealta* | V | V |
| Basket fern | *Drynaria ruigidula* | E | - |
| Bopple nut | *Hicksbeachia pinnatifolia* | V | V |
| Coolamon | *Syzygium moorei* | V | - |
| Fine-leaved tuckeroo | *Lepiderema pulchella* | V | - |
| Marblewood | *Acacia bakeri* | V | - |
| Rough-shelled bush nut | *Macadamia tetraphylla* | V | V |
| Rusty rose walnut | *Endiandra hayesii* | V | V |
| Small-leaved tamarind | *Diploglottis campbellii* | E | - |
| Southern ochrosia | *Ochrosia moorei* | E | E |
| Spiny gardenia | *Randia moorei* | E | - |
| Stinking laurel | *Cryptocarya foetida* | V | V |
| Sweet myrtle | *Gossia fragrantissima* | E | E |
| White laceflower | *Archidendron hendersonii* | V | - |
| Yellow satinheart | *Bosistoa transversa* | V | V |
| Yiel yiel | *Grevillea hilliana* | E | - |

V = Vulnerable, E = Endangered

Seven (7) ROTAP species were also identified on the site:

- Ardisia (*Ardisia bakeri*);
- Black walnut (*Endiandra globosa*);
- Blunt wisteria (*Millettia australis*);
- Long-leaved tuckeroo (*Cupaniopsis newmanii*);
- Smooth scrub turpentine (*Rhodamnia maideniana*);
- Stream lily (*Helmholtzia glaberrima*); and
- Veiny laceflower (*Archidendron muellerianum*).

5.1.2.2 Fauna values

A detailed fauna assessment which includes a description of the methods used in determining which fauna species use, or are likely to use, the Study area and a discussion of the results of fauna surveys completed on the subject site is also provided

within **VOLUME 2 (APPENDIX 2)**. Fauna surveys on the subject site have revealed the presence of seven (7) amphibian species, six (6) reptile species, seventy-nine (79) bird species and twenty-one (21) mammal species.

A total of eight (8) Threatened fauna species have been recorded from the subject site to date, including:

- Rose-crowned fruit-dove (*Ptilinopus regina*);
- White-eared monarch (*Monarcha leucotis*);
- Black flying-fox (*Pteropus alecto*);
- Eastern bent-wing bat (*Miniopteris schreibersii oceanensis*);
- Eastern free-tail bat (*Mormopterus norfolkensis*);
- Little bent-wing bat (*Miniopterus australis*);
- Grey-headed flying-fox (*Pteropus poliocephelus*); and
- Koala (*Phascolarctos cinereus*).

It is worth noting that indirect evidence of Koala activity was recorded from the eastern portion of the subject site during a study by JWA in 2004. Koalas were not recorded in the 1996 WBM Oceanics survey, and have not been recorded on the site by Groundskeepers (Bill Clarke – Head Groundskeeper *pers comm.* April 2005). No evidence of Koala activity was recorded during recent site surveys.

Additionally, five (5) Migratory species as listed within schedules of the EPBC Act (1999) were also recorded:

- Cattle egret (*Ardea ibis*);
- Rainbow bee-eater (*Merops ornatus*);
- Rufous fantail (*Rhipidura rufifrons*);
- Spectacled monarch (*Monarcha trivirgatus*); and
- White-bellied sea-eagle (*Haliaetus leucogaster*).

A further fifteen (15) Threatened fauna species were considered to be likely or possible occurrences on the Subject site due to the presence of suitable habitat (**VOLUME 2 – APPENDIX 2**). These include:

- Albert's lyrebird (*Menura alberti*);
- Barred cuckoo-shrike (*Coracina lineata*);
- Beccari's free-tail bat (*Mormopterus beccarii*);
- Black breasted button quail (*Turnix melanogaster*);
- Common planigale (*Planigale maculata*);
- Coxen's fig parrot (*Cyclopsitta diophthalma coxenii*);
- Eastern long-eared bat (*Nyctophilus bifax*);
- Eastern pygmy possum (*Cercartetus nanus*);
- Koala (*Phascolarctos cinereus*);
- Masked owl (*Tyto novaehollandiae*);
- Sooty owl (*Tyto tenebriscosa*);
- Square-tailed kite (*Lophoictinia isura*);
- Three-toed snake toothed skink (*Coeranoscincus reticulatus*);
- Wompoo fruit dove (*Ptilinopus magnificus*); and

- Yellow-bellied sheathtail bat (*Saccolaimus flaviventris*).

### *5.1.3 Threatened species and their habitats*

#### 5.1.3.1 Introduction

Several species of flora and fauna listed as threatened species under the *Threatened Species Conservation Act* (1995), as well as an Endangered Ecological Community, occur on the site or are considered possible or likely occurrences. Loss of habitat for Threatened species and losses of EEC's have been calculated as the possible maximum loss based on the concept plan. However, there may be opportunities to retain Threatened species and/or their habitat, and EEC's within the proposed development footprint and this will be the subject of a detailed assessment at the Development Application stage.

Seven (7) part tests have been completed for all Threatened flora and fauna species as well as Endangered Ecological Communities in accordance with the *Threatened Species Conservation Amendment Act 2002* and are included in **VOLUME 2 (APPENDIX 3).** Seven (7) part tests will be re-assessed when it is likely that a more detailed assessment is required at the Development Application stage with Tweed Shire Council on a future precinct basis.

An assessment under the Commonwealth Environment Protection and Biodiversity Conservation Act (1999) has also been completed **VOLUME 2 (APPENDIX 4).** The assessment concluded that the proposed development will not have a significant impact on any matters of National Environmental Significance. Commonwealth assessment of the proposal is therefore not considered to be required.

#### 5.1.3.2 Impacts on Threatened Flora

Threatened flora species with potential to be lost under the proposed development layout are shown in **TABLE 6**. An overlay of the proposed development on Threatened species locations is shown in **FIGURES 14(a) – 14(e)**. Due to the large number of Threatened flora on the site, each individual tree was not given its own GPS point. Rather, any trees within radius of up to 10 metres of a point were grouped together, with records noted of the species and number of trees and approximate height. Threatened species details that correspond to each point are included in **VOLUME 2, APPENDIX 5.**

**TABLE 6**
**ESTIMATED LOSS OF THREATENED FLORA TO THE DEVELOPMENT**

| Common name | Botanical name | Total number recorded | Number to be removed (%) |
|---|---|---|---|
| Axebreaker | *Geijera paniculata* | 40 | - |
| Ball nut | *Floydia praealta* | 1 | - |
| Basket fern | *Drynaria rigidula* | 1 | - |
| Bopple nut | *Hicksbeachia pinnatifolia* | 49 | - |
| Coolamon | *Syzygium moorei* | 5 (+ 4 planted) | 1 planted (0% natural population) |

FIGURE 14A

FIGURE 14B

FIGURE 14C

FIGURE 14D

FIGURE 14E

**LEGEND**

- # Threatened Flora to be Retained
- # Threatened Flora which may be Removed
- Site Outline

N

SOURCE:
Threatened Flora - James Warren & Associates GPS Surveys Feb/March 2006, Feb/March 2007, June 2007
Layout - ML Designs (Ref: A-MP-01-16B.dwg)
Bushfire Track - Cardno (Ref: 510038-03-SK01 Layout Plan.dwg)
Aerial Photograph - Michel Group Services taken 2006 (Ref: bilambil_heights_2006-reduced.jpeg)

0 300m

SCALE: 1 : 10 000 @ A3

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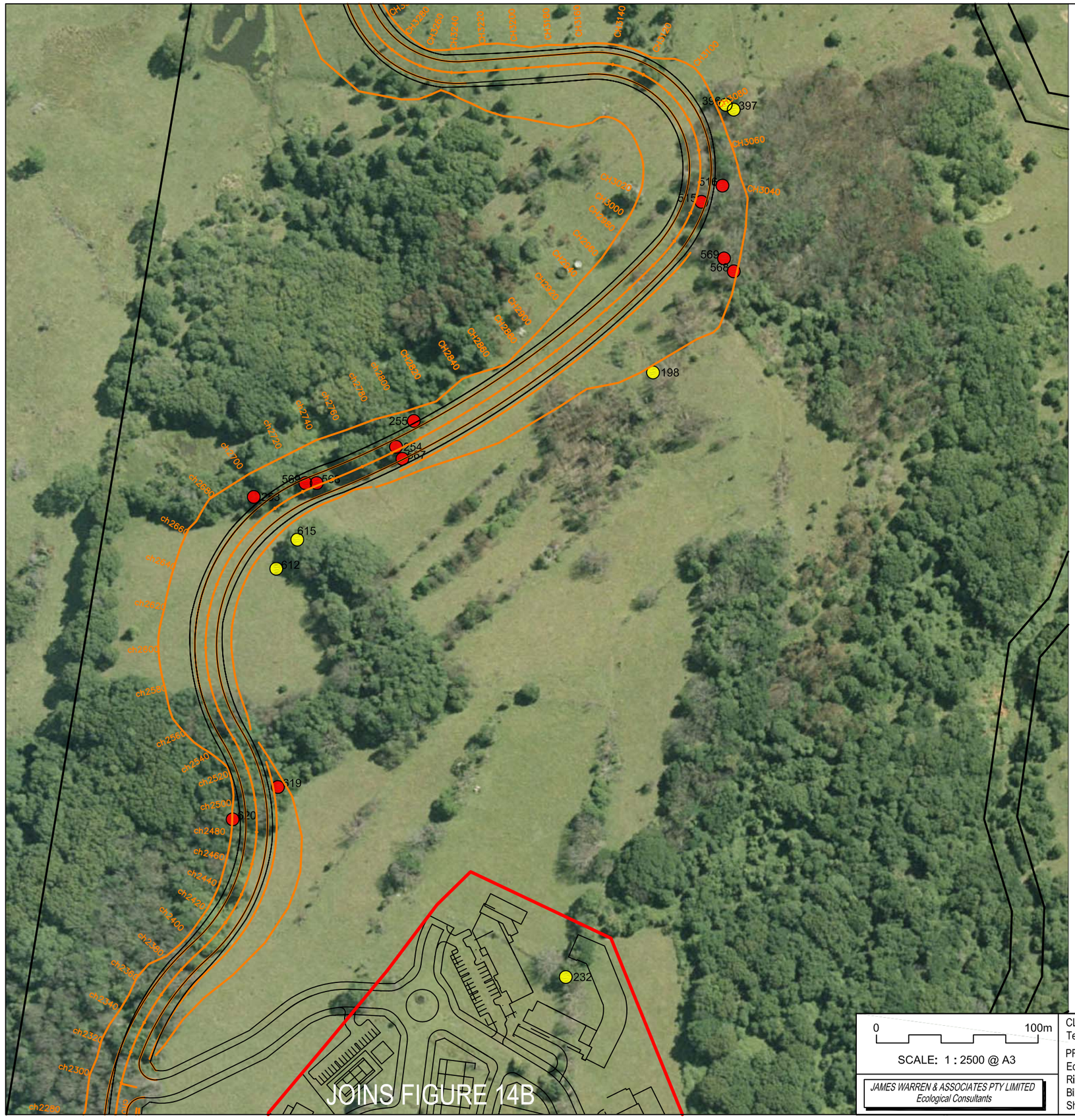
VOLUME 1
FIGURE 14

PREPARED: BW
DATE: 27 April 2009
FILE: N01051_EA_Base.dwg

TITLE
IMPACT ON THREATENED FLORA




## LEGEND

- # Threatened Flora to be Retained
- # Threatened Flora which may be Removed
- Site Outline

N

SOURCE:
Threatened Flora - James Warren & Associates GPS Surveys Feb/March 2006, Feb/March 2007, June 2007
Layout - ML Designs (Ref: A-MP-01-16B.dwg)
Bushfire Track - Cardno (Ref: 510038-03-SK01 Layout Plan.dwg)
Aerial Photograph - Michel Group Services taken 2006 (Ref: bilambil_heights_2006-reduced.jpeg)

0 100m
SCALE: 1 : 2500 @ A3

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FIGURE 14A

PREPARED: BW
DATE: 27 April 2009
FILE: N01051_EA_Base.dwg

TITLE
IMPACT ON THREATENED FLORA

JOINS FIGURE 14A

JOINS FIGURE 14C

## LEGEND

- Threatened Flora to be Retained
- Threatened Flora which may be Removed
- Site Outline

SOURCE:
Threatened Flora - James Warren & Associates GPS Surveys Feb/March 2006, Feb/March 2007, June 2007
Layout - ML Designs (Ref: A-MP-01-16B.dwg)
Bushfire Track - Cardno (Ref: 510038-03-SK01 Layout Plan.dwg)
Aerial Photograph - Michel Group Services taken 2006 (Ref: bilambil_heights_2006-reduced.jpeg)

0 100m
SCALE: 1 : 2500 @ A3

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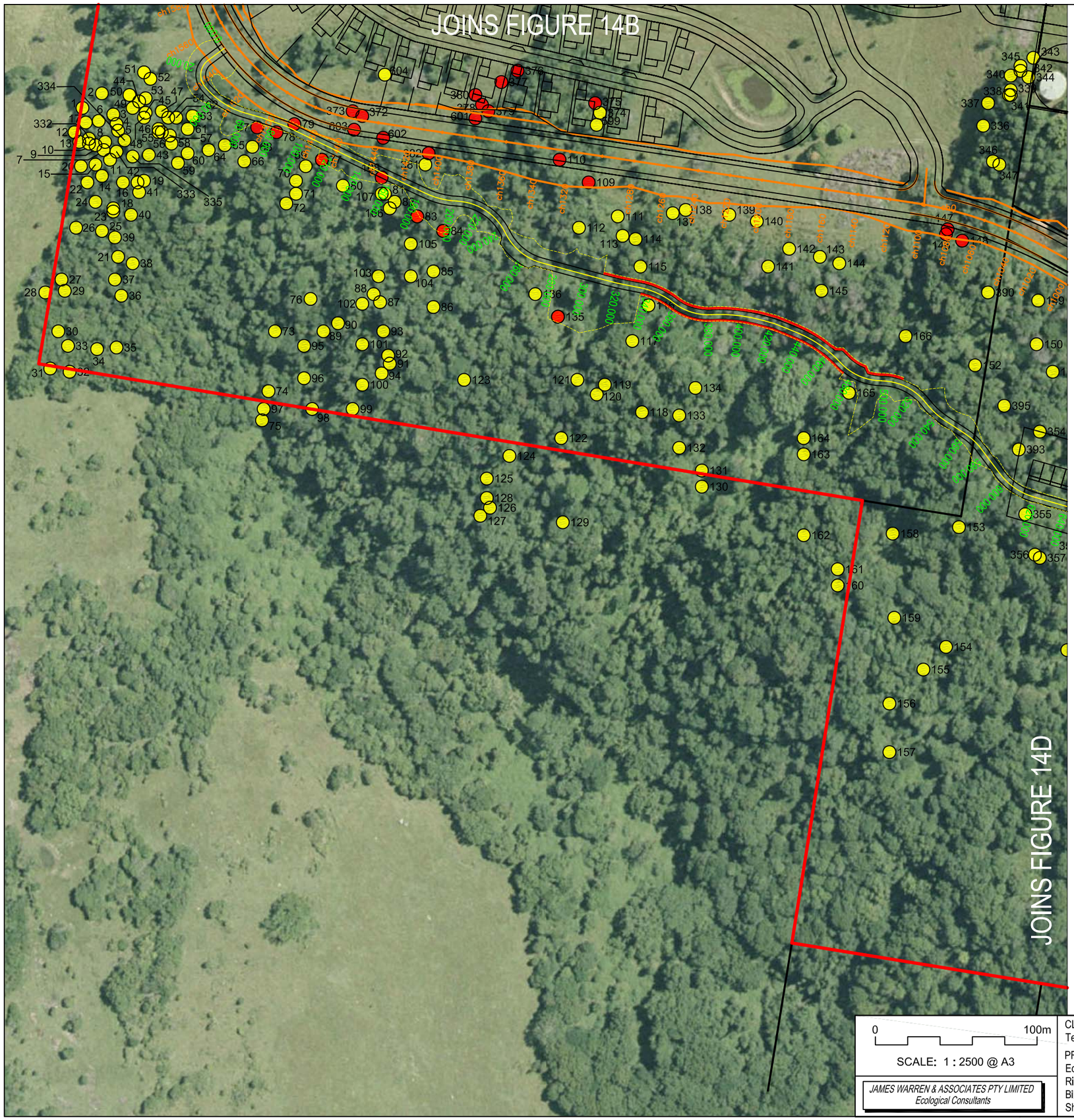
VOLUME 1
FIGURE 14B

PREPARED: BW
DATE: 27 April 2009
FILE: N01051_F&F_Base.dwg

TITLE
IMPACT ON THREATENED FLORA

JOINS FIGURE 14B



**LEGEND**

- Threatened Flora to be Retained
- Threatened Flora which may be Removed
- Site Outline

JOINS FIGURE 14D

SOURCE:
Threatened Flora - James Warren & Associates GPS Surveys Feb/March 2006, Feb/March 2007, June 2007
Layout - ML Designs (Ref: A-MP-01-16B.dwg)
Bushfire Track - Cardno (Ref: 510038-03-SK01 Layout Plan.dwg)
Aerial Photograph - Michel Group Services taken 2006 (Ref: bilambil_heights_2006-reduced.jpeg)

0 100m
SCALE: 1 : 2500 @ A3

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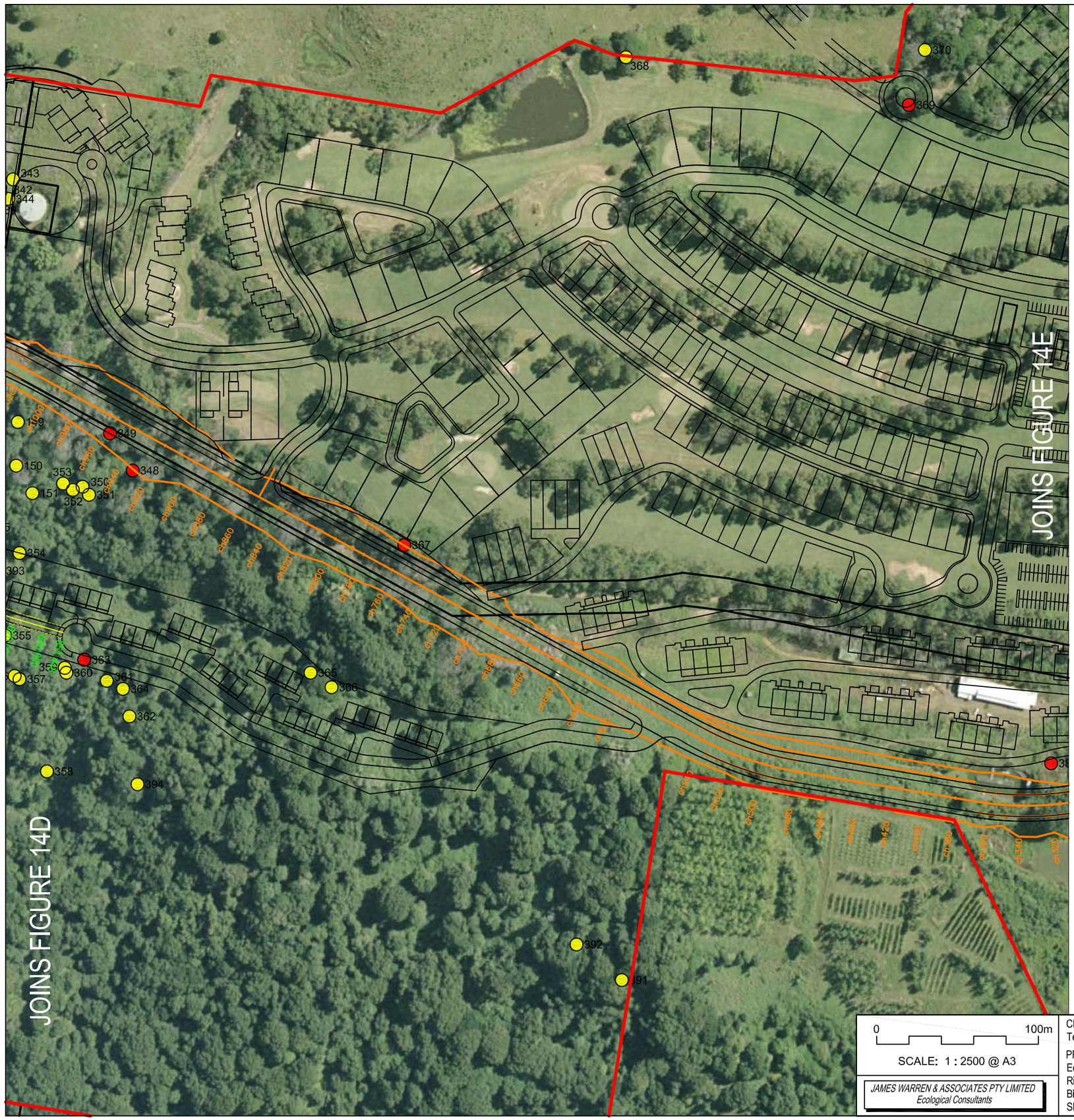
VOLUME 1
FIGURE 14C

PREPARED: BW
DATE: 27 April 2009
FILE: N01051_EA_Base.dwg

TITLE
IMPACT ON THREATENED FLORA




**LEGEND**

- # Threatened Flora to be Retained
- # Threatened Flora which may be Removed
- Site Outline

N

SOURCE:
Threatened Flora - James Warren & Associates GPS Surveys Feb/March 2006, Feb/March 2007, June 2007
Layout - ML Designs (Ref: A-MP-01-16B.dwg)
Bushfire Track - Cardno (Ref: 510038-03-SK01 Layout Plan.dwg)
Aerial Photograph - Michel Group Services taken 2006 (Ref: bilambil_heights_2006-reduced.jpeg)

0 100m

SCALE: 1 : 2500 @ A3

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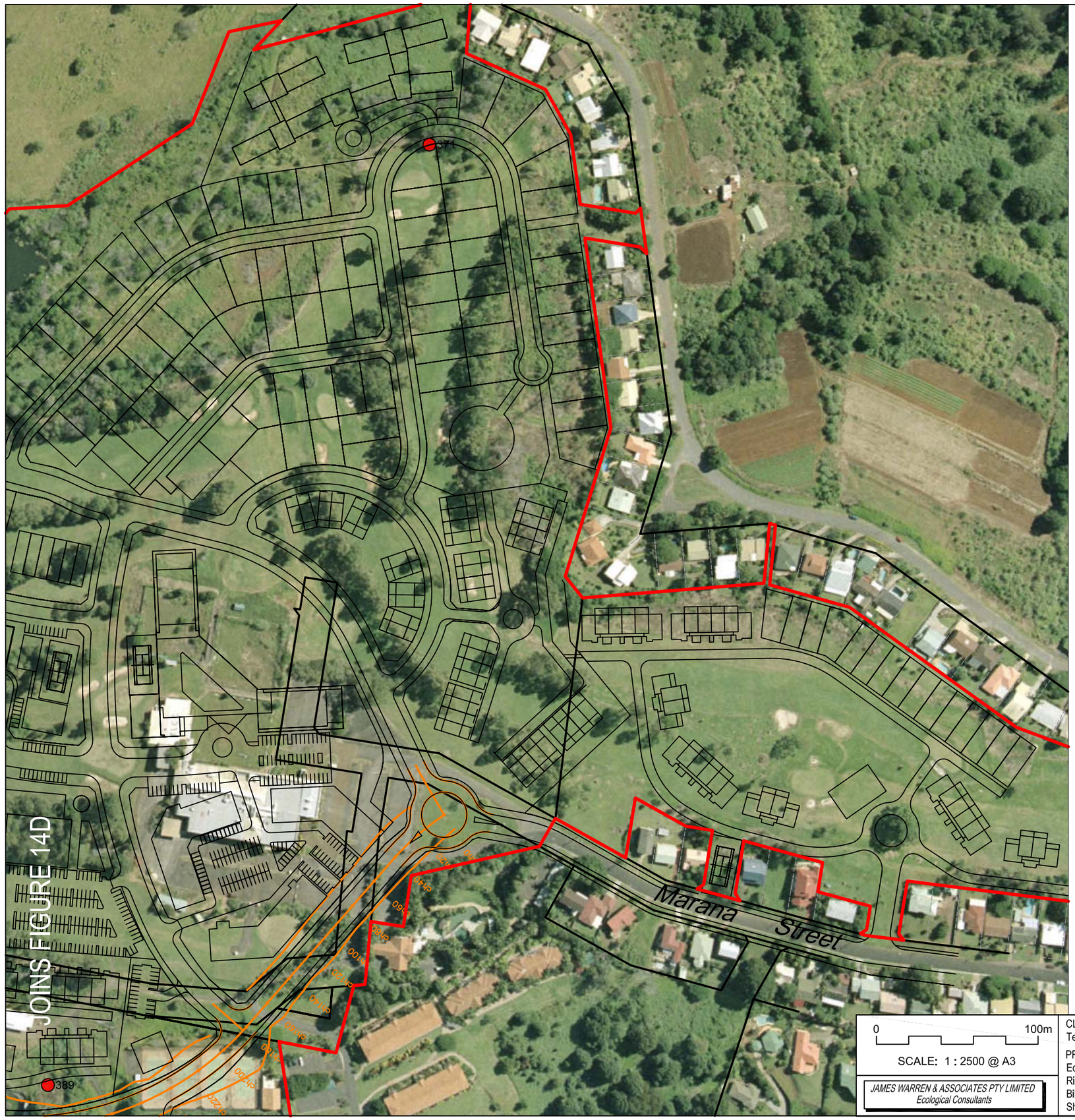
VOLUME 1
FIGURE 14D

PREPARED: BW
DATE: 27 April 2009
FILE: N01051_EA_Base.dwg

TITLE
IMPACT ON THREATENED FLORA




**LEGEND**

- # Threatened Flora to be Retained
- # Threatened Flora which may be Removed
- Site Outline

N

SOURCE:
Threatened Flora - James Warren & Associates GPS Surveys Feb/March 2006, Feb/March 2007, June 2007
Layout - ML Designs (Ref: A-MP-01-16B.dwg)
Bushfire Track - Cardno (Ref: 510038-03-SK01 Layout Plan.dwg)
Aerial Photograph - Michel Group Services taken 2006 (Ref: bilambil_heights_2006-reduced.jpeg)

0 100m
SCALE: 1 : 2500 @ A3

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VOLUME 1
FIGURE 14E

PREPARED: BW
DATE: 27 April 2009
FILE: N01051_EA_Base.dwg

TITLE
IMPACT ON THREATENED FLORA

| Common name | Botanical name | Total number recorded | Number to be removed (%) |
|---|---|---|---|
| Fine-leaved tuckeroo | *Lepiderema pulchella* | 1,132 | 114 (10.1%) |
| Marblewood | *Acacia bakeri* | 19 | - |
| Rough-shelled bush nut | *Macadamia tetraphylla* | 392 | 29 (7.4%) |
| Rusty rose walnut | *Endiandra hayesii* | 1 | - |
| Small-leaved tamarind | *Diploglottis campbellii* | 24 (+ 2 planted) | - |
| Southern ochrosia | *Ochrosia moorei* | 48 | - |
| Spiny gardenia | *Randia moorei* | 61 | 1 (1.6%) |
| Stinking laurel | *Cryptocarya foetida* | 137 | 49 (35.8%) |
| Sweet myrtle | *Gossia fragrantissima* | 57 | 5 (8.8%) |
| White laceflower | *Archidendron hendersonii* | 4 | - |
| Yellow satinheart | *Bosistoa transversa* | 173 | 7 (4%) |
| Yiel yiel | *Grevillea hilliana* | 50 | 11 (22%) |

Two hundred and seventeen (217) stems of Threatened flora will be removed as part of the proposed development. The most significant losses are to the Fine-leaved tuckeroo, Stinking laurel and Rough-shelled bush nut.

Due to the large numbers of both Fine-leaved tuckeroo (*Lepiderema pulchella*) and Rough-shelled bush nut (*Macadamia tetraphylla*) occurring on the site and within the locality, it is considered that loss of numerous trees of these species is unlikely to have any significant impact on the local populations. It is highly likely that the forty-nine (49) Stinking laurel saplings to be affected can be translocated to a more suitable location on the site, where they will have better opportunities to develop to maturity.

#### 5.1.3.3 Avoidance of impacts on Threatened Flora

The proposed development has been designed to utilise existing cleared areas where possible. The majority of vegetation to be removed consists of exotic pasture with scattered trees, landscape plantings (i.e. disused golf course), disturbed land and Camphor laurel dominated vegetation. The layout avoids the majority of Threatened plants on the site.

An Assessment of Significance (7 part test) was completed in accordance with Schedules of the TSC Act (1995) (**VOLUME 2, APPENDIX 3**) and determined that the proposed development is unlikely to have a significant impact on any Threatened flora species.

An assessment under the Commonwealth Environment Protection and Biodiversity Conservation Act (1999) has also been completed **VOLUME 2 (APPENDIX 4).** The assessment concluded that the Proposed development will not have a significant impact on any Commonwealth listed Threatened flora species.

5.1.3.4 Mitigation for Threatened flora

The proposed conservation areas over the entire subject site have been divided into forty-three (43) Rehabilitation Areas (RA's). Individual regeneration and revegetation plans are to be completed for each of the forty-three (43) RA's. RA's 33 - 43 occur within the MP08-0234 development area (**FIGURE 15**).

A Site Rehabilitation & Pest Management Plan (JWA 2009) has been prepared for the subject site (**VOLUME 3**). The objectives of the regeneration and revegetation plan are:

- To enhance the vegetation to be conserved;
- To revegetate disturbed areas with endemic species including threatened plant species;
- To obtain a minimum of 70% native canopy cover within rehabilitation areas;
- To obtain a minimum five (5) metre buffer of retained or rehabilitated native vegetation around each retained threatened species, to reduce detrimental edge effects and other disturbance related impacts;
- To improve the value of the subject site as habitat for fauna groups; and
- To manage weeds using plantings of endemic species and best practice control methods to achieve less than 10% exotic weed cover within each stratum.

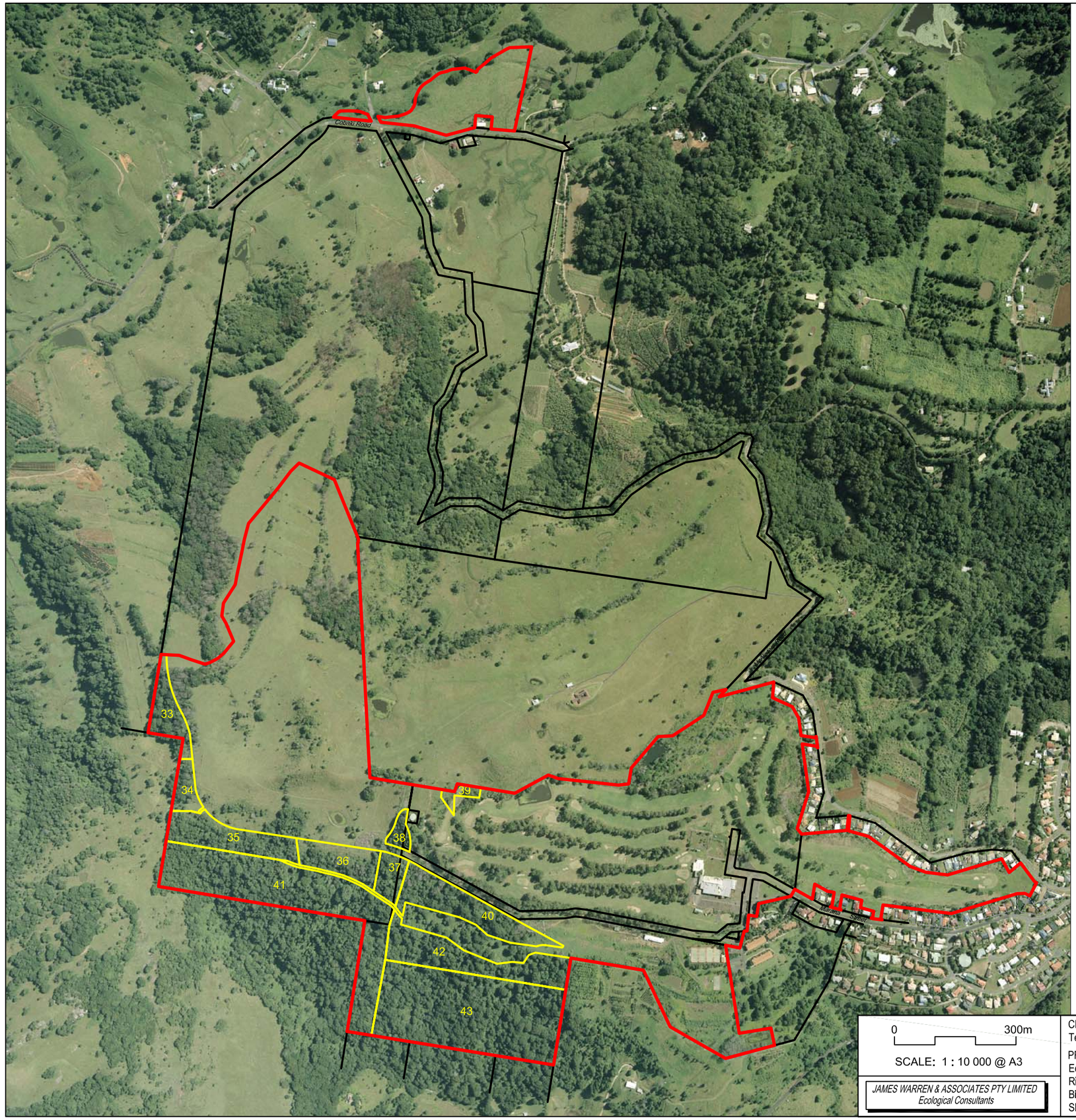
5.1.3.5 Offsets for Threatened flora

A planting trial for the proposed regeneration and revegetation works at the subject site has commenced and has included the planting of 9,181 plants including 1,941 Threatened species. Locations of trial plantings are shown in **FIGURE 16.** Species planted to date and numbers are provided in **VOLUME 2, APPENDIX 6.**

Any Threatened flora species removed during the development will be offset at a minimum rate of 5:1 (i.e. 5 replacement plants for every 1 removed) within RA's in the MP08-0234 development area.

Offsets for the removal of Threatened flora to date have included the planting of:

- Coolamon (*Syzygium moorei*) x 163, to offset the potential removal of 1 stem (planted), resulting in an increase of 162 plants on the subject site;
- Fine-leaved tuckeroo (*Lepiderema pulchella*) x 547, to offset the potential removal of 114 stems, resulting in an increase of 433 plants on the subject site;
- Marblewood (*Acacia bakeri*) x 17, resulting in an increase of 17 plants on the subject site;
- Rough-shelled bush nut (*Macadamia tetraphylla*) x 334, to offset the potential removal of 29 stems, resulting in an increase of 305 plants on the subject site;
- Rusty rose walnut (*Endiandra hayesii*) x 9, resulting in an increase of 9 plants on the subject site;
- Small-leaved tamarind (*Diploglottis campbellii*) x 413, resulting in an increase of 413 plants on the subject site;




**LEGEND**

| | |
|---|---|
| # | Rehabilitation Areas |
| | Site Outline |

N

SOURCE:
Rehab Areas - James Warren & Associates & Michel Group Services (Ref: 8715-37.dwg)
Aerial Photograph - Michel Group Services taken 2006 (Ref: bilambil_heights_2006-reduced.jpeg)

0 300m

SCALE: 1 : 10 000 @ A3

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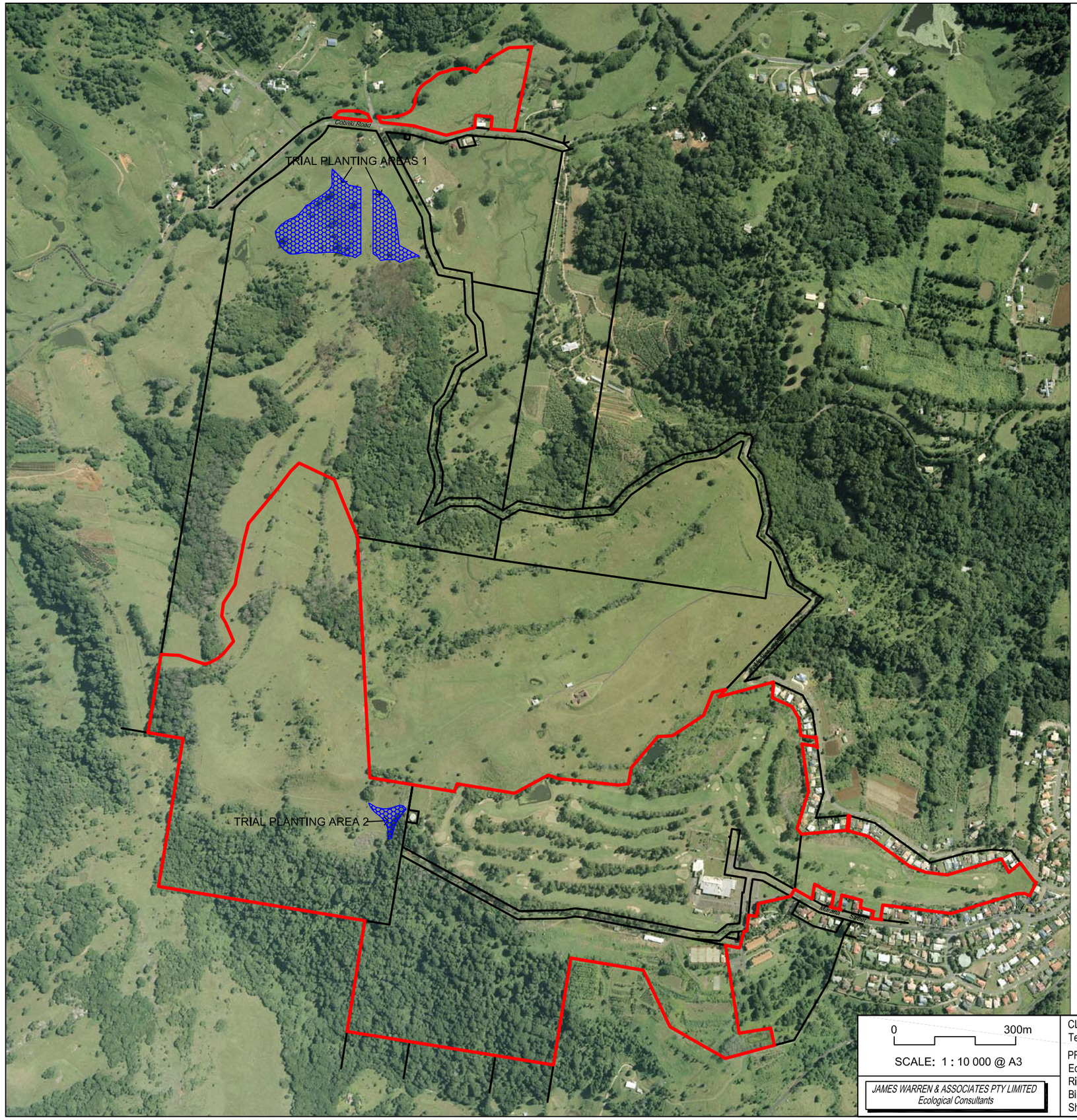
VOLUME 1
FIGURE 15

PREPARED: BW
DATE: 27 April 2009
FILE: N01051_EA_Base.dwg

TITLE

# REHABILITATION AREAS




**LEGEND**

Trial Plantings

Site Outline

N

SOURCE:
Trial Planting Areas - Michel Group Services (Ref: 8715-37A.dwg)
Aerial Photograph - Michel Group Services taken 2006 (Ref: bilambil_heights_2006-reduced.jpeg)

0 300m

SCALE: 1 : 10 000 @ A3

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VOLUME 1
FIGURE 16

PREPARED: BW
DATE: 27 April 2009
FILE: N01051_EA_Base.dwg

TITLE

LOCATION OF TRIAL PLANTINGS

- Spiny gardenia (*Randia moorei*) x 16, to offset the potential removal of 1 stem, resulting in an increase of 15 plants on the subject site;
- Sweet myrtle (*Gossia fragrantissima*) x 337, to offset the potential removal of 5 stems, resulting in an increase of 332 plants on the subject site;
- White laceflower (*Archidendron hendersonii*) x 74, resulting in an increase of 17 plants on the subject site;
- Yellow satinheart (*Bosistoa transversa*) x 8, to offset the potential removal of 7 stems, resulting in an increase of 1 plant on the subject site; and
- Yiel yiel (*Grevillea hilliana*) x 32, to offset the potential removal of 11 stems, resulting in an increase of 21 plants on the subject site.

#### 5.1.3.6 Impacts on Endangered Ecological Communities

One (1) Endangered Ecological Community (EEC) – Lowland rainforest – occurs on the subject site and covers a total area of 20.52ha. Better quality rainforest in the south of the site and some patches in the northern portion of the site are considered to represent the EEC Lowland rainforest. Additionally, several areas that have been subject to Camphor laurel poisoning practices are regenerating into this rainforest EEC. The locations of the EEC are shown in **FIGURE 13.**

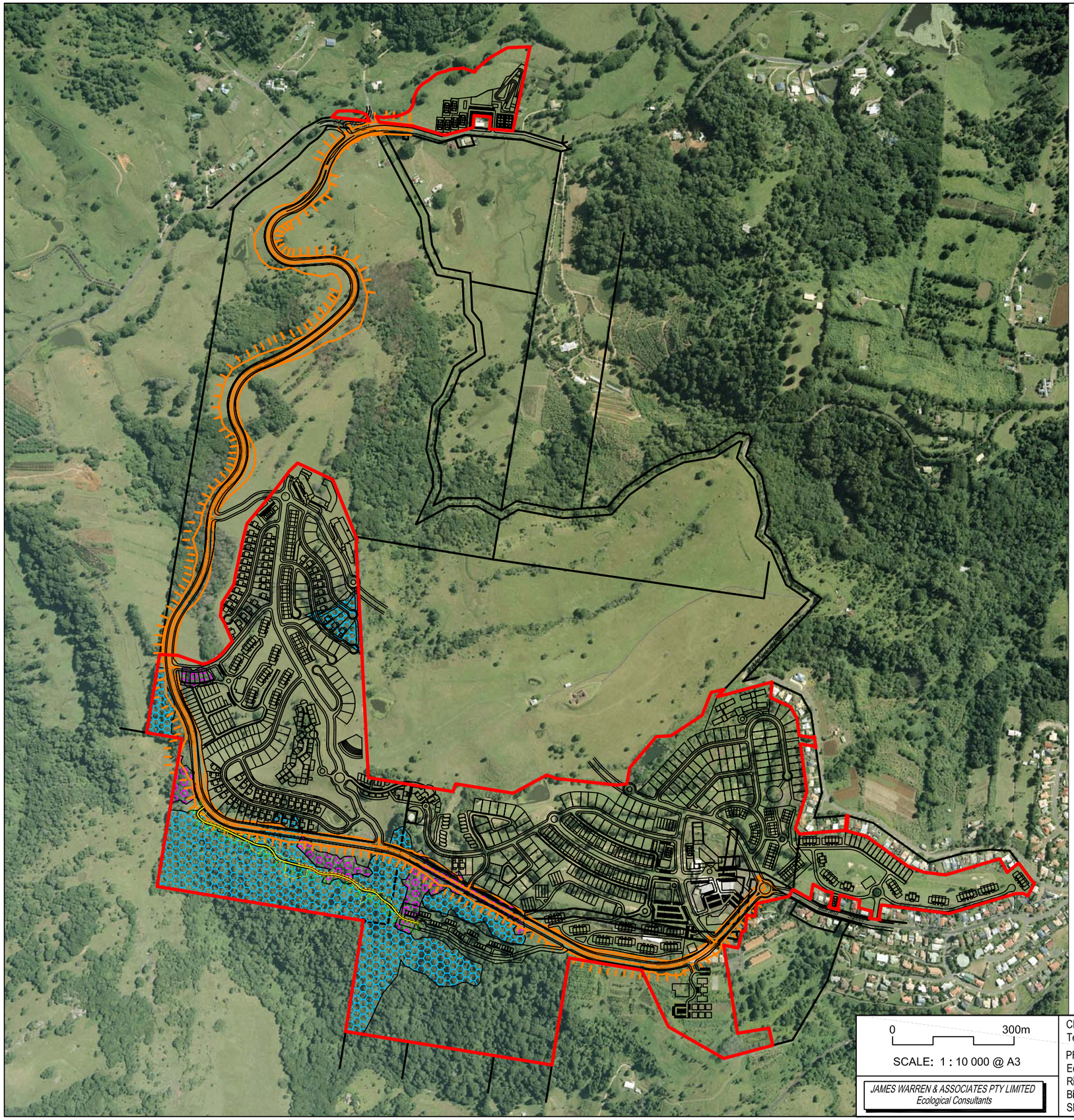
The potential impacts of the proposed development on the EEC recorded on the site are discussed briefly below. A plan showing the locations of the EEC in relation to the proposed development is shown in **FIGURE 17**.

Approximately 4.21 hectares of this EEC (20.5%) comprised of 2.62ha of mature rainforest (community 2) and 1.59ha of regenerating rainforest (community 4) will be lost from the subject site (**FIGURE 17**). The removal of this small area of Lowland rainforest from the subject site is not considered to represent a significant impact in relation to the regional distribution of this community.

Additional impacts on this EEC may include:

- Clearance of areas of the Subject site represents a loss of habitat available for dispersal for plants and will reduce visits by pollination and dispersal vectors;
- Disturbance to the Subject site creates opportunities for weeds to colonise. Weeds may be introduced to the site in construction materials or by vehicles.
- Occupation of the Subject site creates opportunities for weeds to become established. Landscape species may escape to retained areas of vegetation;
- The removal of vegetation from the Subject site represents the loss of organic material from the site; and
- Residents may create walking tracks through areas of EEC. This may result in direct loss of vegetation, change in vegetation structure and increased opportunities for weeds and disturbance-adapted animal species.

An Assessment of Significance (7 part test) was completed in accordance with Schedules of the TSC Act (1995) (**VOLUME 2, APPENDIX 3**) and determined that the proposed development is unlikely to have a significant impact on this EEC.



**LEGEND**

- Lowland rainforest EEC
- Regenerating Lowland rainforest EEC
- Site Outline

N

SOURCE:
EEC's - James Warren & Associates GPS Survey Feb/March 2006
Layout - ML Designs (Ref: A-MP-01-16B.dwg)
Bushfire Track - Cardno (Ref: 510038-03-SK01 Layout Plan.dwg)
Aerial Photograph - Michel Group Services taken 2006 (Ref: bilambil_heights_2006-reduced.jpeg)

0 300m

SCALE: 1 : 10 000 @ A3

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VOLUME 1
FIGURE 17

PREPARED: BW
DATE: 27 April 2009
FILE: N01051_EA_Base.dwg

TITLE
IMPACT ON ENDANGERED ECOLOGICAL COMMUNITIES (EEC'S)

5.1.3.7 Avoidance of impacts on Endangered Ecological Communities

The proposed development has been designed to utilise existing cleared areas where possible. The majority of vegetation to be removed consists of exotic pasture with scattered trees, landscape plantings (i.e. disused golf course), disturbed land and Camphor laurel dominated vegetation. The layout avoids the majority of the EEC – Lowland rainforest on the subject site.

Approximately 4.21 hectares of this EEC (20.5%) comprised of 2.62ha of mature rainforest and 1.59ha of regenerating rainforest within the MP08-0234 development area, will require removal.

An Assessment of Significance (7 part test) was completed in accordance with Schedules of the TSC Act (1995) (**VOLUME 2, APPENDIX 3**) and determined that the proposed development is unlikely to have a significant impact on this EEC.

5.1.3.8 Mitigation for Endangered Ecological Communities

The major amelioration strategy for the EEC on the subject site is the retention and long-term protection of these vegetation communities. The Site Rehabilitation & Pest Management Plan (**VOLUME 3**) outlines the various measures to ensure that the retained EEC areas are adequately managed. Revegetation/regeneration will be completed in accordance with this plan to offset any loss of EEC's.

Furthermore, retained patches of this EEC will be buffered from the proposed development and embellished to increase the overall extent of isolated patches and reduce existing anthropogenic impacts. The Site Rehabilitation & Pest Management Plan includes specific performance criteria as well as a detailed maintenance and monitoring program to ensure the persistence of this EEC in the long-term.

5.1.3.9 Offsets for Endangered Ecological Communities

In total, 28.9 hectares of rainforest will be regenerated/revegetated as part of the proposed development (**FIGURE 15**) to offset the loss of 4.21 hectares. The rehabilitation works include:

- Restoration and embellishment of approximately 15.42ha of existing mature EEC (54.4% of rehabilitation area);
- Assisted regeneration of approximately 2.1ha of existing regenerating EEC (7.3% of rehabilitation area);
- Regeneration of approximately 10.14ha of disturbed land/depauperate rainforest to create additional EEC (35.1% of rehabilitation area); and
- Revegetation of approximately 1.2ha cleared land to create additional EEC (4.2% of rehabilitation area).

Proposed rehabilitation works in accordance with the Site Rehabilitation & Pest Management Plan (**VOLUME 3**) will result in an increase of 11.34ha of EEC to offset the loss of 4.21ha.

5.1.3.10 Impacts on Threatened Fauna and their habitat

A total of seven (7) Threatened fauna species have been recorded from the subject site to date, including:

- Rose-crowned fruit-dove (*Ptilinopus regina*);
- White-eared monarch (*Monarcha leucotis*);
- Black flying-fox (*Pteropus alecto*);
- Eastern bent-wing bat (*Miniopteris schreibersii oceanensis*);
- Eastern free-tail bat (*Mormopterus norfolkensis*);
- Little bent-wing bat (*Miniopterus australis*); and
- Grey-headed flying-fox (*Pteropus poliocephelus*).

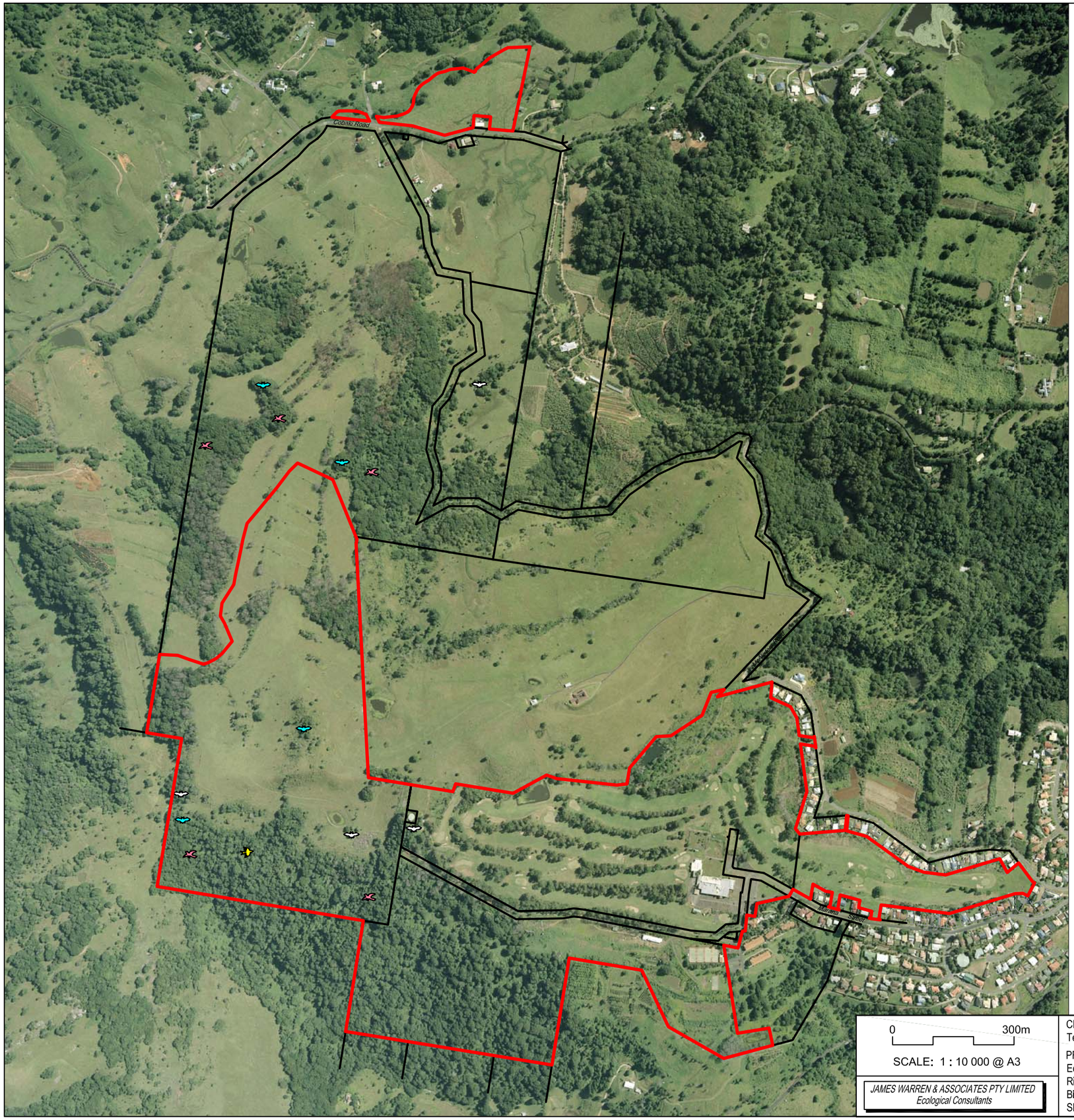
A further fifteen (14) Threatened species were considered likely or possible occurrences on the Subject site (**VOLUME 2, APPENDIX 2**).

- Albert's lyrebird (*Menura alberti*);
- Barred cuckoo-shrike (*Coracina lineata*);
- Beccari's free-tail bat (*Mormopterus beccarii*);
- Black breasted button quail (*Turnix melanogaster*);
- Common planigale (*Planigale maculata*);
- Coxen's fig parrot (*Cyclopsitta diophthalma coxenii*);
- Eastern long-eared bat (*Nyctophilus bifax*);
- Eastern pygmy possum (*Cercartetus nanus*);
- Koala (*Phascolarctos cinereus*);
- Masked owl (*Tyto novaehollandiae*);
- Sooty owl (*Tyto tenebriscosa*);
- Square-tailed kite (*Lophoictinia isura*);
- Three-toed snake toothed skink (*Coeranoscincus reticulatus*);
- Wompoo fruit dove (*Ptilinopus magnificus*); and
- Yellow-bellied sheathtail bat (*Saccolaimus flaviventris*).

The known locations of Threatened fauna sightings on the subject site are shown in **FIGURE 18.** A summary of impacts for each species recorded on the subject site, or considered a possible occurrence, is provided in **TABLE 7.** A more detailed discussion of impacts is provided below.

**TABLE 7**
**POTENTIAL LOSS OF THREATENED FAUNA HABITAT**
**FROM THE PROPOSED DEVELOPMENT AREA**

| Species | Existing habitat (ha) | Habitat Loss (ha) | Habitat Loss (%) |
|---|---|---|---|
| Grey-headed flying-fox[#] | 29.64 | 12.49 | 42.1% |
| Little bent-wing bat[1] | 29.64 | 12.49 | 42.1% |
| Eastern bent-wing bat[1] | 29.64 | 12.49 | 42.1% |
| Eastern free-tail bat[1] | 29.64 | 12.49 | 42.1% |
| White-eared monarch | 17.13 | 2.62 | 15.3% |
| Rose-crowned fruit-dove | 29.64 | 12.49 | 42.1% |
| Black flying-fox[#] | 29.64 | 12.49 | 42.1% |
| Albert's lyrebird | 17.13 | 2.62 | 15.3% |




N

**LEGEND**

- Rose-crowned fruit dove (*Ptilinopus regina*)
- White-eared monarch (*Monarcha leucotis*)
- Grey-headed flying fox (*Pteropus poliocephalus*)
- Black flying fox (*Pteropus alecto*)
- Site Outline

SOURCE:
Fauna - James Warren & Associates GPS Survey June 2007
Aerial Photograph - Michel Group Services taken 2006 (Ref: bilambil_heights_2006-reduced.jpeg)

0 300m

SCALE: 1 : 10 000 @ A3

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VOLUME 1
FIGURE 18

PREPARED: BW
DATE: 27 April 2009
FILE: N01051_EA_Base.dwg

TITLE

# LOCATION OF THREATENED FAUNA

| Species | Existing habitat (ha) | Habitat Loss (ha) | Habitat Loss (%) |
|---|---|---|---|
| Barred cuckoo-shrike | 17.13 | 2.62 | 15.3% |
| Beccari's free-tail bat[1] | 29.64 | 12.49 | 42.1% |
| Black breasted button quail | 17.13 | 2.62 | 15.3% |
| Common planigale | 20.52 | 4.21 | 20.5% |
| Coxen's fig parrot | 17.13 | 2.62 | 15.3% |
| Eastern long-eared bat[1] | 29.64 | 12.49 | 42.1% |
| Eastern pygmy possum | 17.13 | 2.62 | 15.3% |
| Koala[#] | 0 | 0 | 0% |
| Masked owl[#1] | 0 | 0 | 0% |
| Sooty owl[#1] | 17.13 | 2.62 | 15.3% |
| Square-tailed kite[#1] | 0 | 0 | 0 |
| Three-toed snake-toothed skink | 17.13 | 2.62 | 15.3% |
| Wompoo fruit dove | 29.64 | 12.49 | 42.1% |
| Yellow-bellied sheathtail bat[1] | 29.64 | 12.49 | 42.1% |

[#] Landscape plantings have not been included in habitat calculations.
[1] Forage habitat for these species has been calculated based on more suitable habitat (i.e. forested areas). Other areas of the site (i.e. open areas) may also be utilised for foraging purposes on occasions but have not been included in this calculation.

An Assessment of Significance (7 part test) was completed for all Threatened fauna considered a possible or likely occurrence on the subject site in accordance with Schedules of the TSC Act (1995) (**VOLUME 2, APPENDIX 3**) and determined that the proposed development is unlikely to have a significant impact on any Threatened fauna species.

An assessment under the Commonwealth Environment Protection and Biodiversity Conservation Act (1999) has also been completed **VOLUME 2 (APPENDIX 4).** The assessment concluded that the Proposed development will not have a significant impact on any Commonwealth listed Threatened fauna species.

A discussion of amelioration measures to reduce potential impacts on Threatened fauna species is included below.

**Grey-headed flying-fox**

The NPWS database (March 2009) contains fifteen (15) records of this species within 10 km of the Subject site. One hundred and eighty-four (184) records occur within the Tweed LGA. The Grey-headed flying-fox has been recorded foraging in various locations on the subject site (**FIGURE 18**). This species is known to roost in rainforest and swamp forest communities. A day-roost site for a small group (15 to 20 individuals) of this species has been recorded from Hidden Valley, to the north-east of the subject site.

The Grey-headed flying-fox forages in rainforests, wet and dry sclerophyll forest, mangroves, fruit orchids and fruiting trees in parks and urban areas. The proposed development has the potential to result in the loss of foraging habitat for this species and reduce the foraging efficiency of any individuals foraging in the Study area.

It is estimated that approximately 29.64 hectares of suitable forage habitat occurs on the subject site for this species (i.e. Communities 1 – 4). Approximately 12.49 hectares (42.1%) of potential forage habitat will be removed from the subject site, the majority of which is comprised of Camphor laurel dominated forest. It should be noted that landscape plantings and scattered trees within open areas have not been included in this calculations.

Suitable roosting habitat for this species may occur in the intact rainforest community located in the southern portion of the subject site which will be retained. Given the high mobility of this species, the loss of 12.49 hectares of known and potential foraging habitat is not considered significant in relation to the regional distribution of potential foraging habitat for this species. The Grey-headed flying-fox is considered likely to continue foraging within retained areas of vegetation on the site and restored areas of vegetation on the site.

**Little bent-wing bat and Eastern bent-wing bat**

The NPWS database (March 2009) contains ten (10) records of the Little bent-wing bat and one (1) record of the Eastern bent-wing bat within 10 km of the Subject site. Fifty-two (52) records of the Little bent-wing bat and eight (8) records of the Eastern bent-wing bat occur within the Tweed LGA.

The Little bent-wing bat and Eastern bent-wing bat forage on insects in forested habitats, and roosts in caves, tunnels or similar structures located nearby. The proposed development will result in the loss of some foraging habitat for these species, and reduce the foraging efficiency of any individuals foraging in the Study area.

It is estimated that approximately 29.64 hectares of suitable forage habitat occurs on the subject site for these species (i.e. Communities 1 – 4). Approximately 12.49 hectares (42.1%) of potential forage habitat will be removed from the subject site, the majority of which is comprised of Camphor laurel dominated forest. It should be noted that landscape plantings and scattered trees within open areas have not been included in this calculations.

Given the high mobility of these species, the loss of potential foraging habitat is not considered significant in relation to the regional distribution of habitat for the species. No roost habitat will be affected by the proposed development and it is considered that these species will continue to forage over the retained vegetation on the subject site and restored areas of vegetation on the site.

**Eastern free-tail bat**

The NPWS database (March 2009) does not contain any records of the Eastern free-tail bat within 10 km of the Subject site. Three (3) records occur within the Tweed LGA.

The Eastern free-tail bat is a poorly known species for which specific habitat requirements are not known. The species has been recorded from forest types ranging from rainforest to dry sclerophyll forest and woodland, but most records are from dry sclerophyll forest and woodland (NPWS 2002).

Breeding sites for the Eastern free-tail bat as consist of large mature tree hollows in dry forest woodland and possibly in moist forest (Environment Australia 1999). Inferences from wing morphology and echolocation call design suggest that it forages for flying insects in more open forest as well as adjacent cleared areas (Allison 1983).

It is estimated that approximately 29.64 hectares of suitable forage habitat occurs on the subject site for this species (i.e. Communities 1 – 4). Approximately 12.49 hectares (42.1%) of potential forage habitat will be removed from the subject site, the majority of which is comprised of Camphor laurel dominated forest. It should be noted that landscape plantings and scattered trees within open areas have not been included in this calculations.

Given the high mobility of these species, the loss of potential foraging habitat is not considered significant in relation to the regional distribution of habitat for this species. No roost habitat will be affected by the proposed development and it is considered that this species will continue to forage over the retained vegetation on the subject site and restored areas of vegetation on the site.

**White-eared monarch**

The NPWS database (March 2009) contains seven (7) records of this species within 10 km of the Subject site. Eighty-six (86) records occur within the Tweed LGA. This species has been recorded from rainforest communities in the southern portion of the subject site on a number of occasions.

The White-eared monarch inhabits Lowland subtropical rainforest edges and remnants, Littoral and floodplain rainforest, swamp sclerophyll forest with mesomorphic mid-storey, and coastal wet sclerophyll forest and seems to prefer edges with rainforest, edges of gaps within forests and edges between forests and cleared land.

Suitable habitat for this species is considered to be comprised of undisturbed rainforest communities on and adjacent to the subject site. It is estimated that approximately 17.13 hectares of potential forage habitat occurs on the subject site for the White-eared monarch (i.e. Community 2). Approximately 2.62 hectares (15.3%) of potential forage habitat will be removed from the subject site. Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the regional distribution of habitat for this species.

**Rose-crowned fruit-dove & Wompoo fruit-dove**

The NPWS database (March 2009) contains six (6) records of the Rose-crowned fruit-dove within 10 km of the Subject site. One hundred and two (102) records occur within the Tweed LGA.

The NPWS database (March 2009) contains two (2) records of the Wompoo fruit-dove within 10 km of the Subject site. Sixty-two (62) records occur within the Tweed LGA.

The Rose-crowned fruit-dove has been recorded from rainforest and Camphor laurel dominated communities throughout the subject site on a number of occasions. The Superb and Wompoo fruit-doves have not been recorded from the subject site however suitable habitat occurs.

The fruit-doves generally inhabit subtropical, dry and warm-temperate rainforests and wet sclerophyll forests, with a good fruit supply nearby. Common food items include the fruits of Figs, Laurels, Quandong and Giant stinging trees, as well as scattered Figs in cleared habitat. They will also utilise remnants dominated by Camphor laurel and regenerating rainforest communities.

Suitable habitat for the fruit-doves is considered to be comprised of rainforest communities (including degraded/regenerating areas) on and adjacent to the subject site. It is estimated that approximately 29.64 hectares of potential forage habitat occurs on the subject site for this species (i.e. Communities 1 – 4). Approximately 12.49 hectares (42.1%) of potential forage habitat will be removed from the subject site, the majority of which is comprised of Camphor laurel dominated forest.

Given the high mobility of the fruit-doves, the loss of potential foraging habitat is not considered significant in relation to the regional distribution of habitat for these species. It is considered that the proposed development is highly unlikely to result in the local extinction of these species.

**Black flying-fox**

The NPWS database (March 2009) contains no records of this species within 10 km of the Subject site or within the Tweed LGA. This species has been recorded from rainforest communities on the subject site.

The Black flying fox forages in subtropical rainforest with mosaic of resources including rainforest fruit, nectar and pollen. The proposed development has the potential to result in the loss of foraging habitat for this species and reduce the foraging efficiency of any individuals foraging in the Study area.

It is estimated that approximately 29.64 hectares of suitable forage habitat occurs on the subject site for this species (i.e. Communities 1 – 4). Approximately 12.49 hectares (42.1%) of potential forage habitat will be removed from the subject site, the majority of which is comprised of Camphor laurel dominated forest. It should be noted that landscape plantings and scattered trees within open areas have not been included in this calculations.

Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the regional distribution of habitat for this species. Suitable roosting habitat for this species may currently occur in the better quality rainforest community in the southern portion of the subject site which will be retained. The Black flying-fox is considered likely to continue foraging within retained areas of vegetation on the site and restored areas of vegetation on the site.

**Albert's lyrebird**

The NPWS database (March 2009) contains one (1) record of this species within 10 km of the Subject site. Seventy-six (76) records occur within the Tweed LGA. This species has not been recorded from the subject site however suitable habitat is considered to occur.

Albert's lyrebird inhabits Wet sclerophyll, temperate subtropical rainforest with dark southerly slopes sometimes abutting cliff lines, lawyer vine thickets, tree-ferns and stumps. They usually use a well developed litter layer.

Suitable habitat for this species is considered to be comprised of undisturbed rainforest communities on and adjacent to the subject site. It is estimated that approximately 17.13 hectares of potential forage habitat occurs on the subject site for Albert's lyrebird (i.e. Community 2). Approximately 2.62 hectares (15.3%) of potential forage habitat will be removed from the subject site. The loss of potential foraging habitat is not considered significant in relation to the regional distribution of habitat for this species.

**Barred cuckoo-shrike**

The NPWS database (March 2009) contains two (2) records of this species within 10 km of the Subject site. Fourteen (14) records occur within the Tweed LGA. This species has not been recorded from the subject site however suitable habitat is considered to occur.

The Barred cuckoo shrike inhabits low elevation subtropical and littoral rainforest and coastal wet sclerophyll forest close to fruiting figs with the preferred habitat being a mature canopy.

Suitable habitat for this species is considered to be comprised of undisturbed rainforest communities on and adjacent to the subject site. It is estimated that approximately 17.13 hectares of potential forage habitat occurs on the subject site (i.e. Community 2). Approximately 2.62 hectares (15.3%) of potential forage habitat will be removed from the subject site. The loss of potential foraging habitat is not considered significant in relation to the regional distribution of habitat for this species.

**Beccari's free-tail bat**

The NPWS database (March 2009) contains two (2) records of this species within 10 km of the Subject site, and within the Tweed LGA. This species has not been recorded from the subject site however suitable habitat is considered to occur.

Beccari's free-tail bat forages in open forests and roosts in hollows in trees and dead stags. The proposed development will result in the loss of some potential foraging habitat for this species.

It is estimated that approximately 29.64 hectares of suitable forage habitat occurs on the subject site for this species (i.e. Communities 1 – 4). Approximately 12.49 hectares (42.1%) of potential forage habitat will be removed from the subject site, the majority of which is comprised of Camphor laurel dominated forest. It should be noted that landscape plantings and scattered trees within open areas have not been included in this calculations.

Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the regional distribution of habitat. No roost habitat will be affected by the proposed development.

**Black-breasted button quail**

The NPWS database (March 2009) does not contain any records of this species within 10 km of the Subject site. Thirteen (13) records occur within the Tweed LGA. This species has not been recorded from the subject site however suitable habitat is considered to occur.

The Black-breasted button quail inhabits dry rainforest in association with eucalypt forest and with a well developed litter layer, disturbed areas with a lantana understorey, areas of subtropical rainforest adjacent to eucalypt forest, and dry rainforest with an emergent layer dominated by Hoop pine.

Suitable habitat for this species is considered to be comprised of undisturbed rainforest communities on and adjacent to the subject site. It is estimated that approximately 17.13 hectares of potential forage habitat occurs on the subject site (i.e. Community 2). Approximately 2.62 hectares (15.3%) of potential forage habitat will be removed from the subject site. The loss of potential foraging habitat is not considered significant in relation to the regional distribution of habitat for this species.

**Common planigale**

The NPWS database (March 2009) contains four (4) records of this species within 10 km of the Subject site. Thirty (30) records occur within the Tweed LGA. This species has not been recorded from the subject site however suitable habitat is considered to occur.

Common planigales inhabit rainforest, eucalypt forest, heathland, marshland, grassland, and rocky areas where there is surface cover, and usually close to water. They are active at night and shelter during the day in saucer-shaped nests of eucalypt leaves in crevices, logs, under bark, in cracks in the soil, under rocks or in grass tussocks.

Suitable habitat for this species is considered to be comprised of undisturbed and regenerating rainforest communities on and adjacent to the subject site. It is estimated that approximately 20.52 hectares of potential forage habitat occurs on the subject site (i.e. Communities 2 & 4). Approximately 4.21 hectares (20.5%) of potential forage habitat will be removed from the subject site. The loss of potential foraging habitat is not considered significant in relation to the regional distribution of habitat for this species.

**Coxen's fig parrot**

The NPWS database (March 2009) does not contain any records of this species within 10 km of the Subject site or within the Tweed LGA. This species has not been recorded from the subject site however suitable habitat is considered to occur.

Recent records of the Coxen's fig-parrot are from sub-tropical rainforest, sub-littoral mixed scrub, developing littoral rainforest, riparian rainforest corridors in eucalypt woodland and cleared land, and urbanised and agricultural areas with fig trees (NPWS 2002b). The species shows a decided preference for fig trees, but also feeds on other fruiting rainforest plants, nectar, insect larvae and perhaps fungi from bark.

Suitable habitat for this species is considered to be comprised of undisturbed rainforest communities on and adjacent to the subject site. It is estimated that approximately 17.13 hectares of potential forage habitat occurs on the subject site (i.e. Community 2). Approximately 2.62 hectares (15.3%) of potential forage habitat will be removed from the subject site. The loss of potential foraging habitat is not considered significant in relation to the regional distribution of habitat for this species.

**Eastern long-eared bat**

The NPWS database (March 2009) contains four (4) records of this species within 10 km of the Subject site. Thirty (30) records occur within the Tweed LGA. This species has not been recorded from the subject site however suitable habitat is considered to occur.

The Eastern long-eared bat forages on flying insects and gleans insects from leaves and bark and prefers to forage within structurally complex forests. The proposed development will result in the loss of some potential foraging habitat for this species.

Suitable habitat for this species is considered to be comprised of undisturbed rainforest communities on and adjacent to the subject site. It is estimated that approximately 17.13 hectares of potential forage habitat occurs on the subject site (i.e. Community 2). Approximately 2.62 hectares (15.3%) of potential forage habitat will be removed from the subject site.

Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the regional distribution of habitat. No roost habitat will be affected by the proposed development.

**Eastern pygmy possum**

The NPWS database (March 2009) contains one (1) record of this species within 10 km of the Subject site, and within the Tweed LGA. This species has not been recorded from the subject site however suitable habitat is considered to occur.

The Eastern pygmy possum inhabits a range of vegetation types from rainforest through sclerophyll forest to heath. Hollows in trees are favoured as nest sites and there is a preference for small hollow entrances.

Suitable habitat for this species is considered to be comprised of undisturbed rainforest communities on and adjacent to the subject site. It is estimated that approximately 17.13 hectares of potential forage habitat occurs on the subject site (i.e. Community 2). Approximately 2.62 hectares (15.3%) of potential forage habitat will be removed from the subject site. No roost habitat will be affected by the proposed development.

**Koala**

The NPWS database (March 2009) contains one hundred and forty-seven (147) records of this species within 10 km of the Subject site. Five hundred and fifty-two (552) records occur within the Tweed LGA.
It is worth noting that indirect evidence of Koala activity was recorded from the eastern portion of the subject site during a study by JWA in 2004. Koalas were not

recorded in the 1996 WBM Oceanics survey, and have not been recorded on the site by Groundskeepers (Bill Clarke – Head Groundskeeper *pers comm.* April 2005). No evidence of Koala activity was recorded during recent site surveys.

The only habitat for the Koala on the subject site occurs as planted trees (*Eucalyptus robusta*) within the disused golf course. Combined with the relative isolation of the site, and lack of any connectivity with good quality Koala habitat, any extensive use of the site, save for the very occasional straying individual is considered highly unlikely.

Although the majority of planted feed trees associated with the golf course are likely to be removed, retention of the small area of planted Swamp mahogany on the north-west of the golf course will continue to provide a marginal forage resource for any individuals of the species which may occasionally stray through the site.

**Masked owl**

The NPWS database (March 2009) contains two (2) records of this species within 10 km of the Subject site. Twelve (12) records occur within the Tweed LGA. This species has not been recorded from the subject site however suitable habitat is considered to occur.

The Masked owl feeds in sclerophyll forest with sparse, open understorey, particularly in the ecotone between wet and dry forest and non-forest habitat. This species may potentially forage over the majority of the subject site however, it is estimated that better quality forage habitat on the subject site is comprised of mature Eucalypts associated with the disused golf course. It is noted that this species will also forage over open areas (i.e. grasslands etc.) however these areas are not considered to form a significant component of the habitat for this species.

Although the majority of planted trees associated with the golf course are likely to be removed, the relative isolation of the site, and lack of any connectivity with good quality forage habitat suggests that any extensive use of the site, save for the very occasional straying individual is considered highly unlikely.

Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the regional distribution of habitat for this species.

**Sooty owl**

The NPWS database (March 2009) contains one (1) record of this species within 10 km of the Subject site. Sixty-six (66) records occur within the Tweed LGA. This species has not been recorded from the subject site however suitable habitat is considered to occur.

The sooty owl inhabits rainforest and tall, moist eucalypt forest of coastal and near coastal areas. An abundant and diverse supply of arboreal and terrestrial mammals, especially Common ringtail possums, Sugar gliders, Bush rats and Brown antechinuses, and a selection of large tree hollows are prime factors in determining the location of this species.
Suitable habitat for this species is considered to be comprised of undisturbed rainforest communities on and adjacent to the subject site. It is estimated that approximately

17.13 hectares of potential forage habitat occurs on the subject site (i.e. Community 2). Approximately 2.62 hectares (15.3%) of potential forage habitat will be removed from the subject site. No roost habitat will be affected by the proposed development.

Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the regional distribution of habitat for this species.

**Square-tailed kite**

The NPWS database (March 2009) contains one (1) record of this species within 10 km of the Subject site. Two (2) records occur within the Tweed LGA. This species has not been recorded from the subject site however suitable habitat is considered to occur.

Square-tailed kites are uncommon yet widespread. They inhabit dry woodland and open forest mainly in coastal or subcoastal districts, preferring vegetation along major rivers and belts of trees in urban or semi-urban areas for hunting. This species may potentially forage over the majority of the subject site however, it is estimated that better quality forage habitat on the subject site is comprised of mature Eucalypts associated with the disused golf course. It is noted that this species will also forage over open areas (i.e. grasslands etc.) however these areas are not considered to form a significant component of the habitat for this species.

Although the majority of planted trees associated with the golf course are likely to be removed, the relative isolation of the site, and lack of any connectivity with good quality forage habitat suggests that any extensive use of the site, save for the very occasional straying individual is considered highly unlikely.

Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the regional distribution of habitat for this species.

**Three-toed snake toothed skink**

The NPWS database (March 2009) contains no records of this species within 10 km of the Subject site. Two (2) records occur within the Tweed LGA. This species has not been recorded from the subject site however suitable habitat is considered to occur.

The Three-toed snake-toothed skink inhabits areas of friable soil, leaf litter and large logs in subtropical and temperate rainforest, wet sclerophyll forest, and possibly open coastal forest. Soils typically have moderate to high moisture levels. Sheltering sites are similar but include rocks and deep leaf litter. This species requires continuous forest cover for dispersal.

Suitable habitat for this species is considered to be comprised of undisturbed rainforest communities on and adjacent to the subject site. It is estimated that approximately 17.13 hectares of potential forage habitat occurs on the subject site (i.e. Community 2). Approximately 2.62 hectares (15.3%) of potential forage habitat will be removed from the subject site. The loss of potential foraging habitat is not considered significant in relation to the regional distribution of habitat for this species.

**Yellow-bellied sheathtail bat**

The NPWS database (March 2009) contains three (3) records of this species within 10 km of the Subject site. Four (4) records occur within the Tweed LGA. This species has not been recorded from the subject site however suitable habitat is considered to occur.

Foraging and seasonal movements of this species are poorly known, however it is thought to forage on aerial insects in open areas such as above the forest canopy or in open habitat. This species is thought to roost in tree hollows of mature eucalypts and is thus likely to be sensitive to the loss of hollow-bearing trees.

It is estimated that approximately 29.64 hectares of suitable forage habitat occurs on the subject site for this species (i.e. Communities 1 – 4). Approximately 12.49 hectares (42.1%) of potential forage habitat will be removed from the subject site, the majority of which is comprised of Camphor laurel dominated forest. It should be noted that landscape plantings and scattered trees within open areas have not been included in this calculations.

Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the regional distribution of habitat. No roost habitat will be affected by the proposed development.

#### 5.1.3.11 Avoidance of impacts on Threatened fauna and their habitat

The proposed development has been designed to utilise existing cleared areas where possible. The majority of vegetation to be removed consists of exotic pasture with scattered trees, landscape plantings (i.e. disused golf course), disturbed land and Camphor laurel dominated vegetation.

#### 5.1.3.12 Mitigation for Threatened fauna and their habitat

Rehabilitation works to be completed as part of proposed development in accordance with the Site Rehabilitation & Pest Management Plan (**VOLUME 3**) will result in the regeneration/revegetation of 28.9 hectares of rainforest communities. These areas are all likely to provide suitable forage habitat for Threatened fauna species in the long-term. It is considered that the proposed development is highly unlikely to result in the local extinction of any Threatened fauna species.

#### 5.1.3.13 Offsets for Threatened fauna and their habitat

Rehabilitation works to be completed as part of the proposed development in accordance with the Site Rehabilitation & Pest Management Plan (**VOLUME 3**) will result in the regeneration/revegetation of 28.9 hectares of rainforest communities. The proposed rehabilitation works include:

- Restoration and embellishment of approximately 15.42ha of existing mature EEC (54.4% of rehabilitation area);
- Assisted regeneration of approximately 2.1ha of existing regenerating EEC (7.3% of rehabilitation area);

- Regeneration of approximately 10.14ha of disturbed land/depauperate rainforest to create additional EEC (35.1% of rehabilitation area); and
- Revegetation of approximately 1.2ha cleared land to create additional EEC (4.2% of rehabilitation area).

Proposed rehabilitation works in accordance with the Site Rehabilitation & Pest Management Plan (**VOLUME 3**) will result in a long-term net gain of approximately 16.48ha - 26.28ha of suitable forage and/or corridor habitat for Threatened fauna species to offset the loss of 2.62 – 12.49ha of habitat, including embellishment of existing habitat and revegetation/rehabilitation works.

### *5.1.4 Koala Habitat*

In the absence of a shire-wide Koala Plan of Management (KPoM), State Environmental Planning Policy No. 44 (SEPP 44) applies.

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

In response to the state-wide decline of Koala populations the Department of Planning has enacted SEPP - 44 Koala Habitat Protection. The Policy aims to "encourage the proper conservation and management of area of natural vegetation that provide habitat for Koalas, to ensure permanent free-living populations over their present range and to reverse the current trend of population decline."

A number of criteria in the SEPP are to be addressed:

*1. Does the policy apply?*

*Does the subject land occur in an LGA identified in Schedule 1?*

The Subject site occurs in the Tweed LGA, which is listed under Schedule 1.

*Is the landholding to which the DA applies greater than 1 hectare in area?*

Yes.

*Is the land potential Koala habitat?*
*Does the site contain areas of native vegetation where the trees of types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component?*

No

A number of species classified as Koala food trees have been planted within the Gulf Course. These trees are less than 15% of the total number of trees in the upper or lower strata of the tree component of the Subject site.

*3. Is there core Koala habitat on the subject land?*
The site does not support core Koala habitat.

*4. Is there a requirement for the preparation of a Plan of Management for identified core Koala habitat?*

No.

## 5.2 Address the Management of Threatened species and natural open space areas

### *5.2.1 Introduction*

This section will discuss management strategies for Threatened species and open space areas, both during the construction phase and ongoing.

A Site Rehabilitation & Pest Management Plan (JWA 2009) has been prepared for the site and is provided in **VOLUME 3.**

### *5.2.2 Vegetation Management*

#### 5.2.2.1 Background

A program of poisoning Camphor laurel and Large-leaved privet has been in progress on the site for the last five (5) years. The loss of these weeds can be seen clearly in the aerial photograph shown in **FIGURE 4** and **FIGURE 12**. The sudden influx of light to many of the smaller trees and shrubs in the understorey has resulted in rapid growth of many of these understorey plants. Large numbers of native pioneer species including Macaranga (*Macaranga tanarius*) seedlings in particular were noted to have germinated in some parts of the site, and it is anticipated that widespread germination of other native species such as Guioa (*Guioa semiglauca*) will follow.

#### 5.2.2.2 Methodology

The proposed conservation areas over the entire subject site have been divided into forty-three (43) Rehabilitation Areas (RA's). Individual regeneration and revegetation plans are to be completed for each of the forty-three (43) RA's. RA's 33 - 43 occur within the MP08-0234 development area.

A Site Rehabilitation & Pest Management Plan (JWA 2009) has been prepared for the subject site (**VOLUME 3**). The objectives of the regeneration and revegetation plan are:

- To enhance the vegetation to be conserved;
- To revegetate disturbed areas with endemic species including threatened plant species;
- To obtain a minimum of 70% native canopy cover;
- To obtain a minimum five (5) metre buffer of retained native vegetation around each retained threatened species, to reduce detrimental edge effects and other disturbance related impacts;
- To improve the value of the subject site as habitat for fauna groups; and
- To manage weeds using plantings of endemic species and best practice control methods to achieve less than 10% exotic weed cover within each stratum.

In most areas large numbers of both Large-leaved privet and Camphor laurel seedlings have responded to the opened canopy and are competing with native species for light and resources. These seedlings will require management (by spraying) to limit any re-establishment of these species. Care will be required to limit the spraying of native species, particularly Threatened species, such as Fine-leaved tuckeroo which often produce large numbers of seedlings. This work will only be undertaken by a qualified and experienced bush regenerator.

Focus will continue on weed control in the more degraded portions of the site. Vegetation in the south-west of the site (zoned 7A) is generally in excellent condition and it is not considered necessary to commence works within this community. The degraded area of land in the south of the site adjacent to the 7A area requires intensive work to eliminate infestations of Lantana and Crofton weed. While some natural regeneration is likely to occur in these areas, ongoing maintenance will be a long term prospect, while the topography of the area is likely to make regular maintenance very difficult. It is recommended that this area be targeted for rehabilitation once works in the north of the site have been in progress for at least a two (2) year period.

#### 5.2.2.3 Regeneration

There are excellent opportunities for natural regeneration throughout much of the site, due to the great diversity of native species on the site. Mass regeneration of the pioneer species Macaranga has already occurred in some parts of the site where large scale Camphor laurel poisoning has reduced the canopy and resulted in sunlight penetration. The presence of many mature figs is also likely to result in birds and bats bringing in seed from the locality onto the site.

It is likely that over time, and with appropriate management, regeneration of much of the site is likely to result in establishment of good quality rainforest which will continue to support a diversity of Threatened flora species.

The site serves as a high quality seed bank for Threatened flora species, and there are excellent opportunities to collect and propagate seed of these species for use in the regeneration process. Threatened species such as the Small-leaved tamarind, Rough-shelled bush nut and Fine-leaved tamarind all propagate readily from seed. Furthermore, the wide variety of other rainforest species on the site also provides a diverse seed source worthy of propagation. If proven to be viable a rainforest nursery may be established on the site to support the regeneration process (in addition to providing landscaping plantings) utilising local seed sources. Early implementation of a propagation program will enable tubestock of Threatened species in particular, to be grown up and ready to utilise in future rehabilitation plantings.

### *5.2.3 Pest Management*

The Site Rehabilitation & Pest Management Plan (**VOLUME 3**) provides background information on the following pest animal species potentially occurring on the Subject site and outlines the management strategy for each:

- Wild dogs
- Feral cats
- Rabbits/hares
- Cane toads
- Foxes

Management of pests in parks and reserves within the Tweed area is dealt with in the NSW National Parks and Wildlife Service *Northern Rivers Region Pest Management Strategy 2008 – 2011.* The measures outlined in the Site Rehabilitation & Pest Management Plan (**VOLUME 3**) aim to complement the goals of the NPWS strategy.

## 5.3 Assess impacts of native vegetation clearing and provide details of any offset strategy or suitable mitigation measures

### *5.3.1 Introduction*

This section details the extent of native vegetation clearing as a result of the proposed development. The possible direct and indirect impacts of the proposal are outlined, along with proposed strategies to ensure that there is no net loss of native vegetation values. The potential impacts on significant vegetation (i.e. Threatened flora species & EEC's) has been discussed in previous sections of this report.

### *5.3.2 Potential Impacts on Native Vegetation*

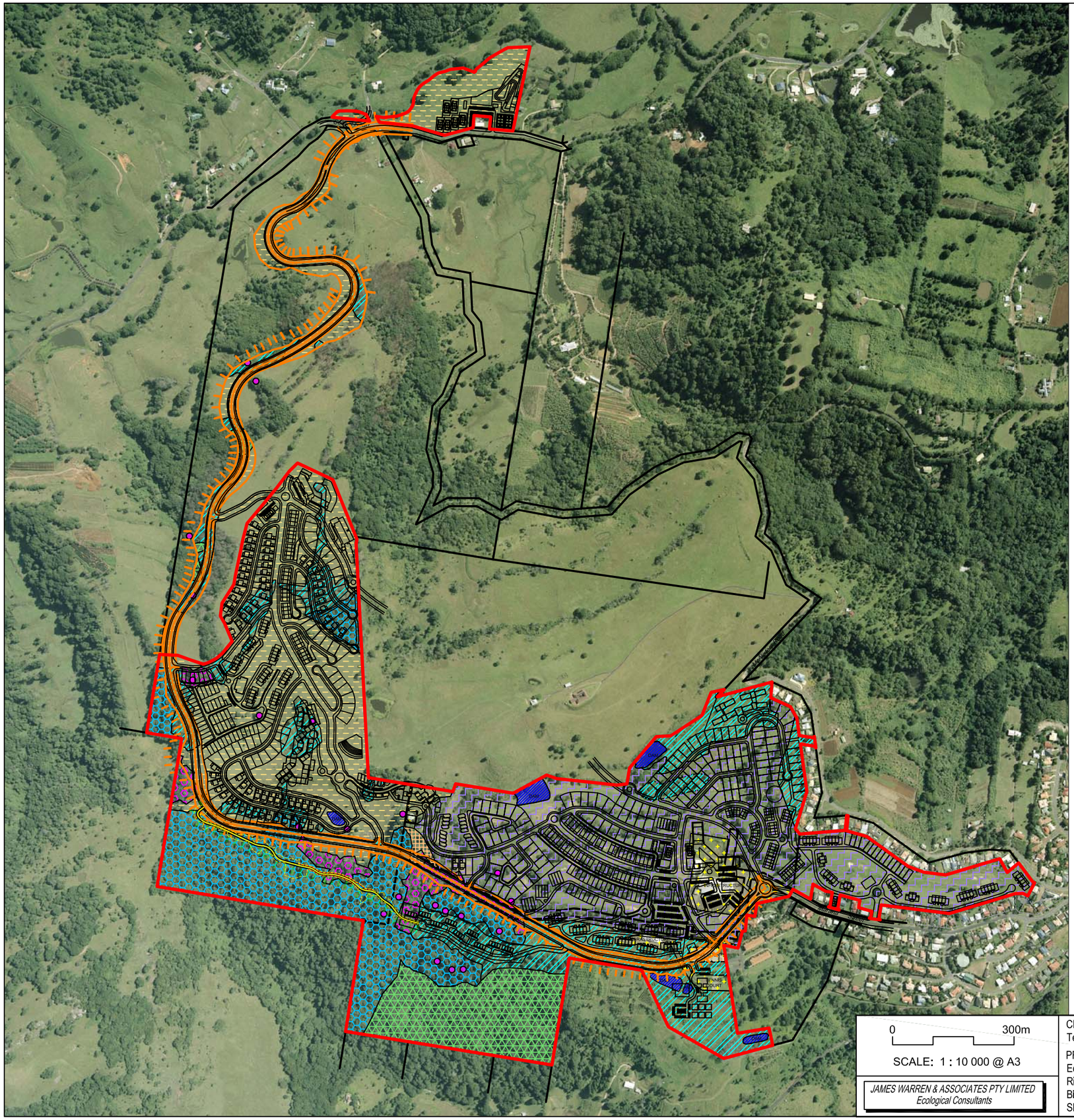
Development in accordance with the proposed layout will result in the loss of vegetation for the construction of buildings, access roads, driveways and associated infrastructure. An overlay of the proposed development layout on the vegetation is shown in **FIGURE 19**.

A summary of vegetation types that will be lost as a result of the proposed layout is shown in **TABLE 8**.

**TABLE 8**
**VEGETATION TO BE LOST AS A RESULT OF THE PROPOSED DEVELOPMENT**

| Vegetation Community | Total area (ha) | Area to be lost (ha) | Percentage of area lost | Percentage of TOTAL vegetation to be removed |
|---|---|---|---|---|
| Community 1 - Tall closed forest (*Cinnamomum camphora* +/- mixed species) | 8.77 | 7.93 | 90.4% | 7.8% |
| Community 2 - Tall closed forest (mixed species) | 17.13 | 2.62 | 15.3% | 2.6% |
| Community 3 - Tall closed forest (*Lophostemon confertus*) | 0.35 | 0.35 | 100% | 0.3% |
| Community 4 - Regrowth closed forest (mixed species) | 3.39 | 1.59 | 46.9% | 1.6% |
| Community 5 - Landscape plantings | 35.61 | 33.74 | 94.7% | 32.9% |
| Community 6 - Disturbed land | 21.12 | 18.89 | 89.4% | 18.5% |
| Community 7 - Grassland with scattered trees | 38.01 | 37.16 | 97.8% | 36.3% |
| **TOTAL VEGETATION REMOVED** | **124.38 ha** | **102.28 ha** | **82.2%** | |

In total, 102.28 hectares of vegetation will be removed for the proposed development. However, it should be noted that 37.16 ha (36.3% of the total vegetation to be removed) consists of exotic pasture with scattered trees (Community 7) and 33.74 ha (32.9% of the total vegetation to be removed) consists of landscape plantings (i.e. disused golf course) in addition to approximately 18.89 hectares (18.5% of the total



## LEGEND

- Community 1 - Tall closed forest (*Cinnamomum camphora* +/- mixed species)
- Community 2 - Tall closed forest (Mixed species)
- Community 3 - Tall closed forest (*Lophostemon confertus*)
- Community 4 - Regenerating closed forest (Mixed species)
- Community 5 - Landscape plantings (Disused golf courses)
- Community 6 - Disturbed land
- Community 7 - Grassland with scattered trees
- Dams
- Existing Infrastructure
- Location of Figs (*Ficus* sp.)
- Site Outline

N

SOURCE:
Vegetation - James Warren & Associates GPS Survey Feb/March 2006
Layout - ML Designs (Ref: A-MP-01-16B.dwg)
Bushfire Track - Cardno (Ref: 510038-03-SK01 Layout Plan.dwg)
Aerial Photograph - Michel Group Services taken 2006 (Ref: bilambil_heights_2006-reduced.jpeg)

0 300m

SCALE: 1 : 10 000 @ A3

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VOLUME 1
FIGURE 19

PREPARED: BW
DATE: 27 April 2009
FILE: N01051_EA_Base.dwg

TITLE

# IMPACT ON EXISTING SITE VEGETATION

vegetation to be removed) of disturbed land (Community 5) and approximately 7.93 hectares (7.8% of the total vegetation to be removed) of Camphor laurel dominated vegetation (Community 1).

The most significant vegetation loss in regard to conservation status will be the loss of 2.26ha of Sub-tropical rainforest (Community 2), and 1.59ha of regenerating rainforest representing 15.3% of rainforest communities within the MP08-0234 development area.

Additional impacts on vegetation communities include:

- Clearance of areas of the Subject site represents a loss of habitat available for dispersal for plants and will reduce visits by pollination and dispersal vectors;
- Disturbance to the Subject site creates opportunities for weeds to colonise. Weeds may be introduced to the site in construction materials or by vehicles. Occupation of the Subject site creates opportunities for weeds to become established. Landscape species may escape to retained areas of vegetation;
- The removal of vegetation from the Subject site represents the loss of organic material from the site;
- Residents may create walking tracks through bushland areas. This may result in direct loss of vegetation, change in vegetation structure and increased opportunities for weeds and disturbance-adapted animal species; and
- Occupation of the site may increase the risk of fire release into the surrounding bushland.

### *5.3.3 Proposed Offset strategy/mitigation measures to ensure that there is no net loss of native vegetation values.*

The proposed development may result in the loss of native vegetation as discussed within Section 5.4.2. Vegetation communities occurring within the proposed Rehabilitation Areas will be retained (**FIGURE 15**). Additionally, these areas will be revegetated or regenerated in accordance with a detailed Site Rehabilitation & Pest Management Plan (**VOLUME 3**). The Plan outlines the restoration works which are to be completed in the areas of vegetation that will be retained and rehabilitated.

## 5.4 Outline the management arrangements for ongoing control of weeds and pests

The developer has committed to future rehabilitation works on the site as recommended in this report and within the Site Rehabilitation & Pest Management Plan (JWA 2009). This plan outlines measures for weed and pest animal control as part of the ongoing rehabilitation efforts and is provided in **VOLUME 3**.

The proposed conservation areas, of the entire subject site, have been divided into forty three (43) Rehabilitation Areas (RA's). Individual rehabilitation management plans are to be completed for each of the forty three (43) precincts. RA's 33 – 43 occur within the MP08-0234 development area.

The Site Rehabilitation and Pest Management plan should be read in conjunction with detailed plans prepared for each RA. Each RA plan will contain:

- A detailed set of directions on the most appropriate methods of:
  - Weed control;
  - Regeneration techniques;
  - Pest control;
  - Monitoring procedures.
- Measurable performance criteria.

By achieving the objectives outlined in these plans via the suggested strategies, all conservation areas are to be successfully regenerated or revegetated.

The Performance Objectives within each plan will contain measures designed to allow the applicant to demonstrate that revegetation objectives are being achieved, to allow Council to sign off on the success of the program.

## 5.5 Discuss as relevant the development of ecological corridors, as well as ecological buffers between land uses

### *5.5.1 Wildlife corridors*

#### 5.5.1.1 Introduction

This section will outline the occurrence of potential wildlife corridors within the Subject site and the local area. Potential impacts on these corridors as a result of the development will be assessed and amelioration measures proposed to ensure ongoing functionality of corridors.

#### 5.5.1.2 Applicability to the subject site

The site occurs within Macpherson Range – Cobaki Regional Corridor (NPWS Key Habitats and Corridors database), which links Mt. Tomewin and McAllisters Road. This is shown as **FIGURE 20**. The Bilambil Subregional Corridor traverses the southern and eastern portions of the site and links McAllisters Road and Durobby Creek.

The site has substantial areas of vegetation which comprise moderate to good quality fauna habitat. Adjacent land to the north, south and east also features large areas of vegetation, and highly mobile fauna (i.e. birds and bats) are likely to move between these remnants.

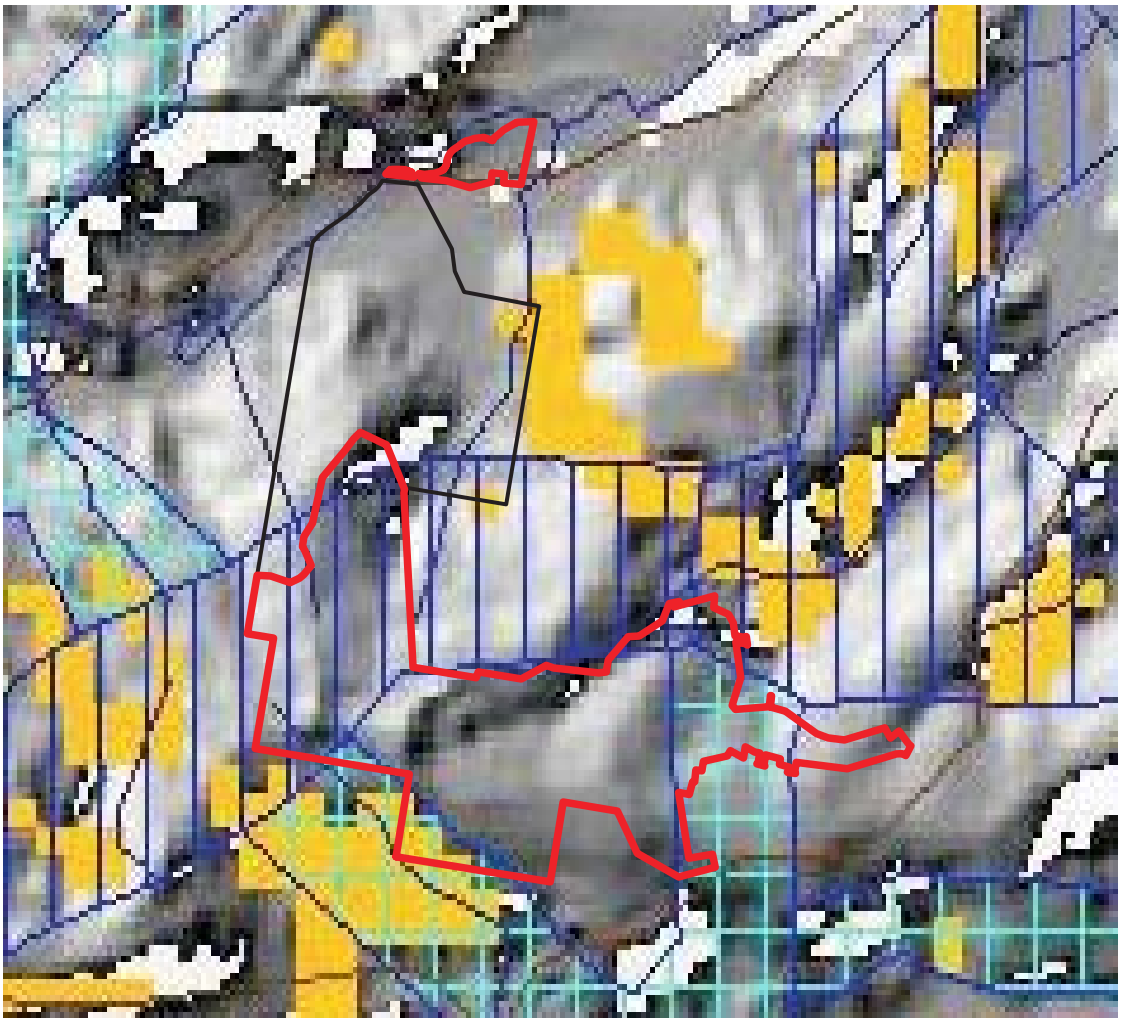
#### 5.5.1.3 Accuracy of NPWS mapping

Site assessments have revealed that the NPWS Corridor mapping appears to be inaccurate over the subject site. Large areas of the site that are included in the mapping have been cleared of vegetation. An overlay of the NPWS Corridor mapping on a recent aerial photograph of the site is included as **FIGURE 21**. Inaccuracies within the NPWS Corridor mapping are as follows:

- Macpherson Range – Cobaki Regional Corridor – the majority of this mapped "Regional Corridor" on the subject site is comprised of cleared land (**FIGURE 21**);
- The Bilambil Subregional corridor – this corridor incorporates rainforest and Camphor laurel communities along the southern boundary of the subject site however, where this corridor traverses the eastern portion of the site it is comprised of landscape plantings associated with the disused golf course (**FIGURE 21**).

#### 5.5.1.4 Potential impacts

The proposed development will result in the removal of vegetated portions of the subject site. However, the majority of vegetation to be removed is comprised of grassland with scattered trees, landscape plantings and areas dominated by Camphor laurel. Under the proposed development large areas of the site will be regenerated and/or revegetated therefore increasing the sites habitat and movement corridor values.



**LEGEND**

- Regional Corridor
- Subregional Corridor
- Key Habitat
- Site Outline

N

0 1000m

SOURCE: CANRI Website - Natural Resources Atlas (30.03.06)

SCALE: 1 : 25 000 @ A4

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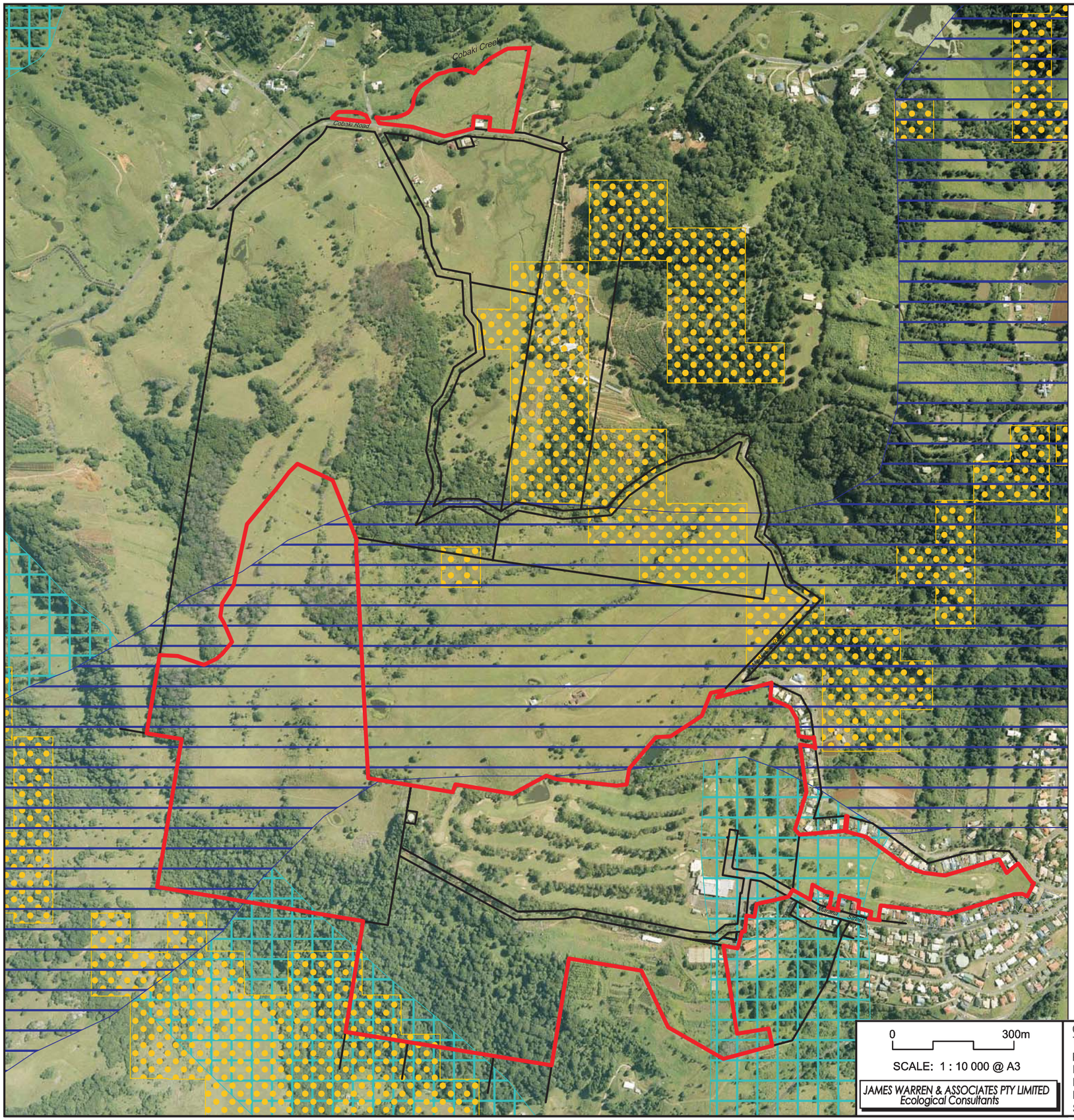
**VOLUME 1**
**FIGURE 20**

PREPARED: VJA/BW
DATE: 27 April 2009
FILE: 01051_EA_Canri.cdr

TITLE

**NPWS KEY HABITATS AND WILDLIFE CORRIDORS**




**LEGEND**

- Regional Corridor
- Subregional Corridor
- Key Habitat
- Site Outline

N

SOURCE:
Corridors - CANRI Website - Natural Resources Atlas (30.03.06)
Aerial Photograph - Michel Group Services taken 2006 (Ref: bilambil_heights_2006-reduced.jpeg)

0 300m

SCALE: 1 : 10 000 @ A3

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**VOLUME 1**
**FIGURE 21**

PREPARED: BW
DATE: 27 April 2009
FILE: N01051_EA_Corridors.cdr

TITLE
**OVERLAY OF NPWS CORRIDORS ON AERIAL PHOTOGRAPH**

Edge effects may also further impact on retained vegetation and corridor habitat. An overlay of the proposed development on the NPWS corridors is shown in **FIGURE 22.** Specific impacts on the NPWS corridors on the subject site are as follows:

- Cobaki-Terranora Regional Corridor – The majority of the mapped area on the subject site occurs within areas which are proposed to be developed (**FIGURE 22**). Some vegetation retention will occur within this mapped corridor as well as regeneration/revegetation works.
- The Bilambil Subregional corridor – rainforest and Camphor laurel communities along the southern boundary of the subject site within this corridor will be retained and rehabilitated. Development is proposed where this corridor traverses the eastern portion of the site and is comprised of landscape plantings associated with the disused golf course (**FIGURE 22**).

#### 5.5.1.5 Proposed amelioration measures

The proposed development has been designed to utilise existing cleared areas where possible. A network of existing substantial vegetated corridors will be retained along the southern and western boundaries of the subject site. Additionally, smaller interlinking corridors will be provided on the subject site through regeneration and revegetation works.

A Site Rehabilitation & Pest Management Plan has been prepared for the subject site (**VOLUME 3**) and will result in approximately 28.9ha of revegetation/regeneration within the MP08-0234 development area to provide vegetated links across the site and ensure that the remaining wildlife corridors will be embellished utilising revegetation and natural regeneration principles.

### *5.5.2 Buffers*

#### 5.5.2.1 Introduction

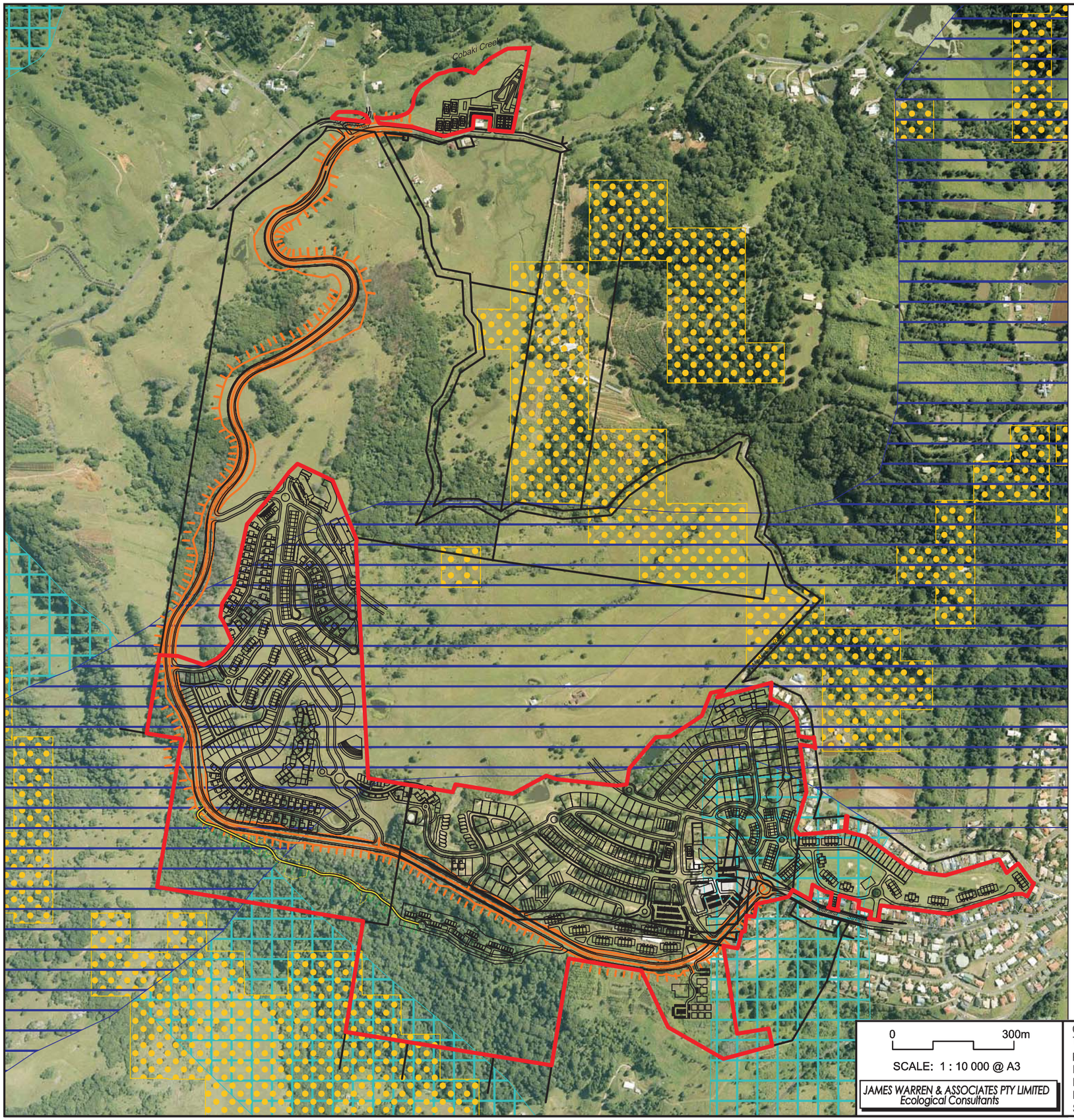
This section will describe the various treatments of ecological buffers on the subject site and will include details on the interactions of ecological buffers with the following:

1. Threatened flora species;
2. Endangered Ecological Communities;
3. Environmental restoration and enhancement works; and
4. Asset Protection Zones.

#### 5.5.2.2 Proposed buffers

**Buffers to Threatened flora**

The locations of Threatened flora species on the subject site are shown in **FIGURES 14(a) – 14(e)**. A large proportion of Threatened species on the subject site occur within the rainforest communities in the southern portion of the subject site, or in areas of the subject site otherwise designated for retention.




**LEGEND**

- Regional Corridor
- Subregional Corridor
- Key Habitat
- Site Outline

SOURCE:
Corridors - CANRI Website - Natural Resources Atlas (30.03.06)
Layout - ML Design (Ref: A-MP-01-16B.dwg)
Bushfire Track - Cardno (Ref: 510038-03-SK01 Layout Plan.dwg)
Aerial Photograph - Michel Group Services taken 2006 (Ref: bilambil_heights_2006-reduced.jpeg)

0 300m

SCALE: 1 : 10 000 @ A3

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**VOLUME 1**
**FIGURE 22**

PREPARED: BW
DATE: 27 April 2009
FILE:N01051_EA_Impact corridor.cdr

TITLE

**IMPACT ON NPWS CORRIDORS**

A Vegetation Management Plan will be prepared for the subject site and discusses measures to be implemented to protect Threatened flora species during the construction phase. The remnant rainforest community in the southern portion of the site will be conserved and buffered by a minimum of 10 metres of planted vegetation to ameliorate the potential impacts of adjacent development (in accordance with the Site Rehabilitation & Pest Management Plan – **VOLUME 3**). The Plan will also ensure that a minimum five (5) metre revegetated buffer is marked for all known specimens of Threatened flora to be retained, and the cleared parts of these areas are revegetated with locally endemic flora species.

An indicative cross-section of the interface between development and the locations of retained Threatened flora is shown in **FIGURES 23(a) & 23(b)**. These areas will be maintained in their natural condition with minimal disturbance, except where the development is sensitive to and consistent with the conservation values of these areas, and undertaken in accordance with an approved management plan.

Allowable uses: No uses will be allowed within this area.

Landscape and Built Form: Maintenance of existing significant vegetation is the primary aim within this area. Management of these areas may also include the replanting of appropriate native species in accordance with an approved Management Plan.

Lot Reconfiguration: No lot reconfiguration is envisaged within this precinct.

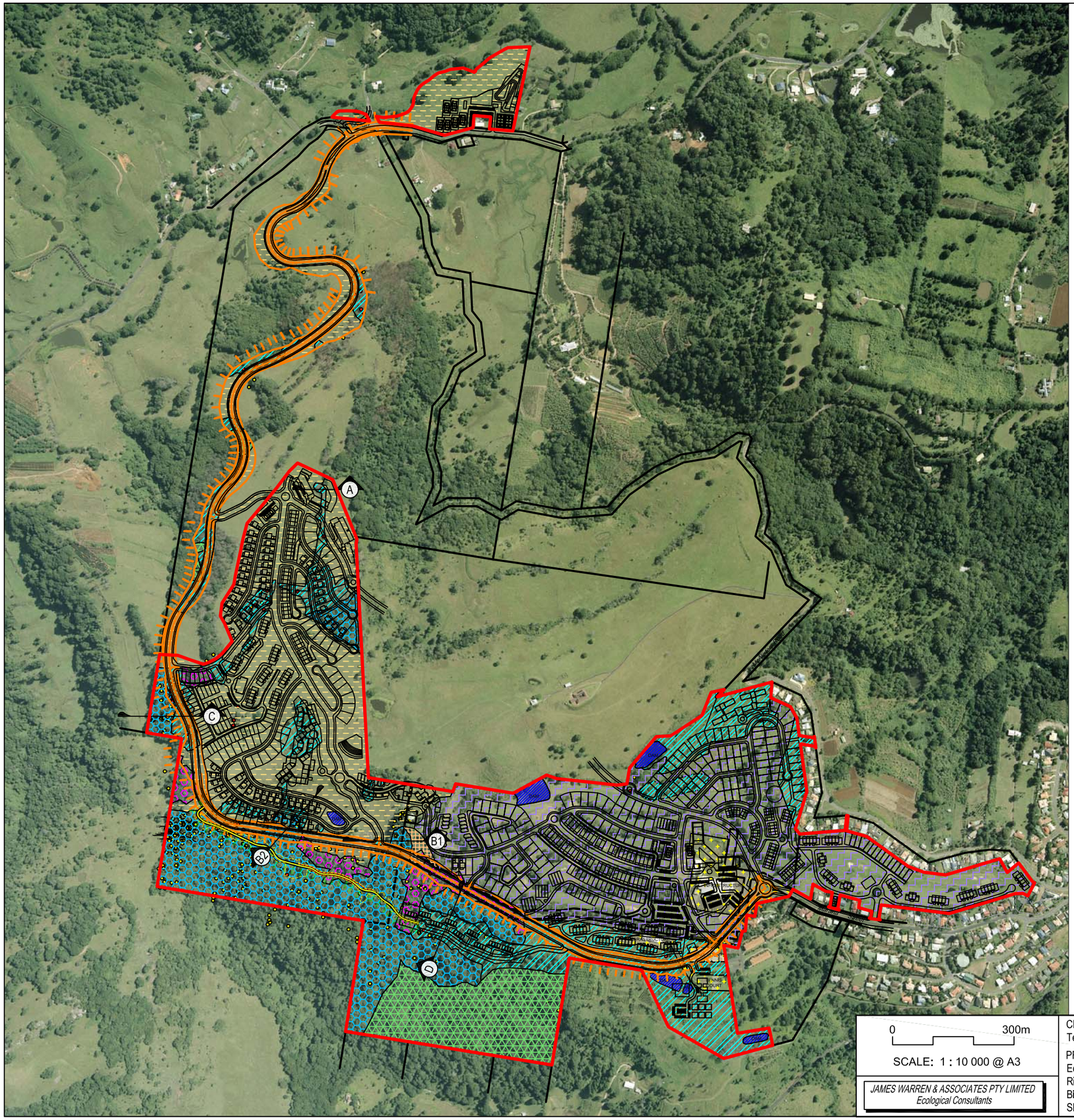
**Buffers to Endangered Ecological Communities**

The concept plan has been designed to retain the majority of EEC on the subject site (**FIGURE 12**). Retained EEC on the subject site will be buffered by a minimum of 10 metres of vegetation where possible to ameliorate potential impacts of adjacent development (in accordance with the Site Rehabilitation & Pest Management Plan – **VOLUME 3**). Where sufficient area is not available to provide a 10m buffer (i.e. particularly steep land adjacent to land zoned for development & 'spine road') a dense screen of vegetation will be planted to minimise edge effects and the interface of the EEC and development will be monitored for weed infestations (in accordance with the Site Rehabilitation & Pest Management Plan – **VOLUME 3**). A Vegetation Management Plan will be prepared for the subject site at the time of the Development Application. This plan will discuss measures to be implemented to protect the EEC during the construction phase.

An indicative cross-section of the interface between development and the retained EEC is shown in **FIGURES 23(a) & 23(b)**. These areas will be maintained in their natural condition with minimal disturbance, except where the development is sensitive to and consistent with the conservation values of these areas, and undertaken in accordance with an approved management plan.

Allowable uses: No uses will be allowed within this area.

Landscape and Built Form: Maintenance of existing significant vegetation is the primary aim within this area. Management of these areas may also include the




## LEGEND

- Community 1 - Tall closed forest (*Cinnamomum camphora* +/- mixed species)
- Community 2 - Tall closed forest (Mixed species)
- Community 3 - Tall closed forest (*Lophostemon confertus*)
- Community 4 - Regenerating closed forest (Mixed species)
- Community 5 - Landscape plantings (Disused golf courses)
- Community 6 - Disturbed land
- Community 7 - Grassland with scattered trees
- Dams
- Existing Infrastructure
- # Threatened Flora to be Retained
- # Threatened Flora which may be Removed
- Site Outline

N

SOURCE:
Vegetation - James Warren & Associates GPS Survey Feb/March 2006
Threatened Flora - James Warren & Associates GPS Surveys Feb/March 2006, Feb/March 2007, June 2007
Layout - ML Designs (Ref: A-MP-01-16B.dwg)
Bushfire Track - Cardno (Ref: 510038-03-SK01 Layout Plan.dwg)
Aerial Photograph - Michel Group Services taken 2006 (Ref: bilambil_heights_2006-reduced.jpeg)

0 300m
SCALE: 1 : 10 000 @ A3

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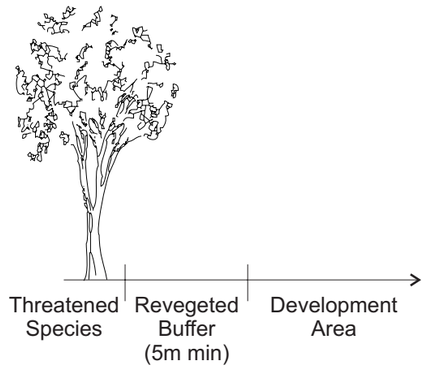
VOLUME 1
FIGURE 23A

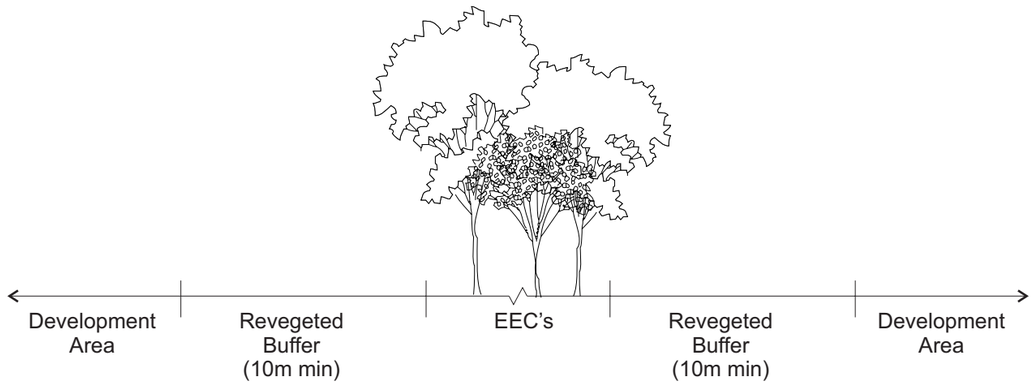
PREPARED: BW
DATE: 27 April 2009
FILE: N01051_EA_Base.dwg

TITLE
ECOLOGICAL BUFFERS - CROSS-SECTIONS

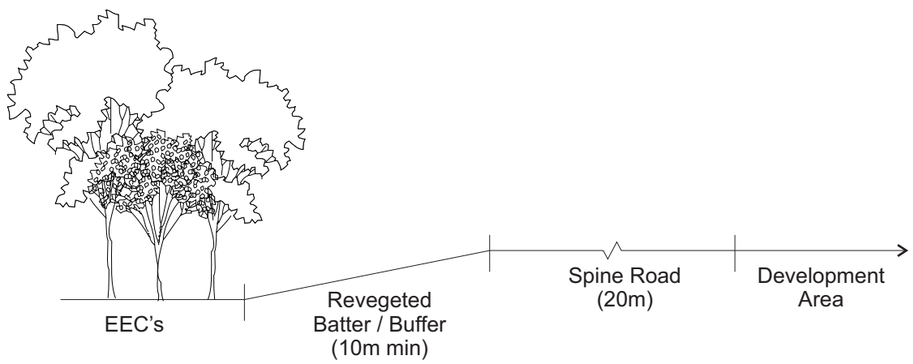
## CROSS-SECTION A
## BUFFERS TO THREATENED FLORA



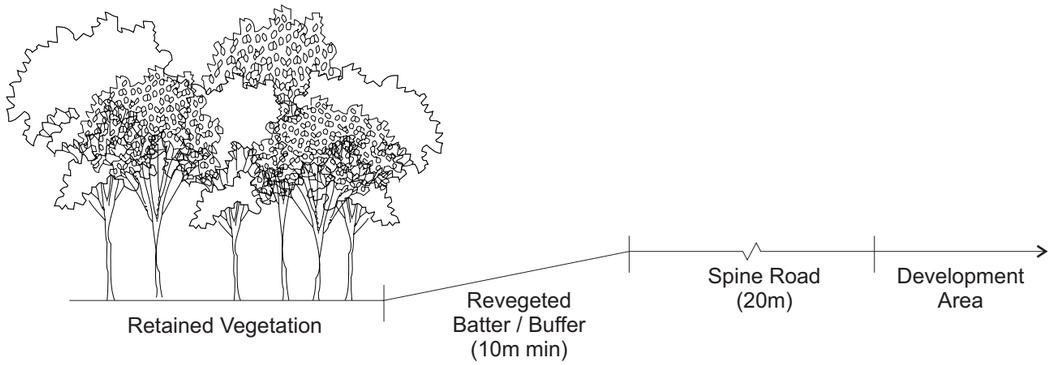

## CROSS-SECTION B1
## BUFFERS TO EEC'S



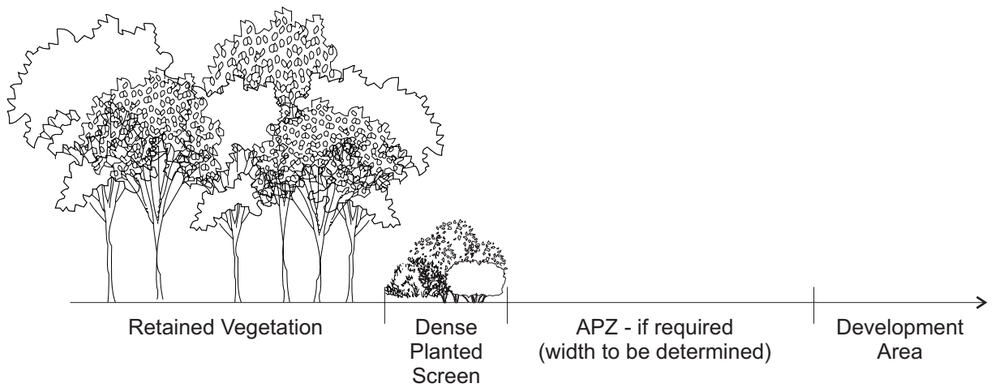

## CROSS-SECTION B2
## BUFFERS TO EEC'S




## CROSS-SECTION C
## BUFFERS TO RETAINED VEGETATION




## CROSS-SECTION D
## BUFFERS/APZ'S TO RETAINED VEGETATION




0 10m

Scale: 1 : 250 @ A3

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**VOLUME 1**
**FIGURE 23B**

PREPARED: BW
DATE: 27 April 2009
FILE:N01051_EA_cross sections.cdr

TITLE
**ECOLOGICAL BUFFERS - CROSS-SECTIONS**

replanting of appropriate native species in accordance with an approved Management Plan.

Lot Reconfiguration: No lot reconfiguration is envisaged within this precinct.

**Environmental restoration and enhancement works**

The concept plan has been designed to retain the majority of remnant bushland on the subject site (**FIGURE 14**). These areas will be buffered where possible by a minimum of 10 metres of planted vegetation to ameliorate potential impacts of adjacent development (in accordance with the Site Rehabilitation & Pest Management Plan – **VOLUME 3**). Where sufficient area is not available to provide a 10m buffer (i.e. particularly steep land adjacent to land zoned for development & 'spine road') a dense screen of vegetation will be planted to minimise edge effects and the interface of the remnant bushland and development will be monitored for weed infestations (in accordance with the Site Rehabilitation & Pest Management Plan – **VOLUME 3**). A Vegetation Management Plan will be prepared for the subject site, at the time of the Development Application. This plan will discuss measures to be implemented to protect retained vegetation during the construction phase.

In some instances an Asset Protection Zone (APZ) will be required on the interface between rehabilitated bushland and the development. The treatment of this interface is discussed below.

An indicative cross-section of the interface between development and retained remnant bushland is shown in **FIGURES 23(a) & 23(b)**. These areas will be maintained in their natural condition with minimal disturbance, except where the development is sensitive to and consistent with the conservation values of these areas, and undertaken in accordance with an approved management plan.

Allowable uses: No uses will be allowed within this area.

Landscape and Built Form: Maintenance of existing significant vegetation is the primary aim within this area. Management of these areas may also include the replanting of appropriate native species in accordance with an approved Management Plan.

Lot Reconfiguration: No lot reconfiguration is envisaged within this precinct.

**Asset Protection Zones**

The NSW Rural Fire Services guidelines "Planning for Bushfire Protection 2006" list six (6) key Bushfire Protection Measures which in combination must be addressed in a development assessment context. In relation to Asset Protection Zones (APZ's), Table A2.3 in the guidelines classifies the Tweed local council area as having a Forest Danger Index rating of 80 assumed as a 1:50 year event.

Table A2.5 of the guidelines sets the minimum width of APZ's for residential development based on the adjacent forest type. These minimum APZ widths range from 20m (for situations where the slope towards the vegetation ranges from uphill, to a

maximum of $5^{o}$ downhill) to 45m (for situations where the adjacent forested slope is up to $18^{o}$ downhill).

Any Asset Protection Zones (APZs) will be accommodated generally within already cleared land. The interface between retained vegetation areas and any APZ's will be planted with a dense screen of fire-resistant vegetation to minimise edge effects and will be monitored for weed infestations (in accordance with the Site Rehabilitation & Pest Management Plan – **VOLUME 3**). There may also be opportunities for revegetation within APZ's with fire-resistant plant species. An indicative cross-section showing the interaction of APZ's with retained vegetation is shown in **FIGURES 23(a) & 23(b).**

## 5.6 Assess any potential impact on surrounding waterways in terms of water quality and aquatic ecosystems

### *5.6.1 Background*

Stormwater runoff from the subject site has the potential to impact on the hydrological regime of the adjacent Cobaki Creek to the north of the site. Amelioration measures will be discussed in detail within a Stormwater Management Plan prepared by a suitably qualified firm as part of the MP08-0234 application.

### *5.6.2 General Impacts*

The proposed development has the potential to result in impacts on Cobaki Creek related to:

- Alterations of hydrology;
- Change to the hydrological regime may alter the current distribution of vegetation communities;
- Increased sediment loads from construction activities;
- Impacts on water quality and hydrology as a result of stormwater runoff from the proposed development;
- Increased visitation, with potential for trampling of riparian vegetation, dumping of rubbish or refuse in creek habitats (particularly discarded fishing line, bait bags etc.), disturbance of fauna; and
- Disturbance to the Subject site creates opportunities for weeds to colonise. Weeds may be introduced to the Study site in construction materials or by vehicles. Occupation of the Subject site creates opportunities for weeds to become established.

### *5.6.3 Erosion*

The subject site shows some evidence of soil erosion. A number of factors contribute to the level of erosion evident on the site. These factors include:

- The nature of the alluvial soil structure,
- The high rainfall and climatic conditions of the Subject site, and
- Land management practices.

Earthworks will increase the potential for soil erosion.

### *5.6.4 Stormwater Impacts*

Due to the steep slope in parts of the Subject site and the periods of high rainfall, stormwater runoff may potentially impact on the Subject site and Study area in a number of ways.

Impacts may include:

- Increased soil erosion,
- Increased soil dispersal,

- Alteration of habitat microclimate conditions for flora and fauna, and
- Alteration of water quality of aquatic habitats downstream from the Subject site.

### *5.6.5 Amelioration measures*

A minimum 50m buffer is proposed between the Unstructured Sports Park (Precinct U) (**FIGURE 8**) and Cobaki Creek. Areas of retained vegetation will assist in sedimentation deposition and nutrient uptake for any stormwater runoff from the development area. These vegetated areas also provide habitat and movement opportunities for fauna in the Study area (including Threatened fauna).

A Stormwater Management Plan will be prepared for the subject site at the time of the Development Application. This plan will incorporate the current best-practise measures to ensure that untreated stormwater does not flow directly into Cobaki Creek. All stormwater treatment areas should occur within land designated as Open Space and be designed to provide wetland habitat.

Stormwater management will involve the creation and use of suitable planted buffer zones where necessary.

## 5.7 Detailed plan for the control of environmental weeds and pest animal species

The developer has committed to future rehabilitation works on the site as recommended in this report and within the Site Rehabilitation & Pest Management Plan (JWA 2009). This plan outlines measures for weed and pest control as part of the ongoing rehabilitation efforts and is provided in **VOLUME 3**.

The proposed conservation areas on the entire subject site have been divided into forty three (43) Rehabilitation Areas (RA's). Individual rehabilitation management plans are to be completed for each of the forty three (43) precincts. RA's 33 – 43 occur within the MP08-0234 development area.

# 5. SUMMARY OF IMPACTS, MITIGATION & OFFSETS

A summary of impacts on threatened species and their habitats, EEC's and wildlife corridors is provided in **TABLE 9** below. Also addressed are the mitigation and offset measures proposed to ensure minimal impacts on ecologically significant areas and species.

**TABLE 9**
**SUMMARY OF IMPACTS, MITIGATION AND OFFSETS**

| | Potential impacts | Mitigation measures | Proposed offset | Net loss/gain |
|---|---|---|---|---|
| **Threatened flora** | | | | |
| • Axebreaker (*Geijera paniculata*)<br>• Ball nut (*Floydia praealta*)<br>• Basket fern (*Drynaria rigidula*)<br>• Bopple nut (*Hicksbeachia pinnatifolia*)<br>• Coolamon (*Syzygium* | • None of the forty (40) stems of Axebreaker recorded on the site occur within the proposed development footprint (**FIGURE 13**).<br>• The single stem of Ball nut recorded on the site does not occur within the proposed development footprint (**FIGURE 13**).<br>• The single Basket fern recorded on the site does not occur within the proposed development footprint (**FIGURE 13**).<br>• None of the forty-nine (49) stems of Bopple nut recorded on the site occur within the proposed development footprint (**FIGURE 13**).<br>• One (1) planted stem of Coolamon occur within areas of the proposed development footprint. None of the five (5) naturally occurring | • Approximately 16.31 hectares (79.5%) of suitable habitat for these species will be retained.<br>• Rehabilitation of rainforest communities will be completed.<br>• Retained patches of rainforest will be buffered from the proposed development and embellished to increase the overall extent of isolated patches and reduce existing anthropogenic impacts.<br>• Propagation of Threatened flora species has commenced and will continue as part of the rehabilitation works on the subject site in an attempt to bolster local populations.<br>• As a minimum, every retained Threatened plant on the subject site will be provided with a 5m vegetated buffer.<br>• Weed control will be completed on the interface of remnant bushland by a qualified Bush regenerator;<br>• Weed control will be undertaken on a progressive basis on an anticipated three (3) – five (5) year period;<br>• All areas of remnant vegetation will be fenced where necessary to exclude pedestrian traffic and cattle grazing; | • Rehabilitation of an additional 28.9ha of rainforest communities in accordance with the Site Rehabilitation & Pest Management Plan (**VOLUME 3**) to offset the loss of 4.21 ha and ensure protection for retained Threatened flora species.<br>• Any Threatened flora species removed during any stage of the development will be offset at a minimum rate of 5:1 (i.e. 5 replacement plants for every 1 removed) within RA's in the MP08-0234 development area.<br>• Offsets for the removal of Threatened flora to date have included the planting of:<br>o Coolamon (*Syzygium moorei*) x 163, to offset the potential removal of 1 stem (planted), resulting in an increase of 162 plants on the subject site;<br>o Fine-leaved tuckeroo (*Lepiderema* | • The local populations of these species will be bolstered through propagation and replanting works.<br>• The rehabilitation works include:<br>• Restoration and embellishment of approximately 15.42ha of existing mature EEC (54.4% of rehabilitation area);<br>• Assisted regeneration of approximately 2.1ha of existing regenerating EEC (7.3% of rehabilitation area);<br>• Regeneration of approximately 10.14ha of disturbed land/depauperate rainforest to create additional EEC (35.1% of rehabilitation area); and<br>• Revegetation of approximately 1.2ha cleared land to create additional EEC (4.2% of |

| | Potential impacts | Mitigation measures | Proposed offset | Net loss/gain |
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| *moorei*)<br><br>• Fine-leaved tuckeroo (*Lepiderema pulchella*)<br><br>• Marblewood (*Acacia bakeri*)<br><br>• Rough-shelled bush-nut (*Macadamia tetraphylla*)<br><br>• Rusty rose walnut (*Endiandra hayesii*) | Coolamons will be removed (**FIGURE 13**).<br><br>• The proposed development will potentially remove one hundred and fourteen (114) stems (10.1%) of Fine-leaved tuckeroo recorded on the site (**FIGURE 13**).<br><br>• None of the nineteen (19) stems of Marblewood recorded on the site occur within the proposed development footprint (**FIGURE 13**).<br><br>• The proposed development will potentially remove twenty-nine (29) stems (7.4%) of Rough-shelled bush nuts recorded on the site (**FIGURE 13**).<br><br>• The single stem of Rusty rose walnut recorded on the site does not occur within the proposed development footprint (**FIGURE 13**).<br><br>• None of the twenty-four (24) stems of Small- | • Formal pathways are to be provided through areas of remnant vegetation to prevent the creation of numerous informal tracks;<br>• A monitoring and maintenance program for areas of remnant vegetation is included in the Site Rehabilitation & Pest Management Plan (**VOLUME 3**).<br>• It is highly likely that the forty-nine (49) Stinking laurel saplings to be affected can be translocated to a more suitable location on the site, where they will have better opportunities to develop to maturity. | *pulchella*) x 547, to offset the potential removal of 114 stems, resulting in an increase of 433 plants on the subject site;<br>o Marblewood (*Acacia bakeri*) x 17, resulting in an increase of 17 plants on the subject site;<br>o Rough-shelled bush nut (*Macadamia tetraphylla*) x 334, to offset the potential removal of 29 stems, resulting in an increase of 305 plants on the subject site;<br>o Rusty rose walnut (*Endiandra hayesii*) x 9, resulting in an increase of 9 plants on the subject site;<br>o Small-leaved tamarind (*Diploglottis campbellii*) x 413, resulting in an increase of 413 plants on the subject site;<br>o Spiny gardenia (*Randia moorei*) x 16, to offset the potential removal of 1 stem, resulting in an increase of 15 plants on the subject | rehabilitation area).<br><br>and will result in a long-term net gain of approximately 11.34ha of suitable habitat for these species. |

| | Potential impacts | Mitigation measures | Proposed offset | Net loss/gain |
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| • Small-leaved tamarind (*Diploglottis campbellii*)<br>• Southern ochrosia (*Ochrosia moorei*)<br>• Spiny gardenia (*Randia moorei)*<br>• Stinking laurel (*Cryptocarya foetida*)<br>• Sweet myrtle (*Gossia fragrantissima*) | leaved tamarind occur within the proposed development footprint (**FIGURE 12**).<br>• None of the forty-eight (48) stems of Southern ochrosia recorded on the site occur within the proposed development footprint (**FIGURE 13**).<br>• The proposed development will potentially remove one (1) stem (1.6%) of Spiny gardenia recorded on the site (**FIGURE 13**).<br>• The proposed development will potentially remove forty-nine (49) stems (35.8%) of Stinking laurels recorded on the site (**FIGURE 13**).<br>• The proposed development will potentially remove five (5) stems (8.8%) of Sweet myrtle recorded on the site (**FIGURE 13**).<br>• None of the four (4) stems of White lace flower recorded on the | | site;<br>o Sweet myrtle (*Gossia fragrantissima*) x 337, to offset the potential removal of 5 stems, resulting in an increase of 332 plants on the subject site;<br>o White laceflower (*Archidendron hendersonii*) x 74, resulting in an increase of 17 plants on the subject site;<br>o Yellow satinheart (*Bosistoa transversa*) x 8, to offset the potential removal of 7 stems, resulting in an increase of 1 plant on the subject site; and<br>o Yiel yiel (*Grevillea hilliana*) x 32, to offset the potential removal of 11 stems, resulting in an increase of 21 plants on the subject site. | |

| | Potential impacts | Mitigation measures | Proposed offset | Net loss/gain |
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| • White lace flower (*Archidendron hendersonii*)<br>• Yellow satinheart (*Bosistoa transversa*)<br>• Yiel yiel (*Grevillea hilliana*) | site occur within the proposed development footprint (**FIGURE 13**).<br>• The proposed development will potentially remove seven (7) stems (4%) of Yellow satinheart recorded on the site (**FIGURE 13**).<br>• The proposed development will potentially remove eleven (11) stems (22%) of Yiel yiel recorded on the site (**FIGURE 13**). | | | |
| **Endangered Ecological Communities** | | | | |
| • Lowland rainforest | • Approximately 4.21 hectares (20.5%) of Lowland rainforest will be lost (**FIGURE 16**).<br>• Edge effects may impact on retained EEC's. | • Amelioration for the removal of Lowland rainforest will be provided through revegetation works on the subject site.<br>• A Site Rehabilitation & Pest Management Plan has been prepared for the subject site and includes measures to offset any loss of this EEC from the subject site (**VOLUME 3**).<br>• Furthermore, retained patches of this EEC will be buffered from the | • In total, 28.9 hectares of Lowland rainforest on floodplain will be regenerated/revegetated on the subject site (**FIGURE 15**) to offset the loss of 4.21 hectares. | • Revegetation works on the subject site will result in a long-term net gain of approximately 27.8ha of Lowland rainforest.<br>• The rehabilitation works include:<br>  • Restoration and embellishment of approximately 15.42ha of existing mature EEC (54.4% of rehabilitation |

| | Potential impacts | Mitigation measures | Proposed offset | Net loss/gain |
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| | | proposed development and embellished to increase the overall extent of isolated patches and reduce existing anthropogenic impacts.<br>• The Site Rehabilitation & Pest Management Plan includes specific performance criteria as well as a detailed maintenance and monitoring program to ensure the persistence of this EEC in the long-term.<br>• Weed control will be completed on the interface of EEC's by a qualified Bush regenerator;<br>• All areas of EEC will be fenced to exclude pedestrian traffic and cattle grazing;<br>• Formal pathways are to be provided through areas of retained EEC to prevent the creation of numerous informal tracks;<br>• A monitoring and maintenance program for areas of remnant vegetation is included in the Site Rehabilitation & Pest Management Plan (**VOLUME 3**). | | area);<br>• Assisted regeneration of approximately 2.1ha of existing regenerating EEC (7.3% of rehabilitation area);<br>• Regeneration of approximately 10.14ha of disturbed land/depauperate rainforest to create additional EEC (35.1% of rehabilitation area); and<br>• Revegetation of approximately 1.2ha cleared land to create additional EEC (4.2% of rehabilitation area).<br>and will result in a long-term net gain of approximately 11.34ha of suitable habitat for these species. |
| **Threatened fauna** | | | | |
| • Grey-headed flying-fox (*Pteropus poliocephelus*) | • Approximately 12.49 hectares (42.1%) of potential forage habitat will be removed from the subject site.<br>• Suitable roosting habitat will be retained in the | • The Grey-headed flying-fox is considered likely to continue foraging within retained areas of vegetation on the site.<br>• Furthermore, 28.9 hectares of rainforest vegetation will be regenerated/revegetated on the | • In total, 28.9 hectares of vegetation likely to provide suitable forage habitat for the Grey-headed flying-fox will be regenerated/ revegetated on the subject site (**FIGURE 14**) to offset the loss of 12.42 hectares. | • Revegetation works on the subject site will result in a long-term net gain of approximately 16.48ha of suitable forage and/or corridor habitat for the Grey-headed flying-fox including embellishment of |

| | Potential impacts | Mitigation measures | Proposed offset | Net loss/gain |
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| | southern portion of the subject site.<br>• Given the high mobility of this species, the loss of 12.42 hectares of known and potential foraging habitat is not considered significant in relation to the regional distribution of potential foraging habitat for this species. | subject site (**FIGURE 14**) in accordance with the Site Rehabilitation & Pest Management Plan (**VOLUME 3**).<br>• These areas are likely to provide suitable forage habitat for this species and offset the loss of 12.42ha. | | existing habitat and revegetation/ rehabilitation works. |
| • Little bent-wing bat *Miniopterus australis*) & Eastern bent-wing bat (*Miniopterus schreibersii oceanensis*) | • Approximately 12.49 hectares (42.1%) of potential forage habitat will be removed from the subject site.<br>• Given the high mobility of these species, the loss of potential foraging habitat is not considered significant in relation to the regional distribution of habitat for this species.<br>• No roost habitat will be affected by the proposed development and it is considered that this species will continue to forage over the retained vegetation on the subject site. | • Approximately 28.9ha of revegetation/regeneration will be completed in accordance with the Site Rehabilitation & Pest Management Plan (**VOLUME 3**) to offset any loss of vegetation.<br>• These areas are all likely to provide suitable forage habitat for these species in the long-term. | • In total, 28.9 hectares of vegetation likely to provide suitable forage habitat for these species will be regenerated/revegetated on the subject site (**FIGURE 14**) to offset the loss of 12.42 hectares. | • Revegetation works on the subject site will result in a long-term net gain of approximately 16.48ha of suitable forage habitat for these species including embellishment of existing habitat and revegetation/ rehabilitation works. |
| • Eastern free- | • Approximately 12.49 hectares (42.1%) of | • It is considered that this species will continue to utilise retained | • In total, 28.9 hectares of vegetation likely to provide | • Revegetation works on the subject site will result in a |

| | Potential impacts | Mitigation measures | Proposed offset | Net loss/gain |
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| tail bat (*Mormopterus norfolkensis*) | potential forage habitat will be removed from the subject site.<br>• Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the regional distribution of habitat for this species.<br>• No roost habitat will be affected by the proposed development and it is considered that this species will continue to forage over the retained vegetation on the subject site. | vegetation for foraging.<br>• Furthermore, approximately 28.9ha of revegetation /regeneration will be completed in accordance with the Site Rehabilitation & Pest Management Plan (**VOLUME 3**) to offset any loss of vegetation. | suitable forage habitat for these species will be regenerated/revegetated on the subject site (**FIGURE 14**) to offset the loss of 12.42 hectares. | long-term net gain of approximately 16.48ha of suitable forage habitat for this species including embellishment of existing habitat and revegetation/ rehabilitation works. |
| • White-eared monarch (*Monarcha leucotis*) | • Approximately 2.62 hectares (15.3%) of potential forage habitat will be removed from the subject site.<br>• Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the regional distribution of habitat for this species. | • Approximately 28.9ha of revegetation/regeneration will be completed in accordance with the Site Rehabilitation & Pest Management Plan (**VOLUME 3**) to offset any loss of vegetation.<br>• These areas are all likely to provide suitable forage habitat for this species in the long-term. | • In total, 28.9ha of vegetation that may provide suitable forage habitat for this species in the long-term will be regenerated/ revegetated on the subject site (**FIGURE 14**) to offset the loss of 2.62 hectares. | • Revegetation works on the subject site will result in a long-term net gain of approximately 26.28ha of potential forage habitat for the White-eared monarch including embellishment of existing habitat and revegetation/ rehabilitation works. |
| • Rose-crowned fruit-dove (*Ptilinopus regina*) & | • Approximately 12.49 hectares (42.1%) of potential forage habitat will be removed from the | • Rehabilitation works in accordance with the Site Rehabilitation & Pest Management Plan (**VOLUME 5**) will result in the regeneration/ | • In total, 28.9ha of vegetation that may provide suitable forage habitat for these species in | • Revegetation works on the subject site will result in a long-term net gain of approximately 26.28ha of |

| | Potential impacts | Mitigation measures | Proposed offset | Net loss/gain |
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| Wompoo fruit-dove (*P. magnificus*) | subject site.<br>• Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the regional distribution of habitat. | revegetation of 28.9 hectares of rainforest vegetation.<br>• These areas will provide suitable habitat for the fruit-dove in the long-term and offset the loss of 12.49ha of potential forage habitat. | the long-term will be regenerated/ revegetated on the subject site (**FIGURE 14**) to offset the loss of 12.49 hectares. | potential forage habitat for the fruit-dove. |
| • Black flying-fox (*Pteropus alecto*) | • Approximately 12.49 hectares (42.1%) of potential forage habitat will be removed from the subject site.<br>• Suitable roosting habitat will be retained in the southern portion of the subject site.<br>• Given the high mobility of this species, the loss of 12.49 hectares of known and potential foraging habitat is not considered significant in relation to the regional distribution of potential foraging habitat for this species. | • The Black flying-fox is considered likely to continue foraging within retained areas of vegetation on the site.<br>• Furthermore, 28.9 hectares of rainforest vegetation will be regenerated/revegetated on the subject site (**FIGURE 14**) in accordance with the Site Rehabilitation & Pest Management Plan (**VOLUME 3**).<br>• These areas are likely to provide suitable forage habitat for this species and offset the loss of 12.49ha. | • In total, 28.9 hectares of vegetation likely to provide suitable forage habitat for the Black flying-fox will be regenerated/ revegetated on the subject site (**FIGURE 14**) to offset the loss of 12.49 hectares. | • Revegetation works on the subject site will result in a long-term net gain of approximately 16.48ha of suitable forage and/or corridor habitat for the Black flying-fox. |
| **Wildlife corridors** | | | | |
| | • The proposed development will result in the removal of vegetated portions of the subject site. However, the majority of vegetation to be removed is comprised of grassland | • The proposed development utilises existing cleared areas.<br>• A network of existing vegetated corridors will be retained on the site.<br>• Additionally, smaller interlinking corridors will be provided on the | • A Site Rehabilitation & Pest Management Plan has been prepared for the subject site (**VOLUME 3**) to provide vegetated links across the site and ensure that the remaining wildlife corridors will be embellished | • A net gain of approximately 28.9ha of vegetation providing suitable corridor habitat will occur as a result of the proposed development. |

| | Potential impacts | Mitigation measures | Proposed offset | Net loss/gain |
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| | with scattered trees, landscape plantings and areas dominated by Camphor laurel.<br>• Edge effects may impact on retained corridor habitat. | subject site through regeneration and revegetation works.<br>• Rehabilitation works on the subject site will include buffers to retained vegetation corridors as well as weed maintenance along edges. | utilising revegetation and natural regeneration principles. | |