JAMES WARREN & Associates Pty Ltd

ENVIRONMENTAL CONSULTANTS

REVISED ECOLOGICAL ASSESSMENT

COBAKI LAKES

PREFERRED PROJECT REPORT

JUNE 2010

A REPORT TO LEDA MANORSTEAD PTY LTD

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1. INTRODUCTION

1.1 Background

The Minister for Planning authorised a Concept Plan for the proposed residential community at Cobaki Lakes on the 24th January 2007. Subsequently, the Director General's Environmental Assessment Requirements (DGEAR's) were issued to LEDA Manorstead Pty Ltd on the 21st August 2007. James Warren and Associates (JWA) were engaged by LEDA Manorstead Pty Ltd to complete an Ecological Assessment for land at Cobaki Lakes, Cobaki in November 2008.

Following submissions from the public and State Agencies, and subsequent amendments to the proposed Concept Plan, this Ecological Assessment has been revised to provide additional information. The Ecological Assessment has involved the following:

- Mapping and ground truthing vegetation units and determining their conservation status;
- Searching for and recording Threatened (TSC Act 1995), ROTAP (Briggs & Leigh 1995) and regionally significant (Sheringham and Westaway 1995) plant species;
- Determining the suite of Threatened fauna (TSC Act 1995) that occurs within the locality;
- Assessing habitat provided by the site in relation to adjacent habitat and making an assessment of the corridor value of the site;
- Assessing the requirements of the Tweed Shire Council Development Control Plan (DCP) 25 – Biting Midge and Mosquito Control;
- Addressing statutory requirements including the State Environmental Planning Policy No. 44 (SEPP 44 – Koala Habitat Protection), SEPP 14 – Coastal Wetlands, Section 5A of the Environmental Planning & Assessment Act (1979) and the Commonwealth EPBC Act (1999).

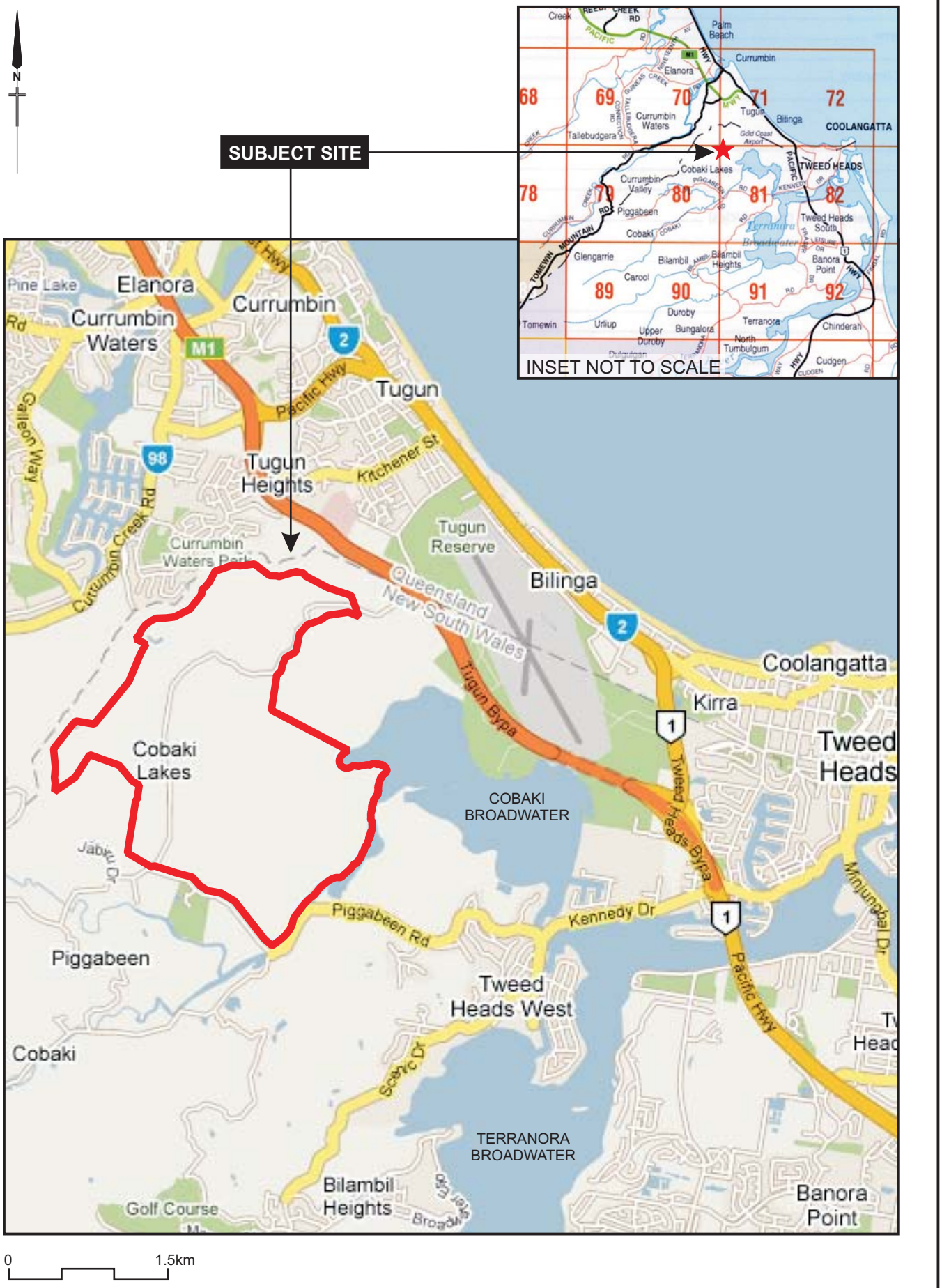
1.2 Locality

1.2.1 Introduction

The Locality is defined as the area within a 10km radius of the Subject site. The Locality therefore extends from North Tumbulgum in the south to Burleigh Heads in the north and from Currumbin Valley in the west to Tweed Heads in the east (**FIGURE 1**).

Prominent features in the locality include the townships of Coolangatta, Palm Beach and Banora Point and the villages of Tallebudgera, Pigabeen and Bilambil Heights. Prominent water bodies in the locality include the Cobaki Broadwater, Currumbin Creek, Cobaki Creek, Terranora Broadwater and the Coral Sea.

Dominant habitat types are eucalypt forest, swamp sclerophyll forest, heathlands, sedgelands, rushlands, subtropical rainforest, littoral rainforest and intertidal communities. Land uses within the locality include residential, forestry, conservation, tourism, commercial, fishing, grazing and agriculture.



SOURCE: Google Maps SCALE: 1 : 50 000 @ A4 JAMES WARREN & ASSOCIATES PTY LIMITED Environmental Consultants	CLIENT Leda Developments Pty Ltd PROJECT Revised Ecological Assessment Cobaki Lakes, Cobaki, NSW Shire of Tweed	**FIGURE 1** PREPARED: BW DATE: 30 June 2010 FILE: 97038_EA_Locality v3.cdr	TITLE **LOCALITY PLAN**

1.2.2 Conservation Reserves/Ecologically significant areas in the locality

There are three (3) dedicated conservation reserves in the locality:

- Tweed Estuary Nature Reserve, an area of 59 hectares to the east of the Subject site.
- Stotts Island Nature Reserve, an area of 142 hectares to the south of the Subject site; and
- Ukerebagh Nature Reserve, an area of 150 hectares to the east of the Subject site.

State Environmental Planning Policy No. 14 – Coastal Wetlands (SEPP 14) provides protection for a large number of mapped wetlands along the east coast of NSW. Mapped SEPP 14 Wetlands numbers 1 - 30 occur within 10km of the locality, and are shown in **FIGURE 2**. A large area of SEPP 14 wetland no. 1 is located immediately east of the subject site adjacent to Cobaki Broadwater and Cobaki Creek **FIGURE 3**.

Littoral rainforests are protected by State Environmental Planning Policy No. 26 – Littoral Rainforest (SEPP 26). Mapped SEPP 26 Littoral Rainforests numbers 2A, 2B, and 2C occur within the locality and are shown in **FIGURE 4**.

1.2.3 The Study Area

The study area is defined as the subject site together with any proximate areas that may be affected by the proposed development. The site is surrounded by a narrow belt of forested land adjacent to the northern and western boundaries of the site. This belt of vegetation occurs within the Crown Reserve separating Queensland from New South Wales. Private large landholdings occur adjacent to the southern site boundary. Piggabeen Road separates these landholdings from the Cobaki Lakes site.

Cobaki Creek (tidal) occurs adjacent to part of the eastern boundary of the site. Cobaki Broadwater and a large area of wetland occur alongside the north-eastern boundary.

1.3 The Subject Site

The subject site consists of land described as Lot 1 DP 570076, Lot 2 DP 566529, Lot 1 DP 562222, Lot 1 DP 570077, Lot 1 823679, Lots 46, 54, 55, 199, 200, 201, 202, 205, 206, 209, 228 & 305 DP 755740, Cobaki Lakes, off Pigabeen Road, Tweed Heads. The site covers an area of approximately 605 hectares and is shown in **FIGURE 5**.

The site lies adjacent to private landholdings to the north-west and south-east, and comprises a large portion of land cleared for agricultural purposes (i.e. grazing) throughout which a number of vegetation communities occur. Extensive clearing and subsequent slashing over the drainage basin has resulted in the recruitment of a combination of native and introduced grass species in place of native plants. Forested Crown lands which form the NSW-QLD border also form the northern and western boundary of the Cobaki Lakes site.

Legend

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

Subject Site

N

0 1500m

SOURCE: State Env. Planning Policy No. 14 Coastal Wetlands Amendment No. 14

SCALE: 1 : 60 000 @ A4

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FIGURE 2

PREPARED: BW
DATE: 30 June 2010
FILE:97038_EA_SEPP14regional.cdr

TITLE

SEPP 14 COASTAL WETLANDS

N

LEGEND

Area subject to SEPP No. 14

Site Outline

SOURCE:
SEPP - Michel Group Services
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 500m

SCALE: 1 : 12 500 @ A3

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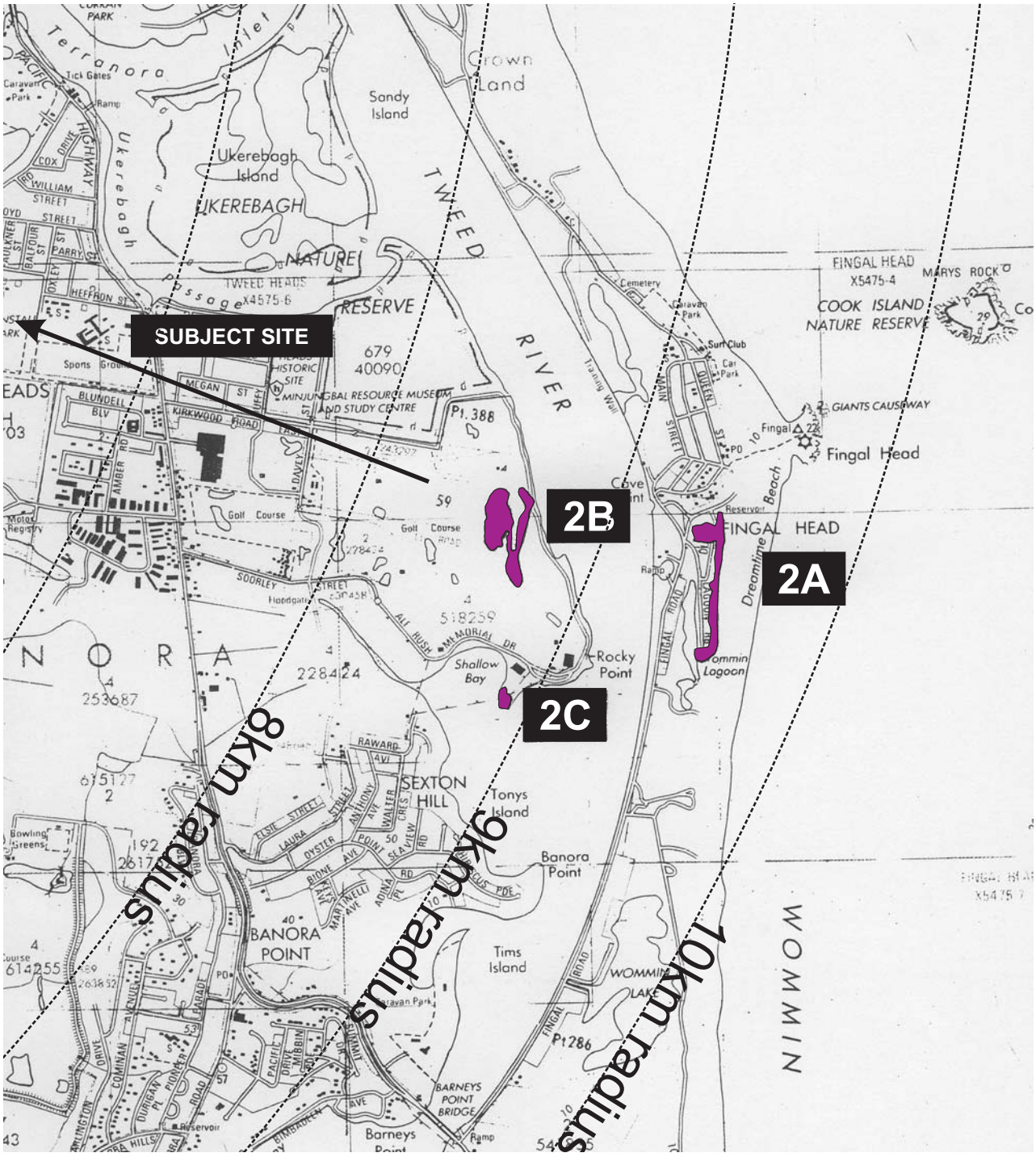
FIGURE 3

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE
SEPP 14
COASTAL
WETLANDS



Legend

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

Subject Site

N

SOURCE: State Env. Planning Policy No. 26 Littoral Rainforests SCALE: 1 : 25 000 @ A4 JAMES WARREN & ASSOCIATES PTY LIMITED Environmental Consultants	CLIENT Leda Developments Pty Ltd PROJECT Revised Ecological Assessment Cobaki Lakes, Cobaki, NSW Shire of Tweed	**FIGURE 4** PREPARED: BW DATE: 30 June 2010 FILE: 97038_EA_SEPP26.cdr	TITLE **SEPP 26 LITTORAL RAINFOREST**

N

LEGEND

- Cadastral Boundaries
- Restriction on Use Area
- Site Outline

SOURCE:
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 500m

SCALE: 1 : 12 500 @ A3

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FIGURE 5

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE

SUBJECT SITE

FIGURE 6 shows a recent aerial photograph of the site. Currently sixteen (16) broad vegetation associations comprising twenty-two (22) vegetation communities occur on the site.

1.4 Landuse Zones

The Environmental zoning process on the Cobaki Lakes site has been in progress for over 15 years. A large number of environmental assessments over this period of time have informed the environmental zoning process.

The Subject site currently contains the following landuse zones:

- 2(c) Urban Expansion
- 2(e) Residential Tourist Zone
- Recreation (Special Purposes)
- Environmental Protection (Scenic Escarpment)
- Environmental Protection (Habitat)

The current zoning plan is shown in **FIGURE 7.** The Concept Plan proposes amendments to the current zoning of the site based on the results of the numerous environmental assessments completed over the site. These amendments fall into five categories as follows:

1. Amendments in accordance with Clause 52 of the Tweed LEP 2000;
2. Amendments to zonings contemplated by existing Development Consents;
3. Other proposed additions to the 2(c) Urban Expansion zone;
4. Proposed additions to the 7(l) Environmental Protection (Habitat) zone; and
5. Proposed additions to the 6(b) Recreation zone.

The proposed amended zoning plan is shown in **FIGURE 8.**

1.5 Soils and Geology

The subject site occupies the lower or eastern end of the Cobaki – Pigabeen Valley system**.** The site topography is considered as two (2) separate systems:

- The Sub-coastal foothills and outcrops of the eastern end of the McPherson Range, which comprises the western and northern part of the site and covers an area of approximately 280 hectares, or 42% of the site, and corresponding to a broad north/south line of hills. The terrain of these hills is rolling/hilly to hilly in a series of ridges and spurs with slopes of 10% to 25% and some 16% of the site having slopes in excess of 25%.
- The foothills enclose a coastal plain drainage basin comprising a composite of river/estuarine floodplain and sand-plain formed by sandbanks, beach or rolled and flattened dune systems.

LEGEND

Site Outline

SOURCE:
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 500m

SCALE: 1 : 12 500 @ A3

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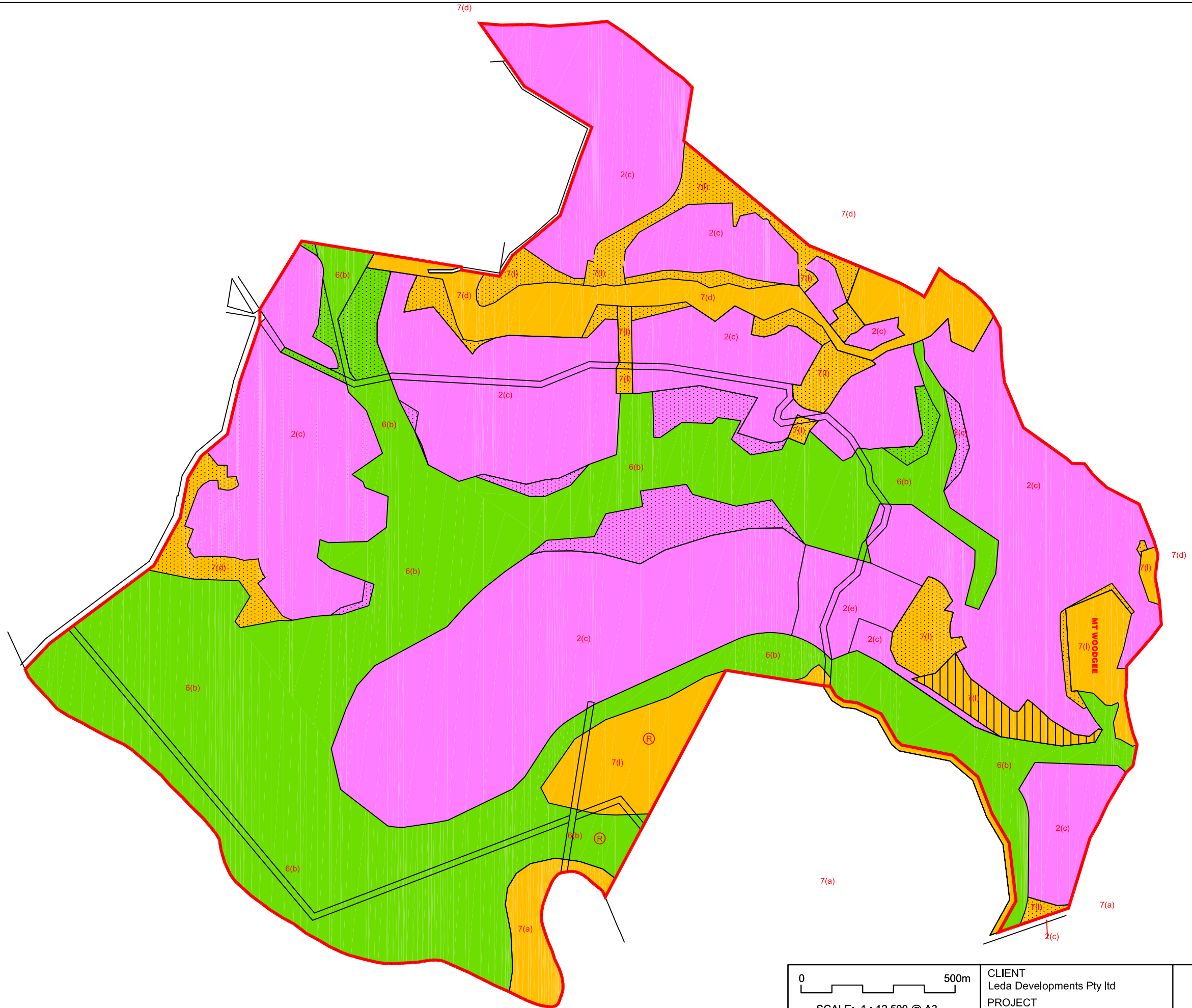
FIGURE 6

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE

AERIAL PHOTOGRAPH



N

LEGEND

1. RURAL

- 1(a) (a) Rural
- 1(b1) (b1) Agricultural Protection
- 1(b2) (b2) Agricultural Protection
- 1(c) (c) Rural Living

2. RESIDENTIAL

- 2(a) (a) Low Density Residential
- 2(b) (b) Medium Density Residential
- 2(c) (c) Urban Expansion
- 2(d) (d) Village
- 2(e) (e) Residential Tourist
- 2(f) (f) Tourism

5. SPECIAL USES

- 5(a) (a) Special Uses

6. OPEN SPACE

- 6(a) (a) Open Space
- 6(b) (b) Recreation

7. ENVIRONMENTAL PROTECTION

- 7(a) (a) Environmental Protection (Wetlands & Littoral Rainforests)
- 7(d) (d) Environmental Protection (Scenic/Escarpment)
- 7(f) (f) Environmental Protection (Coastal Lands)
- 7(l) (l) Environmental Protection (Habitat)
- S14 SEPP14 - Coastal Wetlands
- Clause 52 (Cobaki Lakes)
- Clause 52 (Cobaki Lakes)
- R Restriction On Use (DP1051024)
- Site Outline

SOURCE:
Zoning - Michel Group Services (Ref: 6400-133A.dwg)

0 500m

SCALE: 1 : 12 500 @ A3

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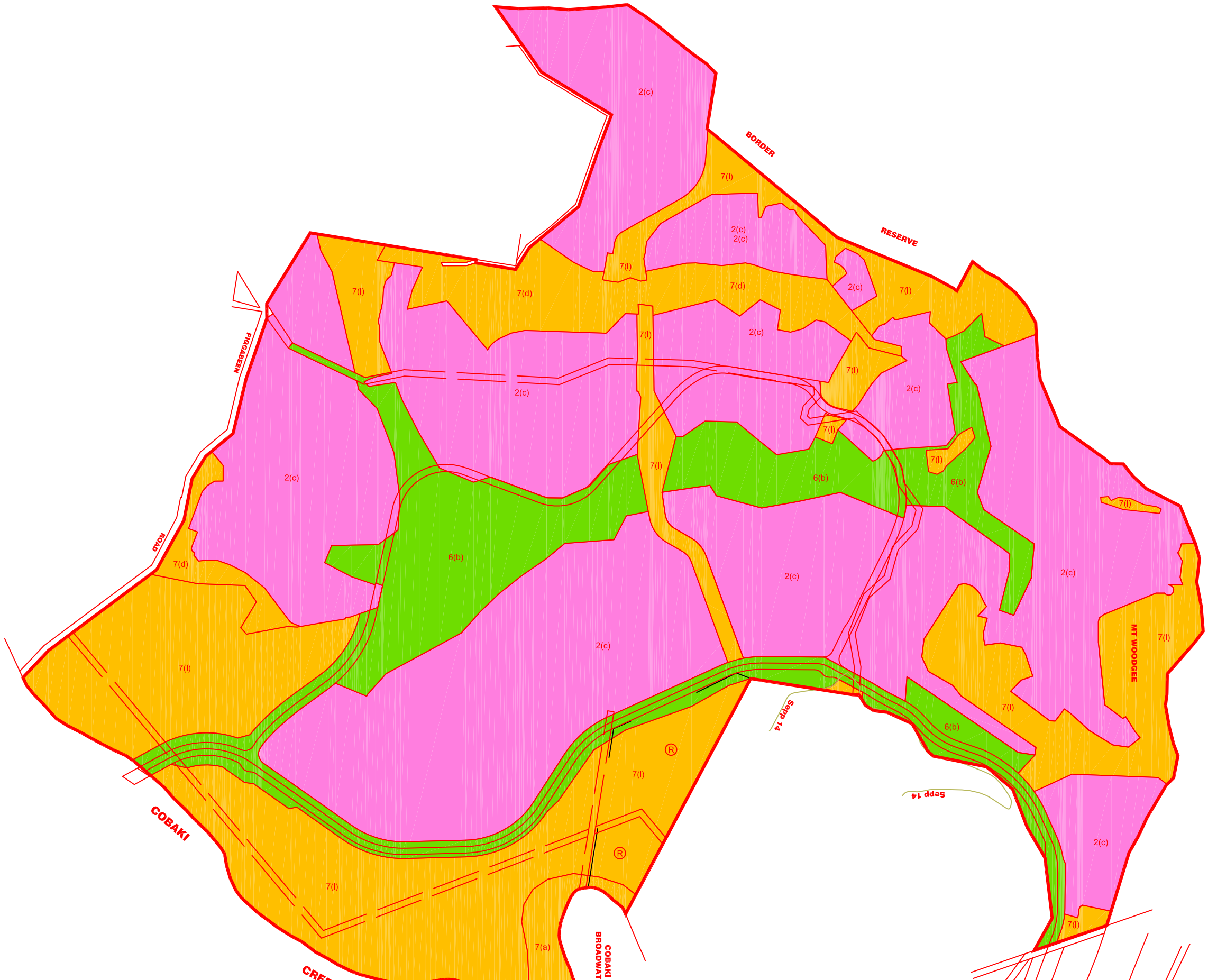
FIGURE 7

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE

LANDUSE ZONES



LEGEND

1. RURAL

- 1(a) (a) Rural
- 1(b1) (b1) Agricultural Protection
- 1(b2) (b2) Agricultural Protection
- 1(c) (c) Rural Living

2. RESIDENTIAL

- 2(a) (a) Low Density Residential
- 2(b) (b) Medium Density Residential
- 2(c) (c) Urban Expansion
- 2(d) (d) Village
- 2(e) (e) Residential Tourist
- 2(f) (f) Tourism

5. SPECIAL USES

- 5(a) (a) Special Uses

6. OPEN SPACE

- 6(a) (a) Open Space
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- 7(f) (f) Environmental Protection (Coastal Lands)
- 7(l) (l) Environmental Protection (Habitat)
- S14 SEPP14 - Coastal Wetlands
- Clause 52 (Cobaki Lakes)
- Clause 52 (Cobaki Lakes)
- R Restriction On Use (DP1051024)
- Site Outline

SOURCE:
Zoning - Michel Group Services (Ref: 969030.dwg)

0 500m

SCALE: 1 : 12 500 @ A3

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FIGURE 8

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE
PROPOSED ZONING AMENDMENTS

The McPherson range foothills and elevated portions of the site derive from bedrock of deeply weathered argillites (greywackes, siltstones and shales) of the Neranleigh – Fernvale Group (metasediments) overlain in parts by basalt fragments of the tertiary volcanics. More recent alluvial and estuarine deposits comprise the coastal plains on the site (Woodward-Clyde 1997).

1.6 Topography and Drainage

Elevations of the poorly drained, or low lying coastal plains, range from Cobaki Broadwater level to approximately four (4) metres AHD. The elevations of the foothills extend to a maximum of approximately one-hundred (100) metres at the north-west extremity of the site, and around ninety-five (95) metres near Mt. Woodgee in the northern extremity of the site (Woodward-Clyde 1997).

A series of drains run through the site (**FIGURE 6**). Dunn's Drain is the main drain, traversing the site in a south-east to north-west direction. A floodgate located at its junction with Cobaki Creek, in the south-east portion of the site, inhibits tidal flows. Tides at the higher levels enter the low-lying land in the south of the site by over-topping the bund wall adjacent to Cobaki Creek.

2. PROPOSED DEVELOPMENT

2.1 Concept plan

The site is proposed to be developed into a master planned residential community. A concept plan for the development is shown in **FIGURE 9**. The proposed development will include the following:

- Town centre/Neighbourhood centre (18.76 hectares);
- Residential (296.86 hectares);
- Community facilities/Education/Infrastructure (8.35 hectares);
- Public open space (87.12 hectares); and
- Environmental protection areas (194.36 hectares).

2.2 Existing Approvals

A number of development and earthworks approvals currently exist over the site. These are shown in **FIGURES 10 & 11** respectively.

An existing development consent over a portion of land in the north-western portion of the site known as the 'Northern Hillside' is to be preserved and implemented. The approved development layout in this portion of the site is shown in **FIGURE 12.** Conditions of consent regulate the management of significant ecological matters which occur in the approved 'Northern Hillside' precinct. Consideration has, however, been given to ecological matters (i.e. Threatened species and EEC's) in all areas of the site during this assessment.

2.3 'Restriction on Use' area

A parcel of land in the eastern portion of the subject site covering an area of approximately 16.375 hectares has been dedicated to Tweed Shire Council under Section 88b of the Conveyancing Act (1919) (**FIGURE 5**). This area has been fenced and remediated by Council as works in compensation for the impact of development by Council elsewhere in the Shire.

The terms of the Restriction on Use are:

> *"That no structure shall be erected, no native fauna or flora shall be damaged in any way and no domestic animal shall be permitted on the land".*

This portion of the subject site will, therefore, not be further considered in this assessment.

BOUNDARY

Queensland

New South Wales

WATER RESERVOR

SANDY ROAD

COBAKI PARKWAY

Piggabeen Road

Cobaki Creek

Environmental Reserve

To Boyd

N

LEGEND

- Town Centre / Neighbourhood Centre
- Residential
- Community Facilities/Education/Utilities
- Open Space
- Environmental Protection Area
- Covenant Protected Areas
- Structured Open Space
- Dam
- Proposed School (approx. 3ha)
- Proposed Community Facilities
- Site Outline

SOURCE:
Layout - Design Forum Pty Ltd
(Ref: SK 01.01 NN Concept Plan.dwg)

0 500m

SCALE: 1 : 12 500 @ A3

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FIGURE 9

PREPARED: BW
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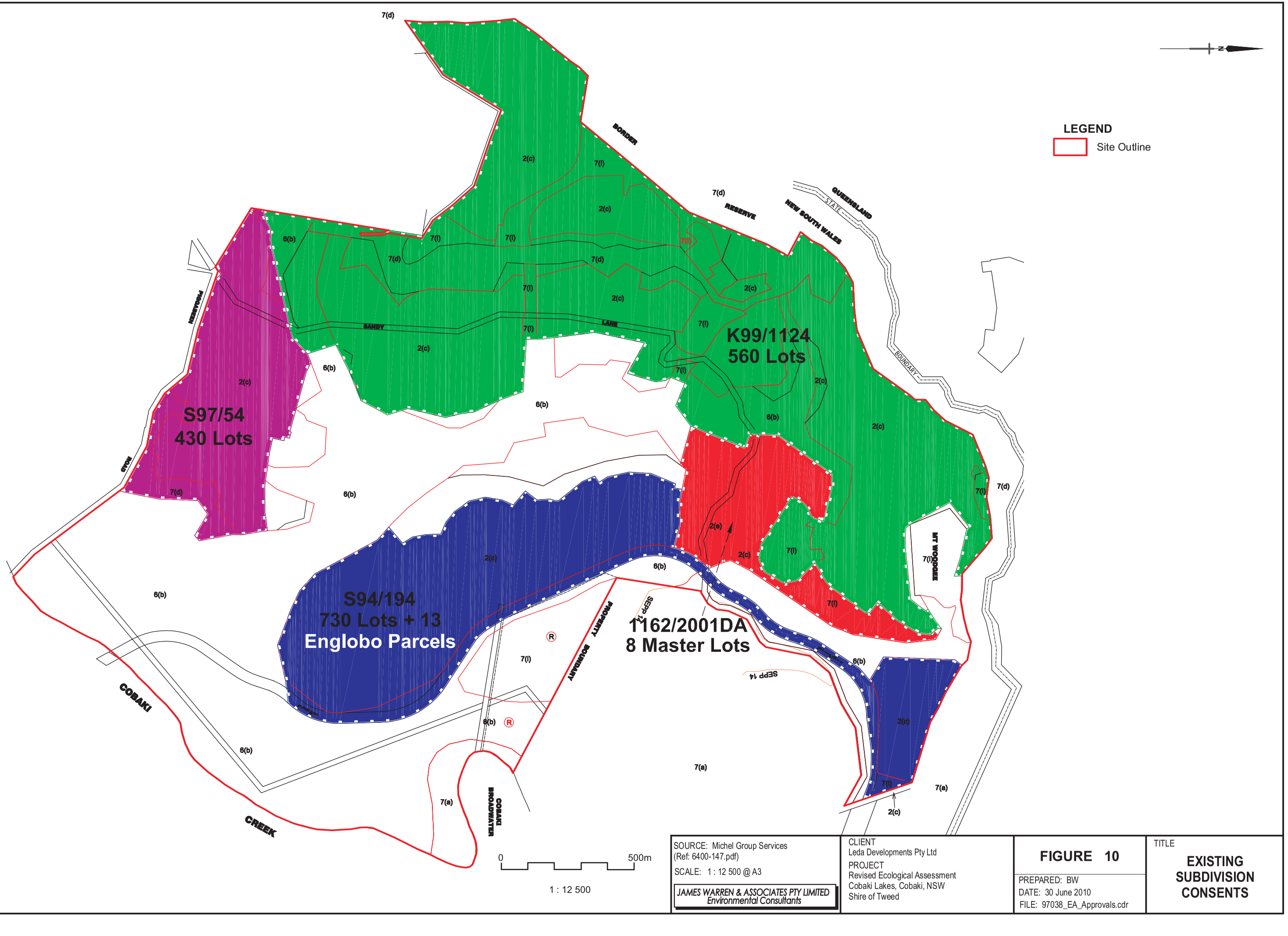
FILE: 97038_EA_Base.dwg

TITLE
DEVELOPMENT CONCEPT PLAN



SOURCE: Michel Group Services (Ref: 6400-147.pdf)

SCALE: 1 : 12 500 @ A3

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Shire of Tweed

FIGURE 10

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Approvals.cdr

TITLE
EXISTING SUBDIVISION CONSENTS

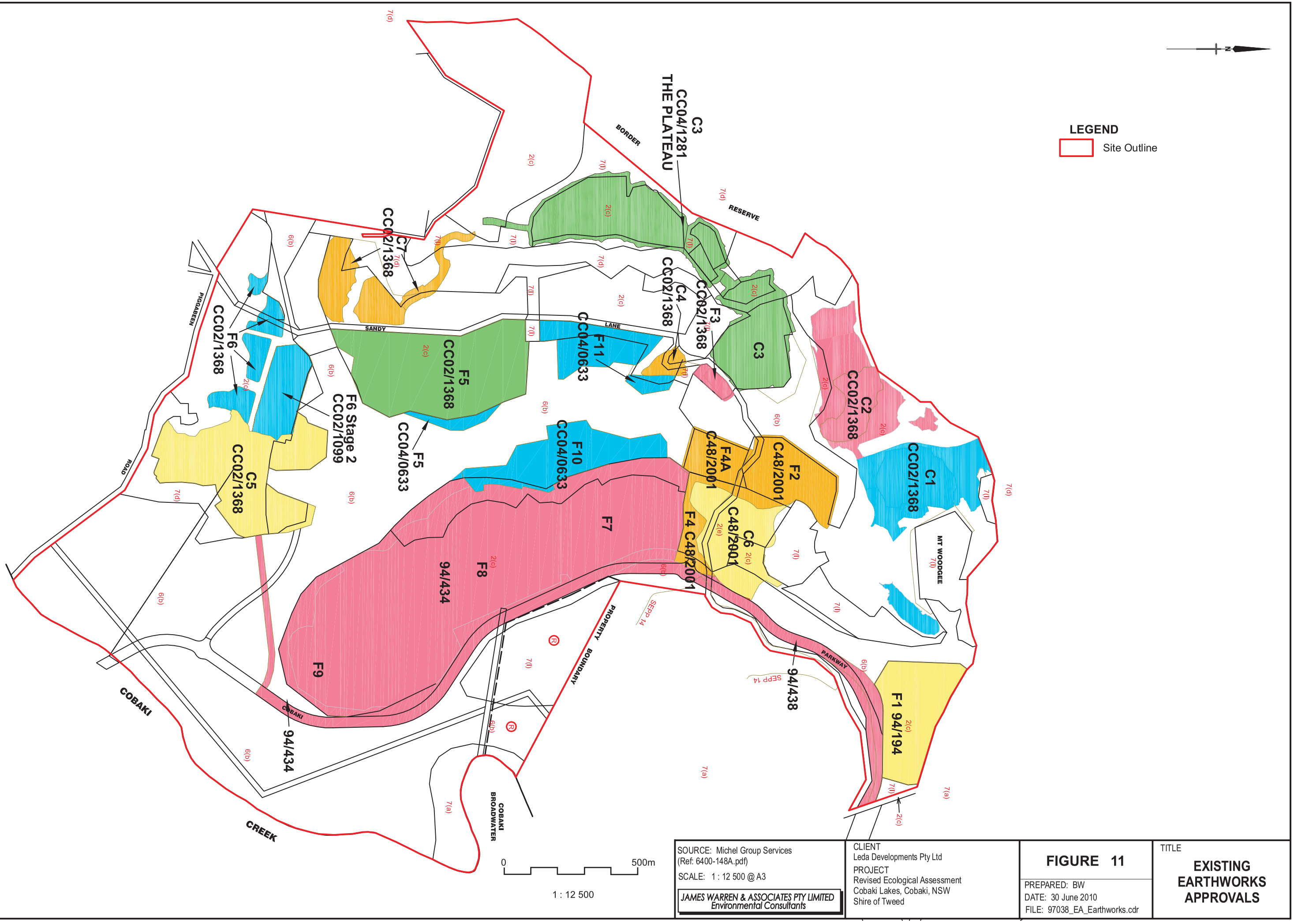
LEGEND
Site Outline
N
C3
CC04/1281
THE PLATEAU
BORDER
RESERVE
C7
CC02/1368
C4
CC02/1368
F3
CC02/1368
C3
C2
CC02/1368
C1
CC02/1368
F6
CC02/1368
PIGGABEEN
ROAD
SANDY
LANE
F5
CC02/1368
F11
CC04/0633
F6 Stage 2
CC02/1099
C5
CC02/1368
F5
CC04/0633
F10
CC04/0633
F4A
C48/2001
F2
C48/2001
C6
C48/2001
F4 C48/2001
F7
F8
94/434
F9
MT WOODGEE
PROPERTY BOUNDARY
SEPP 14
PARKWAY
94/438
F1 94/194
COBAKI
COBAKI
94/434
CREEK
COBAKI BROADWATER
0
500m
1 : 12 500
SOURCE: Michel Group Services
(Ref: 6400-148A.pdf)
SCALE: 1 : 12 500 @ A3
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FIGURE 11
PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Earthworks.cdr
TITLE
EXISTING EARTHWORKS APPROVALS

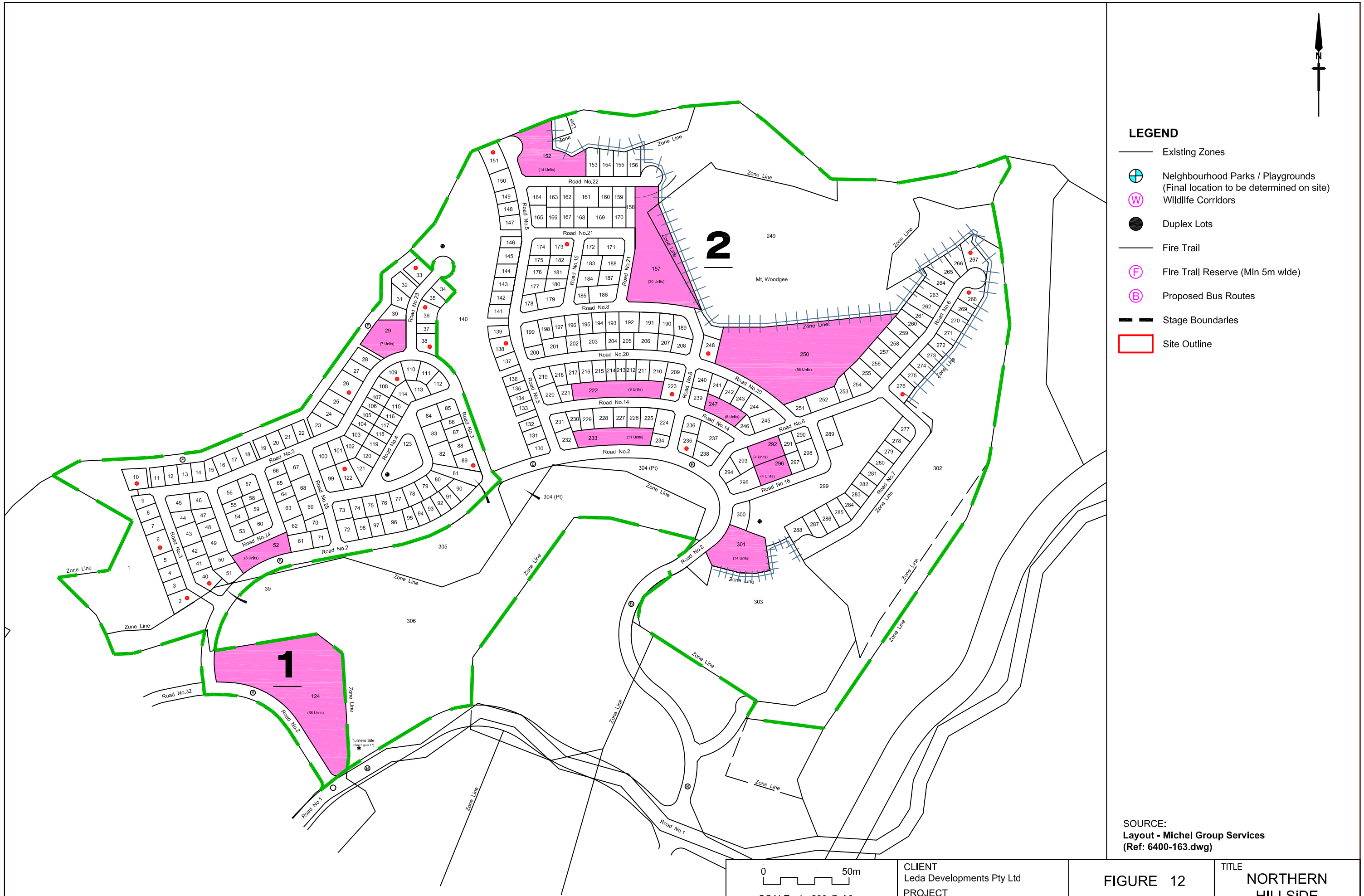
N
LEGEND
Existing Zones
Neighbourhood Parks / Playgrounds
(Final location to be determined on site)
Wildlife Corridors
Duplex Lots
Fire Trail
Fire Trail Reserve (Min 5m wide)
Proposed Bus Routes
Stage Boundaries
Site Outline
1
2
Mt. Woodgee
Zone Line
Road No.1
Road No.2
Road No.3
Road No.4
Road No.5
Road No.6
Road No.7
Road No.8
Road No.14
Road No.15
Road No.16
Road No.20
Road No.21
Road No.22
Road No.23
Road No.24
Road No.25
Road No.32
304 (Pt)
Turners Site
(Ref Figure 17)
0
50m
SCALE: 1 : 200 @ A3
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FIGURE 12
PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_NthHill.dwg
TITLE
NORTHERN HILLSIDE DEVELOPMENT LAYOUT
SOURCE:
Layout - Michel Group Services
(Ref: 6400-163.dwg)

2.4 Existing use rights

The property has been grazed by cattle since the early 1900's. Landuse activities which have been a long term and constant feature of this site are defined in Section 106 of the EP&A Act 1979. Existing use rights occur over the subject site for routine agricultural activities including the construction and maintenance of drains, fencing and firebreaks as well as pasture improvement activities.

3. LITERATURE REVIEW

3.1 Introduction

A number of Flora and Fauna Reports and other sources of information have been reviewed prior to the completion of the current assessment. These include:

- Cameron McNamara (1983) Cobaki Village Environmental Study (Report Prepared for the Bradshaw Group);
- WBM (1990) Evaluation of Terrestrial Fauna – Cobaki Community Project;
- WBM (1991a) Greater Gliders of the Cobaki Lakes Project Property, Cobaki, NSW;
- WBM (1991b) Flora and Fauna Studies, Proposed Boyd Street Extension to Cobaki;
- Warren (1992) Fauna Impact Assessment of the Proposed Boyd Street Access;
- Warren (1993) Flora and Fauna survey of proposed cut/fill areas at Cobaki Lakes development (Unpublished Report);
- Warren (1994) Flora and Fauna survey of the Cobaki Lakes development site (Unpublished Report);
- Warren *et al.* (1994) Draft Management Plan for the Long-nosed Potoroo (*Potorous tridactylus*);
- Debus (1994) Bird Survey of the Cobaki Community Project Site;
- Woodward-Clyde (1997) A Flora and Fauna Assessment of Parcels 7, 8, 9 and 10 of the "Cobaki Lakes Residential Development";
- Woodward-Clyde (1997) Species Impact Statement - AGC Woodward-Clyde Pty Ltd;
- Parker (1999) A Species Impact Statement for the Cobaki Lakes Project; and
- EcoPro Pty Ltd (2004) Tugun Bypass: Species Impact Statement (SIS). A report prepared for the Queensland Department of Main Roads.

A summary of findings is provided below. A detailed literature review was provided in the original Ecological Assessment report (JWA 2008).

3.2 Summary

The literature review has revealed the presence, at one time or another, of twelve (12) Threatened fauna species on the subject site with an additional eighteen (18) Threatened species recorded during surveys on adjacent land (**TABLE 1**).

The literature review has also revealed the presence (historically) of four (4) Threatened flora species and three (3) Rare or Threatened Australian Plants (ROTAP) (Briggs & Leigh 1995) listed flora species on the subject site, with an additional eight (8) Threatened flora species and two (2) ROTAP flora species recorded during surveys on adjacent land (**TABLE 2**).

Species status is listed below in accordance with the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act 1999), NSW *Threatened Species Conservation Act 1995* (TSC Act 1995) and ROTAP (Briggs & Leigh 1995).

TABLE 1
THREATENED FAUNA SPECIES RECORDED ON OR ADJACENT TO THE SUBJECT SITE

Common name	Scientific name	Status	Source
Wallum froglet	*Crinia tinnula*	Vulnerable (TSC Act 1995)	Cameron McNamara 1983, WBM 1990, Warren 1992, 1993, Woodward-Clyde 1997, EcoPro 2004
Wallum sedge-frog*	*Litoria olongburensis*	Vulnerable (TSC Act 1995) & Endangered (EPBC Act 1999)	Warren 1992, Woodward-Clyde 1997, EcoPro 2004
Bush hen*	*Amaurornis olivaceus*	Vulnerable (TSC Act 1995)	EcoPro 2004
Glossy black-cockatoo*	*Calyptorhynchus lathami*	Vulnerable (TSC Act 1995)	EcoPro 2004
Brolga*	*Grus rubicunda*	Vulnerable (TSC Act 1995)	EcoPro 2004
Black bittern*[U]	*Ixobrychus flavicollis*	Vulnerable (TSC Act 1995)	EcoPro 2004
Mangrove honeyeater*	*Lichenostomus fasciogularis*	Vulnerable (TSC Act 1995)	EcoPro 2004
White-eared monarch*	*Monarcha leucotis*	Vulnerable (TSC Act 1995)	EcoPro 2004
Powerful owl	*Ninox strenua*	Vulnerable (TSC Act 1995)	Warren 1993, 1994, Woodward-Clyde 1997
Osprey	*Pandion haliaetus*	Vulnerable (TSC Act 1995)	Cameron McNamara 1983, WBM 1990, Warren 1992, 1993, Woodward-Clyde 1997, EcoPro 2004
Wompoo fruit-dove*	*Ptilinopus magnificus*	Vulnerable (TSC Act 1995)	EcoPro 2004
Rose-crowned fruit-dove*	*Ptilinopus regina*	Vulnerable (TSC Act 1995)	EcoPro 2004
Superb fruit-dove*[U]	*Ptilinopus superbus*	Vulnerable (TSC Act 1995)	EcoPro 2004
Collared kingfisher*	*Todiramphus chloris*	Vulnerable (TSC Act 1995)	EcoPro 2004
Eastern grass owl*	*Tyto capensis*	Vulnerable (TSC Act 1995)	EcoPro 2004
Masked owl	*Tyto novaehollandiae*	Vulnerable (TSC Act 1995)	Debus 1994, Woodward-Clyde 1997, EcoPro 2004

Common name	Scientific name	Status	Source
Black neck-stork	*Xenorhynchus asiaticus*	Endangered (TSC Act 1995)	WBM 1990, Warren 1993, Woodward-Clyde 1997, EcoPro 2004
Little bent-wing bat	*Miniopterus australis*	Vulnerable (TSC Act 1995)	Warren 1994, Woodward-Clyde 1997, EcoPro 2004
Common bent-wing bat	*Miniopterus schreibersii*	Vulnerable (TSC Act 1995)	Warren 1994, Woodward-Clyde 1997
Eastern free-tail bat	*Mormopterus norfolkensis*	Vulnerable (TSC Act 1995)	Warren 1994, Woodward-Clyde 1997
Large-footed myotis*	*Myotis adversus*	Vulnerable (TSC Act 1995)	EcoPro 2004
Eastern long-eared bat*	*Nyctophilus bifax*	Vulnerable (TSC Act 1995)	EcoPro 2004
Squirrel glider*	*Petaurus norfolkensis*	Vulnerable (TSC Act 1995)	EcoPro 2004
Koala	*Phascolarctos cinereus*	Vulnerable (TSC Act 1995)	Woodward-Clyde 1997
Common planigale*	*Planigale maculata*	Vulnerable (TSC Act 1995)	EcoPro 2004
Long-nosed potoroo*	*Potorous tridactylus*	Vulnerable (TSC Act 1995)	Warren 1992, Woodward-Clyde 1997, EcoPro 2004
Grey-headed flying-fox	*Pteropus poliocephelus*	Vulnerable (EPBC Act)	Woodward-Clyde 1997, EcoPro 2004
Yellow-bellied sheathtail bat	*Saccolaimus flaviventris*	Vulnerable (TSC Act 1995)	Warren 1994, Woodward-Clyde 1997
Greater broad-nosed bat	*Scoteanax rueppellii*	Vulnerable (TSC Act 1995)	Warren 1994
Common blossom bat*	*Syconycteris australis*	Vulnerable (TSC Act 1995)	EcoPro 2004

* Recorded adjacent to the subject site only
U Unconfirmed sighting

TABLE 2
THREATENED FLORA SPECIES RECORDED ON OR ADJACENT TO THE SUBJECT SITE

Common name	Scientific name	Status	Source
Marblewood	*Acacia bakeri*	Vulnerable (TSC Act 1995)	Woodward-Clyde 1997, Parker 1999
White lace flower*	*Archidendron hendersonii*	Vulnerable (TSC Act 1995)	EcoPro 2004
Veiny lace flower	*Archidendron muellerianum*	ROTAP LISTED	Woodward-Clyde 1997, EcoPro 2004

Common name	Scientific name	Status	Source
Brush cassia	*Cassia brewsteri* var. *marksiana*	Endangered (TSC Act 1995)	Woodward-Clyde 1997, Parker 1999
Coastal cordyline	*Cordyline congesta*	ROTAP LISTED	Parker 1999, EcoPro 2004
Stinking cryptocarya*	*Cryptocarya foetida*	Vulnerable (TSC Act 1995 & EPBC Act 1999)	EcoPro 2004
Long-leaved tuckeroo*	*Cupaniopsis newmanii*	ROTAP LISTED	EcoPro 2004
Black walnut*	*Endiandra globosa*	ROTAP LISTED	EcoPro 2004
Green-leaved rose-walnut*	*Endiandra muelleri* subsp. *bracteata*	Endangered (TSC Act 1995)	EcoPro 2004
Pink nodding orchid*	*Geodorum densiflorum*	Endangered (TSC Act 1995)	EcoPro 2004
White yiel yiel*	*Grevillea hilliana*	Endangered (TSC Act 1995)	EcoPro 2004
Fine-leaved tuckeroo*	*Lepiderema pulchella*	Vulnerable (TSC Act 1995)	EcoPro 2004
Rough-shelled bush-nut*	*Macadamia tetraphylla*	Vulnerable (TSC Act 1995 & EPBC Act 1999)	EcoPro 2004
Swamp orchid*	*Phaius australis*	Endangered (TSC Act 1995 & EPBC Act 1999)	EcoPro 2004
Spiny gardenia	*Randia moorei*	Endangered (TSC Act 1995 & EPBC Act 1999)	Woodward-Clyde 1997
Smooth scrub turpentine	*Rhodamnia maideniana*	ROTAP LISTED	Warren 1994, Woodward-Clyde 1997, Parker 1999, EcoPro 2004
Coolamon	*Syzygium moorei*	Vulnerable (TSC Act 1995)	Woodward-Clyde 1997, EcoPro 2004

* Historically recorded adjacent to the subject site only

4. DIRECTOR GENERAL'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

4.1 Background

A concept plan for the proposed residential community at Cobaki Lakes was authorised on the 24th of January 2007. Subsequently, the Director-general's Environmental Assessment Requirements (DGEAR's) have been outlined in a letter from the NSW Governments Department of Planning dated 21st August 2007.

As previously discussed, JWA were engaged by LEDA Manorstead Pty Ltd to complete an Ecological Assessment for land at Cobaki Lakes, Cobaki in November 2008. Following submissions from the public and State Agencies, and subsequent amendments to the proposed Concept Plan, this Ecological Assessment has been revised to provide additional information.

This section of the report aims to address the flora and fauna requirements for the Concept Plan Application which are listed in Section 4 of Attachment 1 of the Department of Planning letter.

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

1. Demonstrate that the development footprint will not adversely impact on existing native flora and fauna. This should include consideration of the impact of the proposal on wildlife corridors, any remnant bushland, Koala habitat in accordance with SEPP 44 and consultation with Council and threatened species and their habitats in accordance with draft *Guidelines for Threatened Species Assessment (*July 2005).
2. Provide a description of the proposed treatment of any ecological buffers, including interaction with the proposed land uses, asset protection zones, stormwater structures, extent of proposed environmental restoration and enhancement works.
3. Assess proposed native vegetation clearing with consideration of potential impacts and if applicable, provide details of any offset strategy or other suitable mitigation measures to ensure that there is no net loss of native vegetation values.
4. Consideration of the provision, management and ongoing maintenance of general public open space.
5. Provide an assessment against SEPP 14 – Coastal Wetlands.
6. Address the requirements of Councils DCP 25 – Biting Midge and Mosquito Control.
7. Consideration of impacts, if any, on matters of national environmental significance under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999.*

Each of these requirements will be addressed in the following sections of this report.

4.2 Demonstrate that the development footprint will not adversely impact on existing native flora and fauna

4.2.1 Introduction

This section will consider the impact of the proposed development on wildlife corridors, remnant bushland, Koala habitat in accordance with SEPP 44 and Tweed Shire Council, and any threatened species and their habitats in accordance with draft *Guidelines for Threatened Species Assessment (*July 2005).

4.2.2 Summary of existing flora and fauna values

A detailed flora assessment 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 was provided within the original Ecological Assessment (JWA 2008).

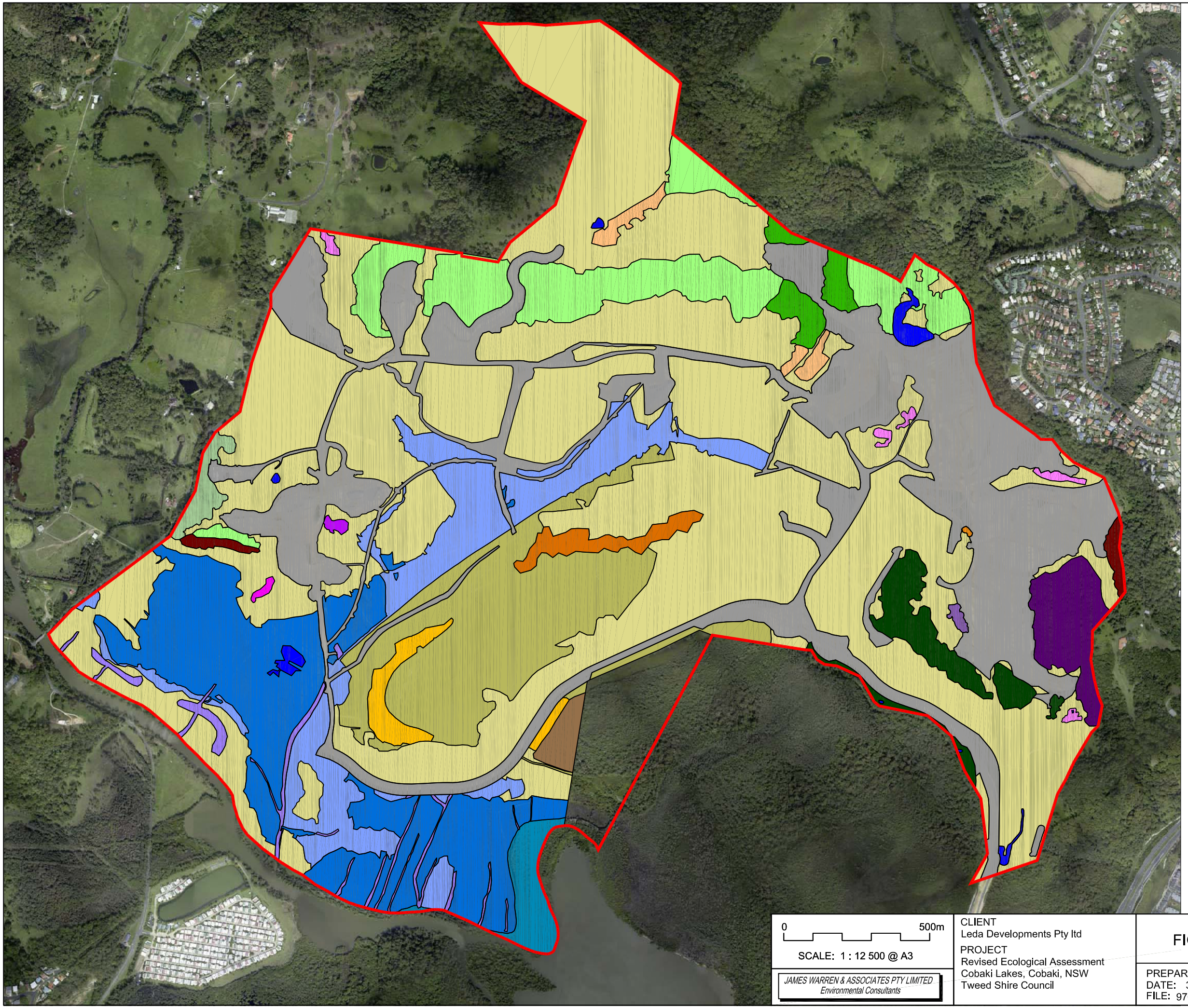
Subsequent to the completion of the 2008 Ecological Assessment, existing earthworks approvals have been implemented in some portions of the subject site and existing use rights (i.e. cattle grazing) have continued. The vegetation mapping prepared in 2008 has therefore been overlayed on a recent aerial photograph (March 2010) and mapped boundaries checked. In areas where vegetation extent was not clear on the aerial photograph, ground-truthing was completed.

The latest flora assessment recorded sixteen (16) broad vegetation associations comprising twenty-two (22) vegetation communities (**FIGURE 13**). In total, four hundred and forty-nine (449) flora species have been recorded at the subject site. This list is a compilation of all plant species recorded from the site by JWA as well as during previous flora assessments (i.e. WBM 1990 & 1991b; Woodward-Clyde 1997 & Parker 1999).

A total of eight (8) threatened flora species have been recorded on the subject site to date. An additional five (5) Threatened flora species have been recorded to date during surveys on adjacent land (EcoPro 2004).

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 was also provided within the original Ecological Assessment (JWA 2008). Fauna surveys on the subject site have revealed the presence of thirteen (13) amphibian species, ten (10) reptile species, one hundred and thirty-eight (138) bird species and thirty-three (33) mammal species.

A total of twelve (12) Threatened fauna species have been recorded from the subject site to date. An additional eighteen (18) Threatened fauna species have been recorded to date during surveys on adjacent land (EcoPro 2004).



LEGEND

Community 1 - Dry sclerophyll communities

- Community 1a - Very tall open/closed sclerophyll forest (*Eucalyptus pilularis* +/- *E. microcorys* +/- *E. propinqua* +/- *Corymbia intermedia*)
- Community 1b - Tall open/closed sclerophyll forest (*E. propinqua*)
- Community 1c - Tall open sclerophyll woodland (*E. pilularis*)
- Community 1d - Tall open sclerophyll forest (*E. pilularis* +/- *E. siderophloia* +/- *E. tereticornis*)

Community 2 - Rainforest communities

- Community 2a - Tall closed forest (*Lophostemon confertus* +/- *Araucaria cunninghamii*)
- Community 2b - Tall open forest (*Archontophoenix cunninghamiana*)
- Community 2c - Very tall closed forest (*A. cunninghamii*)
- Community 2d - Mid-high open/closed forest (Riparian species +/- Mixed species)
- Community 3 - Tall/very tall open/closed forest (*L. confertus* +/- Mixed rainforest species)
- Community 4 - Low closed forest (Heathland)
- Community 5 - Mid-high open woodland (Mixed rainforest species)
- Community 6 - Mid-high open woodland (*E. robusta*)
- Community 7 - Mid-high open woodland (*E. racemosa*)
- Community 8 - Mid-high open woodland (*E. siderophloia*)
- Community 9 - Low closed forest (Revegetation areas +/- Mixed *Eucalyptus* species)
- Community 10 - Low closed grassland with scattered trees (Pastoral grassess +/- Mixed species)
- Community 11 - Low closed grassland (*Sporobolus virginicus*, *Triglochin striata* +/- *Casuarina glauca*)
- Community 12 - Rushland/sedgeland/ grassland (Mixed aquatic species)
- Community 13 - Low to mid-high open mangrove forest (*Avicennia marina* var *australasica* / *Aegiceras corniculatum* +/- *Casuarina glauca*)
- Community 14 - Dams & drainage lines (Mixed aquatic species)
- Community 15 - Low open forest/woodland (*Casuarina glauca* +/- Mixed species)
- Community 16 - Slashed grassland/ heathland/sedgeland (Mixed Species)
- Unvegetated land
- Site Outline

SOURCE:
Vegetation - James Warren & Associates Pty Ltd
July/Sept 2007 & May 2008
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 500m

SCALE: 1 : 12 500 @ A3

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Revised Ecological Assessment
Cobaki Lakes, Cobaki, NSW
Tweed Shire Council

FIGURE 13

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE

VEGETATION COMMUNITIES

4.2.3 Wildlife corridors

4.2.3.1 Applicability to the subject site

The National Parks & Wildlife Service (NPWS) Key Habitats and Corridors database shows a number of regional and sub-regional habitat corridors within the locality of the site (**FIGURE 14**).

The NPWS Key Habitats and Corridors database maps the Cobaki-Terranora Regional Corridor as traversing a large area of the eastern portion of the Subject site. The corridor is a link between Cobaki Wetlands and Terranora Broadwater.

Three (3) Sub-regional corridors branch off this Regional corridor - the Pigabeen corridor, the McPherson corridor and the Cobaki corridor. The Pigabeen corridor traverses the central portion of the site in a generally east-west direction, linking Pigabeen with Cobaki Wetlands. The McPherson corridor traverses the northern portion of the site, forking off to the north and west, and forming a link between the Cobaki Wetlands and Mt Tomewin. The Cobaki corridor branches off the Cobaki-Terranora Regional Corridor across a small portion of the far-eastern edge of the Subject site, linking Cobaki Wetlands with Cobaki Broadwater.

Additionaly, the database mapping shows that key habitat has been identified as occurring within the northern, western and southern portions of the site (**FIGURE 14**). As described by NPWS (2007), key habitats are areas of predicted high conservation value for fauna assemblages, endemic forest vertebrates or endemic invertebrates; depicted spatially as a merging of mapped assemblage hubs, assemblage hot spots and centres of endemism.

The forested Crown lands which form the boundary of NSW and QLD occur between the Cobaki Lakes northern and western boundaries and the border. This elevated forest community creates a link near the north-eastern boundary of the site to 'Wallum' habitats surrounding the Cobaki Broadwater. This link, which extends to Mt. Cougal in the north-west, is considered to be of high importance by NPWS. These issues have been addressed in a previous approval for the Boyd Street access (Warren *et al*. 1994).

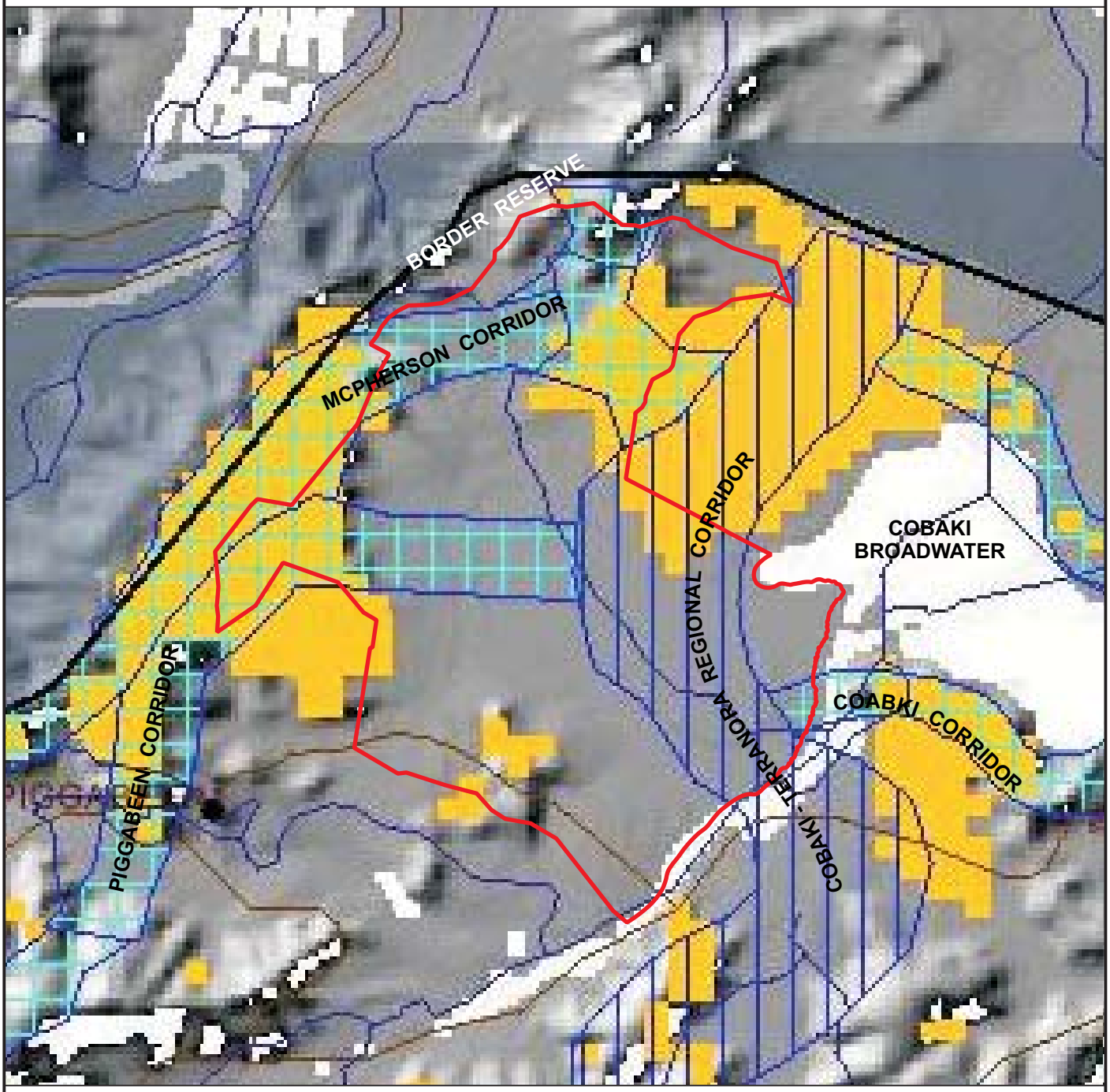
4.2.3.2 Accuracy of NPWS mapping

Site assessments have revealed that the NPWS Corridor mapping is inaccurate over the subject site. Large areas of the site that are included in the mapping have been cleared of vegetation in accordance with various development approvals. An overlay of the NPWS Corridor mapping on a recent aerial photograph of the site is included as **FIGURE 15**.

4.2.3.3 Potential impacts

The Proposed development has the potential to reduce the overall effectiveness of the site as a corridor due to habitat loss and fragmentation. Edge effects may also further impact on retained vegetation and corridor habitat.

Impacts of the proposed development on the NPWS corridor mapping are depicted in **FIGURE 16.**



Legend
- Regional Corridor
- Subregional Corridor
- Key Habitat
- Subject Site

N

0 750m

SOURCE: NSW NPWS Key Habitats & Corridors in North East NSW (NPWS website 22.10.07)

SCALE: 1 : 30 000 @ A4

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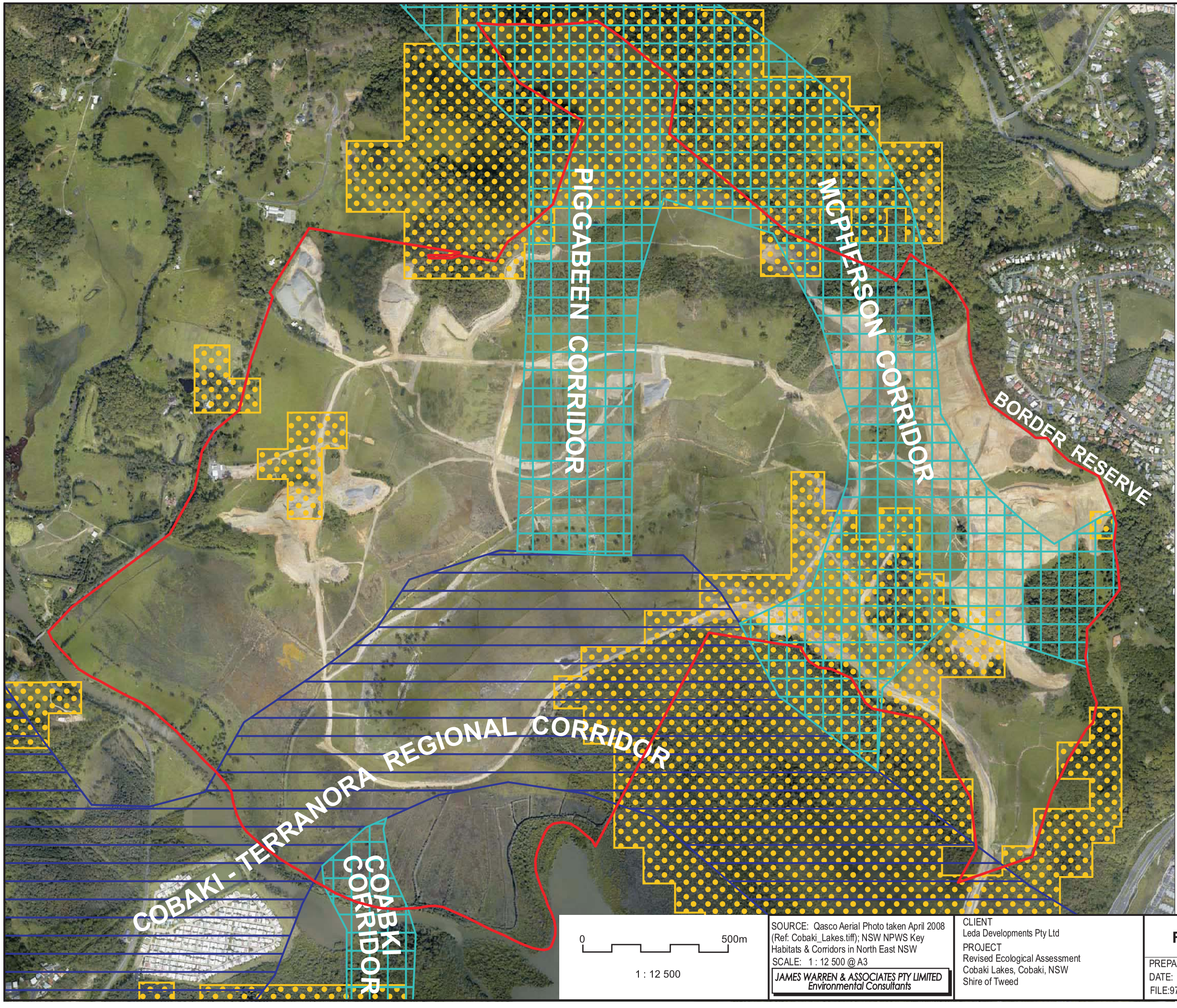
Shire of Tweed

FIGURE 14

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Corridors.cdr

TITLE

NPWS KEY HABITATS & CORRIDORS



N

LEGEND

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

0 500m

1 : 12 500

SOURCE: Qasco Aerial Photo taken April 2008 (Ref: Cobaki_Lakes.tiff); NSW NPWS Key Habitats & Corridors in North East NSW

SCALE: 1 : 12 500 @ A3

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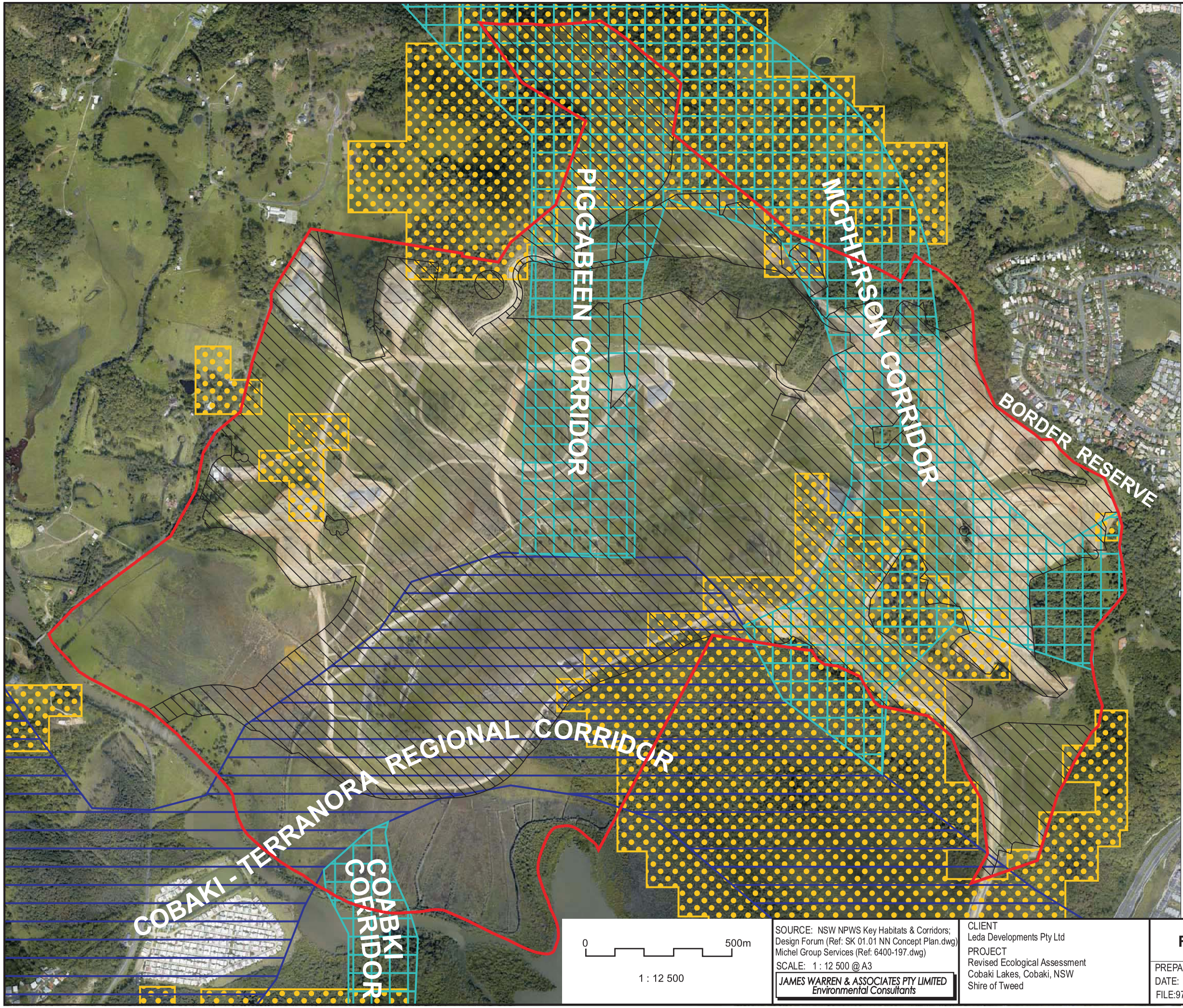
FIGURE 15

PREPARED: BW
DATE: 30 June 2010
FILE:97038_EA_overlay corridor.cdr

TITLE

ACCURACY OF NPWS KEY HABITATS & CORRIDORS



LEGEND

- Regional Corridor
- Subregional Corridor
- Key Habitat
- Proposed Development Areas
- Site Outline

0 500m

1 : 12 500

SOURCE: NSW NPWS Key Habitats & Corridors; Design Forum (Ref: SK 01.01 NN Concept Plan.dwg) Michel Group Services (Ref: 6400-197.dwg)

SCALE: 1 : 12 500 @ A3

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FIGURE 16

PREPARED: BW
DATE: 30 June 2010
FILE:97038_EA_Impact corridor.cdr

TITLE

IMPACT ON NPWS KEY HABITATS & CORRIDORS

4.2.3.4 Proposed amelioration measures

The proposed development has been designed to utilise existing cleared areas where possible. A network of existing vegetated corridors will be retained on the site the most significant of which, include the forested escarpment in the western portion of the site and Mt. Woodgee and associated rainforest habitats in the northern portion of the site. Additionally, smaller interlinking corridors will be provided on the subject site through regeneration and revegetation works.

A Revised Site Regeneration and Revegetation Plan has been prepared for the subject site (JWA 2010a) and will result in approximately 83.06ha of revegetation and 9.54ha of regeneration works. The regeneration and revegetation works will provide vegetated links across the site and ensure that the remaining wildlife corridors will be embellished utilising revegetation and natural regeneration principles.

4.2.4 Remnant Bushland

4.2.4.1 Applicability to the subject site

NPWS (2003) describe remnant vegetation as those patches of native trees, shrubs and grasses remaining following clearing operations. The NSW *Native Vegetation Act* (2003) (NV Act 2003) defines remnant native vegetation as any native vegetation other than regrowth. For the purposes of NV Act 2003, regrowth refers to any native vegetation that has regrown since 1st January 1990.

Remnant vegetation:

- can be of any shape or size;
- can include all types of native vegetation communities, including forest woodland, native grasslands, mallee, coastal heathland or rainforest.

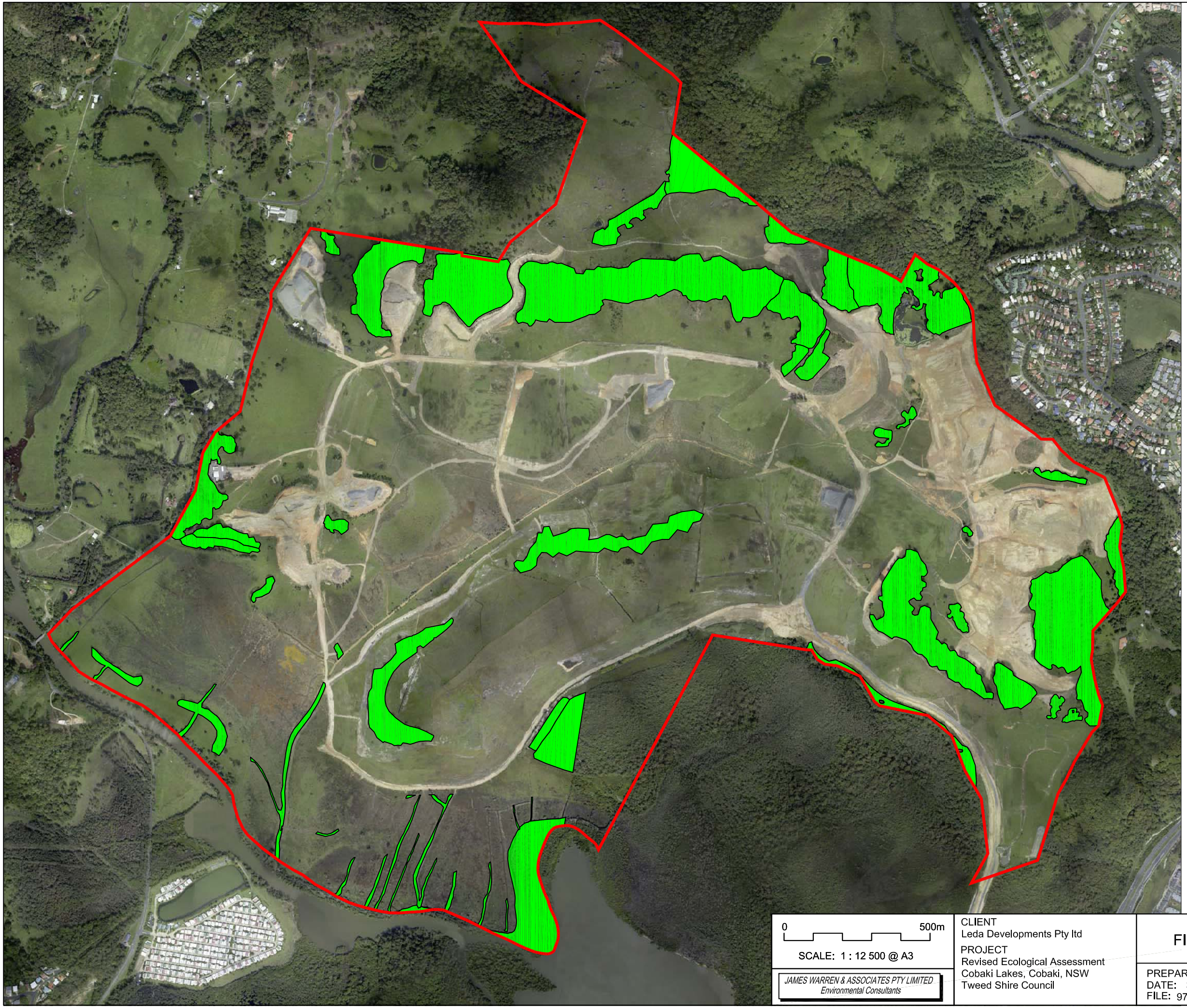
Numerous vegetation surveys have been completed on the subject site by JWA between 2000 and the present and have included detailed mapping of vegetation communities as well as searches for Threatened flora species. A plan showing the location of the remnant bushland occurring on the Subject site is included in **FIGURE 17**.

4.2.4.2 Impacts on Remnant Bushland

The potential impacts on remnant bushland from the proposed development are shown in **FIGURE 18.** A summary of the potential loss of remnant bushland is shown in **TABLE 4**.

TABLE 4
POTENTIAL LOSS OF REMNANT BUSHLAND
FROM THE PROPOSED DEVELOPMENT

Community	TOTAL AREA (ha)	Area to be Removed (ha)	Area to be Removed (%)
1a	31.84	3.80	11.93%
1b	4.84	0.75	15.50%
1c	9.35	0.10	1.07%



N

LEGEND

Remnant Bushland

Site Outline

SOURCE:
Vegetation - James Warren & Associates Pty Ltd
July/Sept 2007 & May 2008
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 500m

SCALE: 1 : 12 500 @ A3

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FIGURE 17

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE

REMNANT BUSHLAND

N

LEGEND

- Remnant Bushland
- Proposed Development Areas
- Site Outline

SOURCE:
Vegetation - James Warren & Associates Pty Ltd
July/Sept 2007 & May 2008
Layout - Design Forum Pty Ltd
(Ref: SK 01.01 NN Concept Plan.dwg)
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 500m

SCALE: 1 : 12 500 @ A3

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FIGURE 18

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE

IMPACT ON REMNANT BUSHLAND

Community	TOTAL AREA (ha)	Area to be Removed (ha)	Area to be Removed (%)
1d	2.58	0.77	29.84%
2a	8.86	0.07	0.79%
2b	0.34	0.02	5.88%
2c	0.39	0.02	5.13%
2d	1.41	0.02	1.42%
3	1.88	0.01	0.53%
4	2.44	-	0%
5	0.07	0.03	42.86%
6	3.80	3.80	100%
7	4.19	4.13	98.57%
8	0.27	-	0%
9	2.67	0.13	4.87%
13	5.66	-	0%
TOTAL	**80.59ha**	**13.80ha**	**17.12%**

In total 13.8 hectares of remnant bushland will be lost from the subject site (17.12% of the total area of remnant bushland). The majority of remnant bushland to be removed occurs within portions of the site with existing development approval whilst a small area of remnant bushland will be removed from areas without current development approvals.

4.2.4.3 Proposed amelioration measures

The majority of existing remnant bushland on the subject site will be retained. A total of 66.79 hectares (82.8%) of the remnant bushland on the subject site will be retained. This bushland will be retained within Environmental Protection Areas as well as Open Space areas throughout the development envelope.

The Revised Site Regeneration and Revegetation Plan (JWA 2010a) outlines the various measures to ensure that the retained remnant vegetation is adequately managed. Approximately 83.06ha of revegetation and 9.54ha of regeneration works will be completed in accordance with this plan to offset any loss of remnant bushland and to provide vegetated links across the site. Additional amelioration measures for the remnant vegetation will include:

- Weed control will primarily be completed by a qualified Bush regenerator;
- All weed control will be completed using the recommended methods (ARBA approved);
- Weed control will be undertaken on a progressive basis over a three (3) – five (5) year period;
- Embellishment plantings are to be used to consolidate each of the areas of remnant vegetation;
- All areas of remnant vegetation will be fenced to exclude pedestrian traffic and cattle grazing;
- Formal pathways are to be provided through areas of remnant vegetation to prevent the creation of numerous informal tracks;

- All of the rehabilitation works are to be completed by qualified bush regenerators;
- A monitoring and maintenance program for areas of remnant vegetation will be included in the Vegetation Rehabilitation and Management Plan.

4.2.5 Koala Habitat

4.2.5.1 Council consultation - Tweed Coast Koala Atlas (TCKA)

In April, 1993 Council resolved to contribute $10,000 to the Australian Koala Foundation (AKF) to assist them in the preparation of a Tweed Coast Koala Atlas for the eastern section of the Shire. The 37,608 hectare study area comprises approximately 29 percent of Tweed Shire.

The Tweed coast Koala atlas maps parts of the site as Secondary Habitat (**FIGURE 19**). However, clearing activities on the subject site have occurred subsequent to the preparation of the Koala habitat mapping. This has resulted in the removal of vegetation within large areas of the mapped secondary habitat which now consists of open grassland and is not considered to represent Koala habitat. Recent vegetation assessments of the site have recorded grasslands with scattered trees occurring over much of the Secondary habitat mapped in the Tweed Koala Atlas.

JWA are of the opinion that the large area of mapped Secondary habitat located on the elevated plateau in the western portion of the site, does not represent secondary Koala habitat as described in the Summary of Tweed Coast Koala Atlas.

It should be noted that in the absence of a shire-wide Koala Plan of Management (KPoM), State Environmental Planning Policy No. 44 (SEPP 44) applies.

4.2.5.2 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.

Legend

- Primary Habitat
- Secondary Habitat (Class A)
- Secondary Habitat (Class B)
- Unknown Habitat Quality
- Mainly Cleared (Some Trees)
- Other Vegetation Communities
- Subject Site

N

0 750m

SOURCE: Australian Koala Foundation - Tweed Coast Koala Habitat Atlas (Tweed Shire Council Mapping)
SCALE: 1 : 30 000 @ A4

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Cobaki Lakes, Cobaki, NSW
Shire of Tweed

FIGURE 19

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Koala.cdr

TITLE

KOALA HABITAT AREAS

2. 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?

The majority of scattered trees within Community 6 in the eastern portion of the site are Swamp mahogany (*Eucalyptus robusta*), which is listed as a Primary Koala food tree under Schedule 2 of SEPP 44. This community covers a total area of approximately 3.80 hectares and Swamp mahogany in this area constitutes 95% of the total number of trees in the upper strata.

The majority of scattered trees within Community 7 in the eastern portion of the site are Scribbly gum (*Eucalyptus signata*), which is listed as a Primary Koala food tree under Schedule 2 of SEPP 44. This community covers a total area of approximately 4.19 hectares and Scribbly gum in this area constitutes 95% of the total number of trees in the upper strata.

At least 15% of the total number of trees in the upper strata of Community 1a (Blackbutt – Tallowwood association), are Tallowwood (*E. microcorys*), which is also listed under Schedule 2 of SEPP 44. This community covers a total area of approximately 31.84 hectares and Tallowwoods constitute at least 15% of the total number of trees in the upper strata, whilst the lower strata comprises a sparse midstorey of dry Sclerophyll species including Crinkle bush (*Lomatia silaifolia*), Geebung, Grass trees, various *Acacia* species (*A. melanoxylon*, *A. orites*), Dogwood, Forest oak, Tree heath, Red ash, Wild may (*Leptospermum flavescens*), Lantana and regenerating *Eucalyptus* species.

At least 15% of the total numbers of trees in the upper strata of Community 1d (Tall open sclerophyll forest) are Forest red gum (*E. tereticornis*), a species listed under Schedule 2 of SEPP 44. This community covers a total area of approximately 2.58 hectares. Forest red gums are scattered throughout this community, and constitute at least 15% of the total number of trees in the upper strata. Around the edges of this community the lower strata is sparse, comprised of species including Camphor laurel, Sweet pittosporum, Umbrella cheese tree, Blunt-leaf bitter-pea, Geebung, various *Acacia* species, Tree heath, Red ash, Lantana and regenerating *Eucalyptus* species.

Tallowwoods, Swamp mahogany and Forest red gums over the remainder of the site are estimated to constitute less than 15% of the total number of trees in the upper and lower strata.

The NPWS online database was consulted for recent sightings and historical records of Koalas in the locality. The NPWS database (June 2010) contained ninety-eight (98) records of this species within 10 kilometres of the site.

The NPWS online database (June 2010) contained five hundred and seventy-four (574) sightings of this species in the Tweed LGA, the nearest of which was within 1km of the Subject site.

Warren (1994) completed a detailed assessment of Koala habitat usage on the subject site. Approximately 483 trees in the Scribbly gum/ Swamp mahogany community and the Blackbutt community were assessed for Koala activity. Most of the trees inspected

were restricted to Grey gum, Tallowwood and Forest red gum as these are known to be preferentially browsed by Koalas in the region. The analysis was based on scratch density on trees as well as the occurrence of faecal pellets around the base of the tree. Each tree was allocated a rating of 0-5 depending on the density of pellets or scratch marks. 0 indicated absence of Koala activity whilst 5 indicated a level of high activity. Only a very small number of trees showed any indication of activity and none of the trees showed an activity level greater than 2. In some cases it was difficult to ascribe the scratches to Koalas as there were no faecal pellets and it is known that Common Brushtail Possums and Lace monitors occur on the site.

More recently (December 2007), areas of the site containing preferred Koala food trees (i.e. Swamp mahogany, Forest red gum, Tallowwood, Grey gum, Scribbly gum) were searched for evidence of Koala activity (i.e. scats, scratches). Two (2) scientists spent approximately twelve (12) hours on this component of the assessment. A nocturnal survey was also completed including spotlighting and call playback techniques. Approximately eight (8) hours was spent on this component of the assessment. No conclusive evidence of Koala activity (scats) was recorded on the site. Whilst a number of trees contained scratch marks, this is not considered a conclusive method of identifying Koala activity when not accompanied by scats, as they may be attributed to other more common arboreal species. One (1) male Koala was heard calling approximately 200-300m north of the south-western corner of the subject site.

No records of a resident population, evidenced by attributes such as breeding females, exist for the Subject site. It is considered that Koalas may occasionally disperse across the site whilst moving through the locality. It is considered that the site does not support core Koala habitat.

Whilst a number of areas of the site contain Primary Koala food trees as discussed above, these comprise less than 1% of the total number of trees on the subject site. No further assessment under SEPP 44 is therefore required.

4.2.5.3 Impacts on Koala Habitat

As discussed within Section 4.2.5.2 above, JWA consider that vegetation communities 1a, 1d, 6 and 7 provide suitable habitat for the Koala due to the presence of preferred food tree species (**FIGURE 20**). Surveys for the Koala on the subject site have revealed that a resident population is not present. However, it is considered that this species may occasionally utilise habitat on the subject site as it disperses through the area. The potential impacts on Koala habitat from the proposed development are shown in **FIGURE 21.**

Suitable Koala habitat to be removed from the subject site occurs within existing 2(c) zoned land (i.e. Urban Expansion), land proposed to be rezoned as 2(c), or land that may otherwise be cleared in accordance with existing use rights. A summary of the potential loss of suitable Koala habitats is shown in **TABLE 5**.

N

LEGEND

- Koala (*Phascolarctos cinereus*) Habitat
- Site Outline

SOURCE:
Habitat - James Warren & Associates Pty Ltd
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 500m

SCALE: 1 : 12 500 @ A3

JAMES WARREN & ASSOCIATES PTY LIMITED
Environmental Consultants

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Leda Developments Pty ltd

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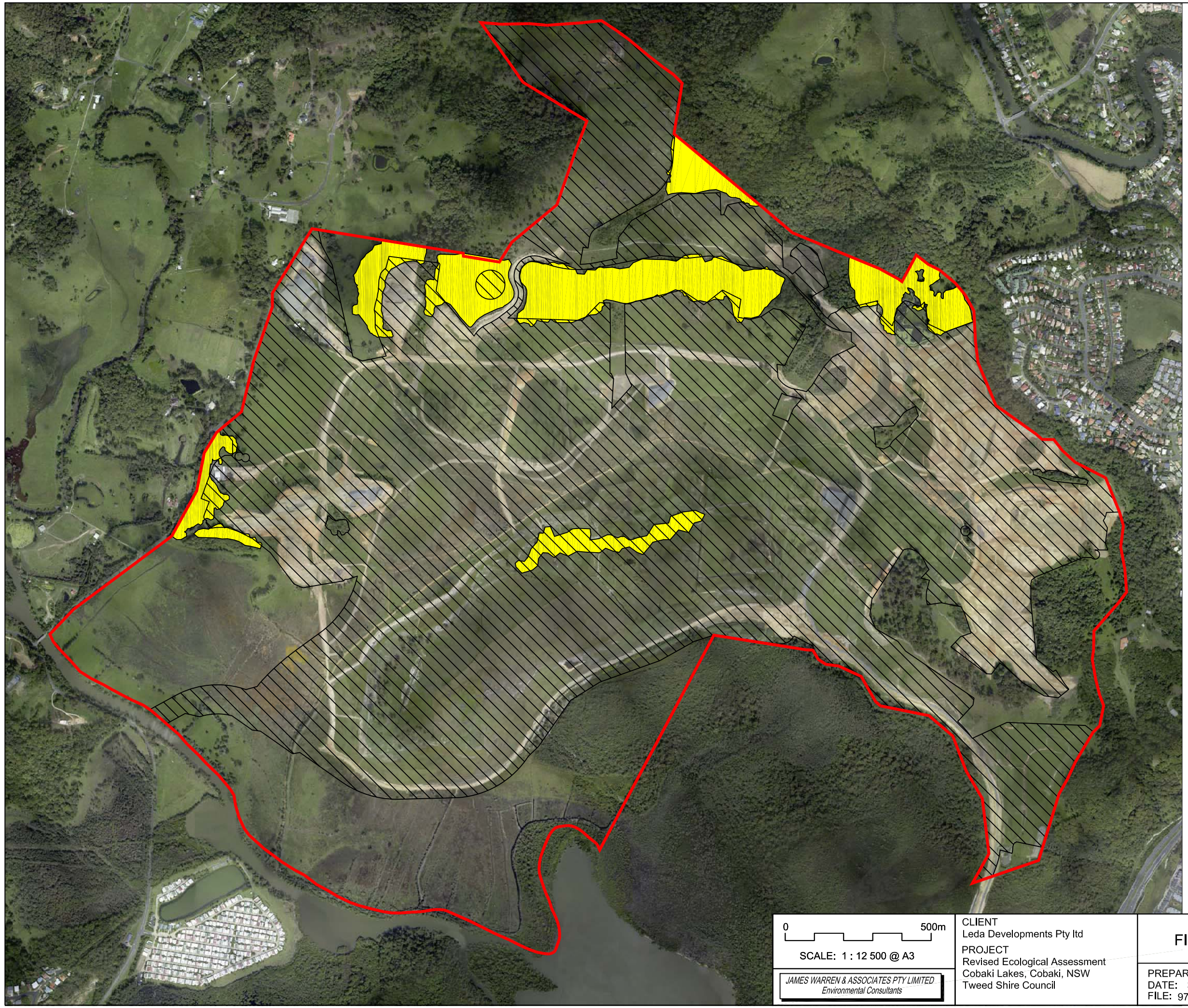
Revised Ecological Assessment
Cobaki Lakes, Cobaki, NSW
Tweed Shire Council

FIGURE 20

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE

IDENTIFIED KOALA HABITAT (JWA 2008)



N

LEGEND

- Koala (*Phascolarctos cinereus*) Habitat
- Proposed Development Areas
- Site Outline

SOURCE:
Habitat - James Warren & Associates Pty Ltd
Layout - Design Forum Pty Ltd
(Ref: SK 01.01 NN Concept Plan.dwg)
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 500m

SCALE: 1 : 12 500 @ A3

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FIGURE 21

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE
IMPACT ON IDENTIFIED KOALA HABITAT (JWA 2008)

TABLE 5
POTENTIAL LOSS OF KOALA HABITAT
RESULTING FROM THE PROPOSED DEVELOPMENT

Community	TOTAL AREA (ha)	Area to be Removed (ha)	Area to be Removed (%)
1a	31.84	3.80	11.93%
1d	2.58	0.77	29.84%
6	3.80	3.80	100%
7	4.19	4.13	98.57%
TOTAL	**42.63ha**	**12.50ha**	**29.32%**

In total 12.5 hectares of suitable Koala habitat (29.3% of the total available habitat) may potentially be lost from the subject site. All potential Koala habitat to be removed occurs within portions of the site with existing development approval.

The most recent Koala survey (December 2007) failed to record recent Koala activity on the subject site. The Swamp mahogany and Scribbly gum communities (communities 6 & 7) on the subject site occur as isolated stands of trees which are likely to be relatively inaccessible to Koalas residing in the locality.

4.2.5.4 Proposed Amelioration Measures

The majority of potential Koala habitat on the subject site will be retained. A total of 30.13 hectares of suitable Koala habitat (70.7% of available habitat) is proposed to be retained. This bushland will be retained within Environmental Protection Areas as well as Open Space areas throughout the development envelope.

Additionally, 83.06ha of proposed revegetation and 9.54ha of regeneration works on the subject site (**FIGURE 22**) will increase the area of available habitat in the long-term and provide vegetated linkages through the landscape.

4.2.6 Threatened species and their habitats

4.2.6.1 Introduction

Several species of flora and fauna listed as threatened species under the *Threatened Species Conservation Act* (1995), as well as several Endangered Ecological Communities, occur on the Cobaki lakes 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 also 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*. These 7-part tests are provided in a separate Assessment of Significance report (JWA 2010d).

N

LEGEND

- Proposed Revegetation Areas
- Proposed Natural Regeneration Areas
- Retained Vegetation
- Proposed Development Areas
- Freshwater Wetland Management Area
- Salt Marsh Rehabilitation Area
- Site Outline

SOURCE:
Regen/Reveg - James Warren & Associates Pty Ltd
Layout - Design Forum Pty Ltd
(Ref: SK 01.01 NN Concept Plan.dwg)
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 500m

SCALE: 1 : 12 500 @ A3

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FIGURE 22

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE
REGENERATION & REVEGETATION AREAS

4.2.6.2 Threatened flora

Eight (8) listed flora species have been recorded on the subject site**.** Threatened flora recorded include the following species:

- White yiel yiel (*Grevillea hilliana*) Endangered (TSC Act 1995);
- Scented acronychia (*Acronychia littoralis*) - Endangered (TSC Act 1995 & EPBC Act 1999);
- Fine-leaved tuckeroo (*Lepiderema pulchella*) - Vulnerable (TSC Act 1995);
- Spiny gardenia (*Randia moorei)* - Endangered (TSC Act 1995 & EPBC Act 1999);
- Marblewood (*Acacia bakeri*) - Vulnerable (TSC Act 1995);
- Brush cassia (*Cassia brewsteri* var. *marksiana*) - Endangered (TSC Act 1995);
- Coolamon (*Syzygium moorei*) - Vulnerable (TSC Act 1995, EPBCA 1999); and
- Green-leaved rose walnut (*Endiandra muelleri* subsp. *bracteata)* Endangered (TSC Act 1995).

The locations of these species are shown in **FIGURES 23, 23a, 23b & 23c.**

An additional five (5) Threatened species have been recorded during surveys on adjacent land, including:

- White lace flower (*Archidendron hendersonii*) – Vulnerable (TSC Act 1995);
- Stinking cryptocarya (*Cryptocarya foetida*) – Vulnerable (TSC Act 1995 & EPBC Act 1999);
- Pink nodding orchid (*Geodorum densiflorum*) - Endangered (TSC Act 1995);
- Rough-shelled bush-nut (*Macadamia tetraphylla*) – Vulnerable (TSC Act 1995 & EPBC Act 1999); and
- Swamp orchid (*Phaius australis*) – Endangered (TSC Act 1995 & EPBC Act 1999).

The known locations of Threatened flora species adjacent to the subject site are shown in **FIGURE 24.**

Suitable habitat for Threatened flora to be removed from the subject site occurs within existing 2(c) zoned land (i.e. Urban Expansion), land proposed to be rezoned as 2(c), or land that may otherwise be cleared in accordance with existing use rights.

A summary of impacts on the habitat for each species recorded on and adjacent to the subject site is provided in **TABLE 6.**

N

LEGEND

- Marblewood (*Acacia bakeri*)
- Fine-leaved tuckeroo (*Lepiderema pulchella*)
- Spiny gardenia (*Randia moorei*)
- Yiel yiel (*Grevillea hilliana*)
- Coolamon (*Syzygium moorei*)
- Brush cassia (*Cassia brewsteri* var. *marksiana*)
- Scented acronychia (*Acronychia littoralis*)
- Green-leaved rose walnut (*Endiandra muelleri* subsp. *bracteata*)
- Site Outline

SOURCE:
Flora - James Warren & Associates Pty Ltd
June/July 2004, July 2006, July/Sept 2007 & Feb 2008
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 500m

SCALE: 1 : 12 500 @ A3

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Tweed Shire Council

FIGURE 23

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE
LOCATION OF THREATENED FLORA

LEGEND

- Marblewood (*Acacia bakeri*)
- Fine-leaved tuckeroo (*Lepiderema pulchella*)
- Spiny gardenia (*Randia moorei*)
- Yiel yiel (*Grevillea hilliana*)
- Coolamon (*Syzygium moorei*)
- Brush cassia (*Cassia brewsteri* var. *marksiana*)
- Scented acronychia (*Acronychia littoralis*)
- Green-leaved rose walnut (*Endiandra muelleri* subsp. *bracteata*)
- Site Outline

SOURCE:
Flora - James Warren & Associates Pty Ltd
June/July 2004, July 2006, July/Sept 2007 & Feb 2008
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 0 50m 100m 500m

SCALE: 1 : 4000 @ A3

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FIGURE 23A

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE
LOCATION OF THREATENED FLORA

N

LEGEND

- Marblewood (*Acacia bakeri*)
- Fine-leaved tuckeroo (*Lepiderema pulchella*)
- Spiny gardenia (*Randia moorei*)
- Yiel yiel (*Grevillea hilliana*)
- Coolamon (*Syzygium moorei*)
- Brush cassia (*Cassia brewsteri* var. *marksiana*)
- Scented acronychia (*Acronychia littoralis*)
- Green-leaved rose walnut (*Endiandra muelleri* subsp. *bracteata*)
- Site Outline

SOURCE:
Flora - James Warren & Associates Pty Ltd
June/July 2004, July 2006, July/Sept 2007 & Feb 2008
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 0 50m 100m 500m

SCALE: 1 : 4000 @ A3

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FIGURE 23B

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE
LOCATION OF THREATENED FLORA

N

LEGEND

- Marblewood (*Acacia bakeri*)
- Fine-leaved tuckeroo (*Lepiderema pulchella*)
- Spiny gardenia (*Randia moorei*)
- Yiel yiel (*Grevillea hilliana*)
- Coolamon (*Syzygium moorei*)
- Brush cassia (*Cassia brewsteri* var. *marksiana*)
- Scented acronychia (*Acronychia littoralis*)
- Green-leaved rose walnut (*Endiandra muelleri* subsp. *bracteata*)
- Site Outline

SOURCE:
Flora - James Warren & Associates Pty Ltd
June/July 2004, July 2006, July/Sept 2007 & Feb 2008
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 0 50m 100m 500m

SCALE: 1 : 4000 @ A3

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FIGURE 23C

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE
LOCATION OF THREATENED FLORA

N

TUGUN

BILINGA

COBAKI
BROADWATER

Legend

- *Archidendron hendersonii*
- *Cryptocarya foetida*
- *Lepiderema pulchella*
- *Macadamia tetraphylla*
- *Syzygium moorei*
- Subject Site

0 500m

1 : 20 000

SOURCE: Tugun Bypass Species Impact Statement (Dec 2004) Figure 4.5

SCALE: 1 : 20 000 @ A3

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Shire of Tweed

FIGURE 24

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Bypass Flora.cdr

TITLE
LOCATION OF THREATENED FLORA ADJACENT TO SUBJECT SITE

TABLE 6
POTENTIAL LOSS OF THREATENED FLORA HABITAT
FROM THE PROPOSED DEVELOPMENT

Species	Existing habitat (ha)	Area to be Removed (ha)	Area to be Removed (%)
White yiel yiel	10.99	0.14	1.3%
Scented acronychia	10.99	0.14	1.3%
Fine-leaved tuckeroo	10.99	0.14	1.3%
Spiny gardenia	10.99	0.14	1.3%
Marblewood	10.99	0.14	1.3%
Brush cassia	10.99	0.14	1.3%
Coolamon	10.99	0.14	1.3%
Green-leaved rose-walnut	10.99	0.14	1.3%
White lace flower	10.99	0.14	1.3%
Stinking cryptocarya	10.99	0.14	1.3%
Pink nodding orchid	3.80	3.80	100%
Rough-shelled bush-nut	10.99	0.14	1.3%
Swamp orchid	3.80	3.80	100%

4.2.6.3 Impacts on Threatened Flora

A plan showing the locations of Threatened flora on the subject site in relation to the proposed development is shown in **FIGURES 25, 25a, 25b & 25c** and a summary of impacts for each species is provided below:

White yiel yiel

The NPWS database (June 2010) contains twenty-four (24) records of this species within 10 km of the Subject site. Twenty-eight (28) records occur within the Tweed LGA. One (1) stem of White yiel yiel have been recorded on the subject site (**FIGURES 23 & 23a**) within the rainforest communities associated with Mt. Woodgee in the northern portion of the subject site. Two (2) additional stems of this species have been recorded within the border reserve to the north of the subject site. This species has also been recorded in adjacent habitat to the east of the subject site (EcoPro 2004) (**FIGURE 24**).

The single stem of White yiel yiel occurs outside of the proposed development footprint and will not be affected by the proposed development (**FIGURE 25a**).

The proposed development will result in the removal or modification of a total of 0.14 hectares (1.3%) of rainforest communities that are considered to represent potential habitat for this species, all of which will occur from areas of the site with existing development approvals.

Queensland
New South Wales

WATER RESERVOIR

SANDY ROAD

COBAKI PARKWAY

FIGURE 25B

FIGURE 25C

FIGURE 25A

Piggabeen Road

Cobaki Creek

Environmental Reserve

To Boyd S

N

LEGEND

- Marblewood (*Acacia bakeri*)
- Fine-leaved tuckeroo (*Lepiderema pulchella*)
- Spiny gardenia (*Randia moorei*)
- Yiel yiel (*Grevillea hilliana*)
- Coolamon (*Syzygium moorei*)
- Brush cassia (*Cassia brewsteri* var. *marksiana*)
- Scented acronychia (*Acronychia littoralis*)
- Green-leaved rose walnut (*Endiandra muelleri* subsp. *bracteata*)
- Town Centre / Neighbourhood Centre
- Residential
- Community Facilities/Education/Utilities
- Open Space
- Environmental Protection Area
- Covenant Protected Areas
- Structured Open Space
- Dam
- Proposed School (approx. 3ha)
- Proposed Community Facilities
- Site Outline

SOURCE:
Flora - James Warren & Associates Pty Ltd
June/July 2004, July 2006, July/Sept 2007 & Feb 2008
Layout - Design Forum Pty Ltd
(Ref: SK 01.01 NN Concept Plan.dwg)
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 500m
SCALE: 1 : 12 500 @ A3

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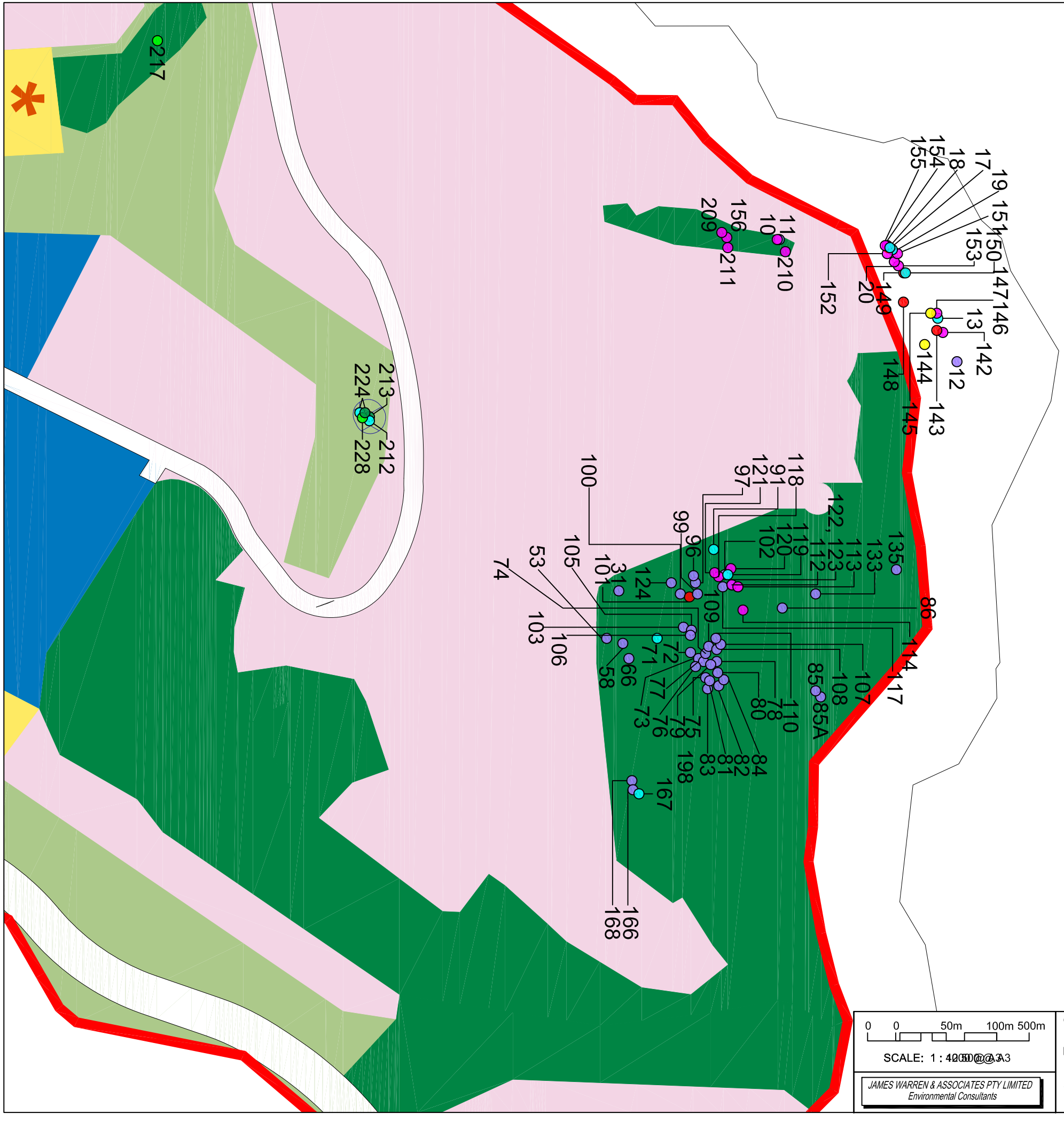
FIGURE 25

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE
IMPACT ON THREATENED FLORA



N

LEGEND

- Marblewood (*Acacia bakeri*)
- Fine-leaved tuckeroo (*Lepiderema pulchella*)
- Spiny gardenia (*Randia moorei*)
- Yiel yiel (*Grevillea hilliana*)
- Coolamon (*Syzygium moorei*)
- Brush cassia (*Cassia brewsteri* var. *marksiana*)
- Scented acronychia (*Acronychia littoralis*)
- Green-leaved rose walnut (*Endiandra muelleri* subsp. *bracteata*)
- Town Centre / Neighbourhood Centre
- Residential
- Community Facilities/Education/Utilities
- Open Space
- Environmental Protection Area
- Covenant Protected Areas
- Structured Open Space
- Dam
- Proposed School (approx. 3ha)
- Proposed Community Facilities
- Site Outline

SOURCE:
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June/July 2004, July 2006, July/Sept 2007 & Feb 2008
Layout - Design Forum Pty Ltd
(Ref: SK 01.01 NN Concept Plan.dwg)
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 0 50m 100m 500m

SCALE: 1 : 4000@A3

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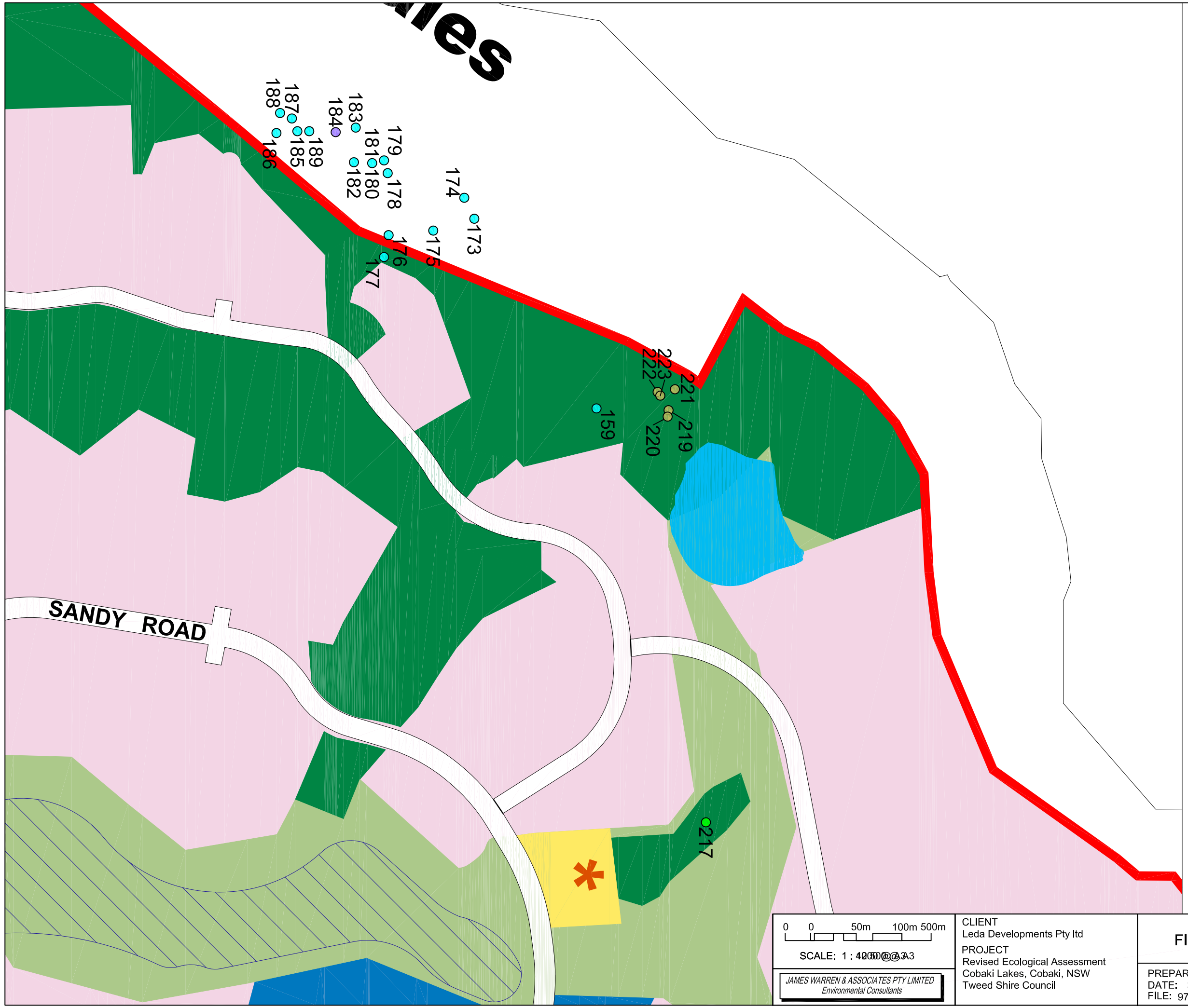
FIGURE 25A

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE
IMPACT ON THREATENED FLORA



LEGEND

- Marblewood (*Acacia bakeri*)
- Fine-leaved tuckeroo (*Lepiderema pulchella*)
- Spiny gardenia (*Randia moorei*)
- Yiel yiel (*Grevillea hilliana*)
- Coolamon (*Syzygium moorei*)
- Brush cassia (*Cassia brewsteri* var. *marksiana*)
- Scented acronychia (*Acronychia littoralis*)
- Green-leaved rose walnut (*Endiandra muelleri* subsp. *bracteata*)
- Town Centre / Neighbourhood Centre
- Residential
- Community Facilities/Education/Utilities
- Open Space
- Environmental Protection Area
- Covenant Protected Areas
- Structured Open Space
- Dam
- Proposed School (approx. 3ha)
- Proposed Community Facilities
- Site Outline

SOURCE:
Flora - James Warren & Associates Pty Ltd
June/July 2004, July 2006, July/Sept 2007 & Feb 2008
Layout - Design Forum Pty Ltd
(Ref: SK 01.01 NN Concept Plan.dwg)
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 0 50m 100m 500m

SCALE: 1 : 4000 @ A3

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FIGURE 25B

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE
IMPACT ON THREATENED FLORA

N

LEGEND

- Marblewood (*Acacia bakeri*)
- Fine-leaved tuckeroo (*Lepiderema pulchella*)
- Spiny gardenia (*Randia moorei*)
- Yiel yiel (*Grevillea hilliana*)
- Coolamon (*Syzygium moorei*)
- Brush cassia (*Cassia brewsteri* var. *marksiana*)
- Scented acronychia (*Acronychia littoralis*)
- Green-leaved rose walnut (*Endiandra muelleri* subsp. *bracteata*)
- Town Centre / Neighbourhood Centre
- Residential
- Community Facilities/Education/Utilities
- Open Space
- Environmental Protection Area
- Covenant Protected Areas
- Structured Open Space
- Dam
- Proposed School (approx. 3ha)
- Proposed Community Facilities
- Site Outline

214

SOURCE:
Flora - James Warren & Associates Pty Ltd
June/July 2004, July 2006, July/Sept 2007 & Feb 2008
Layout - Design Forum Pty Ltd
(Ref: SK 01.01 NN Concept Plan.dwg)
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 0 50m 100m 500m

SCALE: 1 : 4000@A3

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Revised Ecological Assessment
Cobaki Lakes, Cobaki, NSW
Tweed Shire Council

FIGURE 25C

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE
IMPACT ON THREATENED FLORA

The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the local distribution of habitat for this species. It is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Scented acronychia

The NPWS database (June 2010) contains nine (9) records of this species within 10 km of the Subject site. Thirty-two (32) records occur within the Tweed LGA. A total of one (1) stem of Scented acronychia has been recorded from within a small isolated clump of vegetation in the central northern portion of the subject site **FIGURES 23 & 23a**).

The Concept Plan has been amened to include this small patch of vegetation, including the single stem of Scented acronychia, within an area of Public Open Space (**FIGURE 25a**). Furthermore, it is proposed to protect this patch of vegetation under an Environmental Covenant.

The proposed development will result in the removal or modification of a total of 0.14 hectares (1.3%) of rainforest communities that are considered to represent potential habitat for this species, all of which will occur from areas of the site with existing development approvals.

The potential removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the local distribution of habitat for this species. It is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Fine-leaved tuckeroo

The NPWS database (June 2010) contains one hundred and four (104) records of this species within 10 km of the Subject site. One hundred and fifty-five (155) records occur within the Tweed LGA. A total of thirty-six (36) stems of Fine-leaved tuckeroo have been recorded on the subject site (**FIGURES 23, 23a, 23b & 23c**) the majority of which occur within the rainforest communities associated with Mt. Woodgee in the northern portion of the subject site. One (1) stem occurs within a small isolated patch of rainforest in the central southern portion of the subject site (i.e. Community 2b). This species has also been recorded in adjacent habitat to the east of the subject site (EcoPro 2004) (**FIGURE 24**).

All stems of Fine-leaved tuckeroo occur outside of the proposed development footprint and will not be affected by the proposed development (**FIGURE 25a, 25b & 25c**). The small isolated patch of rainforest in the central southern portion of the subject site (i.e. Community 2b) will be retained and protected by an Environmental covenant.

The proposed development will result in the removal or modification of a total of 0.14 hectares (1.3%) of rainforest communities that are considered to represent potential habitat for this species, all of which occurs in areas of the site which have existing development approvals. This species is particularly common within the locality with several hundred having been recorded by JWA at Terranora and Bilambil.

The removal of a small area of potential habitat, from the subject site is not considered to represent a significant impact in relation to the local distribution of habitat for this species. It is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Spiny gardenia

The NPWS database (June 2010) contains forty-two (42) records of this species within 10 km of the Subject site. Eighty-three (83) records occur within the Tweed LGA. A total of twelve (12) stems of Spiny gardenia have been recorded on the subject site (**FIGURES 23 & 23a**) the majority of which occur within the rainforest communities associated with Mt. Woodgee and in a small riparian community (near Mt. Woodgee) in the northern portion of the subject site. Six (6) additional stems of this species have been recorded within the border reserve to the north of the subject site.

All Spiny gardenia stems occur outside of the proposed development footprint and will not be affected by the proposed development (**FIGURE 25a**).

The proposed development will result in the removal or modification of a total of 0.14 hectares (1.3%) of rainforest communities that are considered to represent potential habitat for this species, all of which occurs in areas of the site which have existing development approvals.

The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the local distribution of habitat for this species. It is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Marblewood

The NPWS database (June 2010) contains thirty (30) records of this species within 10 km of the Subject site. One hundred and nineteen (119) records occur within the Tweed LGA. A total of eight (8) stems of Marblewood have been recorded on the subject site (**FIGURES 23, 23a & 23b**) from within the rainforest communities associated with Mt. Woodgee in the northern portion of the subject site, and within small isolated patches of vegetation in the central northern portion of the site. A number of specimens are also located within the steep-sided gullies near the dam on the western boundary of the subject site. Fourteen (14) additional stems of this species have been recorded adjacent to the western boundary and three (3) additional stems within the border reserve to the north.

All stems of Marblewood occur outside of the proposed development footprint and will not be affected by the proposed development (**FIGURE 25a & 25b**).

The proposed development will result in the removal or modification of a total of 0.14 hectares (1.3%) of rainforest communities that provide potential habitat for this species, all of which occurs in areas of the site which have existing development approvals.

The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the local distribution of habitat for this

species. It is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Brush cassia

The NPWS database (June 2010) contains twenty-six (26) records of this species within 10 km of the Subject site. One hundred and nine (109) records occur within the Tweed LGA. A total of two (2) stems of Brush cassia have been recorded on the subject site (**FIGURES 23, 23a & 23b**) from within small isolated patches of vegetation and riparian areas in the central northern portion of the site.

The Concept Plan has been amended to include these isolated patches of vegetation containing the Brush cassia within areas either designated as Environmental Protection Area or to be retained under Environmental covenant (**FIGURE 25a & 25b**).

The proposed development will result in the removal or modification of a total of 0.14 hectares (1.3%) of potential habitat for this species, all of which occurs in areas of the site which have existing development approvals.

The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the local distribution of habitat for this species. It is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Coolamon

The NPWS database (June 2010) contains forty-five (45) records of this species within 10 km of the Subject site. One hundred and ninety-five (195) records occur within the Tweed LGA. No specimens of Coolamon have been recorded on the subject site, however two (2) Coolamon have been recorded within the border reserve to the north of the subject site (**FIGURES 23 & 23a**).

The proposed development is considered unlikely to impact on the Coolamon which occur adjacent to the subject site (**FIGURE 25a**).

The proposed development will result in the removal or modification of a total of 0.14 hectares (1.3%) of rainforest communities considered to represent potential habitat for this species, all of which occurs in areas of the site which have existing development approvals.

The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the local distribution of habitat for this species.

Green-leaved rose walnut

The NPWS database (June 2010) contains six (6) records of this species within 10 km of the Subject site. Thirty-nine (39) records occur within the Tweed LGA. A total of five (5) stems of Green-leaved rose-walnut have been recorded on the subject site (**FIGURES 23 & 23b**) from within the steep-sided gullies near the dam on the western

boundary of the subject site. This species has also been recorded in adjacent habitat to the east of the subject site (EcoPro 2004) (**FIGURE 24**).

None of the Green-leaved rose-walnuts occur within the proposed development footprint (**FIGURE 25b**).

The proposed development will result in the removal or modification of a total of 0.14 hectares (1.3%) of rainforest communities considered to represent potential habitat for this species, all of which occurs in areas of the site which have existing development approvals.

The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the local distribution of habitat for this species. It is considered that the proposed development is highly unlikely to result in the local extinction of this species.

White lace flower

The NPWS database (June 2010) contains sixteen (16) records of this species within 10 km of the Subject site. Twenty-seven (27) records occur within the Tweed LGA. This species has been recorded from rainforest communities adjacent to the subject site (EcoPro 2004) (**FIGURE 24**). However, extensive searches on the subject site (JWA 2000 – 2007) have failed to record this species.

Suitable habitat for the White lace flower is considered to be comprised of undisturbed riverine and lowland subtropical rainforest communities on and adjacent to the subject site. The proposed development will result in the removal or modification a total of 0.14 hectares (1.3%) of potential habitat for this species, all of which occurs in areas of the site which have existing development approvals.

The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the local distribution of habitat for this species. It is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Stinking cryptocarya

The NPWS database (June 2010) contains forty-three (43) records of this species within 10 km of the Subject site. Seventy-two (72) records occur within the Tweed LGA. This species has been recorded from rainforest communities adjacent to the subject site (EcoPro 2004) (**FIGURE 24**). However, extensive searches on the subject site (JWA 2000 – 2007) have failed to record this species.

Suitable habitat for this species is considered to be comprised of undisturbed riverine and lowland subtropical rainforest communities on and adjacent to the subject site. The proposed development will result in the removal or modification a total of 0.14 hectares (1.3%) of potential habitat for this species, all of which occurs in areas of the site which have existing development approvals.

The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the local distribution of habitat for this

species. It is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Pink nodding orchid

The NPWS database (June 2010) contains seven (7) records of this species within 10 km of the Subject site. Seventeen (17) records occur within the Tweed LGA. This species has been recorded from Swamp forest adjacent to the subject site (EcoPro 2004) (**FIGURE 24**). However, extensive searches on the subject site (JWA 2000 – 2007) have failed to record this species.

Suitable habitat for this species is considered to be comprised of undisturbed dry eucalypt forest and coastal swamp forest at lower altitudes on and adjacent to the subject site. The proposed development will result in the removal or modification a total of 3.8 hectares of potential habitat for this species, all of which occurs in areas of the site which have existing development approvals.

The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the local distribution of habitat for this species. It is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Rough-shelled bush-nut

The NPWS database (June 2010) contains seventy-seven (77) records of this species within 10 km of the Subject site. One hundred and seventy (170) records occur within the Tweed LGA. This species has been recorded from rainforest communities adjacent to the subject site (EcoPro 2004) (**FIGURE 24**). However, extensive searches on the subject site (JWA 2000 – 2007) have failed to record this species.

Suitable habitat for this species is considered to be comprised of undisturbed subtropical rainforest communities on and adjacent to the subject site. The proposed development will result in the removal or modification a total of 0.14 hectares (1.3%) of potential habitat for this species, all of which occurs in areas of the site which have existing development approvals.

The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the local distribution of habitat for this species. It is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Swamp orchid

The NPWS database (June 2010) contains two (2) records of this species within 10 km of the Subject site. Four (4) records occur within the Tweed LGA. This species has been recorded from Swamp forest adjacent to the subject site (EcoPro 2004) (**FIGURE 24**). However, extensive searches on the subject site (JWA 2000 – 2007) have failed to record this species.

Suitable habitat for the Swamp orchid is considered to be comprised of undisturbed swamp sclerophyll forest communities on and adjacent to the subject site. The

proposed development will result in the removal or modification a total of 3.8 hectares of potential habitat for this species, all of which occurs in areas of the site which have existing development approvals.

The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the local distribution of habitat for this species. It is considered that the proposed development is highly unlikely to result in the local extinction of this species.

4.2.6.4 Amelioration for Threatened flora

The major amelioration strategy for Threatened flora species on the subject site is the retention and long-term protection of suitable habitat within Environmental Protection Areas.

All of the Threatened plants recorded on and adjacent to the subject site, with the exception of the Swamp orchid and the Pink nodding orchid, are typical of lowland rainforest. Approximately 10.85 hectares (98.7%) of lowland rainforest communities occurring on the subject site will be retained, and an additional 12.12 hectares of land is proposed to be rehabilitated as lowland rainforest in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a). This will ensure a net gain of 11.98ha of suitable habitat for the majority of Threatened flora species on the subject site. Furthermore, these areas will ensure protection for retained Threatened flora species and also provide additional habitat for Threatened flora species occurring on and adjacent to the subject site. Rehabilitation of lowland rainforest communities is discussed further in Section 4.2.6.6.

The Swamp orchid and the Pink nodding orchid have been recorded adjacent to the subject site and are typical of swamp sclerophyll forest communities. The entire area of existing Swamp sclerophyll forest on coastal floodplain will be lost from the subject site. The conservation significance of this community has been severely compromised by past land-use activities including cattle grazing and periodic slashing which has resulted in the removal of the midstorey and the prevalence of introduced grasses and common agricultural weeds in the groundcover layer.

In total, 23.74 hectares of Swamp sclerophyll forest will be regenerated/revegetated on the subject site in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) to offset the loss of 3.8 hectares. This will ensure a net gain of 19.94ha of suitable habitat for these Threatened flora species on the subject site. Furthermore, these areas will ensure protection for retained Threatened flora species and also provide additional habitat for Threatened flora species occurring on and adjacent to the subject site. Rehabilitation of swamp sclerophyll forest communities is discussed further in Section 4.2.6.6.

It is also recommended that propagation of Threatened flora species be undertaken as part of the rehabilitation works on the subject site in an attempt to bolster local populations. The rationale and methodology of Threatened plant propagation will be detailed within individual regeneration and revegetation plans to be completed for each of the rehabilitation precincts (in accordance with the Revised Site Regeneration and Revegetation Plan – JWA 2010a) at the Operational Works stage.

As a minimum, every retained Threatened plant on the subject site will be provided with a 5m vegetated buffer.

4.2.6.5 Impacts on Endangered Ecological Communities

Six (6) Endangered Ecological Communities (EECs) have been recorded on the subject site, including:

- Swamp sclerophyll forest on coastal floodplain - which occurs as an isolated clump of scattered Swamp mahogany in the central eastern of the Subject site;
- Lowland rainforest on floodplain - occurring at various locations generally in association with drainage lines and depressions;
- Lowland rainforest - occurring on Mt. Woodgee and on lower slopes in the northern portion of the subject site;
- Freshwater wetlands - occurring in the central and eastern portions of the site;
- Swamp oak floodplain forest – occurring in association with drainage lines in the south-east of the site; and
- Coastal saltmarsh in the NSW North Coast bioregion - occurring in the south-east of the site.

The locations of these EEC's are shown in **FIGURE 26.** The potential impacts of the proposed development on EEC's recorded on the site are discussed briefly below. A plan showing the locations of EEC's in relation to the proposed development is shown in **FIGURE 27**. A summary of the impacts on EEC's is provided in **TABLE 7.**

TABLE 7
POTENTIAL LOSS OF EEC'S FROM THE PROPOSED DEVELOPMENT

Existing EEC	TOTAL AREA (ha)	Area to be Removed (ha)	Area to be Removed (%)
Swamp Sclerophyll Forest on Coastal Floodplain	3.80	3.80	100%
Lowland Rainforest on Floodplain	1.75	0.04	2.29%
Lowland Rainforest	9.24	0.10	1.08%
Freshwater Wetland	35.39	25.68	72.56%
Swamp oak floodplain forest	4.24	0.95	22.41%
Saltmarsh	54.63	10.25	18.76%

Swamp sclerophyll forest on coastal floodplain

This EEC occurs in the central eastern potion of the subject site and is comprised of approximately 3.80 hectares of Mid-high open woodland (*Eucalyptus robusta*) (**FIGURE 26**).

The entire area of existing Swamp sclerophyll forest on coastal floodplain will be lost from the subject site (**FIGURE 27**). The conservation significance of this community has been severely compromised by past land-use activities including cattle grazing and periodic slashing which has resulted in the removal of the midstorey and the prevalence

N

LEGEND

- Lowland Rainforest
- Lowland Rainforest on Floodplain
- Swamp Sclerophyll Forest on Floodplain
- Swamp Oak Floodplain Forest
- Freshwater Wetland (Degraded)
- Saltmarsh
- Site Outline

SOURCE:
EEC's - James Warren & Associates Pty Ltd
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 500m

SCALE: 1 : 12 500 @ A3

JAMES WARREN & ASSOCIATES PTY LIMITED
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Revised Ecological Assessment
Cobaki Lakes, Cobaki, NSW
Tweed Shire Council

FIGURE 26

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE
ENDANGERED ECOLOGICAL COMMUNITIES

N

LEGEND

- Lowland Rainforest
- Lowland Rainforest on Floodplain
- Swamp Sclerophyll Forest on Floodplain
- Swamp Oak Floodplain Forest
- Freshwater Wetland (Degraded)
- Saltmarsh
- Proposed Development Areas
- Site Outline

SOURCE:
EEC's - James Warren & Associates Pty Ltd
Layout - Design Forum Pty Ltd
(Ref: SK 01.01 NN Concept Plan.dwg)
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 500m

SCALE: 1 : 12 500 @ A3

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CLIENT
Leda Developments Pty ltd

PROJECT
Revised Ecological Assessment
Cobaki Lakes, Cobaki, NSW
Tweed Shire Council

FIGURE 27

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE
IMPACT ON ENDANGERED ECOLOGICAL COMMUNITIES

of introduced grasses and common agricultural weeds in the groundcover layer. The Mid-high open woodland (*E. robusta*) community on the subject site is therefore generally comprised of scattered trees within a slashed/grazed grassland environment.

The removal of this vegetation community will occur from an area of the site which has an existing development approval. The removal of this small area of degraded Swamp sclerophyll forest on coastal floodplain from the subject site is not considered to represent a significant impact in relation to the local distribution of this community. Offsets to ensure no net loss are discussed in Section 4.2.6.6.

Lowland rainforest on floodplain

This EEC occurs as several isolated patches of forest in the southern and northern portions of the subject site generally in association with drainage lines and depressions (i.e. riparian forest) (**FIGURE 26**). Lowland rainforest on floodplain covers a total area of approximately 1.75 hectares on the subject site.

In total 0.04 hectares of Lowland rainforest on floodplain (2.3%) will be lost from the subject site (**FIGURE 27**), all of which occurs within portions of the site with existing development approvals.

The conservation significance of these communities has been compromised by historical clearing activities which have resulted in the fragmentation of rainforest communities. The removal of this small area of degraded Lowland rainforest on floodplain from the subject site is not considered to represent a significant impact in relation to the local distribution of this community. Offsets to ensure no net loss are discussed in Section 4.2.6.6.

Lowland rainforest

This EEC occurs on Mt. Woodgee and associated slopes in the northern portion of the subject site (**FIGURE 26**) and covers a total area of approximately 9.24 hectares. Vegetation on Mt. Woodgee (i.e. Community 2a) is relatively intact and is considered to represent one of the most ecologically significant vegetation communities on the subject site, particularly in terms of habitat value for Threatened flora species.

Approximately 0.1 hectares of this EEC (1.1%) will be lost from the subject site (**FIGURE 27**), all of which occurs within portions of the site with existing development approvals. 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 local distribution of this community. Offsets to ensure no net loss are discussed in Section 4.2.6.6.

Freshwater wetlands

This EEC is comprised of areas of Rushland/Sedgeland/Grassland (i.e. Community 12) on the subject site covering a total area of approximately 35.39 hectares (**FIGURE 26**). The large area of Freshwater wetland in the central portion of the site has been heavily degraded by past and existing land use including drain construction and maintenance, grazing and slashing. Scattered patches of this EEC also occur in the eastern portions of

the site which are generally dominated by Saltmarsh communities. It is likely that the freshwater communities in this portion of the site are occurring as a result of historical changes to the tidal inundation in this portion of the site.

In total 25.68 hectares of Freshwater wetland (72.6%) will be lost from the subject site as a direct result of the proposed development (**FIGURE 27**). Furthermore, it is proposed to restore the natural tidal regime in the eastern portion of the subject site with the intention of returning the entire area to its original Saltmarsh status.

The removal of areas of highly degraded Freshwater wetland from the subject site is not considered to represent a significant impact in relation to the local distribution of this community. Offsets to ensure no net loss are discussed in Section 4.2.6.6.

Swamp oak floodplain forest

This EEC occurs in the south-eastern portion of the subject site in association with drainage lines and covers an area of approximately 4.52 hectares (**FIGURE 26**). This community occurs in an area that is currently subject to tidal inundation via the main constructed drain in this portion of the site (i.e. Dunn's drain) and also through a breach in the constructed levy bank adjacent to the creek. This community occurs as linear stands of trees along the edges of constructed drains. Additionally, this area is currently actively grazed by cattle under existing use rights (i.e. routine agricultural activities) which has resulted in the prevalence of introduced grasses and common agricultural weeds in some areas.

In total 0.95 hectares of Swamp oak floodplain (21%) will be lost from the subject site (**FIGURE 27**). The removal of this small area of Swamp oak floodplain forest from the subject site is not considered to represent a significant impact in relation to the local distribution of this community. Offsets to ensure no net loss are discussed in Section 4.2.6.6.

Coastal saltmarsh in the NSW North Coast bioregion

This EEC occurs in the south-eastern potion of the subject site adjacent to Cobaki Creek and covers an area of approximately 54.63 hectares (**FIGURE 26**). This area is currently subject to tidal inundation via the main constructed drain in this portion of the site (i.e. Dunn's drain) and also through a breach in the constructed levy bank adjacent to the creek. This area is currently actively grazed by cattle, and slashed in some areas, under existing use rights (i.e. routine agricultural activities). This has resulted in the prevalence of introduced grasses and common agricultural weeds in some areas.

In total 10.25 hectares of Coastal saltmarsh (18.8%) will be lost from the subject site (**FIGURE 27**). The removal of this small area of degraded Coastal saltmarsh from the subject site is not considered to represent a significant impact in relation to the local distribution of this community. Offsets to ensure no net loss are discussed in Section 4.2.6.6.

4.2.6.6 Amelioration for Endangered Ecological Communities

The major amelioration strategy for EEC's on the subject site is the retention and long-term protection of these vegetation communities where possible within Environmental Protection Areas.

The Site Regeneration and Revegetation Plan (JWA 2010a) outlines the various measures to ensure that the retained EEC's are adequately managed. Furthermore, revegetation/regeneration will be completed in accordance with this plan to offset any loss of EEC's (**FIGURE 28**). A summary of proposed EEC offsets is provided in **TABLE 8.**

Where impacts are likely on EEC's, a combination of offset measures have been proposed as follows:

1. Offset areas will be established and maintained on the subject site in accordance with the following plans:
    a. Revised Site Regeneration and Rehabilitation Plan (JWA 2010a);
    b. Revised Freshwater Wetland Rehabilitation Plan (JWA 2010b); and
    c. Revised Saltmarsh Rehabilitation Plan (JWA 2010c).
2. In instances where appropriate offset areas are not available on the subject site, Leda Manorstead Pty Ltd is currently carrying out negotiations with DECCW with a view to securing appropriate off-site offsets.

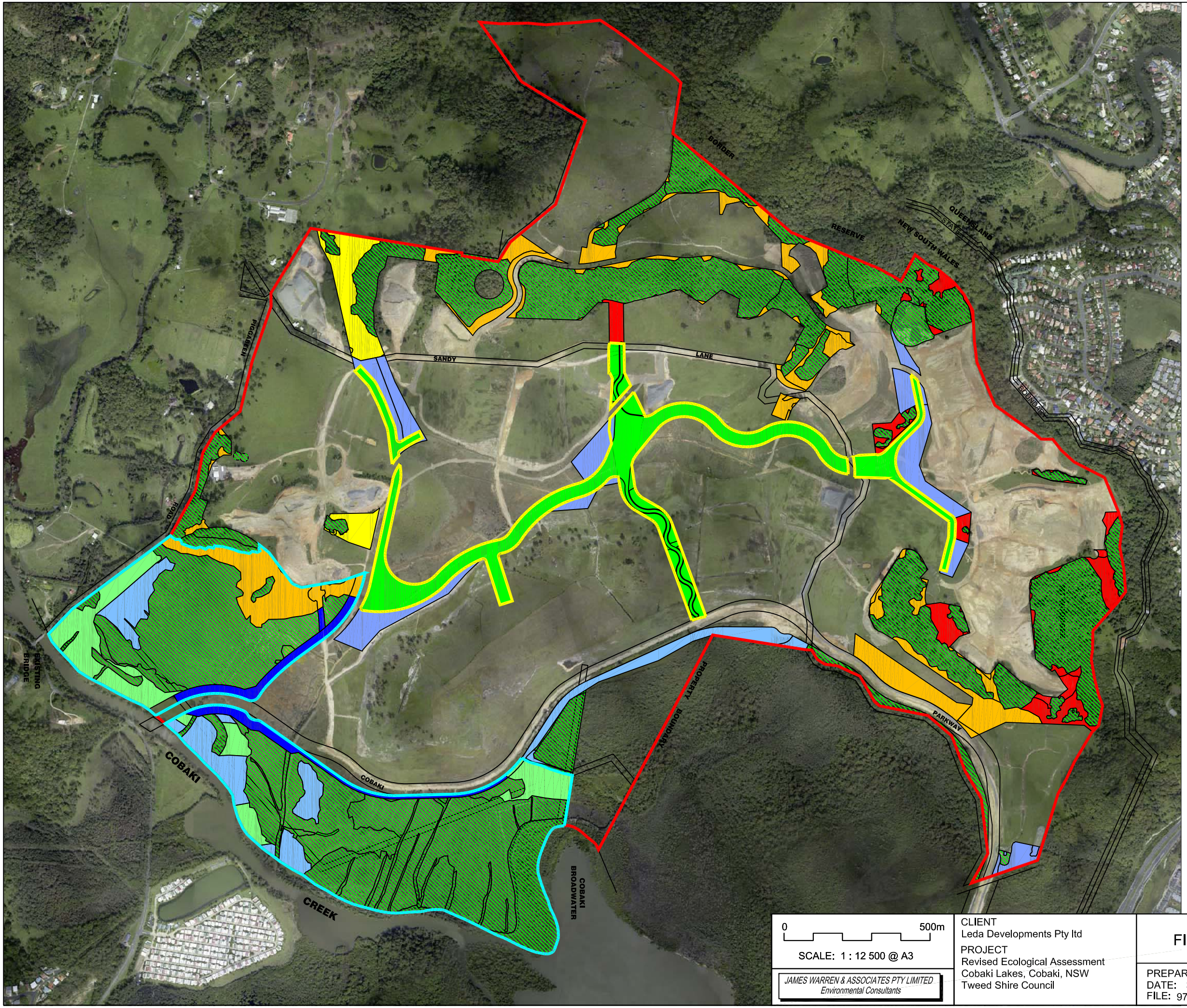
TABLE 8
PROPOSED EEC OFFSETS ON THE SUBJECT SITE

EEC Offset Areas	Current total area (ha)	Loss - TOTAL (ha)	Proposed Offsets (ha)	Total area at completion of development (ha)	Net Loss/Gain (ha)
Swamp Sclerophyll Forest on Floodplain	3.80	3.80	23.74	23.74	+19.94
Lowland Rainforest on Floodplain	1.75	0.04	5.06	6.77	+5.02
Lowland Rainforest	9.24	0.10	7.06	16.20	+6.96
Freshwater Wetland	35.39	25.68	21.77	31.48	-3.91
Saltmarsh	54.63	10.25	14.3[1]	58.68	+4.05
Swamp oak Floodplain Forest	4.52	0.95	9.74[1]	13.31	+8.79

Swamp sclerophyll forest on coastal floodplain

Amelioration for the removal of the degraded Swamp sclerophyll forest on coastal floodplain will be provided through revegetation works on the subject site. The Revised Site Regeneration and Revegetation Plan (JWA 2010a) includes measures to offset the loss of this EEC from the subject site. Additional compensation will be provided through regeneration and revegetation works in accordance with the Revised Freshwater Wetland Rehabilitation Plan (JWA 2010b).

[1] Some of the revegetation of Saltmarsh and Swamp oak floodplain forest will occur in combination over the same area. The Swamp she-oak will make up the canopy and the Saltmarsh the groundcover.



N

LEGEND

ENDANGERED ECOLOGICAL COMMUNITIES (EEC) OFFSET AREAS

- Lowland Rainforest
- Lowland Rainforest on Floodplain
- Swamp Sclerophyll Forest on Floodplain
- Freshwater Wetland
- Saltmarsh
- Swamp Sheoak Floodplain Forest / Saltmarsh

OTHER

- Wet Sclerophyll Forest
- Retained Vegetation
- Freshwater Wetland Management Area
- Salt Marsh Rehabilitation Area
- Site Outline

SOURCE:
EEC's - James Warren & Associates Pty Ltd
Layout - Design Forum Pty Ltd
(Ref: SK 01.01 NN Concept Plan.dwg)
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 500m

SCALE: 1 : 12 500 @ A3

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Tweed Shire Council

FIGURE 28

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE
ENDANGERED ECOLOGICAL COMMUNITIES OFFSET AREAS

In total, 23.74 hectares of Swamp sclerophyll forest will be regenerated/revegetated on the subject site (**FIGURE 28**) to offset the loss of 3.8 hectares. The proposed offsets will result in a net gain of 19.94ha of this EEC on the subject site.

Both the Revised Site Regeneration and Revegetation Plan (JWA 2010a) and the Revised Freshwater Wetland Rehabilitation Plan (JWA 2010b) include specific performance criteria as well as detailed maintenance and monitoring programs and it is therefore considered that the compensatory Swamp sclerophyll forest on coastal floodplain will be more likely to persist in the long-term compared to the existing communities.

Lowland rainforest on floodplain

Amelioration for the removal of a very small area of Lowland rainforest on floodplain (i.e. 0.04ha) will be provided through revegetation works on the subject site. The Revised Site Regeneration and Revegetation Plan (JWA 2010a) includes measures to offset the loss of this EEC from the subject site. 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 Revised Site Regeneration and Revegetation Plan (JWA 2010a) includes specific performance criteria as well as a detailed maintenance and monitoring program to ensure the persistence of this EEC in the long-term.

In total, 5.06 hectares of Lowland rainforest will be regenerated/revegetated on the subject site (**FIGURE 28**) to offset the loss of 0.04 hectares. The proposed offsets will result in a net gain of 5.02ha of this EEC on the subject site. Retained Lowland rainforest on floodplain communities will be provided with a 10m vegetated buffer as a minimum.

Lowland rainforest

Amelioration for the removal of a very small area of Lowland rainforest (i.e. 0.1ha) will be provided through revegetation works on the subject site. The Revised Site Regeneration and Revegetation Plan (JWA 2010a) includes measures to offset any loss of this EEC from the subject site. 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 Revised Site Regeneration and Revegetation Plan (JWA 2010a) includes specific performance criteria as well as a detailed maintenance and monitoring program to ensure the persistence of this EEC in the long-term.

In total, 7.06 hectares of Lowland rainforest on floodplain will be regenerated/revegetated on the subject site (**FIGURE 28**) to offset the loss of 0.1 hectares. The proposed offsets will result in a net gain of 6.96ha of this EEC on the subject site. Retained Lowland rainforest communities will be provided with a 10m vegetated buffer as a minimum.

Freshwater wetlands

The Revised Freshwater Wetland Rehabilitation Plan (JWA 2010b) includes measures to provide more intact wetland communities on the subject site. Offsets for the removal of highly degraded Freshwater wetland vegetation from the subject site will include the following:

1. Recreation of approximately 2.25ha of high quality wetland habitats. These compensatory Freshwater wetlands will be offline from the stormwater treatment train and will also be specifically designed to provide core (breeding) habitat for the Wallum froglet;
2. Approximately 19.52ha of Freshwater wetland vegetation will be provided through revegetation works associated with the stormwater conveyance and treatment infrastructure on the subject site; and
3. Additionally, Leda Manorstead Pty Ltd is currently carry out negotiations with DECCW with a view to securing appropriate off-site offsets.

In total, 21.77 hectares of Freshwater wetlands will be regenerated/revegetated on the subject site (**FIGURE 28**) to partly offset the loss of 25.68 hectares. The Revised Freshwater Wetland Rehabilitation Plan (JWA 2010b) includes specific performance criteria as well as a detailed maintenance and monitoring program and it is therefore considered that the rehabilitated Freshwater wetlands will be more likely to persist in the long-term compared to the existing community.

Swamp oak floodplain forest

The removal of approximately 0.95 hectares of the Swamp oak floodplain forest community from the subject site will be ameliorated by regenerating and revegetating compensatory Swamp oak communities on the subject site. Areas within and adjacent to the existing Saltmarsh communities on the subject site are currently comprised of a mixture of exotic grasses and will be restored to Saltmarsh and Swamp oak communities in accordance with the Revised Saltmarsh Restoration Plan (JWA 2010c). Removal of cattle from the area and subsequent relinquishment of existing use rights is considered an integral component of the rehabilitation process.

In total, 9.74 hectares of Swamp oak floodplain forest will be regenerated/revegetated on the subject site (**FIGURE 28**) to offset the loss of 0.95 hectares. The proposed offsets will result in a net gain of 8.79ha of this EEC on the subject site.

Coastal saltmarsh in the NSW North Coast bioregion

The removal of approximately 10.25 hectares of Saltmarsh communities from the subject site will be ameliorated by regenerating and revegetating compensatory Saltmarsh communities on the subject site (**FIGURE 28**). Offsets for the removal of degraded Saltmarsh vegetation from the subject site will include the following:

1. Large areas adjacent to the existing Saltmarsh communities are currently comprised of a mixture of exotic grasses and will be restored to Saltmarsh

communities in accordance with the Revised Saltmarsh Restoration Plan (JWA 2010c).

2. Re-establishment of saltmarsh species will be completed on the batters along the eastern edge of the Cobaki Parkway after construction is complete.
3. The Revised Saltmarsh Restoration Plan (JWA 2010c) also includes the provision of retreat areas for Saltmarsh communities in the event of sea-level rise.
4. Removal of cattle from the area and subsequent relinquishment of existing use rights is considered an integral component of the rehabilitation process.
5. The entire area of the existing Saltmarsh which is to be retained (i.e. 44.53ha) will be rehabilitated in accordance with the Revised Saltmarsh Restoration Plan (JWA 2010c). This will essentially involve restoring a natural tidal regime to the area.

In total, 14.3 hectares of Saltmarsh vegetation will be regenerated/revegetated on the subject site (**FIGURE 28**) to offset the loss of 10.25 hectares. The proposed offsets listed above will result in a net gain of 4.05ha of this EEC on the subject site.

4.2.6.7 Impacts & Amelioration for Threatened Fauna and their habitat

Twelve (12) Threatened fauna species have been recorded from the subject site including:

- Wallum froglet (*Crinia tinnula*) – Vulnerable (TSC Act 1995);
- Black-necked stork (*Xenorhynchus asiaticus*) – Endangered (TSC Act 1995);
- Powerful owl (*Ninox strenua*) – Vulnerable (TSC Act 1995);
- Masked owl – (*Tyto novaehollandiae*) - Vulnerable (TSC Act 1995);
- Osprey (*Pandion haliaetus*) - Vulnerable (TSC Act 1995);
- Koala (*Phascolarctos cinereus*) - Vulnerable (TSC Act 1995);
- Grey-headed flying-fox (*Pteropus poliocephelus*) - Vulnerable (EPBC Act 1999);
- Little bent-wing bat (*Miniopterus australis*) - Vulnerable (TSC Act 1995);
- Common bent-wing bat (*Miniopterus schreibersii*) - Vulnerable (TSC Act 1995);
- Eastern free-tail bat (*Mormopterus norfolkensis*) - Vulnerable (TSC Act 1995);
- Yellow-bellied sheathtail bat (*Saccolaimus flaviventris*) - Vulnerable (TSC Act 1995); and
- Greater broad-nosed bat (*Scoteanax rueppellii*) - Vulnerable (TSC Act 1995).

Threatened fauna sightings on the subject site are shown in **FIGURE 29.**

An additional eighteen (18) Threatened species have been recorded during surveys on adjacent land, including:

- Wallum sedge-frog (*Litoria olongburensis*) - Vulnerable (TSC Act 1995) & Endangered (EPBC Act 1999);
- Bush hen (*Amaurornis olivaceus*) - Vulnerable (TSC Act 1995);
- Glossy black-cockatoo (*Calyptorhynchus lathami*) - Vulnerable (TSC Act 1995);

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LEGEND

- Black-necked stork (*Ephippiorhynchus asiaticus*)
- Osprey (*Pandion haliaetus*) - Old Nest
- Osprey (*Pandion haliaetus*) - New Nest
- Powerful owl (*Ninox strenua*)
- *Grey-headed flying-fox* (*Pteropus poliocephalus*)
- Koala (*Phascolarctos cinereus*)
- Wallum froglet (*Crinia tinnula*) Locations
- Masked owl (*Tyto novaehollandiae*)
- Site Outline

SOURCE:
Fauna - James Warren & Associates Pty Ltd
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 500m

SCALE: 1 : 12 500 @ A3

JAMES WARREN & ASSOCIATES PTY LIMITED
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Revised Ecological Assessment
Cobaki Lakes, Cobaki, NSW
Tweed Shire Council

FIGURE 29

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE
LOCATIONS OF THREATENED FLORA

- Brolga (*Grus rubicunda*) - Vulnerable (TSC Act 1995);
- Black bittern (*Ixobrychus flavicollis*) - Vulnerable (TSC Act 1995);
- Mangrove honeyeater (*Lichenostomus fasciogularis*) - Vulnerable (TSC Act 1995);
- White-eared monarch (*Monarcha leucotis*) - Vulnerable (TSC Act 1995);
- Wompoo fruit-dove (*Ptilinopus magnificus*) - Vulnerable (TSC Act 1995);
- Rose-crowned fruit-dove (*Ptilinopus regina*) - Vulnerable (TSC Act 1995);
- Superb fruit-dove (*Ptilinopus superbus*) - Vulnerable (TSC Act 1995);
- Collared kingfisher (*Todiramphus chloris*) - Vulnerable (TSC Act 1995);
- Eastern grass owl (*Tyto capensis*) - Vulnerable (TSC Act 1995);
- Large-footed myotis (*Myotis adversus*) - Vulnerable (TSC Act 1995);
- Eastern long-eared bat (*Nyctophilus bifax*) - Vulnerable (TSC Act 1995);
- Squirrel glider (*Petaurus norfolkensis*) - Vulnerable (TSC Act 1995);
- Common planigale (*Planigale maculata*) - Vulnerable (TSC Act 1995);
- Long-nosed potoroo (*Potorous tridactylus*) - Vulnerable (TSC Act 1995);
- Common blossom bat (*Syconycteris australis*) - Vulnerable (TSC Act 1995).

Threatened fauna sightings adjacent to the subject site are shown in **FIGURE 30.**

Suitable habitat for Threatened fauna to be removed from the subject site occurs within existing 2(c) zoned land (i.e. Urban Expansion), land proposed to be rezoned as 2(c), or land that may otherwise be cleared in accordance with existing use rights.

A summary of impacts for each species recorded on and adjacent to the subject site is provided in **TABLE 9.**

TABLE 9
POTENTIAL LOSS OF THREATENED FAUNA HABITAT FROM THE PROPOSED DEVELOPMENT

Species	Existing habitat (ha)	Area to be Removed (ha)	Area to be Removed (%)
Wallum froglet	79.12	69.29	87.58%
Black-necked stork	140.60	82.39	58.60%
Powerful owl	69.82	13.67	19.58%
Masked owl	69.82	13.67	19.58%
Osprey*	-	-	-
Koala	42.41	12.50	29.47%
Grey-headed flying-fox	72.26	13.54	18.74%
Little bent-wing bat[1]	72.26	13.54	18.74%
Common bent-wing bat[1]	72.26	13.54	18.74%
Eastern free-tail bat[1]	72.26	13.54	18.74%
Yellow-bellied sheathtail bat[1]	72.26	13.54	18.74%
Greater broad-nosed bat[1]	72.26	13.54	18.74%
Wallum sedge frog	35.39	25.68	72.56%

N

TUGUN

BILINGA

COBAKI
BROADWATER

Legend

- Black bittern
- Brolga
- Bush hen
- Bush hen (unconfirmed sighting)
- Glossy black cockatoo
- Eastern grass owl
- Mangrove honeyeater
- Masked owl
- Osprey
- Rose-crowned fruit-dove
- Superb fruit-dove (unconfirmed sighting)
- Wallum sedge frog
- Wallum froglet
- Black flying fox
- Common blossom bat
- Common planigale
- Eastern long-eared vat
- Grey-headed flying fox (roost site)*
- Large-footed myotis
- Little bent-wing bat
- Long-nosed potoroo
- Squirrel glider
- Subject Site

Grey-headed flying fox was recorded throughout the area.

0 500m

1 : 20 000

SOURCE: Tugun Bypass Species Impact Statement (Dec 2004) Figures 4.6-4.8

SCALE: 1 : 20 000 @ A3

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Shire of Tweed

FIGURE 30

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Bypass Fauna.cdr

TITLE
LOCATION OF THREATENED FAUNA ADJACENT TO SUBJECT SITE

Species	Existing habitat (ha)	Area to be Removed (ha)	Area to be Removed (%)
Bush hen	1.41	0.02	1.42%
Glossy black-cockatoo	48.61	5.42	11.15%
Brolga	140.60	82.39	58.60%
Black bittern	10.18	0.95	9.33%
Mangrove honeyeater	5.66	-	0%
White-eared monarch	10.99	0.14	1.27%
Wompoo fruit-dove	10.99	0.14	1.27%
Rose-crowned fruit-dove	10.99	0.14	1.27%
Superb fruit-dove	10.99	0.14	1.27%
Collared kingfisher	5.66	-	0%
Eastern grass owl	2.44	-	0%
Large-footed myotis	2.33	1.90	81.55%
Eastern long-eared bat	10.99	0.14	1.27%
Squirrel glider	52.81	9.55	18.08%
Common planigale	74.93	13.67	18.24%
Long-nosed potoroo[#]	-	-	-
Common blossom bat	3.80	3.80	100%

***** Nesting habitat only
[#] Habitat adjacent to the subject site only
[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

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

Wallum froglet

Impacts

The NPWS database (June 2010) contains two hundred and eight (208) records of this species within 10 km of the Subject site. Two hundred and thirty-six (236) records occur within the Tweed LGA. Wallum froglets have been recorded within Paperbark areas, sedgelands and in the main drainage channel and adjacent sedgeland in the east of the property (**FIGURE 31**). This species has also been recorded in a number of locations adjacent to the subject site (EcoPro 2004) and is very widespread (**FIGURE 30**). The local population is estimated to comprise approximately 10,000 individuals (Hero *et al*. 2001).

Core habitat for this species is considered to be comprised of undisturbed wet heathland and wetland communities adjacent to the subject site whilst remaining habitats (i.e. adjoining areas of grassland and slashed areas) are considered to provide forage habitat when inundated during wet periods (**FIGURE 29**). Due to a history of disturbance to wetland communities on the subject site, no core habitat is considered

LEGEND

- Wallum froglet (*Crinia tinnula*) Locations
- Wallum froglet (*Crinia tinnula*) Core Habitat
- Identified Wallum froglet (*Crinia tinnula*) Forage Habitat
- Potential Wallum froglet (*Crinia tinnula*) Forage Habitat (see note)
- Site Outline

Note: Drainage lines and low lying areas in this portion of the site are considered foraging habitat. The exact location and extent of foraging habitat in this area will be the subject of detailed assessment at the DA stage.

SOURCE:
Frogs - James Warren & Associates Pty Ltd
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 500m

SCALE: 1 : 12 500 @ A3

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Revised Ecological Assessment
Cobaki Lakes, Cobaki, NSW
Tweed Shire Council

FIGURE 31

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE
WALLUM FROGLET LOCATIONS & HABITAT

to occur. However, approximately 79.12 hectares of forage habitat is considered likely to occur on the subject site during suitable conditions (i.e. localised flooding after periods of heavy rainfall).

The proposed development may result in direct mortality to individuals of this species during construction due to habitat loss and/or being run over by machinery. However, the loss of some individuals and habitat of this widespread species during construction is unlikely to significant impact upon the local population of Wallum froglets. The proposed development will not remove or modify any area considered to provide core habitat for the Wallum froglet (i.e. breeding habitat, refuge habitat).

Approximately 69.29 hectares (87.58%) of potential forage habitat will be removed from the subject site. The majority of this vegetation removal will occur from portions of the site with existing development approvals.

Additional impacts may include:

- Alteration of water quality in drainage lines due to soil runoff from the construction site.
- Alteration of hydrology of the drainage lines due to construction.
- Contamination or reduction of water quality in drainage lines due to runoff from chemicals or debris (fertilisers, etc).
- Introduction of weed species into core habitat areas.
- Increased competition from disturbance-adapted native, domestic and introduced fauna (such as Cane toads, Noisy miners, foxes, dogs, cats, rats, etc.).

Amelioration

Offsets for the removal of highly degraded Freshwater wetland vegetation from the subject site will include the following:

1. Recreation of approximately 2.25ha of high quality wetland habitats. These compensatory Freshwater wetlands will be offline from the stormwater treatment train and will also be specifically designed to provide core (breeding) habitat for the Wallum froglet;
2. Approximately 19.52ha of Freshwater wetland vegetation will be provided through revegetation works associated with the stormwater conveyance and treatment infrastructure on the subject site; and
3. Additionally, Leda Manorstead Pty Ltd is currently in negotiations with DECCW with a view to securing appropriate off-site offsets.

A number of areas on the subject site will be rehabilitated in accordance with a Revised Freshwater Wetland Rehabilitation Plan (JWA 2010b). These areas will be designed to provide approximately 2.25 hectares of core habitat (i.e. offline from stormwater treatment) and 19.52 hectares of potential forage habitat for the Wallum froglet on the subject site. Furthermore, 23.74 hectares of Swamp sclerophyll forest will be regenerated/revegetated on the subject site (**FIGURE 28**) in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) and these areas are

likely to provide suitable forage habitat for this species and offset any loss of forage habitat. In total, 45.51ha of rehabilitation works on the subject site will result in the creation of suitable forage habitat for the Wallum froglet to partly offset the loss of 69.29ha.

A detailed Stormwater Management Plan has been prepared for the subject site utilising current best-practice management techniques which will ensure no adverse impacts on the hydrology of the current core habitat or the proposed rehabilitated core freshwater wetland. Furthermore any stormwater treatment devices and sedimentation ponds will be designed so that they provide limited opportunities for the introduced Mosquito fish (*Gambusia* sp.) to breed and hence provide better habitat areas for native frogs.

The construction of core habitat areas on the subject site will be subject to a detailed Wallum froglet Compensatory Habitat Plan at the development application stage. With the implementation of the above amelioration measures it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Black-necked Stork

Impacts

The NPWS database (June 2010) contains forty-five (45) 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 foraging within the low-lying eastern and south-eastern portions of the subject site (**FIGURE 29**). The proposed development will not result in significant disturbance to or the removal of habitat for this species within the wetland area located in the south-eastern portion of the site. It is estimated that approximately 140.60 hectares of forage habitat occurs on the subject site during suitable conditions (i.e. localised flooding after periods of heavy rainfall).

Approximately 82.39 hectares (58.6%) of potential forage habitat will be removed from the subject site. The majority of this vegetation removal will occur from portions of the site with existing development approvals. Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species.

Amelioration

Areas in the central portion of the subject site will be rehabilitated in accordance with a Revised Freshwater Wetland Rehabilitation Plan (JWA 2010b). This area will provide approximately 21.77 hectares of additional habitat for the Black-necked stork on the subject site. Furthermore, 23.74 hectares of Swamp sclerophyll forest will be regenerated/revegetated on the subject site (**FIGURE 28**) in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a). In total, 45.51ha of rehabilitation works on the subject site will result in the creation of suitable forage habitat for the Black-necked stork to partly offset the loss of 69.29ha.

Additionally, Leda Manorstead Pty Ltd is currently in negotiations with DECCW with a view to securing appropriate off-site offsets for the removal of degraded Freshwater wetland vegetation from the subject site.

Vegetation within the south-eastern portion of the subject site will be retained and rehabilitated in accordance with the Revised Saltmarsh Rehabilitation Plan (JWA 2010c). This area covers 58.68 hectares and currently provides suitable forage habitat for the Black-necked stork and will continue to do so in the long term.

With the adoption of the above amelioration measures it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Powerful Owl

Impacts

The NPWS database (June 2010) contains no records of this species within 10 km of the Subject site. Twenty (20) records occur within the Tweed LGA. The Powerful owl was recorded in the north-eastern portion of the subject site (**FIGURE 29**) in 1994 (Warren *et al*. 1994). A survey completed by Debus (1994) did not confirm the presence of this species. However, Debus indicated that this absence following the breeding season is consistent with the seasonal shift in the use of different parts of the species' large home range.

These owls were again recorded during November 1997 in the Blackbutt Open Forest in the north-eastern portion of the site (Woodward-Clyde 1997). Further spotlighting and call playback surveys of the subject site (JWA 2000 – 2007) have failed to record this species.

The primary threat to this species and its habitat is the loss and modification of forest and old growth elements, especially trees supporting large nest hollows and areas supporting high densities of prey populations (Debus and Chafer 1994).

This species may potentially forage over the majority of the subject site however it is estimated that approximately 69.82 hectares of better quality forage habitat (i.e. more mature forest and woodland communities) occurs on the subject site. The development will result in the loss of approximately 13.67 hectares of potential habitat for the Powerful owl (approximately 19.58% of available habitat). The majority of this vegetation removal will occur from portions of the site with existing development approvals.

Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species. This species is able to live in disturbed coastal forest (Debus 1994). Loss of Sclerophyll forest and woodland may reduce the availability of arboreal and terrestrial mammalian prey for this species however loss of vegetation from the subject site will approximate to only 2-3% of the estimated home range of a Powerful owl.

Amelioration

The proposed retention of large areas of intact forest is likely to result in the continued foraging of this species on the subject site. Furthermore, approximately 83.06ha of revegetation and 9.54ha of regeneration works will be completed in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) to offset any loss of remnant bushland and to provide vegetated links across the site (**FIGURE 22**). These

areas are all likely to provide suitable forage habitat for the Powerful owl in the long-term and offset the loss of 13.67ha of potential forage habitat.

Retention of old growth trees will also provide continued nesting opportunities for this species. Additionally, the installation of nest boxes of a suitable size for owls within retained vegetation (in accordance with the Fauna Management Plan – JWA 200a) will improve the habitat values of the site for this species and encourage the use of site habitats for nesting purposes.

With the adoption of the above amelioration measures it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Masked Owl

Impacts

The NPWS database (June 2010) contains two (2) records of this species within 10 km of the Subject site. Twelve (12) records occur within the Tweed LGA. The Masked owl was recorded in the north-eastern portion of the subject site (**FIGURE 29**) in 1994 (Debus 1994). Further spotlighting and call playback surveys of the subject site (JWA 2000 – 2007) have failed to record this species. A number of unconfirmed records of this species occurred during survey of adjacent lands to the east (EcoPro 2004) (**FIGURE 30**). This species is typically recorded in dry sclerophyll forest and woodland, but also occasionally forages over open or partly cleared country.

This species may potentially forage over the majority of the subject site however, it is estimated that approximately 69.82 hectares of better quality forage habitat occurs on the subject site comprised of mature dry sclerophyll forests and woodlands. 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.

The development will result in the loss of approximately 13.67 hectares of potential forage habitat for the Masked owl (approximately 19.58% of available habitat). The majority of this vegetation removal will occur from portions of the site with existing development approvals. This species may also be susceptible to road-strike, as birds often forage along roadsides or use roads to move between foraging sites (Debus and Rose 1994).

Loss of Sclerophyll forest may reduce the availability of arboreal and terrestrial mammalian prey for this species however loss of vegetation from the subject site will approximate to only 2%-3% of the estimated home range of a Masked owl.

This species roosts and breeds primarily in wet sclerophyll forested gullies, favouring large roomy hollows for nesting. Nests have been located in both live and dead eucalypts. Roost sites are also typical in mature eucalypts bearing large hollows. It is considered that the proposed development will not remove any suitable nesting or roosting habitat.

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

with the Powerful owl this species is able to live in disturbed coastal forest (Debus 1994). The owls appear to favour a complex local mosaic of dense and sparse tree and ground cover and a high density of old hollow trees. This species will persist in disturbed environments as long as existing and potential nest trees are retained, and suitable areas of forested or woodland areas are conserved so as to conserve prey species (Woodward-Clyde 1997).

Amelioration

The proposed retention of large areas of intact forest is likely to result in the continued foraging of this species on the subject site. Furthermore, approximately 83.06ha of revegetation and 9.54ha of regeneration works will be completed in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) to offset any loss of remnant bushland and to provide vegetated links across the site(**FIGURE 22**). These areas are all likely to provide suitable forage habitat for the Masked owl in the long-term and offset the loss of 13.67ha of potential forage habitat.

Retention of old growth trees will also provide nesting opportunities for this species. Additionally, the installation of nest boxes of a suitable size for owls within retained vegetation (in accordance with the Fauna Management Plan – JWA 2009a) will improve the habitat values of the site for this species and encourage the use of site habitats for nesting purposes.

With the adoption of the above amelioration measures it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Osprey

Impacts

The NPWS database (June 2010) contains three hundred and sixty-nine (369) records of this species within 10 km of the Subject site. Four hundred and four (404) records occur within the Tweed LGA. This species has also been recorded in a number of locations adjacent to the subject site (EcoPro 2004) (**FIGURE 30**).

It is expected that impacts of the proposed development will be restricted to human disturbance near any nest site. A nest site was recorded in the north-eastern portion of the subject site (JWA 2000) and was observed to be utilised by a pair of Ospreys until the crown of the nest tree collapsed during a storm in 2005.

A nest site on a power pole was discovered in the south – east of the site (JWA 2006) away from any future development areas (**FIGURE 32**). Two (2) Ospreys were subsequently observed in the nest on several separate occasions (2006 – 2008). A 100m buffer was designated around this nest location (**FIGURE 32**) however more recent observations on the subject site (2009 – 2010) have revealed that the nest has collapsed and fallen from the pole.

Amelioration

The Ospreys may attempt to rebuild this nest however it is considered that this nest site will not be suitable for use in the long-term. The developer is therefore committed

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LEGEND

- Osprey (*Pandion haliaetus*) - Old Nest (Nest tree has recently collapsed)
- Osprey (*Pandion haliaetus*) - New Nest (Nest no longer present)
- Proposed Nesting Platforms
- 100m Buffer
- Proposed Development Areas
- Site Outline

SOURCE:
Osprey Nests - James Warren & Associates Pty Ltd
Layout - Design Forum Pty Ltd
(Ref: SK 01.01 NN Concept Plan.dwg)
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 500m

SCALE: 1 : 12 500 @ A3

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Cobaki Lakes, Cobaki, NSW
Tweed Shire Council

FIGURE 32

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE

OSPREY NESTS

to erecting at least two (2) artificial nesting platforms on the site (**FIGURE 32**). It is well known that these platforms are highly successful.

It is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Koala

Impacts

The NPWS database (June 2010) contains ninety-eight (98) records of this species within 10 km of the Subject site. Five hundred and seventy-four (574) records occur within the Tweed LGA.

The site contains a number of tree species listed under Schedule 2 of SEPP 44 – Koala Habitat Protection as Koala feed tree species. These include:

- Tallowwood;
- Swamp mahogany;
- Grey gum;
- Forest red gum; and
- Scribbly gum.

Warren (1994) completed a targeted search on the Subject site for evidence of Koala activity (i.e. scratches and scats). A small number of faecal pellets were recorded and a low density of scratches on Grey gums and Tallowwoods were observed throughout the site.

More recently (December 2007), areas of the site containing preferred Koala food trees (i.e. Swamp mahogany, Forest red gum, Tallowwood, Grey gum) were searched for evidence of Koala activity. Two (2) scientists spent approximately twelve (12) hours on this component of the assessment. A nocturnal survey was also completed including spotlighting and call playback techniques. Approximately eight (8) hours was spent on this component of the assessment. No conclusive evidence of Koala activity (scats) was recorded from the site. Whilst a number of trees contained scratch marks, this is not considered a conclusive method of identifying Koala activity when not accompanied by scats and may be attributable to other more common arboreal species (i.e. Common brushtail possum). One (1) male Koala was heard calling approximately 200-300m north of the south-western corner of the subject site (**FIGURE 29**).

It is considered that Koalas may utilise the site occasionally as they disperse throughout the locality, however large areas of more suitable habitat is considered to occur throughout the locality (particularly within intact forested areas to the west) and are likely to be preferred by the local population of Koalas.

It is estimated that approximately 42.41 hectares of potential Koala habitat occurs on the subject site. Approximately 12.50 hectares (29.47%) of potential forage habitat will be removed from the subject site all of which will be removed from areas of the site with existing development approvals.

Additional impacts of the proposed development on Koalas include:

- Increased risk of death or injury from vehicle strike;
- Risk of harassment, death or injury from straying dogs;
- Risk of drowning in swimming pools; and
- Opportunities for Koala movement over the site may be restricted.

Amelioration

The majority of vegetation communities which provide suitable habitat for the Koala on the subject site will be retained (**FIGURE 21**). Furthermore, approximately 83.06ha of revegetation and 9.54ha of regeneration works will be completed in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) to offset any loss of remnant bushland and to provide vegetated links across the site. These areas are all likely to provide suitable forage habitat for the Koala in the long-term and provide vegetated linkages through the landscape (**FIGURE 22**). It is also worth noting that habitat for the Koala will be retained in perpetuity within the adjacent border reserve.

The following amelioration measures should also be considered:

- Traffic movement controls on local roads and awareness signage are to be incorporated into detailed site design.
- Where feasible, box culverts are to be included in road design where they intersect the areas designated as Open Space. These are drainage structures that can function as fauna movement corridors beneath roads.
- Speed on the majority of roads within the development site will be limited to 50 kilometres per hour. Pedestrian crossings planned for these roads will further reduce actual speed. This should significantly reduce Koala road casualties.
- Landowners should control dogs. All animals should reside within fenced enclosures and be on a leash when outside of the enclosure; and
- Swimming pools should be fenced in a manner to restrict access by Koalas.

With the adoption of the above amelioration measures it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Grey-headed flying-fox

Impacts

The NPWS database (June 2010) contains thirty-one (31) records of this species within 10 km of the Subject site. Two hundred and thirty-four (234) records occur within the Tweed LGA. The Grey-headed flying-fox has been recorded foraging in various locations on and adjacent to the subject site (**FIGURES 29 & 30**). 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 (**FIGURE 30**).

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 72.26 hectares of forage habitat occurs on the subject site for this species. Approximately 13.54 hectares (18.74%) of potential forage habitat will be removed from the subject site. The majority of this vegetation removal will occur from portions of the site with existing development approvals.

Amelioration

Suitable roosting habitat for this species may occur in the rainforest community located on Mt. Woodgee which will be retained. Given the high mobility of this species, the loss of 13.54 hectares of known and potential foraging habitat is not considered significant in relation to the local 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.

Furthermore, 23.74 hectares of Swamp sclerophyll forest, 5.06 hectares of Lowland rainforest, 7.06 hectares of Lowland rainforest on floodplain and 20.66ha of Wet sclerophyll forest will be regenerated/ revegetated on the subject site (**FIGURE 28**) in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a). These areas are likely to provide suitable forage habitat for this species and offset the loss of 13.54ha.

With the adoption of the above amelioration measures it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Little bent-wing bat & Common bent-wing bat

Impacts

The NPWS database (June 2010) contains thirteen (13) records of the Little bent-wing bat within 10 km of the Subject site. Sixty-one (61) records occur within the Tweed LGA. This species has also been recorded in a number of locations adjacent to the subject site (EcoPro 2004) (**FIGURE 30**).

The NPWS database (June 2010) contains no records of the Common bent-wing bat within 10 km of the Subject site or within the Tweed LGA.

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

It is estimated that approximately 72.26 hectares of forage habitat occurs on the subject site for these species. Approximately 13.54 hectares (18.74%) of potential forage habitat will be removed from the subject site. The majority of this vegetation removal will occur from portions of the site with existing development approvals.

Amelioration

Given the high mobility of these species, the loss of potential foraging habitat is not considered significant in relation to the local 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.

Furthermore, approximately 83.06ha of revegetation and 9.54ha of regeneration works will be completed in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) to offset any loss of remnant bushland and to provide vegetated links across the site (**FIGURE 22**). These areas are all likely to provide suitable forage habitat for these species in the long-term and offset the loss of 13.54ha.

With the adoption of the above amelioration measures it is considered that the proposed development is highly unlikely to result in the local extinction of these species.

Eastern free-tail bat, Yellow-bellied sheathtail bat & Greater broad-nosed bat

Impacts

The NPWS database (June 2010) contains one (1) record of the Eastern free-tail bat within 10 km of the Subject site. Four (4) records occur within the Tweed LGA.

The NPWS database (June 2010) contains four (4) records of the Yellow-bellied sheathtail bat within 10 km of the Subject site. Five (5) records occur within the Tweed LGA.

The NPWS database (June 2010) contains no records of the Greater broad-nosed bat within 10 km of the Subject site. Two (2) records occur within the Tweed LGA.

It is estimated that approximately 72.26 hectares of forage habitat occurs on the subject site for these species. Approximately 13.54 hectares (18.74%) of potential forage habitat will be removed from the subject site. The majority of this vegetation removal will occur from portions of the site with existing development approvals.

Amelioration

Given the high mobility of these species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of suitable habitat. There will be a minor loss of potential roost sites (i.e. hollow-bearing trees) for these species however the installation of bat boxes within retained vegetation (in accordance with the Fauna Management Plan – JWA 2009a) will increase roosting opportunities for these species. It is considered that these species will continue to utilise retained vegetation for foraging and retained habitat trees for roosting.

Furthermore, approximately 83.06ha of revegetation and 9.54ha of regeneration works will be completed in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) to offset any loss of remnant bushland and to provide vegetated links across the site. These areas are all likely to provide suitable forage habitat for these species in the long-term and offset the loss of 13.54ha of potential habitat.

With the adoption of the above amelioration measures it is considered that the proposed development is highly unlikely to result in the local extinction of these species.

Wallum sedge-frog

Impacts

The NPWS database (June 2010) contains twenty-two (22) records of this species within 10 km of the Subject site. Twenty-five (25) records occur within the Tweed LGA.

This species has been recorded from swamp forest communities adjacent to the subject site on a number of occasions (Warren 1992, Woodward-Clyde 1997, EcoPro 2004) (**FIGURES 29 & 30**). However, extensive searches on the subject site (JWA 2000 – 2007) have failed to record this species.

The Wallum sedge frog is dependent on low-nutrient wetlands with acidic waters, and often occurs in swamp forests dominated by Broad-leaved paperbark. It is also found along creeks or in marshy or swampy lowlands with emergent vegetation and reeds. The Wallum sedge frog is one of several species that breeds in water of low pH (3.4 to 4.5). Core habitat for this species is considered to be comprised of undisturbed wet heathland and wetland communities on and adjacent to the subject. The proposed development will not remove or modify any area considered to provide core habitat for the Wallum sedge frog.

It is estimated that approximately 35.39 hectares of potential forage habitat may occur on the subject site during suitable conditions (i.e. localised flooding after periods of heavy rainfall) however this habitat is considered to be marginal at best. No core habitat occurs on the subject site for this species.

Approximately 25.68 hectares (72.56%) of this potential forage habitat will be removed from the subject site.

Amelioration

Proposed rehabilitation works in accordance with the Revised Freshwater Wetland Rehabilitation Plan (JWA 2010b) will result in the creation of more suitable habitat for the Wallum sedge frog on the subject site. These areas will be designed to provide approximately 2.25 hectares of core habitat (i.e. offline from stormwater treatment) and 19.52 hectares of potential forage habitat.

Furthermore, 23.74 hectares of Swamp sclerophyll forest will be regenerated/revegetated on the subject site (**FIGURE 28**) in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) and these areas are likely to provide suitable forage habitat for this species and offset any loss of forage habitat. In total, 45.51ha of rehabilitation works on the subject site will result in the creation of suitable forage habitat for the Wallum sedge frog.

General mitigation measures aimed at minimising habitat loss and maintaining hydrological regimes of low-lying areas on and adjacent to the subject site will minimise the impact to this species. Furthermore any stormwater treatment devices and sedimentation ponds will be designed so that they provide limited opportunities for the introduced Mosquito fish (*Gambusia* sp.) to breed, and hence provide better habitat for native frogs.

A detailed Stormwater Management Plan has been prepared for the subject site utilising current best-practice management techniques which will ensure no adverse impacts on the hydrology of the current core habitat and the proposed rehabilitated freshwater wetland. Furthermore any stormwater treatment devices and sedimentation ponds will be designed so that they provide limited opportunities for the introduced Mosquito fish (*Gambusia* sp.) to breed and hence provide better habitat for native frogs.

With the adoption of the above amelioration measures it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Bush hen

Impacts

The NPWS database (June 2010) contains sixteen (16) records of this species within 10 km of the Subject site. Twenty-seven (27) records occur within the Tweed LGA.

This species has been recorded within Swamp mahogany forest at the northern end of the Cobaki Broadwater (EcoPro 2004) (**FIGURE 30**). Critical habitat features for this species appear to be dense vegetation and proximity to water, although it has been recorded some distance from permanent streams on occasions. Extensive searches on the subject site (JWA 2000 – 2007) have failed to record this species.

Potential habitat for this species is considered to be comprised of lowland rainforest and swamp forest communities with a dense midstorey/groundcover and standing water. It is estimated that approximately 1.41 hectares of potential habitat occurs on the subject site for this species, comprised of isolated patches of lowland rainforest.

The proposed development will result in the removal or modification a total of 0.02 hectares (1.42%) of potential habitat for this species, all of which occurs within portions of the site with existing development approvals. Due to their crepuscular and nocturnal nature, this species is most likely to be active around dusk or during the night. This may place any birds at risk of disturbance by street lighting and night-time traffic. Other impacts may include predation by domestic cats.

Amelioration

Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) and Revised Freshwater Wetland Rehabilitation Plan (JWA 2010b) will result in the regeneration/revegetation of 23.74 hectares of Swamp sclerophyll forest, 5.06 hectares of Lowland rainforest on floodplain, 7.06 hectares of Lowland rainforest and 21.77 hectares of Freshwater wetland (**FIGURE 28**). These areas may provide suitable habitat for this species in the long-term and will offset the loss of 0.02ha of habitat.

The following additional amelioration measures should be considered:

- Traffic movement controls on local roads and awareness signage are to be incorporated into detailed site design

- Landowners should control cats. All animals should reside within fenced enclosures and be on a leash when outside of the enclosure.
- Street lights adjacent to retained habitat areas should be capped. Vegetated buffers and/or dense planted screens will also reduce the impacts of lighting.

With the adoption of the above amelioration measures it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Glossy black-cockatoo

Impacts

The NPWS database (June 2010) contains one (1) record of this species within 10 km of the Subject site. Fifty-seven (57) records occur within the Tweed LGA.

This species has been recorded from suitable habitat adjacent to the subject site (EcoPro 2004) (**FIGURE 30**). However, extensive searches on the subject site (JWA 2000 – 2007) have failed to record this species, or evidence of its occurrence (i.e. chewed *Allocasuarina* cones).

Suitable habitat for this species is considered to be comprised of dry and moist sclerophyll forests with an abundance of *Allocasuarina* species. It is estimated that approximately 48.61 hectares of potential forage habitat occurs on the subject site for this species, however few areas of dense mature *Allocasuarina* occur on the site.

The proposed development will result in the removal or modification a total of 5.42 hectares (11.15%) of potential habitat for this species. The majority of this vegetation removal will occur from portions of the site with existing development approvals. Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species.

Amelioration

The proposed development will retain large areas of intact forest that will provide continued foraging resources for this species on the subject site. Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) will result in the regeneration of 9.54ha and revegetation of 83.06ha to offset any loss of vegetation and to provide vegetated links across the site (**FIGURE 28**). These works will utilise *Allocasuarina* species where appropriate to provide suitable forage resources for this species.

Additionally, the installation of nest boxes of a suitable size for cockatoos within retained vegetation (in accordance with the Fauna Management Plan – JWA 2009a) will improve the habitat values of the site for this species and encourage the use of site habitats for nesting purposes.

With the adoption of the above amelioration measures it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Brolga

Impacts

The NPWS database (June 2010) contains no records of this species within 10 km of the Subject site or within the Tweed LGA. This species has been recorded from wetlands adjacent to the subject site (EcoPro 2004) (**FIGURE 30**). However, extensive searches on the subject site (JWA 2000 – 2007) have failed to record this species.

Potential habitat for this species occurs within the low-lying eastern and south-eastern portions of the subject site. The proposed development will not result in disturbance to or the removal of potential habitat for this species within the wetland area located in the south-eastern portion of the site. It is estimated that approximately 140.60 hectares of forage habitat occurs on the subject site during suitable conditions (i.e. localised flooding after periods of heavy rainfall).

Approximately 82.39 hectares (58.60%) of potential forage habitat will be removed from the subject site. The majority of this vegetation removal will occur from portions of the site with existing development approvals. Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species.

Amelioration

Areas in the central portion of the subject site will be rehabilitated in accordance with the Revised Freshwater Wetland Rehabilitation Plan (JWA 2010b). These areas will provide approximately 21.77 hectares of additional suitable habitat for the Brolga on the subject site. Furthermore, 23.74 hectares of Swamp sclerophyll forest will be regenerated/revegetated on the subject site (**FIGURE 28**) in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a). These areas will provide suitable habitat for this species in the long-term and offset the loss of habitat.

Additionally, 58.61 hectares of vegetation within the south-eastern portion of the subject site will be retained and rehabilitated in accordance with the Revised Saltmarsh Rehabilitation Plan (JWA 2010c) (**FIGURE 22**). This area currently provides suitable forage habitat for the Brolga and will continue to do so in the long term.

With the adoption of the above amelioration measures it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Black bittern

Impacts

The NPWS database (June 2010) contains two (2) records of this species within 10 km of the Subject site. Ten (10) records occur within the Tweed LGA.

An unconfirmed sighting of this species occurred near the Cobaki Broadwater adjacent to the subject site (EcoPro 2004) (**FIGURE 30**). However, extensive searches on the subject site (JWA 2000 – 2007) have failed to record this species.

Potential habitat for this species occurs within the low-lying eastern and south-eastern portions of the subject site, particularly in association with the Cobaki Broadwater. It is estimated that approximately 5.66 hectares of potential habitat for this species occurs on the subject site. The proposed development will not result in disturbance to or the removal of potential habitat for this species. Overall, impacts on this species are considered to be relatively low.

Amelioration

Areas in the central portion of the subject site will be rehabilitated in accordance with the Revised Freshwater Wetland Rehabilitation Plan (JWA 2010b). This area will provide approximately 21.77 hectares of additional suitable habitat for the Black bittern on the subject site in the long-term. Furthermore, 23.74 hectares of Swamp sclerophyll forest will be regenerated/revegetated on the subject site (**FIGURE 28**) in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a). These areas may also provide suitable habitat for this species and represent a net gain in available habitat in the long-term.

It is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Mangrove honeyeater

Impacts

The NPWS database (June 2010) contains twenty-two (22) records of this species within 10 km of the Subject site. Twenty-three (23) records occur within the Tweed LGA.

This species has been recorded from mangrove and swamp forest communities adjacent to the subject site (EcoPro 2004) (**FIGURE 30**). However, extensive searches on the subject site (JWA 2000 – 2007) have failed to record this species.

Suitable habitat for this species is considered to be comprised of undisturbed mangrove and wetland communities on and adjacent to the subject site. Potential habitat for this species occurs within the low-lying eastern and south-eastern portions of the subject site, particularly in association with the Cobaki Broadwater. It is estimated that approximately 5.66 hectares of potential habitat for this species occurs on the subject site. The proposed development will not result in disturbance to or the removal of potential habitat for this species. Overall, impacts on this species are considered to be relatively low.

Amelioration

Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) will result in the regeneration/revegetation of 23.74 hectares of Swamp sclerophyll forest (**FIGURE 28**). These areas may also provide suitable habitat for this species and represent a net gain in available habitat in the long-term.

Additionally, 58.68 hectares of vegetation within the south-eastern portion of the subject site will be retained and rehabilitated in accordance with the Revised

Saltmarsh Rehabilitation Plan (JWA 2010c) (**FIGURE 28**). This area currently provides stands of mangrove vegetation suitable as forage habitat for the Mangrove honeyeater and will continue to do so in the long term. It is considered that the proposed development is highly unlikely to result in the local extinction of this species.

White-eared monarch

Impacts

The NPWS database (June 2010) contains six (6) records of this species within 10 km of the Subject site. Eighty-five (85) records occur within the Tweed LGA.

This species has been recorded from rainforest communities adjacent to the subject site (EcoPro 2004) (**FIGURE 30**). However, extensive searches on the subject site (JWA 2000 – 2007) have failed to record this species.

Suitable habitat for this species is considered to be comprised of undisturbed rainforest communities associated with Mt Woodgee on and adjacent to the subject site. It is estimated that approximately 10.99 hectares of potential forage habitat occurs on the subject site for the White-eared monarch. Approximately 0.14 hectares (1.27%) of potential forage habitat will be removed from the subject site all of which will be removed from areas of the site with existing development approvals. Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species.

Amelioration

Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) will result in the regeneration/revegetation of 5.06 hectares of Lowland rainforest on floodplain and 7.06 hectares of Lowland rainforest (**FIGURE 28**). These areas may provide suitable habitat for this species in the long-term and offset the loss of 0.14ha of potential habitat.

With the adoption of the above amelioration measures it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Wompoo fruit-dove, Rose-crowned fruit-dove & Superb fruit-dove

Impacts

The NPWS database (June 2010) contains one (1) record of the Wompoo fruit-dove within 10 km of the Subject site. One hundred and fifteen (115) records occur within the Tweed LGA.

The NPWS database (June 2010) contains eight (8) records of the Rose-crowned fruit-dove within 10 km of the Subject site. One hundred and eight (108) records occur within the Tweed LGA.

The NPWS database (June 2010) contains no records of the Superb fruit-dove within 10 km of the Subject site. Two (2) records occur within the Tweed LGA.

The Wompoo fruit-dove and Rose-crowned fruit-dove have been recorded from rainforest and swamp forest communities adjacent to the subject site, and an unconfirmed sighting of the Superb fruit-dove also occurred (EcoPro 2004) (**FIGURE 30**). However, extensive searches on the subject site (JWA 2000 – 2007) have failed to record these species.

Suitable habitat for the fruit-doves is considered to be comprised of undisturbed rainforest communities associated with Mt Woodgee on and adjacent to the subject site. It is estimated that approximately 10.99 hectares of potential forage habitat occurs on the subject site for these species. Approximately 0.14 hectares (1.27%) of potential forage habitat will be removed from the subject site all of which will be removed from areas of the site with existing development approvals. Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species.

Amelioration

Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) will result in the regeneration/revegetation of 5.06 hectares of Lowland rainforest on floodplain and 7.06 hectares of Lowland rainforest and 23.74 hectares of Swamp sclerophyll forest (**FIGURE 28**). These areas may provide suitable habitat for the fruit-doves in the long-term and offset the loss of 0.14ha of potential habitat.

With the adoption of the above amelioration measures it is considered that the proposed development is highly unlikely to result in the local extinction of these species.

Collared kingfisher

Impacts

The NPWS database (June 2010) contains fifty-nine (59) records of the Collared kingfisher within 10 km of the Subject site. Sixty-one (61) records occur within the Tweed LGA.

This species has been recorded from the Cobaki Broadwater adjacent to the subject site (EcoPro 2004) (**FIGURE 30**). However, extensive searches on the subject site (JWA 2000 – 2007) have failed to record this species.

Suitable habitat for this species is considered to be comprised of undisturbed mangrove communities on and adjacent to the subject site. Potential habitat for this species occurs within the low-lying eastern and south-eastern portions of the subject site, particularly in association with the Cobaki Broadwater. It is estimated that approximately 5.66 hectares of potential habitat for this species occurs on the subject site. The proposed development will not result in disturbance to or the removal of potential habitat for this species.

Amelioration

Overall, impacts on this species are considered to be relatively low. 58.68 hectares of vegetation within the south-eastern portion of the subject site will be retained and rehabilitated in accordance with the Revised Saltmarsh Rehabilitation Plan (JWA 2010c) (**FIGURE 28**). This area currently provides stands of mangrove vegetation suitable as forage habitat for the Collared kingfisher and will continue to do so in the long term. It is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Eastern grass owl

Impacts

The NPWS database (June 2010) contains three (3) records of this species within 10 km of the Subject site. Twenty-four (24) records occur within the Tweed LGA.

An individual Eastern grass owl was recorded in sedgeland at the southern end of the airport runway, approximately 1.75km to the east of subject site (EcoPro 2004) (**FIGURE 30**). However, extensive searches on the subject site (JWA 2000 – 2007) have failed to record this species.

This species has been recorded inhabiting coastal and inland grasslands, coastal heath, agricultural crops and swamp margins (NSW State Forests 1995; Shields 1995). Primary breeding habitat appears to be dense, secluded grass tussock swards, sometimes near water (NSW State Forests 1995). It hunts nocturnally, feeding mainly on rodents. However birds, insects, frogs and reptiles are also consumed (Shields 1995). Nesting occurs in trodden-down grass under bushes or tussocks.

This species may forage over the low-lying eastern portions of the subject site. Potential nesting/roost habitat for this species also occurs within the low-lying eastern and south-eastern portions of the subject site. It is estimated that approximately 2.44 hectares of potential nesting/roost habitat for this species occurs on the subject site. The proposed development will not result in disturbance to or the removal of potential nesting/roost habitat for this species.

Given the high mobility of this species, the loss of potential foraging habitat on the subject site is not considered significant in relation to the local distribution of potential foraging habitat for this species.
Increased vehicular traffic on the subject site may result in the increased risk of vehicular strike. In the vicinity of Ballina in northern NSW birds are often recorded as road kills along the edge of the Pacific Highway, suggesting that they may use the road verge for foraging (Maciejewski 1996).

Amelioration

Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) will result in the regeneration/revegetation of 23.74 hectares of Swamp sclerophyll forest (**FIGURE 28**). These areas may provide suitable habitat for this species and will result in a net gain of suitable habitat in the long-term.

It is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Large-footed myotis

Impacts

The NPWS database (June 2010) contains four (4) records of this species within 10 km of the Subject site. Nineteen (19) records occur within the Tweed LGA.

This species has been recorded during surveys adjacent to the subject site (EcoPro 2004) (**FIGURE 30**). However, numerous surveys on the subject site (JWA 2000 – 2007) have failed to record this species.

Large-footed myotis generally roost close to water in caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage. They forage over streams and pools catching insects and small fish. Potential forage habitat for this species is generally restricted to the adjacent Cobaki Broadwater and the large farm dam in the south-western portion of the site. The proposed development will not result in disturbance to or the removal of potential habitat for this species. Overall, impacts on this species are considered to be relatively low.

Amelioration

The retention of large areas of intact forest communities, including a number of old growth trees, will continue to provide potential roost sites. Additionally, the installation of bat boxes within retained vegetation (in accordance with the Fauna Management Plan – JWA 2009a) will improve the habitat values of the site for this species and encourage the use of site habitats for roosting purposes.

With the adoption of the above amelioration measures it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Eastern long-eared bat

Impacts

The NPWS database (June 2010) 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 been recorded from rainforest communities adjacent to the subject site (EcoPro 2004) (**FIGURE 30**). However, numerous surveys on the subject site (JWA 2000 – 2007) have failed to record this species.

Suitable habitat for the Eastern long-eared bat is considered to be comprised of lowland subtropical rainforest and swamp sclerophyll forest. This species roosts in hollows in trees and also in the hanging foliage of palms, in dense clumps of foliage of rainforest trees and under bark. It forages within structurally complex forests. It is estimated that approximately 10.99 hectares of potential forage habitat occurs on the subject site for this species, comprised of the intact rainforest community associated with Mt Woodgee, and smaller isolated rainforest patches.

Approximately 0.14 hectares (1.27%) of potential forage habitat will be removed from the subject site, all of which will be removed from areas of the site with existing development approvals. Given the high mobility of this species, the loss of a small area of potential foraging habitat is not considered significant in relation to the local

distribution of habitat for this species. The retention of large areas of intact forest communities, including a number of old growth trees, will continue to provide potential roost sites.

Amelioration

Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) will result in the regeneration/revegetation of 5.06 hectares of Lowland rainforest on floodplain and 7.06 hectares of Lowland rainforest and 23.74 hectares of Swamp sclerophyll forest (**FIGURE 28**). These areas may provide additional suitable habitat for this species in the long-term and offset the loss of 0.14ha of potential habitat.

The installation of bat boxes within retained vegetation (in accordance with the Fauna Management Plan – JWA 2009a) may also improve the habitat values of the site for this species and encourage the use of site habitats for roosting purposes.

With the adoption of the above amelioration measures it is considered that the proposed development is highly unlikely to result in the local extinction of these species.

Squirrel glider

Impacts

The NPWS database (June 2010) contains no records of this species within 10 km of the Subject site. Three (3) records occur within the Tweed LGA.

This species has been recorded from forest communities adjacent to the subject site (EcoPro 2004) (**FIGURE 30**). However, numerous surveys on the subject site (JWA 2000 – 2007) have failed to record this species.

Suitable habitat for the Squirrel glider is considered to be comprised of mature dry sclerophyll and wet sclerophyll forests with abundant hollows for refuge and den sites. It is estimated that approximately 52.81 hectares of potential forage habitat occurs on the subject site for this species.

In total 9.55 hectares (18.08%) of potential habitat (i.e. remnant bushland with hollow-bearing trees) will be lost from the subject site. The majority of habitat to be removed occurs within portions of the site with existing development approvals. The loss of potential habitat on the subject site is not considered significant in relation to the local distribution of habitat for this species.

Amelioration

The Revised Site Regeneration and Revegetation Plan (JWA 2010a) outlines the various measures to ensure that the retained remnant vegetation is adequately managed. Approximately 83.06ha of revegetation and 9.54ha of regeneration works will be completed in accordance with this plan (**FIGURE 22**) to offset the loss of 9.55ha of potential habitat and to provide vegetated links across the site.

The retention of large areas of intact forest communities, including a number of old growth trees, will continue to provide potential roost sites. Additionally, the installation of nest boxes within retained vegetation (in accordance with the Fauna Management Plan – JWA 2009a) will improve the habitat values of the site for this species and encourage the use of site habitats for denning purposes.

With the adoption of the above amelioration measures it is considered that the proposed development is highly unlikely to result in the local extinction of these species.

Common planigale

Impacts

The NPWS database (June 2010) contains nine (9) records of this species within 10 km of the Subject site. Thirty-two (32) records occur within the Tweed LGA.

This species has been recorded from a very small area (i.e. about 1 hectare) consisting of Swamp Mahogany-Brushbox Forest adjacent to the subject site (EcoPro 2004) (**FIGURE 30**). However, numerous surveys on the subject site (JWA 2000 – 2007) have failed to record this species.

Suitable habitat for the Common planigale is considered to be comprised of mature rainforest, eucalypt forest and heathland on and adjacent to the subject site. It is estimated that approximately 74.93 hectares of potential forage habitat occurs on the subject site for these species.

In total 13.67 hectares (18.24%) of potential habitat will be lost from the subject site. The majority of habitat to be removed occurs from portions of the site with existing development approval. The loss of potential habitat is not considered significant in relation to the local distribution of habitat for this species.

This species, if present, would be particularly susceptible to predation by cats and dogs. Habitat disturbance associated with construction, especially noise and vibration, may also have a significant impact on this species.

Amelioration

The Revised Site Regeneration and Revegetation Plan (JWA 2010a) outlines the various measures to ensure that the retained remnant vegetation is adequately managed. Approximately 83.06ha of revegetation and 9.54ha of regeneration works will be completed in accordance with this plan (**FIGURE 22**) to offset the loss of 13.67ha of habitat and to provide vegetated links across the site.

The retention of large areas of intact forest communities, including a number of old growth trees, will continue to provide potential habitat for this species. Additionally, the installation of nest boxes within retained vegetation (in accordance with the Fauna Management Plan – JWA 2009a) will improve the habitat values of the site for this species and encourage the use of site habitats for denning purposes.

Landowners should control cats and dogs. All animals should reside within fenced enclosures and be on a leash when outside of the enclosure.

With the adoption of the above amelioration measures it is considered that the proposed development is highly unlikely to result in the local extinction of these species.

Long-nosed potoroo

Impacts

The NPWS database (June 2010) contains three (3) records of this species within 10 km of the Subject site. Twelve (12) records occur within the Tweed LGA. It is also worth noting that the Long-nosed potoroo population adjacent to the subject site has been listed as an Endangered Population.

A small disjunct population of Long-nosed potoroos has been recorded adjacent to the north-eastern corner of the subject site (Warren 1992, Woodward-Clyde 1997, EcoPro 2004) (**FIGURE 30**). However, numerous surveys on the subject site (Warren 1992, 1993, Woodward-Clyde 1997, Parker 1999, JWA 2000 – 2007) and within the border reserve to the north and north-west of the subject site (JWA 2000 – 2007), have failed to record this species.

Suitable habitat for the Long-nosed potoroo is considered to be comprised of heathland and dry and wet sclerophyll forests with a dense understorey adjacent to the north-eastern boundary of the subject site. A sandy loam soil is also a common feature. The proposed development will not result in disturbance to or the removal of potential habitat for this species. This species has historically been recorded from the north and south of the existing site access road, which has essentially formed two small sub-populations.

Without mitigation, road kills may significantly affect these populations. Predation by domestic cats and dogs is also a potential impact of the development.

Amelioration

The Revised Site Regeneration and Revegetation Plan (JWA 2010a) outlines the various measures to ensure that the retained remnant vegetation is adequately managed. Approximately 83.06ha of revegetation and 9.54ha of regeneration will be completed in accordance with this plan (**FIGURE 22**) to offset any loss of vegetation and to provide vegetated links across the site.

Furthermore, a Management Plan has been prepared for the Long-nosed potoroo population at Cobaki Lakes (Warren *et al*. 1994) as is to be adopted as part of the proposed Cobaki Lakes development. The following is a summary of the management strategies to be implemented:

- ensure that the potoroo population in Cobaki Crown Reserve remains viable;
- to maximise Potoroo population in available and potential habitat;

- monitoring of predator presence, use of the culverts for fauna access should be carried out by the NPWS and Cobaki Lakes;
- all domestic stock will be removed from known and potential Potoroo habitat;
- all domestic stock will be removed from Potoroo habitat rehabilitation areas;
- feral animals be monitored and controlled for several years after completion of construction of the road;
- all known and potential Long-nosed potoroo habitat in the Cobaki Crown Reserve will be conserved where possible;
- Selected portions of land occurring on contiguous freehold property will be rehabilitated to eventually form Potoroo habitat;
- All fire be excluded for approximately 15 years;
- In the long term, strategic burning will be necessary. A long term Management Plan (including the use of fire) be established by the future managers (presumably NSW NPWS) for the Crown Wetland and Border Reserve which:
    - accommodates rejuvenation/revitalisation of plant communities;
    - provides food and suitable habitat for the fauna;
- Fauna underpasses should be constructed as an integral part of the Boyd Street access roadworks. Wing fences, steel grates and dense habitat rehabilitation are all strategies which will be utilised in conjunction with the underpasses;
- Other management features will include minimal habitat disturbance, minimal faunal underpass lengths, road signage and vehicle speed reduction.
- Biennial reports on Potoroo and feral animal monitoring activities will be prepared.

With the adoption of these amelioration measures, it is unlikely that the proposed development will result in the extinction of this Endangered Population.

Common blossom bat

Impacts

The NPWS database (June 2010) contains five (5) records of this species within 10 km of the Subject site. Twenty-five (25) records occur within the Tweed LGA.

This species has been recorded during surveys of land adjacent to the subject site (EcoPro 2004) (**FIGURE 30**). However, numerous surveys on the subject site (JWA 2000 – 2007) have failed to record this species.

Common blossom-bats often roost in littoral rainforest and feed on flowers in adjacent heathland and paperbark swamps. Potential forage habitat for this species occurs in the low-lying eastern portion of the subject site. The proposed development will result in the removal or modification a total of 3.8 hectares of Swamp sclerophyll forest on floodplain. Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species.

Amelioration

Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) will result in the regeneration/revegetation of 23.74 hectares of Swamp sclerophyll forest (**FIGURE 28**). These areas may provide additional suitable forage habitat for this species in the long-term and offset the loss of 3.8ha of potential habitat.

It is considered that the proposed development is highly unlikely to result in the local extinction of these species.

4.3 Provide a description of the proposed treatment of any ecological buffers

4.3.1 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. Retained remnant bushland areas;
4. Stormwater treatment areas;
5. Asset Protection Zones; and
6. Environmental restoration and enhancement works.

4.3.2 Proposed buffers

4.3.2.1 Buffers to Threatened flora

The locations of Threatened flora species on the subject site are shown in **FIGURES 23, 23a, 23b & 23c** and have been described within Section 4.2.5.2 of this report. A large proportion of Threatened species on the subject site occur within the rainforest communities associated with Mt. Woodgee in the northern portion of the subject site, or in areas of the subject site otherwise designated for retention (**FIGURES 25, 25a, 25b & 25c**).

A Vegetation Management Plan has been prepared for the subject site (JWA 2009b) and discusses measures to be implemented to protect Threatened flora species during the construction phase. The Mt. Woodgee remnant 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 Revised Site Regeneration and Revegetation Plan – JWA 2010a). The Revised Site Regeneration and Revegetation 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 33a & 33b**. 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.

N

LEGEND

- Lowland Rainforest
- Lowland Rainforest on Floodplain
- Swamp Sclerophyll Forest on Floodplain
- Swamp Oak Floodplain Forest
- Freshwater Wetland (Degraded)
- Saltmarsh
- Threatened Flora Species
- Remnant Bushland
- 20m APZ
- 20 - 40m APZ
- Cross-sections (Refer to Figure 31B)
- Proposed Development Areas
- Site Outline

SOURCE:
Threatened Flora - James Warren & Associates Pty Ltd
EEC's - James Warren & Associates Pty Ltd
Remnant Bushland - James Warren & Associates Pty Ltd
APZ's - Michel Group Services (6400-172.dwg)
Zoning - Michel Group Services (Ref: 969030.dwg)
Aerial - Michel Group Services (Ref: 6400-197.dwg)

0 500m

SCALE: 1 : 12 500 @ A3

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Revised Ecological Assessment
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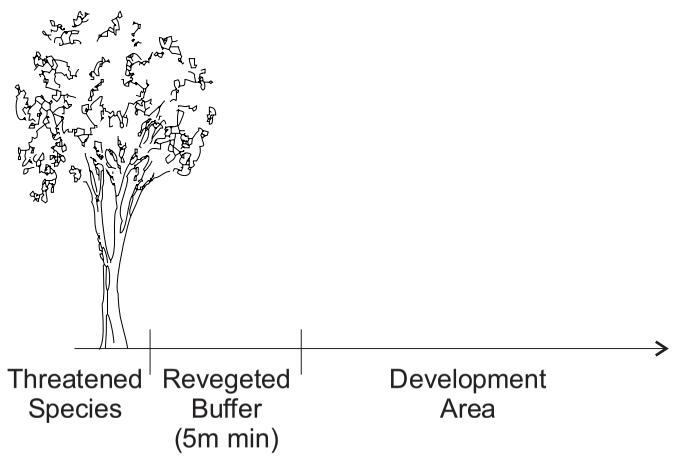
FIGURE 33A

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

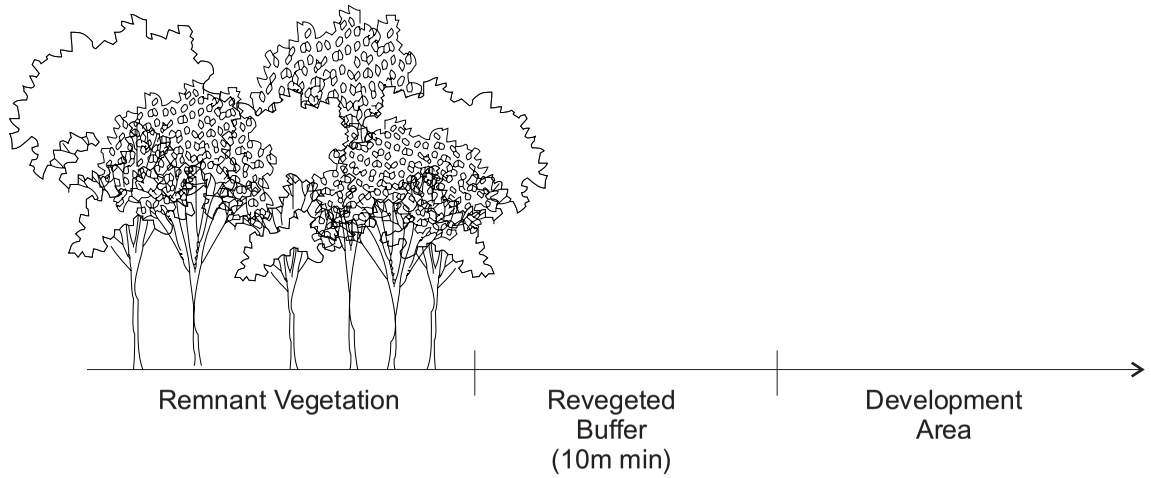
TITLE

ECOLOGICAL BUFFERS

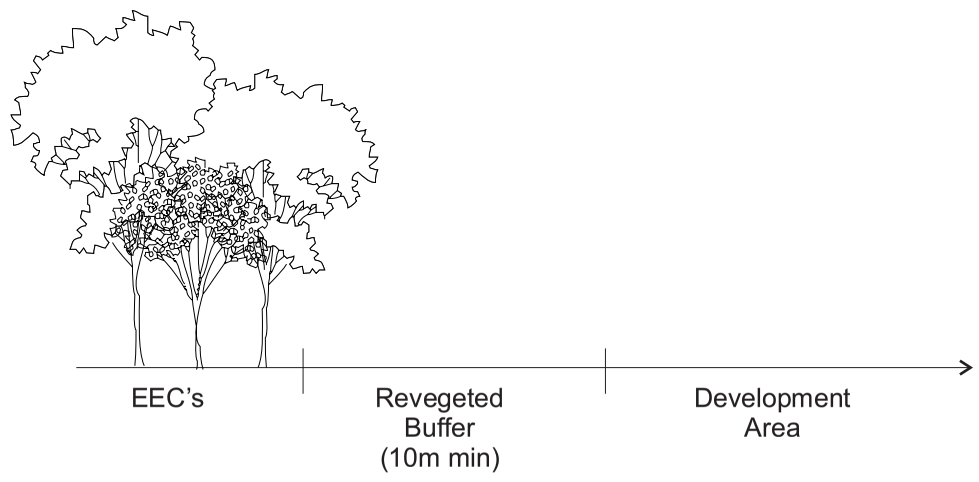
CROSS-SECTION A
BUFFERS TO THREATENED FLORA



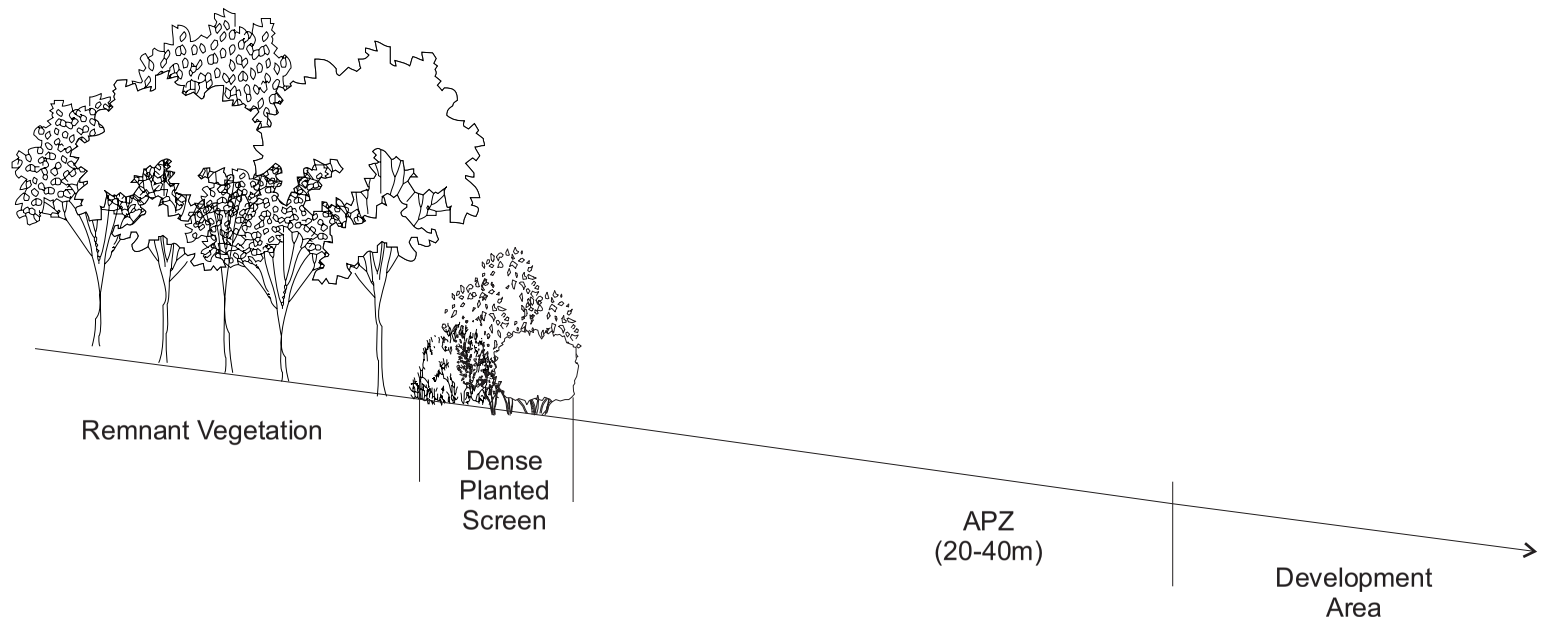
CROSS-SECTION C
BUFFERS TO REMNANT VEGETATION



CROSS-SECTION B
BUFFERS TO EEC'S



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



0 10m

1 : 250

SOURCE: JWA Site Investigations

SCALE: 1 : 250 @ A3

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Shire of Tweed

FIGURE 33B

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Cross-sections.cdr

TITLE
ECOLOGICAL BUFFERS - CROSS-SECTIONS

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

4.3.2.2 Buffers to Endangered Ecological Communities

Retained EEC's 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 Revised Site Regeneration and Revegetation Plan – JWA 2010a). Where sufficient area is not available to provide a 10m buffer (i.e. particularly steep land adjacent to land zoned for development & Cobaki Parkway) 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. A Vegetation Management Plan has been prepared for the subject site (JWA 2009b) and discusses measures to be implemented to protect EEC's during the construction phase.

An indicative cross-section of the interface between development and retained EEC's is shown in **FIGURES 33a & 33b**. 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.

4.3.2.3 Buffers to Remnant Bushland

The concept plan has been designed to retain the majority of remnant bushland on the subject site (**FIGURE 18**). 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 Revised Site Regeneration and Revegetation Plan – JWA 2010a). Where sufficient area is not available to provide a 10m buffer (i.e. particularly steep land adjacent to land zoned for development) 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. A Vegetation Management Plan has been prepared for the subject site (JWA 2009b) and discusses 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 retained Remnant Bushland and the development. The treatment of this interface is discussed in Section 4.3.2.5.

An indicative cross-section of the interface between development and retained remnant bushland is shown in **FIGURES 33a & 33b**. 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.

4.3.2.4 Stormwater treatment areas

A detailed Stormwater Management Plan has been prepared for the subject site. The conceptual planning of the urban development proposed for Leda Manorstead's land at Cobaki has followed a constraints-based approach, which recognises:

a) The sensitivity of the receiving environment within the Cobaki Broadwater;
b) The large mosquito breeding areas currently on site; and
c) The major opportunity that the careful rehabilitation of the southern areas could provide by way of an ongoing fisheries habitat contribution to the Broadwater.

Starting from the watershed of each sub-catchment, the stormwater treatment train involves the following measures:

a) Compliance with BASIX;
b) Bioretention devices within constructed swales on slopes <5% and Gross Pollutant traps (GPTs);
c) Sedimentation basins;
d) Constructed wetlands with a minimum 30% soft-edge treatment;
e) Diffuse low-flow discharge ($<Q_{3month}$) and stormwater treatment within the rehabilitation areas;
f) High-flow bypass channels to protect the rehabilitation areas; and
g) Discharge of fully treated water to the Cobaki Broadwater.

All stormwater treatment areas occur within land designated as Open Space or Environmental Protection and have been designed to provide wetland habitat. These devices and surrounding areas will be revegetated through a combination of landscaping works and rehabilitation (in accordance with the Revised Site Regeneration and Revegetation Plan – JWA 2010a).

4.3.2.5 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). Requirements for APZ's on the Cobaki Lakes site are shown in **FIGURE 34**.

Asset Protection Zones (APZs) will generally be accommodated within already cleared land unless further clearing is required within existing 2(c) zoned land (i.e. Urban Expansion), land proposed to be rezoned as 2(c), or land that may otherwise be cleared in accordance with existing use rights.

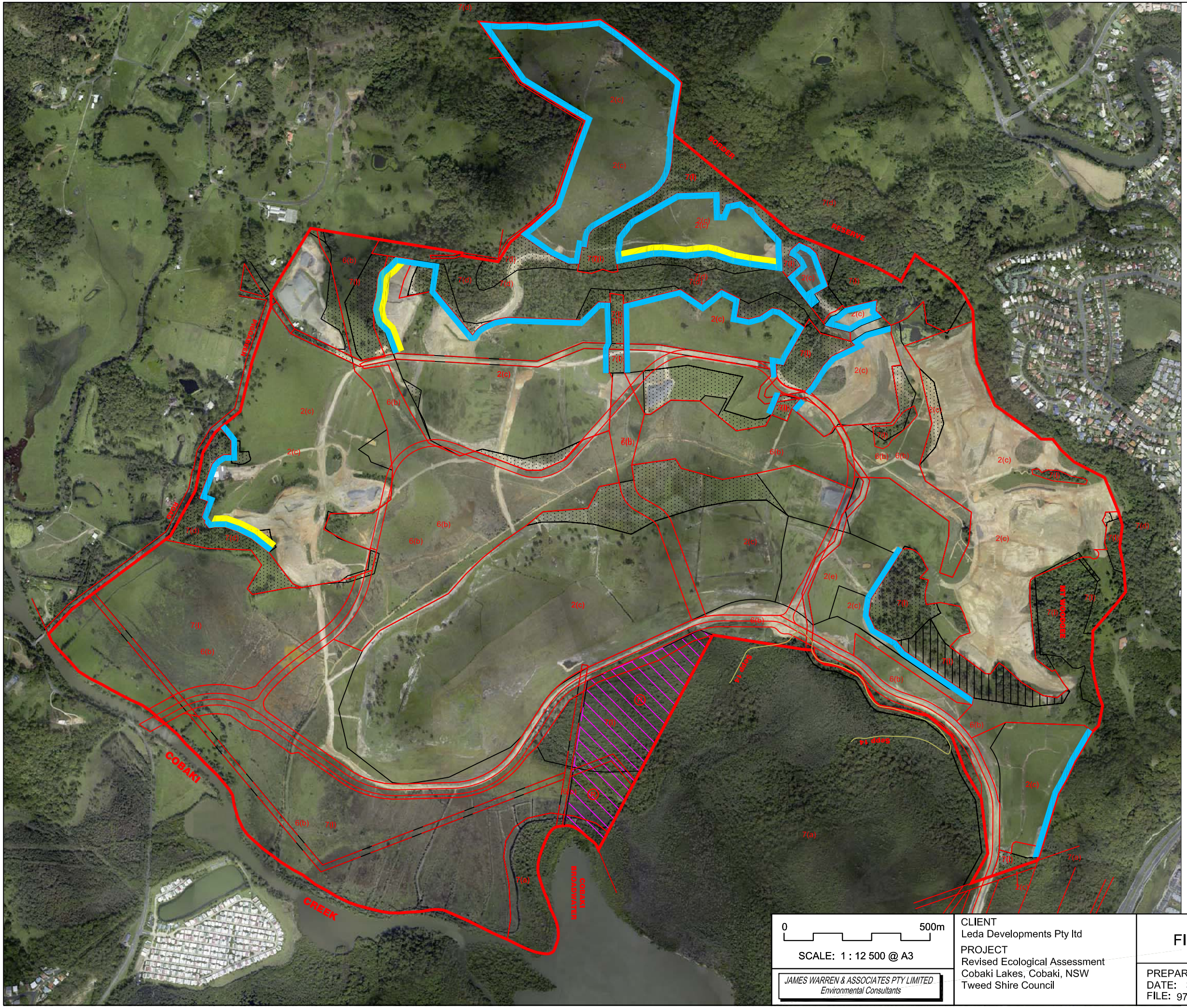
The interface between retained vegetation areas and APZ's will be planted with a dense screen of fire-resistant vegetation to minimise edge effects and will be monitored for weed infestations (in accordance with the Revised Site Regeneration and Revegetation Plan – JWA 2010a). There may also be opportunities 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 33a & 33b.**

4.3.2.6 Environmental restoration and enhancement works

A Revised Site Regeneration and Revegetation Plan (JWA 2010a) has been completed to accompany this Ecological Assessment. The Plan outlines the restoration works which are to be completed in the areas of vegetation that will be retained and rehabilitated, including buffer areas (**FIGURE 22**).

The basic principles of the Revised Site Regeneration and Revegetation Plan include:

- Weed control will occur within the Environmental protection areas, open space and any ecological buffers;
- All weed control will be completed using the recommended methods, including poisoning of Camphor laurel, cut and paint of woody weeds and selective spot spraying of any weedy annuals and grasses.
- All herbicide applications will be completed by suitably qualified persons;
- Weed control will be undertaken on a progressive basis over a three (3) – five (5) year period;
- Embellishment plantings are to be used to consolidate each of the Environmental Protection Areas (EPA's). Planting efforts will be divided into moderate planting zones and high density planting zones.



LEGEND

1. RURAL

- 1(a) (a) Rural
- 1(b1) (b1) Agricultural Protection
- 1(b2) (b2) Agricultural Protection
- 1(c) (c) Rural Living

2. RESIDENTIAL

- 2(a) (a) Low Density Residential
- 2(b) (b) Medium Density Residential
- 2(c) (c) Urban Expansion
- 2(d) (d) Village
- 2(e) (e) Residential Tourist
- 2(f) (f) Tourism

5. SPECIAL USES

- 5(a) (a) Special Uses

6. OPEN SPACE

- 6(a) (a) Open Space
- 6(b) (b) Recreation

7. ENVIRONMENTAL PROTECTION

- 7(a) (a) Environmental Protection (Wetlands & Littoral Rainforests)
- 7(d) (d) Environmental Protection (Scenic/Escarpment)
- 7(f) (f) Environmental Protection (Coastal Lands)
- 7(l) (l) Environmental Protection (Habitat)
- S14 SEPP14 - Coastal Wetlands
- Clause 52 (Cobaki Lakes)
- Clause 52 (Cobaki Lakes)
- (R) Restriction On Use (DP1051024)
- Restriction on Use Area
- 20m APZ
- 20 - 40m APZ
- Site Outline

SOURCE:
APZ's - Michel Group Services (6400-172.dwg)
Zoning - Michel Group Services (Ref: 969030.dwg)
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 500m

SCALE: 1 : 12 500 @ A3

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Cobaki Lakes, Cobaki, NSW
Tweed Shire Council

FIGURE 34

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE
ASSET PROTECTION ZONES (APZ'S)

- All revegetation areas will fenced to exclude cattle and reduce native fauna grazing;
- All revegetation will include the planting of native species that are representative of the species composition of the community concerned;
- All of the rehabilitation work is to be completed by qualified bush regenerators;
- A detailed maintenance program for each area will be included which outlines the maintenance to be completed over the next three (3) – five (5) years.
- A detailed monitoring program will be completed by a qualified ecologist. Reports on the progress of the rehabilitation are to be issued to Tweed Shire Council on a quarterly basis.

4.4 Assess proposed native vegetation clearing with consideration of potential impacts

4.4.1 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 offset strategies to ensure that there is no net loss of native vegetation values. The potential impacts on significant vegetation (i.e. remnant bushland, Threatened flora species, EEC's etc.) has been discussed in previous sections of this report.

The majority of vegetation to be removed will be in accordance with existing DA's and construction certificates.

4.4.2 Potential Impacts on Native Vegetation

The proposed development concept will result in the loss of vegetation for the construction of a town centre, residential dwellings, educational buildings, a business park, access roads, driveways and associated infrastructure. Vegetation to be removed from the subject site occurs within existing 2(c) zoned land (i.e. Urban Expansion), land proposed to be rezoned as 2(c), or land that may otherwise be cleared in accordance with existing use rights. The impact of the proposed development on vegetation communities on the site is shown in **FIGURE 35**.

A summary of vegetation that may be removed and their respective areas is shown in **TABLE 10**. It should be noted that portions of the subject site that have been cleared in accordance with existing development and earthworks approvals (covering 131.33 hectares) have not been included in the following table and calculations.

TABLE 10
POTENTIAL VEGETATION LOSS AS A RESULT OF THE PROPOSED DEVELOPMENT

Community	TOTAL AREA (ha)	Area to be Removed (ha)	Area to be Removed (%)
1a	31.84	3.80	11.93%
1b	4.84	0.75	15.50%
1c	9.35	0.10	1.07%
1d	2.58	0.77	29.84%
2a	8.86	0.07	0.79%
2b	0.34	0.02	5.88%
2c	0.39	0.02	5.13%
2d	1.41	0.02	1.42%
3	1.88	0.01	0.53%
4	2.44	0.00	0.00%
5	0.07	0.03	42.86%
6	3.80	3.80	100.00%
7	4.19	4.13	98.57%

N

LEGEND

Community 1 - Dry sclerophyll communities

- Community 1a - Very tall open/closed sclerophyll forest (*Eucalyptus pilularis* +/- *E. microcorys* +/- *E. propinqua* +/- *Corymbia intermedia*)
- Community 1b - Tall open/closed sclerophyll forest (*E. propinqua*)
- Community 1c - Tall open sclerophyll woodland (*E. pilularis*)
- Community 1d - Tall open sclerophyll forest (*E. pilularis* +/- *E. siderophloia* +/- *E. tereticornis*)

Community 2 - Rainforest communities

- Community 2a - Tall closed forest (*Lophostemon confertus* +/- *Araucaria cunninghamii*)
- Community 2b - Tall open forest (*Archontophoenix cunninghamiana*)
- Community 2c - Very tall closed forest (*A. cunninghamii*)
- Community 2d - Mid-high open/closed forest (Riparian species +/- Mixed species)
- Community 3 - Tall/very tall open/closed forest (*L. confertus* +/- Mixed rainforest species)
- Community 4 - Low closed forest (Heathland)
- Community 5 - Mid-high open woodland (Mixed rainforest species)
- Community 6 - Mid-high open woodland (*E. robusta*)
- Community 7 - Mid-high open woodland (*E. racemosa*)
- Community 8 - Mid-high open woodland (*E. siderophloia*)
- Community 9 - Low closed forest (Revegetation areas +/- Mixed *Eucalyptus* species)
- Community 10 - Low closed grassland with scattered trees (Pastoral grassess +/- Mixed species)
- Community 11 - Low closed grassland (*Sporobolus virginicus*, *Triglochin striata* +/- *Casuarina glauca*)
- Community 12 - Rushland/sedgeland/ grassland (Mixed aquatic species)
- Community 13 - Low to mid-high open mangrove forest (*Avicennia marina* var *australasica* / *Aegiceras corniculatum* +/- *Casuarina glauca*)
- Community 14 - Dams & drainage lines (Mixed aquatic species)
- Community 15 - Low open forest/woodland (*Casuarina glauca* +/- Mixed species)
- Community 16 - Slashed grassland/ heathland/sedgeland (Mixed Species)
- Unvegetated land
- Proposed Development Areas
- Site Outline

SOURCE:
Vegetation - James Warren & Associates Pty Ltd
July/Sept 2007 & May 2008
Layout - Design Forum Pty Ltd
(Ref: SK 01.01 NN Concept Plan.dwg)
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

SOURCE:
Vegetation - James Warren & Associates Pty Ltd
July/Sept 2007 & May 2008
Layout - Design Forum Pty Ltd
(Ref: 01.01 Concept Plan.dwg Issue U)
Aerial - Qasco taken April 2008 (Cobaki_Lakes.tiff)

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FIGURE 35

PREPARED: BW
DATE: 30 June 2010
FILE: 97038_EA_Base.dwg

TITLE
IMPACT ON VEGETATION COMMUNITIES

Community	TOTAL AREA (ha)	Area to be Removed (ha)	Area to be Removed (%)
8	0.27	0.00	0.00%
9	2.67	0.13	4.87%
10	252.66	209.56	82.94%
11	54.63	10.25	18.76%
12	35.39	25.68	72.56%
13	5.66	0.00	0.00%
14	2.33	1.90	81.55%
15	4.52	0.95	21.02%
16	43.73	43.61	99.73%
TOTAL	**473.86**	**305.62**	**64.50%**

In total, 305.62 hectares of vegetation occurs within the proposed development footprint the majority of which is comprised of grassland communities. Of this vegetation, the majority occurs in areas of the site with existing development approvals. As previously mentioned, existing use rights over the subject site would allow for the continued maintenance of drainage lines, fence lines and firebreaks as well as pasture improvement activities throughout the subject site.

It should be noted that the maximum area of vegetation to be lost has been calculated based on the concept plan. There may be opportunities to retain areas of native vegetation within the proposed development footprint and this will be the subject of a detailed assessment at the Development Application stage.

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 Study 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.

4.4.3 Impacts on Threatened flora

The potential impacts on Threatened flora species on the subject site have been discussed in Section 4.2.6.3. Seven (7) part tests have also been completed in accordance with the *Threatened Species Conservation Amendment Act 2002* (JWA 2010d).

With the adoption of the proposed amelioration measures it is considered that the proposed development is highly unlikely to result in the local extinction of any Threatened flora species recorded on or adjacent to the subject site.

4.4.4 Proposed Offset strategy to ensure that there is no net loss of native vegetation values.

The proposed development will result in the loss of native vegetation as discussed within Section 4.4.2. The majority of vegetation communities occurring within the Environmental protection areas will be retained (**FIGURE 9**). Additionally, numerous areas of the site will be revegetated or regenerated (**FIGURE 22**) in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a). The Plan outlines the restoration works which are to be completed in the areas of vegetation that will be retained and rehabilitated.

The basic principles of the Revised Site Regeneration and Revegetation Plan include:

- Weed control will primarily consist of minor weed control within the Environmental protection areas, open space and any ecological buffers, the SEPP 14 wetland;
- All weed control will be completed using the recommended methods, including poisoning of Camphor laurel, cut and paint of woody weeds and selective spot spraying of any weedy annuals and grasses.
- All herbicide use will be completed by a qualified Bush regenerator;
- Weed control will be undertaken on a progressive basis over a three (3) – five (5) year period;
- Embellishments planting are to be used to consolidate each of the Environmental protection areas (EPA's). Planting efforts will be divided into moderate planting zones and high density planting zones.
- All revegetation areas will fenced to exclude cattle and reduce native fauna grazing;
- All revegetation will included the planting of native species that are representative of the species composition of the community concerned;
- All of the rehabilitation work is to be completed by qualified bush regenerators;
- A detailed maintenance program for each area will be included which outlines the maintenance to be completed over the next three (3) – five (5) years.
- A detailed monitoring program will be completed by a qualified ecologist. Reports on the progress of the rehabilitation are to be issued to Tweed Shire Council on a quarterly basis.

As previously discussed, approximately 305.62 hectares of vegetation occurs within the proposed development envelope, the majority of which is comprised of Low closed grassland.

In terms of remnant vegetation, 13.80 hectares occurs within the proposed development envelope (17.12% of the total area of remnant bushland). The Revised Site Regeneration and Revegetation Plan (JWA 2010a) will ensure that rehabilitation works to be completed will adequately offset any vegetation loss, through rehabilitation works and the provision of detailed monitoring and maintenance programs and specific performance objectives.

The proposed offset strategy on the subject site focuses on the revegetation/regeneration of EEC's and their associated habitat values. Proposed EEC offsets are shown in **FIGURE 28.** A summary of proposed EEC offsets was provided in Section 4.2.6.5 and is again provided in **TABLE 11** below**.**

Where impacts are likely on EEC's, a combination of offset measures have been proposed as follows:

1. Offset areas will be established and maintained on the subject site in accordance with the following plans:
    a. Revised Site Regeneration and Rehabilitation Plan (JWA 2010a);
    b. Revised Freshwater Wetland Rehabilitation Plan (JWA 2010b); and
    c. Revised Saltmarsh Rehabilitation Plan (JWA 2010c).
2. In instances where appropriate offset areas are not available on the subject site, Leda Manorstead Pty Ltd is currently in negotiations with DECCW with a view to securing appropriate off-site offsets.

TABLE 11
PROPOSED EEC OFFSETS ON THE SUBJECT SITE

EEC Offset Areas	Current total area (ha)	Loss - TOTAL (ha)	Proposed Offsets (ha)	Total area at completion of development (ha)	Net Loss/Gain (ha)
Swamp Sclerophyll Forest on Floodplain	3.80	3.80	23.74	23.74	+19.94
Lowland Rainforest on Floodplain	1.75	0.04	5.06	6.77	+5.02
Lowland Rainforest	9.24	0.10	7.06	16.20	+6.96
Freshwater Wetland	35.39	25.68	21.77	31.48	-3.91
Saltmarsh	54.63	10.25	14.3[2]	58.68	+4.05
Swamp oak Floodplain Forest	4.52	0.95	9.74[1]	13.31	+8.79

[2] Some of the revegetation of Saltmarsh and Swamp oak floodplain forest will occur in combination over the same area. The Swamp she-oak will make up the canopy and the Saltmarsh the groundcover.

4.5 Consideration of the provision, management and ongoing maintenance of general public open space

4.5.1 Introduction

This section will discuss the location of proposed Environmental Protection Areas within the open space network on the subject site and also address the management and maintenance of these Environmental Protection Areas. The management intent of the remaining active and passive open space areas is detailed within the Landscape Concept Plan (Place 2008).

4.5.2 Description of Environmental Protection Areas

The concept plan for the proposed development of the Cobaki lakes site includes approximately 194.36 ha of Environmental Protection Areas (**FIGURE 9**). The Environmental Protection Areas have been designated primarily for conservation of ecologically significant areas and retention/revegetation of habitat linkages from the vegetated ridgelines adjacent to and within the western portion of the subject site through the central Open Space area to the adjoining Environmental Reserve to the east of the site.

The key ecological values of the Environmental Protection Areas will be retained through the following measures:

- No development except for tracks for pedestrian access or for essential environmental management purposes.
- Pedestrian access is to be limited to designated tracks.
- Vehicular access, apart from for essential environmental management purposes, will be precluded.

4.5.3 Management of Environmental Protection Areas

An Environmental Protection Area Management Plan (EPAMP) will be completed for the proposed residential development at Cobaki lakes at the Development Application stage. The EPAMP will provide details on the specific uses and management for the Environmental Protection Areas, including the following:

- A description of the existing features;
- An outline of the rehabilitation or revegetation to be completed, including a detailed description of which species are to be planted;
- A detailed maintenance and monitoring program, including performance indicators, deadlines for completion, reporting and reviewing and any corrective action that may be required.

4.5.4 Maintenance

The maintenance of the Environmental Protection Areas will be described in detail in the EPAMP. The EPAMP will detail a 5 year maintenance program and it is intended that maintenance would become public responsibility after this time period.

4.6 Provide an assessment against SEPP 14 – Coastal Wetlands

4.6.1 Introduction

In response to the state-wide degradation of coastal wetlands, the Department of Planning enacted SEPP – 14 Coastal Wetlands in 1985. The policy aims to "ensure that the coastal wetlands are preserved and protected in the environmental and economic interests of the State".

This section provides an assessment of the potential impacts and the planned amelioration measures to reduce impacts associated with the proposed development.

4.6.2 Impacts on SEPP 14 wetland No.1

4.6.2.1 Background

SEPP 14 - Coastal Wetland No.1 occurs adjacent to the Subject site as shown in **FIGURE 3.** This wetland area is protected by State Environmental Planning Policy No. 14 – Coastal wetlands. The portion of the wetland that occurs on the subject site occurs almost entirely within the area dedicated to council (under Section 88b of the Conveyancing Act 1919) and the approved alignment of the Cobaki Parkway (i.e. a major arterial road to be constructed through the subject site).

It is therefore considered that the proposed residential development of the subject site is unlikely to have any significant direct impacts on the ecology of the wetland area. However, there is potential for the wetland area to be affected indirectly by changes in water quality, alteration of the local hydrological regime, sedimentation or a combination of these factors.

Stormwater runoff from the subject site has the potential to impact on the hydrological regime of the adjacent area of wetland. Amelioration measures are discussed in detail within the Stormwater Management Plan.

4.6.2.2 General Impacts

The proposed development has the potential to result in impacts on the SEPP 14 wetland related to:

- Alterations of hydrology within SEPP 14 wetlands;
- 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 intertidal 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.

4.6.2.3 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.

4.6.2.4 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.

4.6.3 Amelioration measures

The entire development footprint occurs to the west of the approved alignment of the Cobaki Parkway (i.e. a major arterial road to be constructed through the subject site). 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 has been prepared for the subject site which incorporates current best-practise measures to ensure that untreated stormwater does not flow directly into the SEPP 14 wetland. Stormwater management will involve the creation and use of suitable planted buffer zones where necessary, in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a).

4.7 Address the requirements of Councils DCP 25 – Biting Midge and Mosquito Control

4.7.1 Introduction

This section addresses the requirements of Tweed Shire Council's DCP 25 – Biting Midge and Mosquito Control. A Development Control Plan (DCP 25) relating to biting insects problems in the Tweed Shire was adopted by Tweed Shire Council in 1993. The DCP outlines the nuisance of biting insects, suggests ways to avoid biting insect problems, and includes maps of biting insect breeding areas. DCP 25 can be used in the planning stages of development, alleviating the nuisance and health risks associated with biting insects for residents and visitors.

4.7.2 Literature review

A Mosquito Management Report was compiled by Anthony E. Wright in 2001. The report addressed a number of strategies for the effective prevention of the vast majority of mosquito breeding at Cobaki Lakes, which may have the potential to "significantly constrain or prevent the successful development of the Cobaki lakes site". This report will be utilised in the assessment of mosquito nuisance at the Cobaki Lakes development site due to the localized nature of the report.

4.7.3 Mosquito control

The existing site at Cobaki Lakes frequently breeds large populations of mosquitoes, in particular the saltmarsh mosquito *Aedes vigilax* (Wright 2001). This species, and several others, create both an intolerable level of nuisance and health risks from mosquito borne viruses including Ross River (RR) and Barmah Forest (BF). Wright (2001) suggests three options for the effective prevention of the vast majority of mosquito breeding at Cobaki Lakes, including:

- "Cobaki Lakes Wetland Habitat Restoration" (Tweed Shire);
- Solid fill, laser levelling and freshwater lagoon; and
- Liquid fill and freshwater lagoon.

A Biting Midge and Mosquito Control Plan for the Cobaki Lakes site has been prepared by Mosquito Consulting Services Pty Ltd (McGinn 2008). This plan has been developed in consultation with JWA and Gilbert & Sutherland. Furthermore, the Stormwater Management Plan provides for the diffuse discharge of treated stormwater to both the freshwater and saltwater habitats through the construction of under-drained swales with level-spreader devices. By controlling, repairing and improving the surface water management within the rehabilitated areas, it is anticipated that the mosquito and biting midge problem will be reduced.

This Biting Midge and Mosquito Control Plan (McGinn 2008), in association with the Stormwater Management Plan, is considered to adequately address the requirements of Tweed Shire Council DCP 25.

4.8 Consideration of impacts on matters of national environmental significance (EPBC Act 1999)

4.8.1 Introduction

The *Environment Protection & Biodiversity Conservation Act 1999 (EPBC Act 1999)* was passed by Commonwealth Parliament in June 1999 and came into force on 16 July, 2000. A person must not, without an approval under the Act, take an action that has or will have, or is likely to have, a significant impact on a matter of National Environmental Significance (NES). A Commonwealth Assessment will be required for proposed activities on the subject site if they affect a matter of NES.

A detailed assessment of the Environment Protection & Biodiversity Conservation (EPBC) Act (1999) was included within the original Ecological Assessment report (JWA 2008). A summary of this assessment is provided below.

4.8.2 Summary

Flora

Six (6) Commonwealth Threatened flora species have been recorded on and/or adjacent to the Subject site:

- Coolamon
- Spiny gardenia
- Scented acronychia
- Stinking cryptocarya
- Rough-shelled bush-nut
- Swamp orchid

Potential impacts on these species and amelioration measures to retain/enhance habitat on the subject site have been discussed in section 4.2.

Fauna

One (1) Commonwealth Threatened fauna species, the Grey-headed flying-fox, was recorded on the Subject site. The Long-nosed potoroo and the Wallum sedgefrog were recorded on land adjacent to the Subject site, in the SEPP 14 wetlands to the east and in Crown land to the south-east, respectively. Mitchell's rainforest snail is considered a possible occurrence at the site.

It is considered that the Subject site does not support an important population of any species listed in the *EPBC Act (1999)* and a significant impact on these species will not be incurred.

Listed Migratory Species

It is considered that although two (2) listed migratory species, the Osprey and Black-tailed godwit, are known or likely to occur occasionally in the Study area, no area of important habitat occurs in the Study area for listed migratory species.

4.8.3 Requirement for Commonwealth Assessment

The proposal has been referred to the Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA) for assessment.

5. SUMMARY OF IMPACTS, MITIGATION & OFFSETS

The environmental zoning process on the subject site over 15 years has ensured that areas of ecological significance have been included in environmental protection zones. These areas have, therefore, been avoided in the development planning process. Ecologically significant plants or areas occurring within residentially zoned land will either be avoided or replaced in non-developed portions of the site. The emphasis will be to avoid the loss of these plants or EEC's in the Development Application phase.

As previously discussed, the proposed offset strategy on the subject site focuses on the revegetation/regeneration of EEC's and their associated habitat values. Where impacts are likely on EEC's, a combination of offset measures have been proposed as follows:

1. Offset areas will be established and maintained on the subject site in accordance with the following plans:
    a. Revised Site Regeneration and Rehabilitation Plan (JWA 2010a);
    b. Revised Freshwater Wetland Rehabilitation Plan (JWA 2010b); and
    c. Revised Saltmarsh Rehabilitation Plan (JWA 2010c).
2. In instances where appropriate offset areas are not available on the subject site, Leda Manorstead Pty Ltd is currently involved in negotiations with DECCW with a view to securing appropriate off-site offsets.

A summary of impacts on wildlife corridors, remnant bushland, Koala habitat in accordance with SEPP 44 and Tweed Shire Council, and any threatened species and their habitats is provided in **TABLE 12** below. Also addressed are the mitigation and offset measures proposed to ensure minimal impacts on ecologically significant areas and species.

TABLE 12
SUMMARY OF IMPACTS, MITIGATION AND OFFSETS

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
Wildlife corridors				
	• A reduction in the overall effectiveness of the site as a corridor due to habitat loss and fragmentation. • Edge effects may impact on retained corridor habitat.	• The proposed development utilises existing cleared areas. • A network of existing vegetated corridors will be retained on the site. • Additionally, smaller interlinking corridors will be provided on the subject site through regeneration and revegetation works. • Rehabilitation works on the subject site will include buffers to retained vegetation corridors as well as weed maintenance along edges.	• A Revised Site Regeneration and Revegetation Plan (JWA 2010a) has been prepared for the subject site to provide vegetated links across the site and ensure that the remaining wildlife corridors will be embellished utilising revegetation and natural regeneration principles. • A total of 83.06ha of regeneration and 9.54ha of revegetation works are proposed.	• A net gain of approximately 78.79ha of vegetation providing suitable corridor habitat will occur as a result of the proposed development.
Remnant bushland				
	• 13.80 hectares (17.12%) of remnant bushland will be lost. • Edge effects may impact on retained remnant bushland.	• A total of 70.49 hectares (82.88%) of remnant bushland will be retained on the subject site. • Weed control will be completed on the interface of remnant bushland by a qualified Bush regenerator; • Weed control will be undertaken on a progressive basis over a three (3) – five (5) year period; • Embellishment plantings are to be used to consolidate each of the areas of remnant vegetation;	• The Revised Site Regeneration and Revegetation Plan (JWA 2010a) includes 83.06ha of regeneration and 9.54ha of revegetation works to offset the loss of 13.80ha of remnant bushland and outlines the various measures to ensure that the retained remnant vegetation is adequately	• Revegetation on the subject site will result in a long-term net gain of approximately 78.79ha of remnant bushland.

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
		• All areas of remnant vegetation will be fenced to exclude pedestrian traffic and cattle grazing; • Formal pathways are to be provided through areas of remnant vegetation to prevent the creation of numerous informal tracks; • A monitoring and maintenance program for areas of remnant vegetation is included in the Revised Site Regeneration and Revegetation Plan (JWA 2010a).	managed.	
Koala habitat				
	• 12.50 hectares (29.47%) of suitable Koala habitat may potentially be lost. • All potential Koala habitat to be removed occurs within portions of the site with existing development approval. • No conclusive evidence of Koala activity has been recorded from the subject site.	• A total of 29.91 hectares (70.53%) of suitable Koala habitat is proposed to be retained within Environmental Protection Areas & Open Space areas.	• Proposed revegetation and regeneration works on the subject site (**FIGURE 22**) will increase the area of available Koala habitat in the long-term and provide vegetated linkages through the landscape. • 83.06ha of regeneration and 9.54ha of revegetation works will be completed to offset the loss of 12.5ha of suitable Koala habitat.	• Revegetation on the subject site, including planted Koala food tree species, will result in a long-term net gain of approximately 62.68ha of vegetation suitable as Koala forage and/or corridor habitat.
Threatened flora				
• White yiel yiel (*Grevillea hilliana*)	• No stems of White yiel yiel occur within the proposed development footprint (**FIGURE 25a**).	• Approximately 10.85 hectares (98.7%) of suitable habitat for these species will be retained.	• Rehabilitation of approximately 12.12ha of lowland rainforest in accordance with the	• The local populations of these species will be bolstered through propagation and replanting

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
• Scented acronychia (*Acronychia littoralis*) • Fine-leaved tuckeroo (*Lepiderema pulchella*) • Spiny gardenia (*Randia moorei)* • Marblewood (*Acacia bakeri*)	• One (1) stem of Scented acronychia has been recorded from within a small isolated clump of vegetation in the central northern portion of the subject site (**FIGURE 25a**). This clump of vegetation will be retained and protected under Environmental Covenant. • No stems of Fine-leaved tuckeroo occur within the proposed development footprint (**FIGURE 25a, 25b & 25c**). • No stems of Spiny gardenia occur within the proposed development footprint (**FIGURE 25a**). • No stems of Marblewood occur within the proposed development footprint (**FIGURE 25a & 25b**).	• Rehabilitation of retained lowland rainforest communities will be completed. • 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. • It is also recommended that propagation of Threatened flora species be undertaken as part of the rehabilitation works on the subject site in an attempt to bolster local populations. • As a minimum, every retained Threatened plant on the subject site will be provided with a 5m vegetated buffer. • Weed control will be completed on the interface of retained rainforest habitats by a qualified Bush regenerator. • Weed control will be undertaken on a progressive basis over a three (3) – five (5) year period. • All areas of retained rainforest	Revised Site Regeneration and Revegetation Plan (JWA 2010a) to offset the loss of 0.14 ha and will ensure protection for retained Threatened flora species and their habitats.	of this species. • Revegetation on the subject site will result in a long-term net gain of approximately 11.98ha of suitable habitat for these species.

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
• Brush cassia (*Cassia brewsteri* var. *marksiana*)	• One (1) stem of the Brush cassia occurs within an area designated as Environmental Protection and one (1) stem within an area to be retained and protected by Environmental Covenant (**FIGURE 25a & 25b**).	habitat will be fenced to exclude pedestrian traffic and cattle grazing. • Formal pathways are to be provided throughout the development to prevent the creation of numerous informal tracks.		
• Coolamon (*Syzygium moorei*)	• The proposed development is considered unlikely to impact on the Coolamon which occur adjacent to the subject site (**FIGURE 25a**).	• A monitoring and maintenance program for areas of remnant vegetation is included in the Revised Site Regeneration and Revegetation Plan (JWA 2010a).		
• Green-leaved rose walnut (*Endiandra muelleri* subsp. *bracteata)*	• None of the five (5) stems of Green-leaved rose-walnut recorded on the site occur within the proposed development footprint (**FIGURE 25b**).			
• White lace flower (*Archidendron hendersonii*)	• This species has not been recorded from the subject site.			
• Stinking cryptocarya (*Cryptocarya foetida*)	• This species has not been recorded from the subject site.			

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
• Rough-shelled bush-nut (*Macadamia tetraphylla*)	• This species has not been recorded from the subject site. • The proposed development will remove 0.14 hectares (1.3%) of potential habitat for these species, all of which will occur from areas of the site with existing development approvals.			
• Pink nodding orchid (*Geodorum densiflorum*) • Swamp orchid (*Phaius australis*)	• This species has not been recorded from the subject site. • This species has not been recorded from the subject site. • The proposed development will result in the removal or modification a total of 3.8 hectares of potential habitat for these species, all of which occurs in areas of the site which have existing development approvals.	• Rehabilitation of Swamp sclerophyll forest communities will be completed. • It is also recommended that propagation of Threatened flora species be undertaken as part of the rehabilitation works on the subject site in an attempt to bolster local populations. • As a minimum, every retained Threatened plant on the subject site will be provided with a 5m vegetated buffer. • Weed control will be completed on the interface of retained habitats by a qualified Bush regenerator.	• In total, 23.74 hectares of Swamp sclerophyll forest will be regenerated/ revegetated on the subject site to offset the loss of 3.8 hectares. • These areas will ensure protection for retained Threatened flora species and also provide additional habitat for Threatened flora species occurring on and adjacent to the subject site.	• The local populations of these species will be bolstered through propagation and replanting of this species. • Revegetation/regeneration works on the subject site will result in a long-term net gain of approximately 19.94ha of suitable habitat for these species.

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
	• Edge effects may impact on retained habitat.	• Weed control will be undertaken on a progressive basis over a three (3) – five (5) year period. • All areas of retained habitat will be fenced to exclude pedestrian traffic and cattle grazing. • Formal pathways are to be provided throughout the development to prevent the creation of numerous informal tracks. • A monitoring and maintenance program for areas of remnant vegetation is included in the Revised Site Regeneration and Revegetation Plan (JWA 2010a).		
Endangered Ecological Communities				
• Swamp sclerophyll forest on coastal floodplain	• The entire area (3.8ha) of existing Swamp sclerophyll forest on coastal floodplain will be lost (**FIGURE 27**). • The conservation significance of this community has been severely compromised by	• Amelioration for the removal of the degraded Swamp sclerophyll forest on coastal floodplain will be provided through revegetation works on the subject site. • A Revised Site Regeneration and Revegetation Plan (JWA 2010a) has been prepared for the subject site and includes measures to	• In total, 23.74 hectares of Swamp sclerophyll forest will be regenerated/ revegetated on the subject site (**FIGURE 28**) to offset the loss of 3.8 hectares.	• Revegetation and landscaping works on the subject site will result in a long-term net gain of approximately 19.94ha of Swamp sclerophyll forest on coastal floodplain.

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
	past land-use activities including cattle grazing and periodic slashing which has resulted in the removal of the midstorey and the prevalence of introduced grasses and common agricultural weeds in the groundcover layer. • Edge effects may impact on retained EEC's.	offset the loss of this EEC from the subject site. • Additional compensation will be provided through regeneration and revegetation works in accordance with the Revised Freshwater Wetland Rehabilitation Plan (JWA 2010b). • Both the Revised Site Regeneration and Revegetation Plan and the Revised Freshwater Wetland Rehabilitation Plan include specific performance criteria as well as detailed maintenance and monitoring programs and it is therefore considered that the compensatory Swamp sclerophyll forest on coastal floodplain will be more likely to persist in the long-term compared to the existing communities. • Weed control will be completed on the interface of EEC's by a qualified Bush regenerator. • Weed control will be undertaken on a progressive basis over a three (3) – five (5) year period.		

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
		• Embellishment plantings are to be used to consolidate each of the areas of EEC. • All areas of EEC will be fenced to exclude pedestrian traffic and cattle grazing. • A monitoring and maintenance program for areas of remnant vegetation is included in the Revised Site Regeneration and Revegetation Plan (JWA 2010a).		
• Lowland rainforest on floodplain	• In total 0.04 hectares (2.29%) of Lowland rainforest on floodplain will be lost (**FIGURE 27**), all of which occurs within portions of the site with existing development approvals. • Edge effects may impact on retained EEC's.	• Amelioration for the removal of a small area of Lowland rainforest on floodplain will be provided through revegetation works on the subject site. • The Revised Site Regeneration and Revegetation Plan (JWA 2010a) includes measures to offset the loss of a small area of this EEC from the subject site. • 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.	• In total, 5.06 hectares of Lowland rainforest on floodplain will be regenerated/ revegetated on the subject site (**FIGURE 28**) to offset the loss of 0.04 hectares.	• Revegetation works on the subject site will result in a long-term net gain of approximately 5.01ha of Lowland rainforest on floodplain.

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
		• As a minimum, retained Lowland rainforest on floodplain on the subject site will be provided with a 10m vegetated buffer. • The Revised Site Regeneration and Revegetation Plan (JWA 2010a) includes specific performance criteria as well as a detailed maintenance and monitoring program to ensure the persistence of this EEC in the long-term. • Weed control will be completed on the interface of EEC's by a qualified Bush regenerator. • Weed control will be undertaken on a progressive basis over a three (3) – five (5) year period. • Embellishment plantings are to be used to consolidate each of the areas of EEC. • All areas of EEC will be fenced to exclude pedestrian traffic and cattle grazing. • A monitoring and maintenance program for areas of retained and rehabilitated vegetation is included in the Revised Site Regeneration and Revegetation		

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
		Plan (JWA 2010a).		
• Lowland rainforest	• Approximately 0.10 hectares (1.08%) of Lowland rainforest will be lost (**FIGURE 27**), all of which occurs within portions of the site with existing development approvals. • Edge effects may impact on retained EEC's.	• Amelioration for the removal of a small area of Lowland rainforest will be provided through revegetation works on the subject site. • The Revised Site Regeneration and Revegetation Plan (JWA 2010a) includes measures to offset the loss of a small area of this EEC from the subject site. • 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. • As a minimum, retained Lowland rainforest on the subject site will be provided with a 10m vegetated buffer. • The Revised Site Regeneration and Revegetation Plan (JWA 2010a) includes specific performance criteria as well as a detailed maintenance and monitoring program to ensure the persistence of this EEC in the long-term.	• In total, 7.06 hectares of Lowland rainforest on will be regenerated and/or revegetated on the subject site (**FIGURE 28**) to offset the loss of 0.10 hectares.	• Revegetation works on the subject site will result in a long-term net gain of approximately 6.96ha of Lowland rainforest.

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
		• Weed control will be completed on the interface of EEC's by a qualified Bush regenerator. • Weed control will be undertaken on a progressive basis over a three (3) – five (5) year period. • Embellishment plantings are to be used to consolidate each of the areas of EEC. • All areas of EEC will be fenced to exclude pedestrian traffic and cattle grazing. • A monitoring and maintenance program is included in the Revised Site Regeneration and Revegetation Plan (JWA 2010a).		
• Freshwater wetlands	• In total 25.68 hectares (71.47%) of highly degraded Freshwater wetland will be lost from the subject site (**FIGURE 27**).	• A Revised Freshwater Wetland Rehabilitation Plan (JWA 2010a) has been prepared for the subject site and includes measures to provide more intact wetland communities on the subject site. • The Revised Freshwater Wetland Rehabilitation Plan (JWA 2010a) includes specific performance criteria as well as a detailed maintenance and monitoring program and it is therefore	• Offsets for the removal of highly degraded Freshwater wetland vegetation from the subject site will include the following: 1. Recreation of approximately 2.25ha of high quality wetland habitats (**FIGURE 28**). These compensatory Freshwater wetlands	• The proposed development will result in a net loss of approximately 3.91 ha of Freshwater wetlands. • As previously mentioned Leda Manorstead Pty Ltd is currently in negotiations with DECCW with a view to securing appropriate off-site offsets.

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
		considered that the rehabilitated Freshwater wetlands will be more likely to persist in the long-term compared to the existing community. • Weed control will be completed on the interface of EEC's by a qualified Bush regenerator. • Weed control will be undertaken on a progressive basis over a three (3) – five (5) year period. • All areas of EEC will be fenced to exclude pedestrian traffic and cattle grazing. • A monitoring and maintenance program for areas of remnant vegetation is included in the Revised Freshwater Wetland Rehabilitation Plan (JWA 2010b).	will be offline from the stormwater treatment train and will also be specifically designed to provide core (breeding) habitat for the Wallum froglet; 2. Approximately 19.52ha of Freshwater wetland vegetation will be provided through revegetation works associated with the stormwater conveyance and treatment infrastructure on the subject site (**FIGURE 28**); and 3. Additionally, Leda Manorstead Pty Ltd is currently negotiating with DECCW regarding appropriate off-site offsets.	
• Swamp oak floodplain forest	• In total 0.95 hectares (21.02%) of Swamp oak floodplain will be lost (**FIGURE 27**).	• The removal of approximately 0.95 hectares of the Swamp oak floodplain forest community from the subject site will be ameliorated by regenerating and	• In total, 9.74 hectares of Swamp oak floodplain forest will be regenerated/ revegetated on the subject site (**FIGURE 28**) to offset	• Revegetation works on the subject site will result in a long-term net gain of approximately 8.79ha of Swamp oak floodplain

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
	• Edge effects may impact on retained EEC's.	revegetating compensatory Swamp oak communities on the subject site. • Areas within and adjacent to the existing Saltmarsh communities on the subject site are currently comprised of a mixture of exotic grasses and will be restored to Saltmarsh and Swamp oak communities in accordance with the Revised Saltmarsh Restoration Plan (JWA 2010c). • Removal of cattle from the area and subsequent relinquishment of existing use rights is considered an integral component of the rehabilitation process. • Weed control will be completed on the interface of EEC's by a qualified Bush regenerator. • Weed control will be undertaken on a progressive basis over a three (3) – five (5) year period. • Embellishment plantings are to be used to consolidate each of the areas of EEC. • All areas of EEC will be fenced to	the loss of 0.95 hectares.	forest.

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
		exclude pedestrian traffic and cattle grazing. • A monitoring and maintenance program for areas of Swamp oak floodplain forest is included in the Revised Saltmarsh Rehabilitation Plan (JWA 2010c).		
• Coastal saltmarsh	• In total 10.25 hectares (18.76%) of Coastal saltmarsh will be lost (**FIGURE 27**). • Edge effects may impact on retained EEC's.	• The removal of approximately 10.25 hectares of degraded Saltmarsh communities from the subject site will be ameliorated by regenerating and revegetating compensatory Saltmarsh communities on the subject site. • Large areas adjacent to the existing Saltmarsh communities are currently comprised of a mixture of exotic grasses and will be restored to Saltmarsh communities in accordance with the Revised Saltmarsh Restoration Plan (JWA 2010c). • Removal of cattle from the area and subsequent relinquishment of existing use rights is considered an integral component of the rehabilitation process. • Weed control will be completed on the interface of EEC's by a	• In total, 14.3 hectares of Coastal saltmarsh will be regenerated/revegetated on the subject site (**FIGURE 28**) to offset the loss of 10.25 hectares.	• Revegetation works on the subject site will result in a long-term net gain of approximately 4.05ha of Coastal saltmarsh.

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
		qualified Bush regenerator. • Weed control will be undertaken on a progressive basis over a three (3) – five (5) year period. • All areas of EEC will be fenced to exclude pedestrian traffic and cattle grazing. • A monitoring and maintenance program is included in the Revised Saltmarsh Rehabilitation Plan (JWA 2010c).		
Threatened fauna				
• Wallum froglet (*Crinia tinnula*)	• The proposed development may result in direct mortality to individuals of this species during construction. • The proposed development will not remove or modify any areas of core habitat. • Approximately 69.29 hectares (87.58%) of potential forage habitat will be removed. The majority of forage habitat will be removed from areas with existing development approvals.	• A number of areas in the central portion of the subject site will be rehabilitated in accordance with the Revised Freshwater Wetland Rehabilitation Plan (JWA 2010b). These areas will be designed to provide approximately 2.25 hectares of core habitat for the Wallum froglet on the subject site. • Furthermore, 19.52ha of additional Freshwater wetlands and 23.74ha Swamp sclerophyll forest will be regenerated/revegetated on the subject site (**FIGURE 28**) in accordance with the Revised Freshwater Wetland Rehabilitation	• No core habitat will be removed. • Offsets for the removal of highly degraded Freshwater wetland vegetation from the subject site will include the following: 1. Recreation of approximately 2.25ha of high quality wetland habitats (**FIGURE 28**). These compensatory Freshwater wetlands will be offline from the stormwater	• Revegetation works on the subject site will result in a net gain of approximately 2.25ha of core habitat for the Wallum froglet. • The proposed development will result in a net loss of approximately 26.23ha of highly degraded forage habitat. • As previously mentioned Leda Manorstead Pty Ltd is currently in negotiations with DECCW with a view to securing appropriate off-site offsets.

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
	• Alteration of water quality in drainage lines due to soil runoff from the construction site. • Alteration of hydrology of the drainage lines due to construction. • Contamination or reduction of water quality in drainage lines due to runoff from chemicals or debris (fertilisers, etc). • Introduction of weed species into core habitat areas. • Increased competition from disturbance-adapted native, domestic and introduced fauna (such as Cane toads, Noisy miners, foxes, dogs, cats, rats, etc.).	Plan (JWA 2010b) and the Revised Site Regeneration and Revegetation Plan (JWA 2010a) respectively. These areas are likely to provide suitable forage habitat for this species and partly offset the loss of degraded forage habitat. • A detailed Stormwater Management Plan has been prepared for the subject site utilising current best-practice management techniques which will ensure no adverse impacts on the hydrology of the current core habitat (adjacent to the site) and the proposed rehabilitated freshwater wetlands. • Furthermore any stormwater treatment devices and sedimentation ponds will be designed so that they provide limited opportunities for the introduced Mosquito fish (*Gambusia* sp.) to breed and hence provide better habitat for native frogs. • Weed control will be completed on the interface of compensatory habitat areas by a qualified Bush	treatment train and will also be specifically designed to provide core (breeding) habitat for the Wallum froglet; 2. Approximately 19.52ha of Freshwater wetland vegetation (**FIGURE 28**) will be provided through revegetation works associated with the stormwater conveyance and treatment infrastructure on the subject site; and 3. Additionally, Leda Manorstead Pty Ltd is currently in negotiations with DECCW with a view to securing appropriate off-site offsets. • Furthermore, 23.74ha Swamp sclerophyll forest will be regenerated and/or revegetated on the subject site (**FIGURE 28**) in accordance with the Revised Site Regeneration	

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
		regenerator. • Weed control will be undertaken on a progressive basis over a three (3) – five (5) year period. • A monitoring and maintenance program for areas of compensatory habitat will be included in within a Wallum Froglet Compensatory Habitat Plan to be completed at the development application stage.	and Revegetation Plan (JWA 2010a).	
• Black-necked stork (*Xenorhynchus asiaticus*)	• Approximately 82.39 hectares (58.60%) of potential forage habitat will be removed from the subject site. The majority of forage habitat will be removed from areas with existing development approvals. • 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.	• Areas in the central portion of the subject site will be rehabilitated in accordance with the Revised Freshwater Wetland Rehabilitation Plan (JWA 2010b). These areas will provide approximately 21.77 hectares of additional habitat for the Black-necked stork on the subject site. • Furthermore, 23.74 hectares of Swamp sclerophyll forest will be regenerated/revegetated on the subject site (**FIGURE 28**) in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a). • These areas are likely to provide suitable forage habitat for this	• In total, 45.50 hectares of vegetation likely to provide suitable forage habitat will be regenerated and/or revegetated on the subject site (**FIGURE 28**) to partly offset the loss of 82.39 hectares. • There will be a net gain of 4.05ha within the Saltmarsh community in the eastern portion of the subject site which currently provides suitable habitat for this species. • Additionally, Leda Manorstead Pty Ltd is currently in negotiations	• The proposed development will result in a net loss of approximately 32.84ha of highly degraded forage habitat. • As previously mentioned Leda Manorstead Pty Ltd is currently in negotiations with DECCW with a view to securing appropriate off-site offsets.

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
		species and offset any loss of forage habitat in the long-term. • Additionally, 58.68 hectares of vegetation within the south-eastern portion of the subject site will be retained and rehabilitated in accordance with the Revised Saltmarsh Rehabilitation Plan (JWA 2010c). This area currently provides suitable forage habitat for the Black-necked stork and will continue to do so in the long term.	with DECCW with a view to securing appropriate off-site offsets for the loss of degraded Freshwater wetland habitats.	
• Powerful owl (*Ninox strenua*)	• The primary threat to this species and its habitat is the loss and modification of forest and old growth elements, especially trees supporting large nest hollows and areas supporting high densities of prey populations (Debus and Chafer 1994). • This species may potentially forage over the majority of the subject site however it is estimated that the development will result in the loss of	• The proposed retention of large areas of intact forest is likely to result in the continued foraging of this species on the subject site. • Furthermore, approximately 83.06ha of regeneration and 9.54ha of revegetation works will be completed in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) to offset the loss of 13.67ha of forage habitat. • These areas are all likely to provide suitable forage habitat for the Powerful owl in the long-term. • Retention of old growth trees will	• In total, 92.59 hectares of vegetation likely to provide suitable forage habitat for the Powerful owl in the long-term will be regenerated/revegetated on the subject site (**FIGURE 28**) to offset the loss of 13.67 hectares.	• Revegetation works on the subject site will result in a long-term net gain of approximately 78.92ha of suitable forage habitat for the Powerful owl.

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
	approximately 13.67 hectares (19.58%) of better quality habitat. • The majority of forage habitat will be removed from areas with existing development approvals. • 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. • Loss of vegetation from the subject site will approximate to only 2-3% of the estimated home range of a Powerful owl.	also provide continued nesting opportunities for this species. • Additionally, the installation of nest boxes of a suitable size for owls within retained vegetation (in accordance with the Fauna Management Plan – JWA 2009a) will improve the habitat values of the site for this species and encourage the use of site habitats for nesting purposes.		
• Masked owl – (*Tyto novaehollandiae*)	• This species may potentially forage over the majority of the subject site however, it is estimated that approximately 13.67 hectares (19.58%) of better quality forage habitat for the Masked owl will be removed.	• The proposed retention of large areas of intact forest is likely to result in the continued foraging of this species on the subject site. • Furthermore, approximately 83.06ha of regeneration and 9.54ha of revegetation works will be completed in accordance with the Revised Site Regeneration and	• In total, 92.59 hectares of vegetation likely to provide suitable forage habitat for the Masked owl in the long-term will be regenerated and/or revegetated on the subject site (**FIGURE 28**) to offset the loss of 13.67 hectares.	• Revegetation works on the subject site will result in a long-term net gain of approximately 78.92ha of suitable forage habitat for the Powerful owl.

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
	• The majority of forage habitat will be removed from areas with existing development approvals. • This species may also be susceptible to road-strike, as birds often forage along roadsides or use roads to move between foraging sites (Debus and Rose 1994). • Loss of Sclerophyll forest may reduce the availability of arboreal and terrestrial mammalian prey for this species however loss of vegetation from the subject site will approximate to only 2%-3% of the estimated home range of a Masked owl. • 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 Plan (JWA 2010a) to offset the loss of 13.67ha of forage habitat. • These areas are all likely to provide suitable forage habitat for the Masked owl in the long-term. • Retention of old growth trees will also provide nesting opportunities for this species. • Additionally, the installation of nest boxes of a suitable size for owls within retained vegetation (in accordance with the Fauna Management Plan – JWA 2009a) will improve the habitat values of the site for this species and encourage the use of site habitats for nesting purposes.		

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
• Osprey (*Pandion haliaetus*)	• It is expected that impacts of the proposed development will be restricted to human disturbance near any nest site. • No active nest sites have been recorded on the subject site in recent times.	• The developer is therefore committed to erecting at least two (2) artificial nesting platforms on the site (**FIGURE 32**). It is well known that these platforms are highly successful.	No forage habitat will be removed from the subject site.	N/A
• Koala (*Phascolarctos cinereus*)	• 12.50 hectares (29.47%) of suitable Koala habitat may potentially be lost. • All potential Koala habitat to be removed occurs within portions of the site with existing development approval. • No conclusive evidence of Koala activity has been recorded from the subject site.	• A total of 29.91 hectares (70.53%) of suitable Koala habitat is proposed to be retained within Environmental Protection Areas & Open Space areas.	• Proposed revegetation and regeneration works on the subject site (**FIGURE 22**) will increase the area of available Koala habitat in the long-term and provide vegetated linkages through the landscape. • 83.06ha of regeneration and 9.54ha of revegetation works will be completed to offset the loss of 12.5ha of suitable Koala habitat.	• Revegetation on the subject site, including planted Koala food tree species, will result in a long-term net gain of approximately 62.68ha of vegetation suitable as Koala forage and/or corridor habitat.
• Grey-headed flying-fox (*Pteropus poliocephelus*)	• Approximately 13.54ha (18.74%) of potential forage habitat will be removed from the subject site. • The majority of forage habitat will be removed from areas with existing	• The Grey-headed flying-fox is considered likely to continue foraging within retained areas of vegetation on the site. • Furthermore, 23.74 hectares of Swamp sclerophyll forest, 5.06 hectares of Lowland rainforest, 7.06 hectares of Lowland	• In total, 56.52 hectares of vegetation likely to provide suitable forage habitat for the Grey-headed flying-fox will be regenerated/ revegetated on the subject site (**FIGURE 28**) to offset the loss of 13.54 hectares.	• Revegetation works on the subject site will result in a long-term net gain of approximately 42.98ha of suitable forage and/or corridor habitat for the Grey-headed flying-fox.

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
	development approvals. • Suitable roosting habitat for this species may occur in the rainforest community located on Mt. Woodgee which will be retained. • Given the high mobility of this species, the loss of 13.54ha is not considered significant in relation to the regional distribution of potential foraging habitat for this species.	rainforest on floodplain and 20.66ha of Wet sclerophyll forest will be regenerated/revegetated on the subject site (**FIGURE 28**) in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a). • These areas are likely to provide suitable forage habitat for this species and offset the loss of 13.54ha.		
• Little bent-wing bat *Miniopterus australis*) & Common bent-wing bat (*Miniopterus schreibersii*)	• Approximately 13.54ha (18.74%) of potential forage habitat will be removed from the subject site. • The majority of forage habitat will be removed from areas with existing development approvals. • Given the high mobility of these species, the loss of potential foraging habitat is not considered significant in relation to the regional distribution	• Approximately 83.06ha of regeneration and 9.54ha of revegetation works will be completed in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) to offset any loss of remnant bushland and to provide vegetated links across the site. • These areas are all likely to provide suitable forage habitat for these species in the long-term and offset the loss of 13.54ha.	• In total, 92.59 hectares of vegetation likely to provide suitable forage habitat for these species will be regenerated/revegetated on the subject site (**FIGURE 28**) to offset the loss of 13.54 hectares.	• Revegetation works on the subject site will result in a long-term net gain of approximately 79.05ha of suitable forage habitat for these species.

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
	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.			
• Eastern free-tail bat (*Mormopterus norfolkensis*), Yellow-bellied sheathtail bat (*Saccolaimus flaviventris*) & Greater broad-nosed bat (*Scoteanax rueppellii*)	• Approximately 13.54ha (18.74%) of potential forage habitat will be removed from the subject site. • The majority of forage habitat will be removed from areas with existing development approvals. • 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. • There will be a minor loss of potential roost sites	• It is considered that these species will continue to utilise retained vegetation for foraging and retained habitat trees for roosting. • Furthermore, approximately 83.06ha of regeneration and 9.54ha of revegetation works will be completed in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) to offset any loss of remnant bushland and to provide vegetated links across the site. • These areas are all likely to provide suitable forage habitat for these species in the long-term. • The installation of bat boxes within retained vegetation (in accordance with the Fauna	• In total, 92.59 hectares of vegetation likely to provide suitable forage habitat for these species will be regenerated/revegetated on the subject site (**FIGURE 28**) to offset the loss of 13.54 hectares.	• Revegetation works on the subject site will result in a long-term net gain of approximately 79.05ha of suitable forage habitat for these species. • Installation of bat boxes within retained vegetation (in accordance with the Fauna Management Plan – JWA 2009a) will increase roosting opportunities for these species and offset the loss of any hollow-bearing trees.

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
	(i.e. hollow-bearing trees) for these species.	Management Plan – JWA 2009a) will increase roosting opportunities for these species.		
• Wallum sedge-frog (*Litoria olongburensis*)	• This species has not been recorded from the subject site, however potential habitat occurs. • The proposed development will not remove or modify any area considered to provide core habitat for the Wallum sedge frog. • Approximately 25.68 hectares (72.56%) of potential forage habitat will be removed from the subject site. • Alteration of water quality in drainage lines due to soil runoff from the construction site. • Alteration of hydrology of the drainage lines due to construction. • Contamination or reduction of water quality in drainage lines	• A number of areas in the central portion of the subject site will be rehabilitated in accordance with the Revised Freshwater Wetland Rehabilitation Plan (JWA 2010b). These areas will be designed to provide approximately 2.25 hectares of core habitat for the Wallum froglet on the subject site and may also provide habitat for the Wallum sedge frog. • Furthermore, 19.52ha of additional Freshwater wetlands and 23.74ha Swamp sclerophyll forest will be regenerated/revegetated on the subject site (**FIGURE 28**) in accordance with the Revised Freshwater Wetland Rehabilitation Plan (JWA 2010b) and the Revised Site Regeneration and Revegetation Plan (JWA 2010a) respectively. These areas are likely to provide suitable forage habitat for this species and partly offset the loss of degraded forage habitat. • A detailed Stormwater Management Plan has been	• No core habitat will be removed. • Offsets for the removal of highly degraded Freshwater wetland vegetation from the subject site will include the following: 1. Recreation of approximately 2.25ha of high quality wetland habitats. These compensatory Freshwater wetlands will be offline from the stormwater treatment train and will also be specifically designed to provide core (breeding) habitat for the Wallum froglet; 2. Approximately 19.52ha of Freshwater wetland vegetation will be provided through revegetation works	• Revegetation works on the subject site will result in a net gain of approximately 2.25ha of core habitat suitable for the Wallum sedge frog. • The proposed development will result in a net loss of approximately 26.23ha of highly degraded forage habitat. • As previously mentioned Leda Manorstead Pty Ltd is currently in negotiations with DECCW with a view to securing appropriate off-site offsets.

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
	due to runoff from chemicals or debris (fertilisers, etc). • Introduction of weed species into core habitat areas adjacent to the subject site. • Increased competition from disturbance-adapted native, domestic and introduced fauna (such as Cane toads, Noisy miners, foxes, dogs, cats, rats, etc.).	prepared for the subject site utilising current best-practice management techniques which will ensure no adverse impacts on the hydrology of the current adjacent core habitat and the proposed rehabilitated freshwater wetlands. • Any stormwater treatment devices and sedimentation ponds will be designed so that they provide limited opportunities for the introduced Mosquito fish (*Gambusia* sp.) to breed and hence provide better habitat for native frogs. • A monitoring and maintenance program for areas of compensatory habitat is included in the Revised Site Regeneration and Revegetation Plan (JWA 2010a).	associated with the stormwater conveyance and treatment infrastructure on the subject site; and 3. Additionally, Leda Manorstead Pty Ltd is currently in negotiations with DECCW with a view to securing appropriate off-site offsets. • Furthermore, 23.74ha Swamp sclerophyll forest will be regenerated and/or revegetated on the subject site (FIGURE 26) in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a).	
• Bush hen (*Amaurornis olivaceus*)	• This species has not been recorded from the subject site, however potential habitat occurs. • The proposed development will result in the removal or modification a total of 0.02 hectares (1.42%) of	• Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) and Revised Freshwater Wetland Rehabilitation Plan (JWA 2010b) will result in the regeneration/revegetation of 23.74 hectares of Swamp sclerophyll forest, 5.06 hectares of Lowland rainforest on floodplain,	• In total, 57.63 hectares of vegetation that may provide suitable forage habitat for this species in the long-term will be regenerated/revegetated on the subject site (**FIGURE 28**) to offset the loss of 0.02 hectares.	• Revegetation/regeneration works on the subject site will result in a long-term net gain of approximately 57.61ha of potential forage habitat for the Bush hen.

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
	potential habitat for this species, all of which occurs within portions of the site with existing development approvals. • Due to their crepuscular and nocturnal nature, this species is most likely to be active around dusk or during the night. This may place any birds at risk of disturbance by street lighting and night-time traffic. • Other impacts may include predation by domestic cats.	7.06 hectares of Lowland rainforest and 21.77 hectares of Freshwater wetland. • These areas may provide a total of 57.63ha of suitable habitat for this species and offset the loss of 0.02ha of habitat. • Traffic movement controls on local roads and awareness signage are to be incorporated into detailed site design. • Landowners should control cats. All animals should reside within fenced enclosures and be on a leash when outside of the enclosure. • Street lights adjacent to retained habitat areas should be capped. Vegetated buffers and/or dense planted screens will also reduce the impacts of lighting.		
• Glossy black-cockatoo (*Calyptorhynchus lathami*)	• This species has not been recorded from the subject site, however potential habitat occurs. • The proposed development will result in the removal or	• The proposed development will retain large areas of intact forest that will provide continued foraging resources for this species on the subject site. • Rehabilitation works in accordance with the Revised Site Regeneration	• In total, 92.59ha of vegetation that may provide suitable forage habitat for this species in the long-term will be regenerated/ revegetated on the subject site (**FIGURE 28**) to offset the	• Revegetation works on the subject site will result in a long-term net gain of approximately 87.17ha of forage habitat for the Glossy black-cockatoo.

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
	modification a total of 5.42 hectares (11.15%) of potential habitat for this species. • The majority of forage habitat will be removed from areas with existing development approvals. • 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.	and Revegetation Plan (JWA 2010a) will result in 83.06ha of regeneration and 9.54ha of revegetation works to offset any loss of vegetation and to provide vegetated links across the site. These works will utilise *Allocasuarina* species where possible to provide suitable forage resources for this species. • Additionally, the installation of nest boxes of a suitable size for cockatoos within retained vegetation (in accordance with Fauna Management Plan – JWA 2009a) will improve the habitat values of the site for this species and encourage the use of site habitats for nesting purposes.	loss of 5.42 hectares.	
• Brolga (*Grus rubicunda*)	• This species has not been recorded from the subject site, however potential habitat occurs. • Approximately 82.39 ha (58.6%) of potential forage habitat will be removed from the subject site. • The majority of forage habitat will be removed	• Areas in the central portion of the subject site will be rehabilitated in accordance with the Revised Freshwater Wetland Rehabilitation Plan (JWA 2010b). These areas will provide approximately 21.77 hectares of additional potential habitat for the Brolga on the subject site. • Furthermore, 23.74 hectares of Swamp sclerophyll forest will be regenerated/revegetated on the	• In total, 45.50 hectares of vegetation likely to provide suitable forage habitat will be regenerated and/or revegetated on the subject site (**FIGURE 28**) to partly offset the loss of 82.39 hectares. • There will be a net gain of 4.05ha within the Saltmarsh community in the eastern portion of the	• The proposed development will result in a net loss of approximately 32.84ha of highly degraded forage habitat. • As previously mentioned Leda Manorstead Pty Ltd is currently in negotiations with DECCW with a view to securing appropriate off-site offsets.

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
	from areas with existing development approvals. • 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.	subject site (**FIGURE 28**) in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a). • These areas are likely to provide suitable forage habitat for this species and offset any loss of forage habitat in the long-term. • Additionally, 58.68 hectares of vegetation within the south-eastern portion of the subject site will be retained and rehabilitated in accordance with the Revised Saltmarsh Rehabilitation Plan (JWA 2010c). This area currently provides potential forage habitat for the Brolga and will continue to do so in the long term.	subject site which currently provides potential habitat for this species. • Additionally, Leda Manorstead Pty Ltd is currently in negotiations with DECCW with a view to securing appropriate off-site offsets for the loss of degraded Freshwater wetland habitats.	
• Black bittern (*Ixobrychus flavicollis*)	• This species has not been recorded from the subject site, however potential habitat occurs. • Approximately 0.95ha (9.33%) of potential forage habitat will be removed from the subject site. • The majority of forage habitat will be removed	• Areas in the central portion of the subject site will be rehabilitated in accordance with the Revised Freshwater Wetland Rehabilitation Plan (JWA 2010b). This area will provide approximately 21.77 hectares of additional suitable habitat for the Black bittern on the subject site. • Furthermore, 23.74 hectares of Swamp sclerophyll forest will be regenerated/revegetated on the	• In total, 45.51ha of vegetation that may provide suitable forage habitat for this species in the long-term will be regenerated/ revegetated on the subject site (**FIGURE 28**) to offset the loss of 0.95 hectares.	• Revegetation works on the subject site will result in a long-term net gain of approximately 44.56ha of potential forage habitat for the Black bittern.

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
	from areas with existing development approvals. • 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.	subject site (**FIGURE 28**) in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a). • These areas may provide suitable habitat for this species and offset any loss of habitat.		
• Mangrove honeyeater (*Lichenostomus fasciogularis*)	• This species has not been recorded from the subject site, however potential habitat occurs. • The proposed development will not result in disturbance to or the removal of potential habitat for this species. • Overall, impacts on this species are considered to be relatively low.	• Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) will result in the regeneration/revegetation of 23.74 hectares of Swamp sclerophyll forest. • Furthermore, 58.68 hectares of vegetation within the south-eastern portion of the subject site will be retained and rehabilitated in accordance with the Revised Saltmarsh Rehabilitation Plan (JWA 2010c). This area currently provides stands of mangrove vegetation suitable as forage habitat for the Mangrove honeyeater and will continue to do so in the long term.	• The proposed development will not result in disturbance to or the removal of potential habitat for this species. • In total, 23.74ha of vegetation that may provide suitable forage habitat for this species in the long-term will be regenerated/ revegetated on the subject site (**FIGURE 28**).	• Revegetation works on the subject site will result in a long-term net gain of approximately 23.74ha of potential forage habitat for the Mangrove honeyeater.

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
• White-eared monarch (*Monarcha leucotis*)	• This species has not been recorded from the subject site, however potential habitat occurs. • Approximately 0.14 hectares (1.27%) of potential forage habitat will be removed from the subject site all of which will be removed from areas of the site with existing development approvals. • 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.	• Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) will result in the regeneration/revegetation of 5.06 hectares of Lowland rainforest on floodplain and 7.06 hectares of Lowland rainforest.	• In total, 12.12ha of vegetation that may provide suitable forage habitat for this species in the long-term will be regenerated/ revegetated on the subject site (**FIGURE 28**) to offset the loss of 0.14 hectares.	• Revegetation works on the subject site will result in a long-term net gain of approximately 11.98ha of potential forage habitat for the White-eared monarch.
• Wompoo fruit-dove (*Ptilinopus magnificus*), Rose-crowned fruit-dove (*Ptilinopus regina*) & Superb fruit-dove (*Ptilinopus superbus*)	• These species have not been recorded from the subject site, however potential habitat occurs. • Approximately 0.14 hectares (1.27%) of potential forage habitat will be removed from the subject site all of which	• Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) will result in the regeneration/revegetation of 5.06 hectares of Lowland rainforest on floodplain and 7.06 hectares of Lowland rainforest. • These areas may provide suitable	• In total, 12.12ha of vegetation that may provide suitable forage habitat for this species in the long-term will be regenerated/ revegetated on the subject site (**FIGURE 28**) to offset the loss of 0.14 hectares.	• Revegetation works on the subject site will result in a long-term net gain of approximately 11.98ha of potential forage habitat for the fruit-doves.

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
	will be removed from areas of the site with existing development approvals. • Given the high mobility of these species, the loss of potential foraging habitat is not considered significant in relation to the regional distribution of suitable habitat.	habitat for the fruit-doves and offset the loss of 0.14ha of potential habitat.		
• Collared kingfisher (*Todiramphus chloris*)	• This species has not been recorded from the subject site, however potential habitat occurs. • The proposed development will not result in disturbance to or the removal of potential habitat for this species. • Overall, impacts on this species are considered to be relatively low.	• 58.68 hectares of vegetation within the south-eastern portion of the subject site will be retained and rehabilitated in accordance with the Revised Saltmarsh Rehabilitation Plan (JWA 2010c). This area currently provides stands of mangrove vegetation suitable as forage habitat for the Collared kingfisher and will continue to do so in the long term.	No forage habitat will be removed from the subject site.	N/A
• Eastern grass owl (*Tyto capensis*)	• This species has not been recorded from the subject site, however potential habitat occurs.	• Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010A) will result in the regeneration/ revegetation of 23.74 hectares of Swamp	• No nesting/roost habitat will be removed from the subject site.	• Revegetation works on the subject site will result in a long-term net gain of approximately 23.74ha of potential habitat for this species.

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
	• The proposed development will not result in disturbance to or the removal of potential nesting/roost habitat for this species. • Given the high mobility of this species, the loss of potential foraging habitat on the subject site is not considered significant in relation to the regional distribution of potential foraging habitat for this species. • Increased vehicular traffic on the subject site may result in the increased risk of vehicular strike.	sclerophyll forest (**FIGURE 28**). These areas may also provide suitable habitat for this species. • Traffic movement controls on local roads and awareness signage are to be incorporated into detailed site design.		
• Large-footed myotis (*Myotis adversus*)	• This species has not been recorded from the subject site, however potential habitat occurs. • The proposed development will not result in disturbance to or the removal of potential habitat for this	• The retention of large areas of intact forest communities, including a number of old growth trees, will continue to provide potential roost sites. • Additionally, the installation of bat boxes within retained vegetation (in accordance with the Fauna Management Plan – JWA 2009a)	No forage habitat will be removed from the subject site.	N/A

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
	species. • Overall, impacts on this species are considered to be relatively low.	will improve the habitat values of the site for this species and encourage the use of site habitats for roosting purposes.		
• Eastern long-eared bat (*Nyctophilus bifax*)	• This species has not been recorded from the subject site, however potential habitat occurs. • Approximately 0.14 hectares (1.27%) of potential forage habitat will be removed from the subject site, all of which will be removed from areas of the site with existing development approvals. • Given the high mobility of this species, the loss of a small area of potential foraging habitat is not considered significant in relation to the regional distribution of habitat for this species.	• The retention of large areas of intact forest communities, including a number of old growth trees, will continue to provide potential roost sites. • Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) and will result in the regeneration/revegetation of 23.74 hectares of Swamp sclerophyll forest, 5.06 hectares of Lowland rainforest on floodplain, 7.06 hectares of Lowland rainforest and 20.66ha of Wet sclerophyll forest. • These areas may provide additional suitable habitat for this species and offset any loss of 0.14ha of potential habitat. • The installation of bat boxes within retained vegetation (in accordance with the Fauna Management Plan – JWA 2009a) may also improve the habitat	• In total, 56.52ha of vegetation that may provide suitable forage habitat for this species in the long-term will be regenerated/ revegetated on the subject site (**FIGURE 28**) to offset the loss of 0.14 hectares.	• Revegetation works on the subject site will result in a long-term net gain of approximately 56.38ha of potential forage habitat for the Eastern long-eared bat.

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
		values of the site for this species and encourage the use of site habitats for roosting purposes.		
• Squirrel glider (*Petaurus norfolkensis*)	• This species has not been recorded from the subject site, however potential habitat occurs. • In total 9.55ha (18.08%) of potential habitat (i.e. remnant bushland with hollow-bearing trees) will be lost from the subject site. • The majority of habitat to be removed occurs within portions of the site with existing development approval. • The loss of potential habitat on the subject site is not considered significant in relation to the regional distribution of habitat for this species.	• Approximately 92.59ha of revegetation/regeneration will be completed in accordance with Revised Site Regeneration and Revegetation Plan (JWA 2010a) to offset any loss of remnant bushland and to provide vegetated links across the site. • The retention of large areas of intact forest communities, including a number of old growth trees, will continue to provide potential roost sites. • Additionally, the installation of nest boxes within retained vegetation (in accordance with the Fauna Management Plan – JWA 2009a) will improve the habitat values of the site for this species and encourage the use of site habitats for denning purposes.	• In total, 92.59ha of vegetation that may provide suitable forage habitat for this species in the long-term will be regenerated/ revegetated on the subject site (**FIGURE 28**) to offset the loss of 9.55 hectares.	• Revegetation works on the subject site will result in a long-term net gain of approximately 83.04ha of potential forage habitat for the Squirrel glider.
• Common planigale (*Planigale maculata*)	• This species has not been recorded from the subject site, however potential habitat occurs.	• Approximately 92.59ha of revegetation/regeneration will be completed in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) to	• In total, 92.59ha of vegetation that may provide suitable forage habitat for this species in the long-term will be	• Revegetation works on the subject site will result in a long-term net gain of approximately 78.92ha of potential forage habitat for

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
	• In total 13.67 hectares (18.24%) of potential habitat will be lost from the subject site. • The majority of habitat to be removed occurs from portions of the site with existing development approval. • The loss of potential habitat is not considered significant in relation to the regional distribution of habitat for this species. • This species would be particularly susceptible to predation by cats and dogs.	offset any loss of vegetation and to provide vegetated links across the site. • The retention of large areas of intact forest communities, including a number of old growth trees, will continue to provide potential habitat for this species. • Additionally, the installation of nest boxes within retained vegetation (in accordance with the Fauna Management Plan – JWA 2009a) will improve the habitat values of the site for this species and encourage the use of site habitats for denning purposes. • Landowners should control cats. All animals should reside within fenced enclosures and be on a leash when outside of the enclosure.	regenerated/ revegetated on the subject site (**FIGURE 28**) to offset the loss of 13.67 hectares.	the Common planigale.
• Long-nosed potoroo (*Potorous tridactylus*)	• This species has not been recorded from the subject site, however potential habitat occurs. • The proposed development will not result in disturbance to	• Approximately 92.59ha of revegetation/regeneration will be completed in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) to offset any loss of vegetation and to provide vegetated links across the site.	• No known habitat will be removed from the subject site.	• Revegetation works on the subject site may potentially result in a long-term net gain of up to 92.59ha of forage habitat for the Long-nosed potoroo.

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
	or the removal of potential habitat for this species. • This species has historically been recorded from the north and south of the existing site access road, essentially two small sub-populations. Without mitigation, road kills may significantly affect these populations. • Predation by domestic cats and dogs is also a potential impact of the development.	• A Potoroo Management Plan has been prepared for this population (Warren *et al.* 1994). It is a recommendation of this report that the construction of the main access road into the Cobaki Lakes development incorporates a number of underpasses/culverts to encourage movements of potoroos between the two identified sub-populations. • Predator control fencing along the interface of the development site and potoroo habitat is also recommended. • With the adoption of these amelioration measures, it is unlikely that the proposed development will result in the extinction of this Endangered Population.		
• Common blossom bat (*Syconycteris australis*)	• This species has not been recorded from the subject site, however potential habitat occurs. • The proposed development will result in the removal or modification a total of	• Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) will result in the regeneration/revegetation of 23.74 hectares of Swamp sclerophyll forest. • These areas may provide	• In total, 23.74 ha of vegetation with the potential to provide suitable forage habitat for the Common blossom bat will be regenerated/ revegetated on the subject site (**FIGURE 28**) to offset the loss of 3.80 hectares.	• Revegetation works on the subject site will result in a long-term net gain of approximately 19.94ha of suitable forage and/or corridor habitat for the Common blossom bat.

	Potential impacts	Amelioration measures	Proposed mitigation/offset	Net loss/gain
	3.80 hectares of Swamp sclerophyll forest on floodplain. • 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.	additional suitable forage habitat for this species and offset the loss of 3.80ha of potential habitat.		

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