JWA PTY LTD
Ecological Consultants
ABN 18 862 762 739

AMENDED BIODIVERSITY ASSESSMENT REPORT

COBAKI ESTATE

A Report Prepared for
Leda Manorstead Pty Ltd

MAY 2017

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Rw5	23.05.17	Matt Jenkins / Adam McArthur	MJ / AM	James Warren	JW

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1 INTRODUCTION

1.1 Background

JWA Pty Ltd has been engaged by Leda Manorstead Pty Ltd to complete a Biodiversity Assessment of a 3.80 ha Swamp mahogany (*Eucalyptus robusta*) community, occurring on the Cobaki Estate site, utilising the Framework for Biodiversity Assessment (FBA) and the BioBanking Credit Calculator (BBCC). The FBA underpins the NSW Biodiversity Offsets Policy for Major Projects. It contains the assessment methodology that is adopted by the policy to quantify and describe the impact assessment and offset requirements that apply to Major Projects. The BBCC is an online application that can be used by accredited assessors to assess the impacts on biodiversity values at a development site. The data obtained using the FBA is entered into the BBCC to assess landscape value, vegetation type and condition, and threatened species habitat. The BBCC uses this data to determine the number and type of credits required to offset the impacts on biodiversity values at a development site.

The initial version of this Biodiversity Assessment Report (BAR) was completed by JWA and forwarded to the Department of Planning and Environment (DoPE) in late April 2016. It was also forwarded to the Office of Environment & Heritage (OEH) for review along with the BBCC assessment in early June 2016. Following discussions with OEH, minor amendments were made to the BBCC assessment/BAR and forwarded to OEH and DoPE in late July 2016. Subsequent discussions have required further minor amendments to the BBCC assessment as detailed within this latest version of the BAR.

The Biodiversity Credit Report and Biodiversity Credit Calculator Report that have informed the preparation of this BAR are available on request.

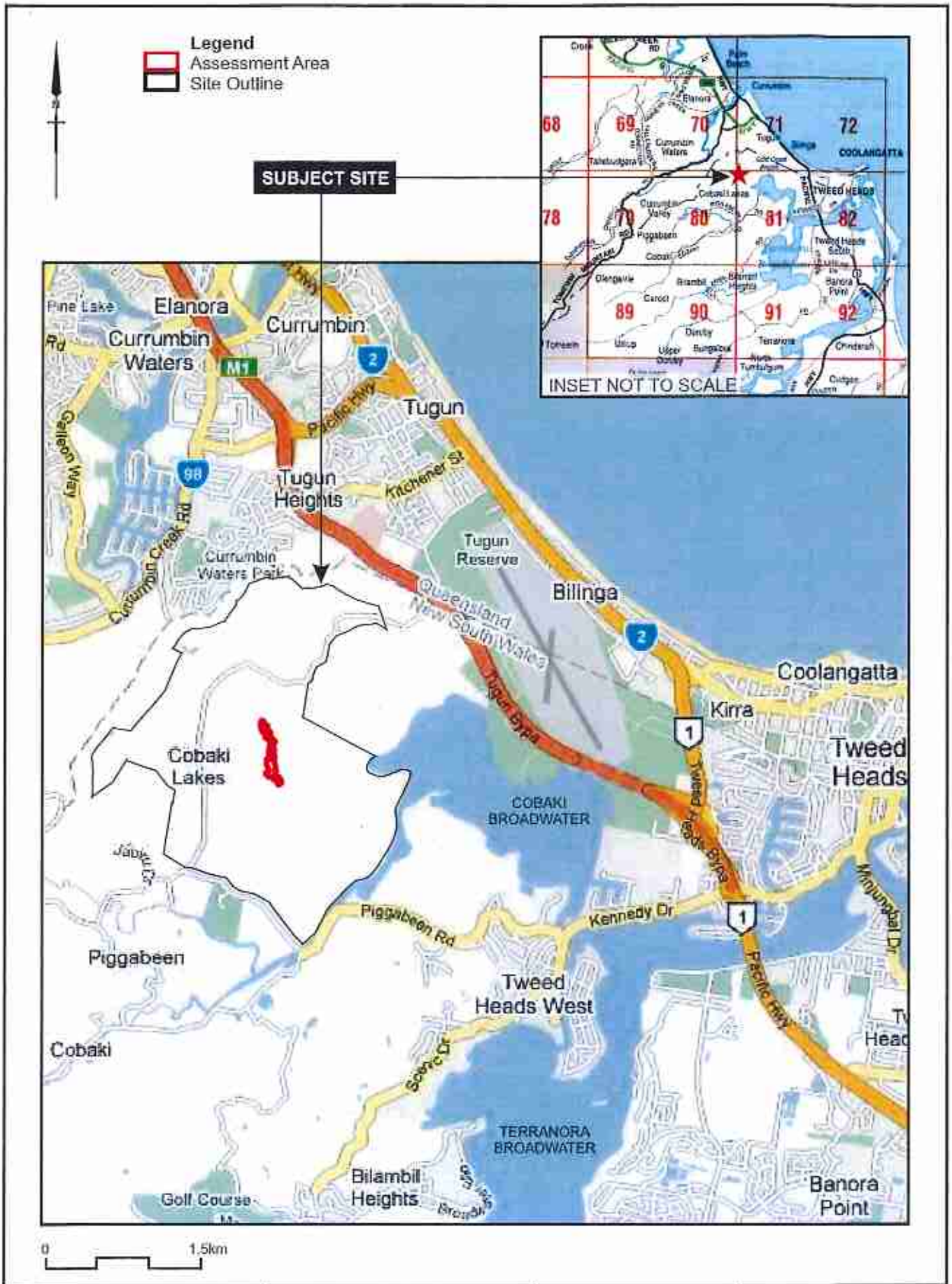
1.2 Locality

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 JWA PTY LTD Ecological Consultants	CLIENT Leda Manorstead Pty Ltd PROJECT Biodiversity Assessment Report Cobaki Estate, Cobaki, NSW Shire of Tweed	**FIGURE 1** PREPARED: BW DATE: 23 May 2017 FILE: 97038_BAR_Locality.cdr	TITLE **LOCATION MAP**

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 in 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**.

1.3 The Development Site and Assessment Area

1.3.1 Development Site

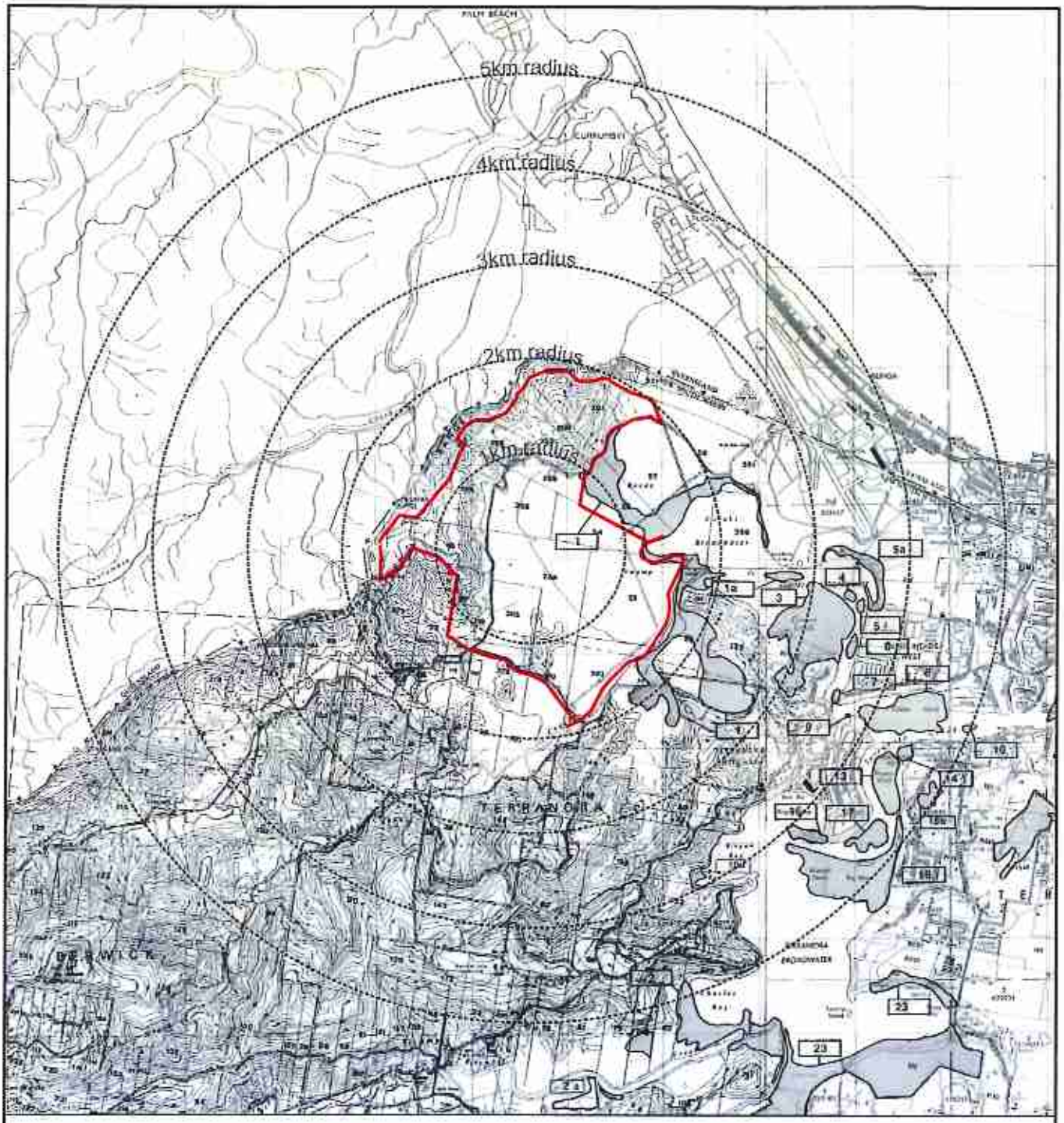
The Cobaki Estate site consists of land described as Lot 1 DP 570076, Lot 2 DP 566529, Lot 1 DP 562222, Lot 1 DP 570077, Lot 1 823679, Lots 46, 54, 55, 199, 200, 201, 202, 205, 206, 209, 228 & 305 DP 755740, Cobaki Lakes, off Pigabeen Road, Tweed Heads. The site covers an area of approximately 605 hectares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

1.3.2 Topography, Soils, Geology and Drainage

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%.



Legend

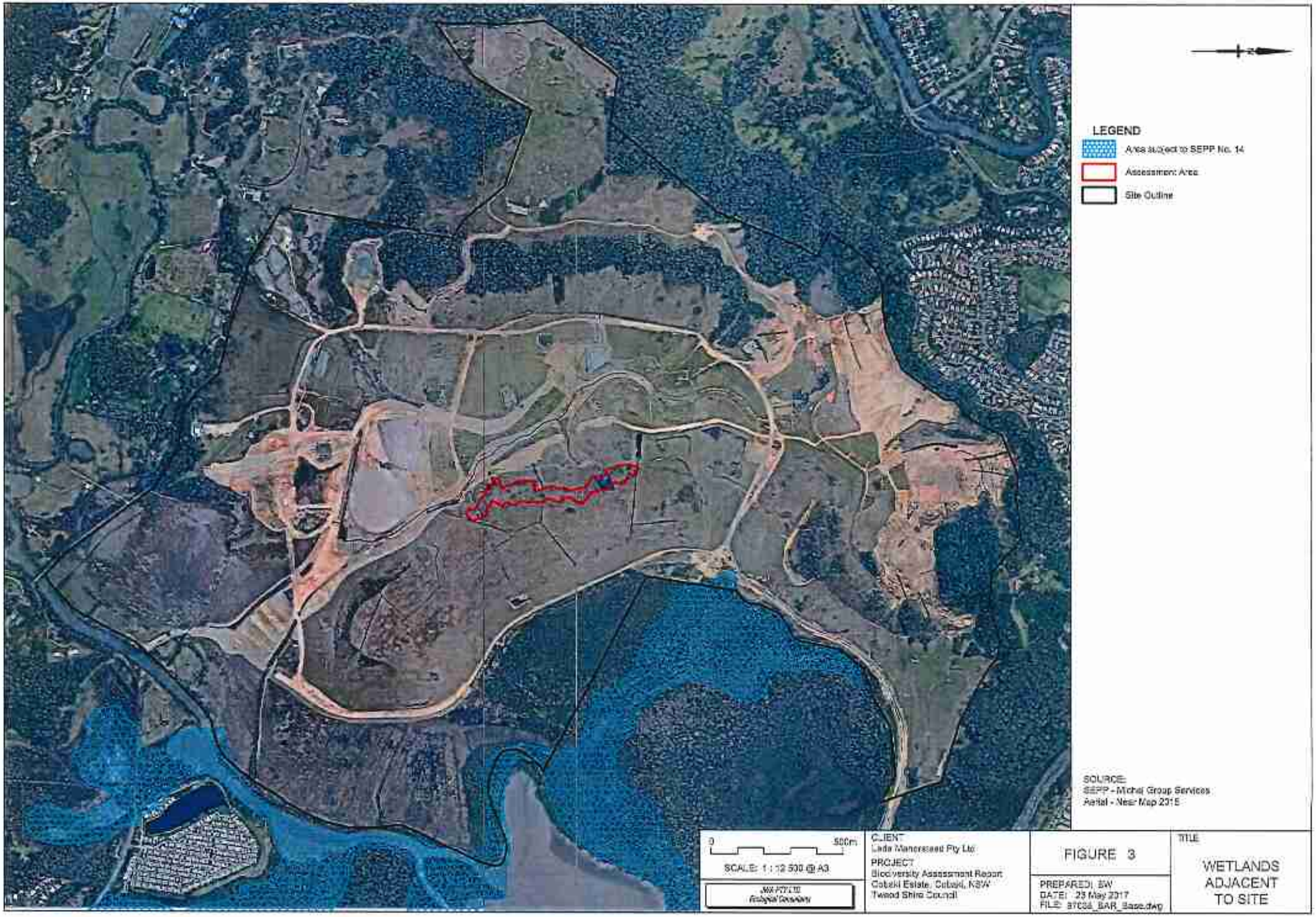
Area Subject to SEPP No. 14 (with Index number)

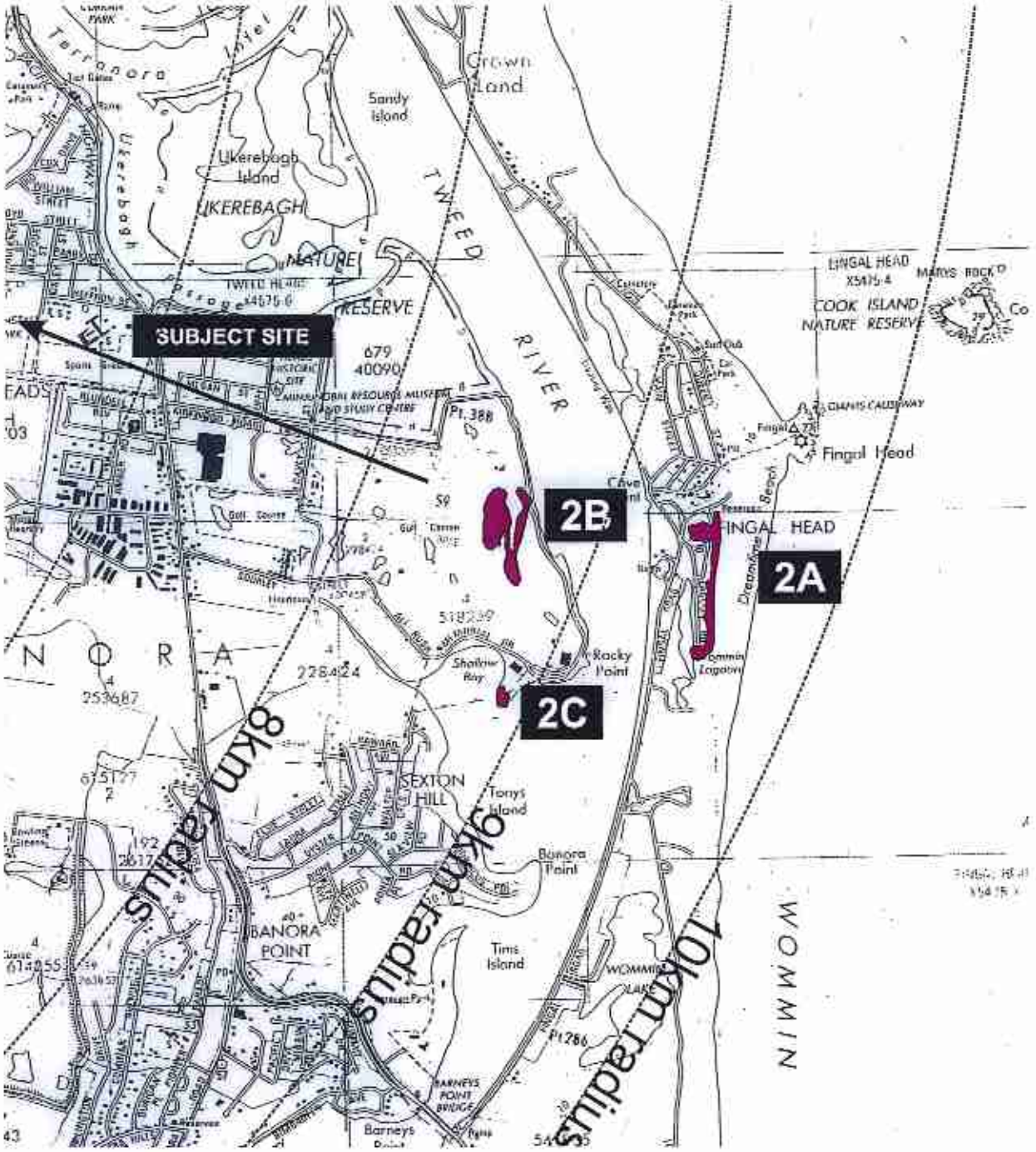
Subject Site

N

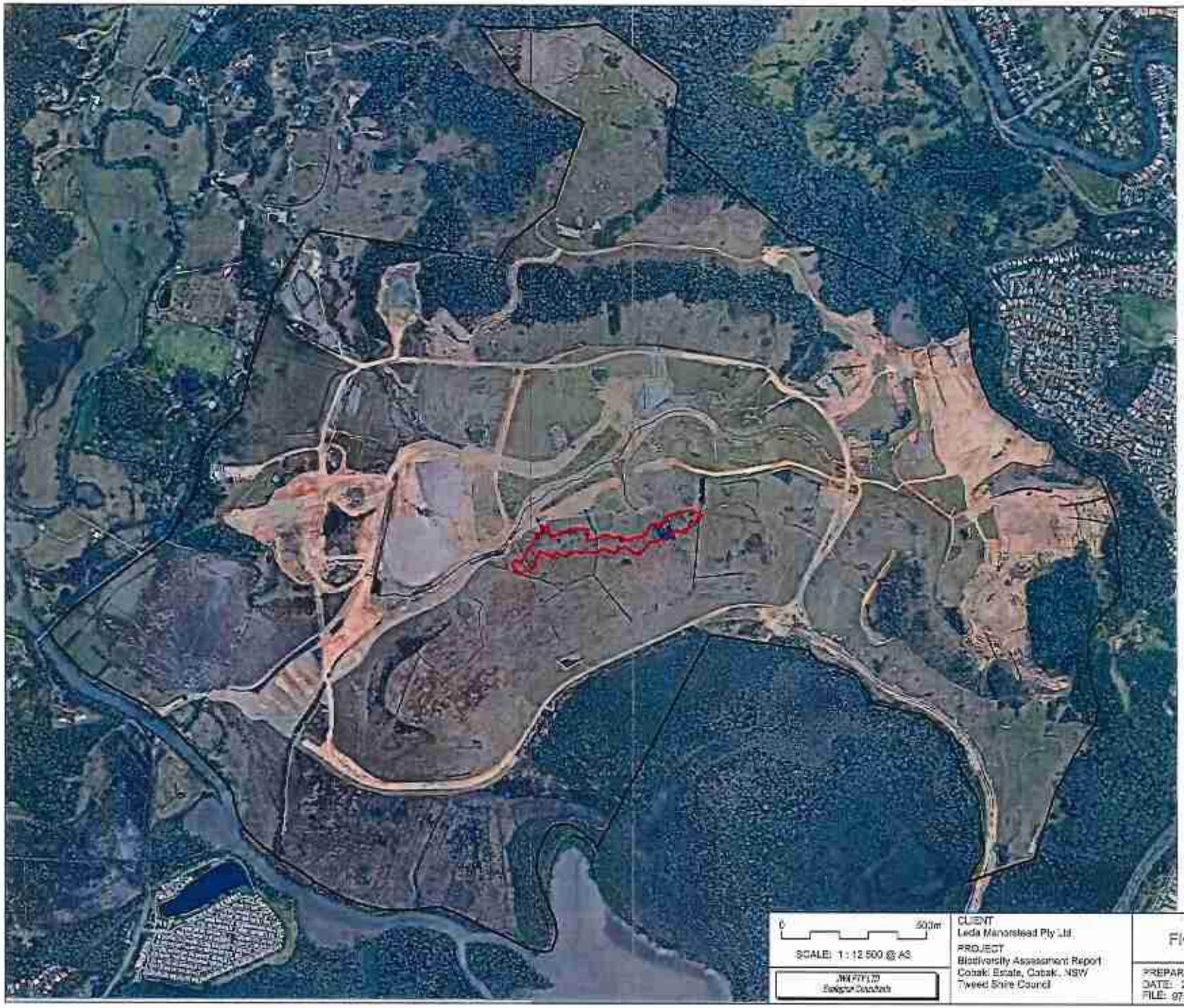
0 1500m

SOURCE: State Env. Planning Policy No. 14 Coastal Wetlands Amendment No. 14 SCALE: 1 : 60 000 @ A4 JWA PTY LTD Ecological Consultants	CLIENT Leda Manorstead Pty Ltd PROJECT Biodiversity Assessment Report Cobaki Estate, Cobaki, NSW Shire of Tweed	**FIGURE 2** PREPARED: BW DATE: 09 March 2016 FILE: 97038_BAR_SEPP14.cdr	TITLE **SEPP 14 COASTAL WETLANDS IN THE LOCALITY**


LEGEND
Area subject to SEPP No. 14
Assessment Area
Site Outline
SOURCE:
SEPP - Michel Group Services
Aerial - Nearmap 2015
0
500m
SCALE: 1 : 12 500 @ A3
CLIENT
Lada Manorstead Pty Ltd
PROJECT
Biodiversity Assessment Report
Cobaki Estate, Cobaki, NSW
Tweed Shire Council
FIGURE 3
PREPARED: SW
DATE: 23 May 2017
FILE: 37036_BAR_Base.dwg
TITLE
WETLANDS ADJACENT TO SITE



SOURCE: State Env. Planning Policy No. 26 Littoral Rainforests SCALE: 1 : 25 000 @ A4 JWA PTY LTD Ecological Consultants	CLIENT Leda Manorstead Pty Ltd PROJECT Biodiversity Assessment Report Cobaki Estate, Cobaki, NSW Shire of Tweed	**FIGURE 4** PREPARED: BW DATE: 09 March 2016 FILE: 97039_BAR_SEPP26.cdr	TITLE **SEPP 26 LITTORAL RAINFOREST**



LEGEND

Assessment Area

Site Outline

SOURCE:
Aerial - Near Map 2015

0 500m

SCALE: 1:12 500 @ A3

CLIENT
Leda Manorstead Pty Ltd

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Biodiversity Assessment Report
Cobaki Estate, Cobaki, NSW
Tweed Shire Council

FIGURE 5

PREPARED: BW
DATE: 23 May 2017
FILE: 97338_BAR_Base.cwg

TITLE

AERIAL PHOTOGRAPH

- 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.

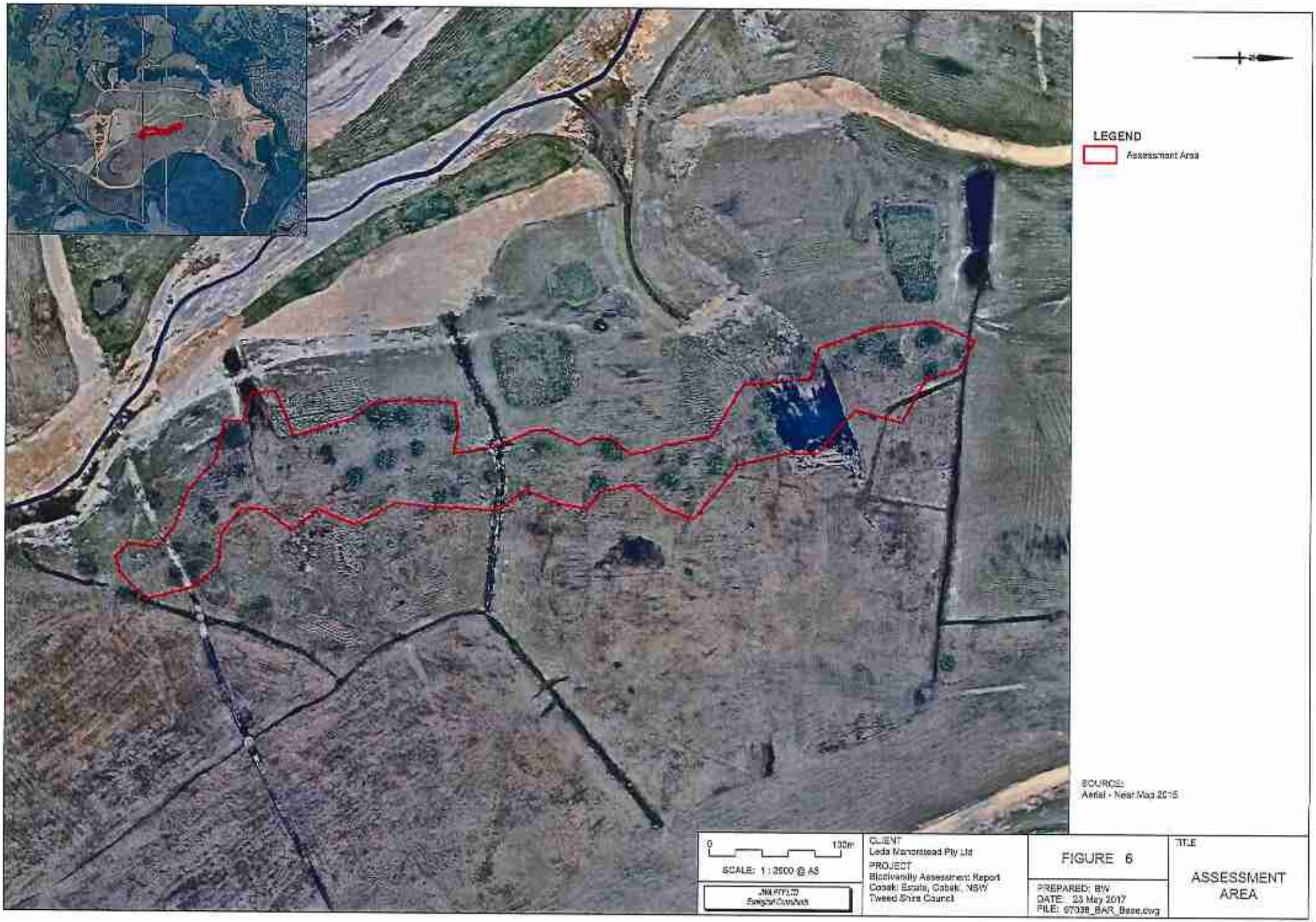
The McPherson range foothills and elevated portions of the site derive from bedrock of deeply weathered argillites (greywackes, siltstones and shales) of the Neranleigh - Fernvale Group (metasediments) overlain in parts by basalt fragments of the tertiary volcanics. More recent alluvial and estuarine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

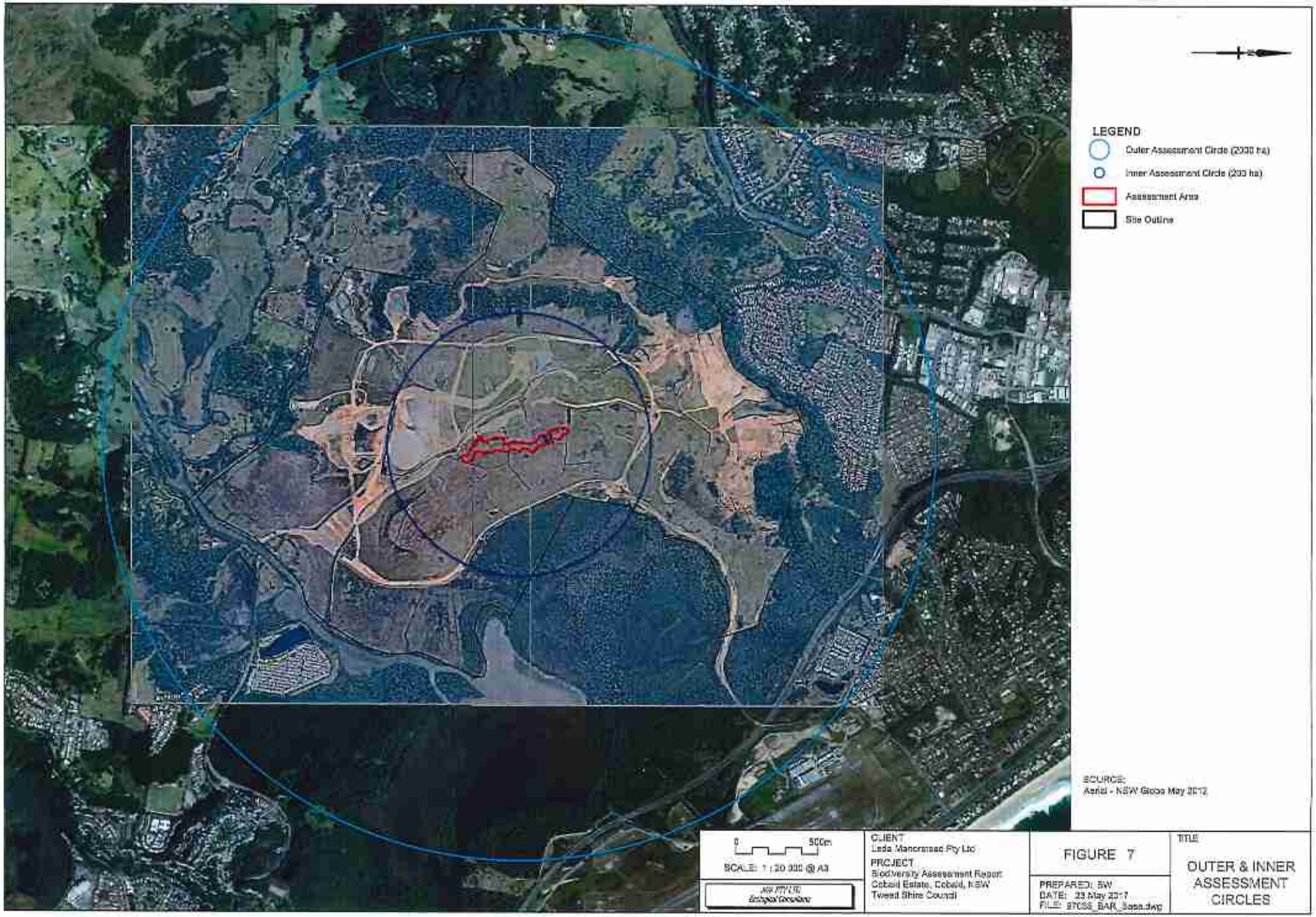
Elevations of the poorly drained, or low lying coastal plains, range from Cobaki Broadwater level to approximately four (4) metres AHD. The elevations of the foothills extend to a maximum of approximately one hundred (100) metres at the north-west extremity of the site, and around ninety-five (95) metres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

A series of drains run through the site (**FIGURE 5**). 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.

1.3.3 Assessment Area

The assessment area includes a single patch of vegetation covering an area of approximately 3.80 ha. This patch of vegetation is predominantly comprised of Swamp mahogany trees (52 in total) and occurs in the central portion of the Cobaki Estate site (**FIGURE 6**). It should be noted that this vegetation community has been extensively modified by past and current land use (e.g. cattle grazing and slashing). For the purpose of the BBCC, an outer assessment circle of 2000 ha has been applied (centred over the Cobaki Estate site) and an inner assessment circle of 200 ha has been applied (centred over the assessment area) (**FIGURE 7**).


LEGEND
Assessment Area
SOURCE:
Aerial - Near Map 2015
0
100m
SCALE: 1:2500 @ A3
CLIENT
Leda Manorstead Pty Ltd
PROJECT
Biodiversity Assessment Report
Cobaki Estate, Cobaki, NSW
Tweed Shire Council
FIGURE 6
PREPARED: BW
DATE: 23 May 2017
FILE: 97038_BAR_Base.cwg
TITLE
ASSESSMENT AREA


LEGEND
Outer Assessment Circle (2000 ha)
Inner Assessment Circle (200 ha)
Assessment Area
Site Outline
SOURCE:
Aerial - NSW Globe May 2012
0
500m
SCALE: 1:20 000 @ A3
CLIENT
Leda Manorrosad Pty Ltd
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Biodiversity Assessment Report
Cobaki Estate, Cobaki, NSW
Tweed Shire Council
FIGURE 7
PREPARED: SW
DATE: 23 May 2017
FILE: 97053_BAR_3asa.dwg
TITLE
OUTER & INNER ASSESSMENT CIRCLES

2 LANDSCAPE FEATURES

2.1 Introduction

This section provides the landscape features, that have been identified at the development site, and the associated data that has been entered in the BioBanking Credit Calculator (BBCC) where relevant. These features include:

- Interim Biogeographic Regionalisation for Australian (IBRA) bioregions, subregions and NSW landscape regions (Mitchell landscapes);
- Native vegetation extent in the outer assessment circle and cleared areas;
- Rivers and streams classified according to stream order;
- Wetlands within, adjacent to and downstream of the development site;
- State, regional and local biodiversity links (corridors); and
- Landscape value components and score.

2.2 IBRA Bioregions, Subregions and NSW Landscape Regions

The development site occurs within the Murwillumbah (Qld - Southeast Hills and Ranges) IBRA subregion. The majority of the site occurs within the Byron-Tweed Alluvial Plains Mitchell landscape. The extent of these regions at the development site is shown in **FIGURE 8.**

2.3 Native Vegetation Extent and Cleared Areas

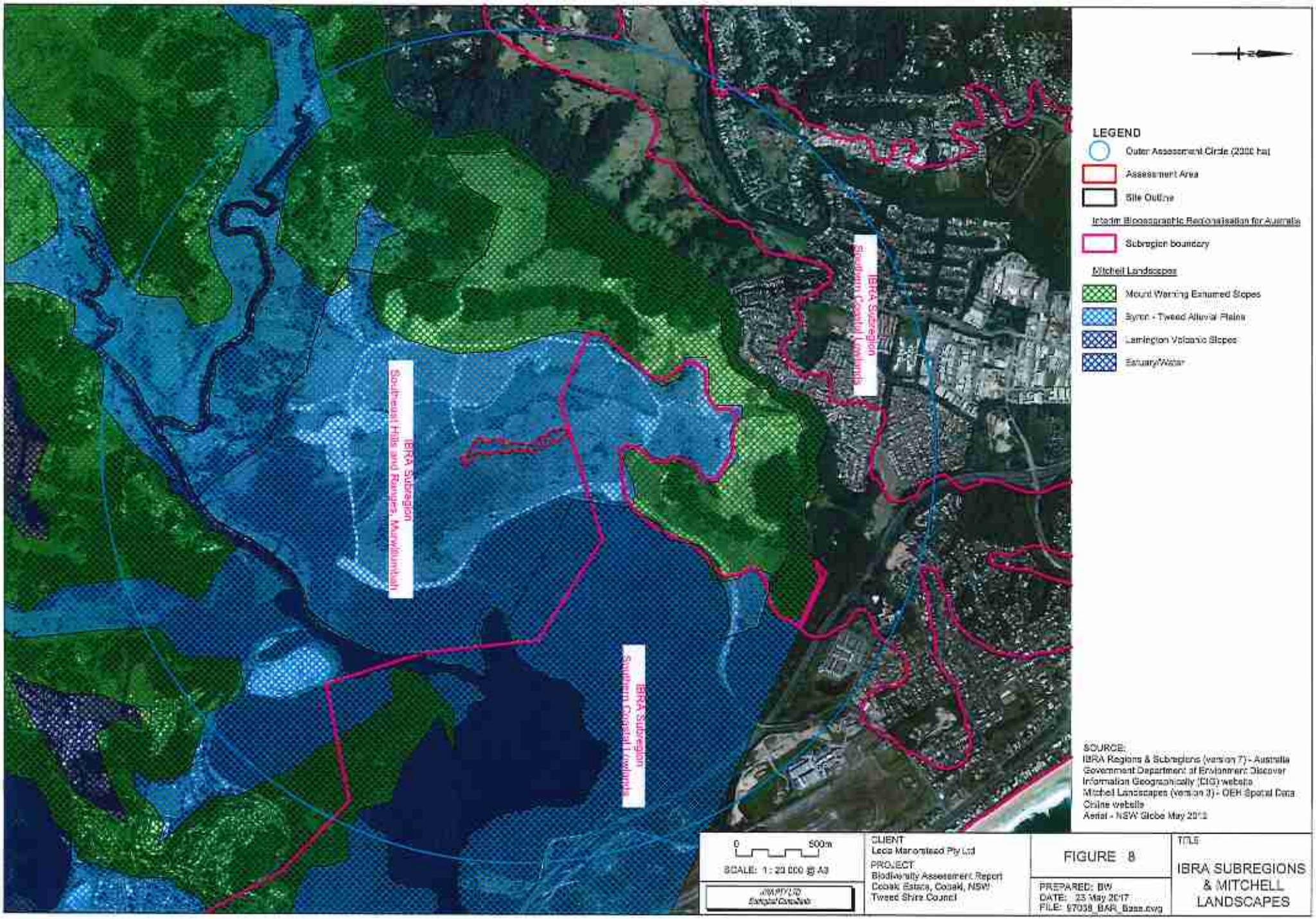
Vegetation mapping completed for the Cobaki Estate site is provided in **FIGURE 9.** Cleared areas within the development site can be seen in **FIGURES 5 & 9.** Native vegetation occurring in the outer assessment circle is shown in **FIGURE 10.** It is estimated that the extent of native vegetation in the outer assessment circle is approximately 833 ha.

2.4 Rivers and Streams

Waterways occurring on and adjacent to the development site can be seen in **FIGURE 11.** Classification of these waterways according to stream order (Strahler 1952) is provided in **TABLE 1.**

TABLE 1
CLASSIFICATION OF STREAM ORDER

Waterway	Stream Order
Dunn's Drain	1st order
Piggabeen Creek	3rd order
Currumbin Creek	4th order
Cobaki Creek	4th order


IBRA Subregion
Southeast Hills and Ranges, Murwillumbah
IBRA Subregion
Southern Coastal Lowlands
IBRA Subregion
Southern Coastal Lowlands
LEGEND
Outer Assessment Circle (2000 ha)
Assessment Area
Site Outline
Interim Biogeographic Regionalisation for Australia
Subregion boundary
Mitchell Landscapes
Mount Warning Eroumed Slopes
Tyalgum - Tweed Alluvial Plains
Lamington Volcanic Slopes
Estuary/Water
SOURCE:
IBRA Regions & Subregions (version 7) - Australia Government Department of Environment Discover Information Geographically (DIG) website
Mitchell Landscapes (version 3) - OEH Spatial Data Online website
Aerial - NSW Globe May 2013
0
500m
SCALE: 1 : 23 000 @ A3
CLIENT
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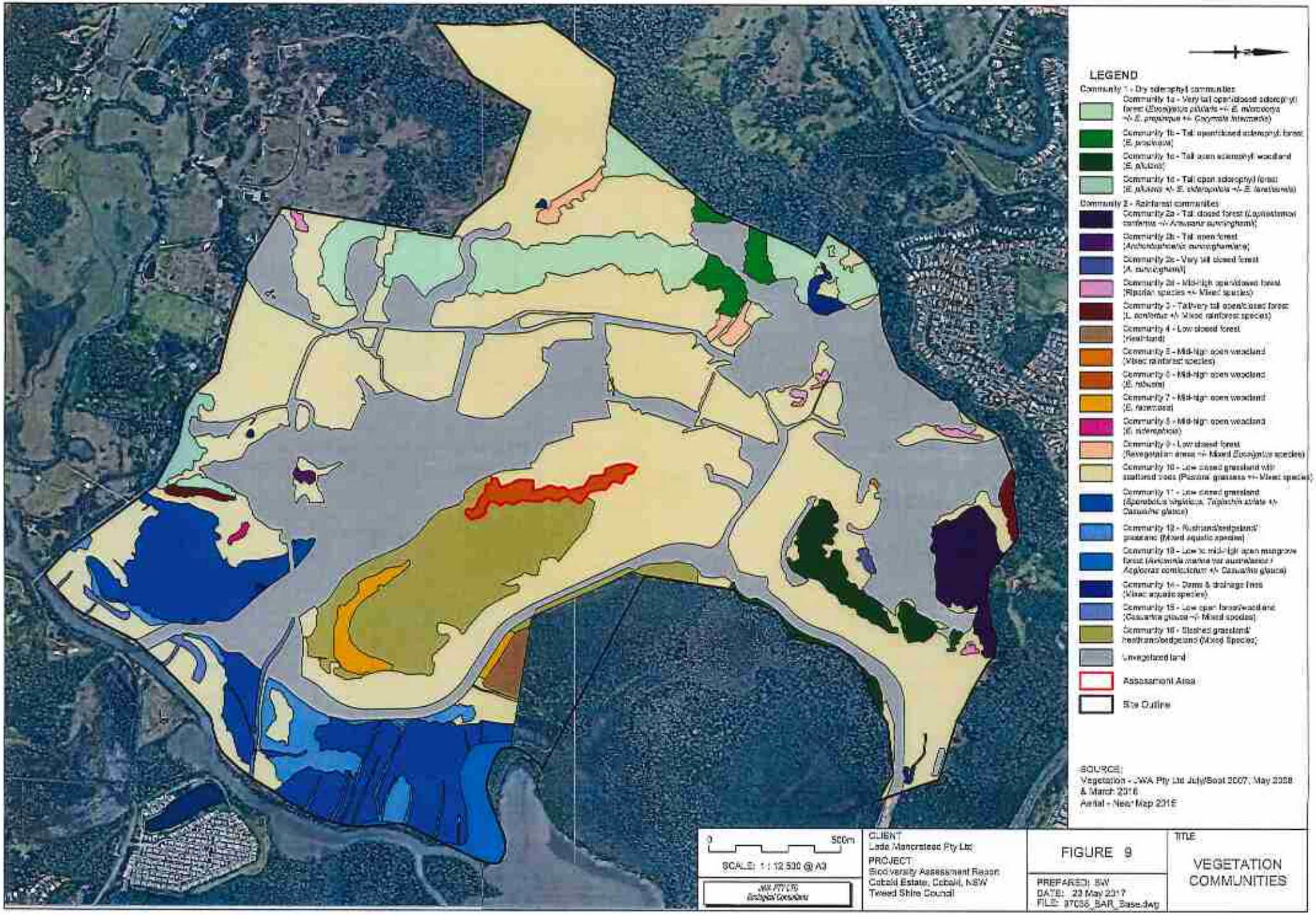
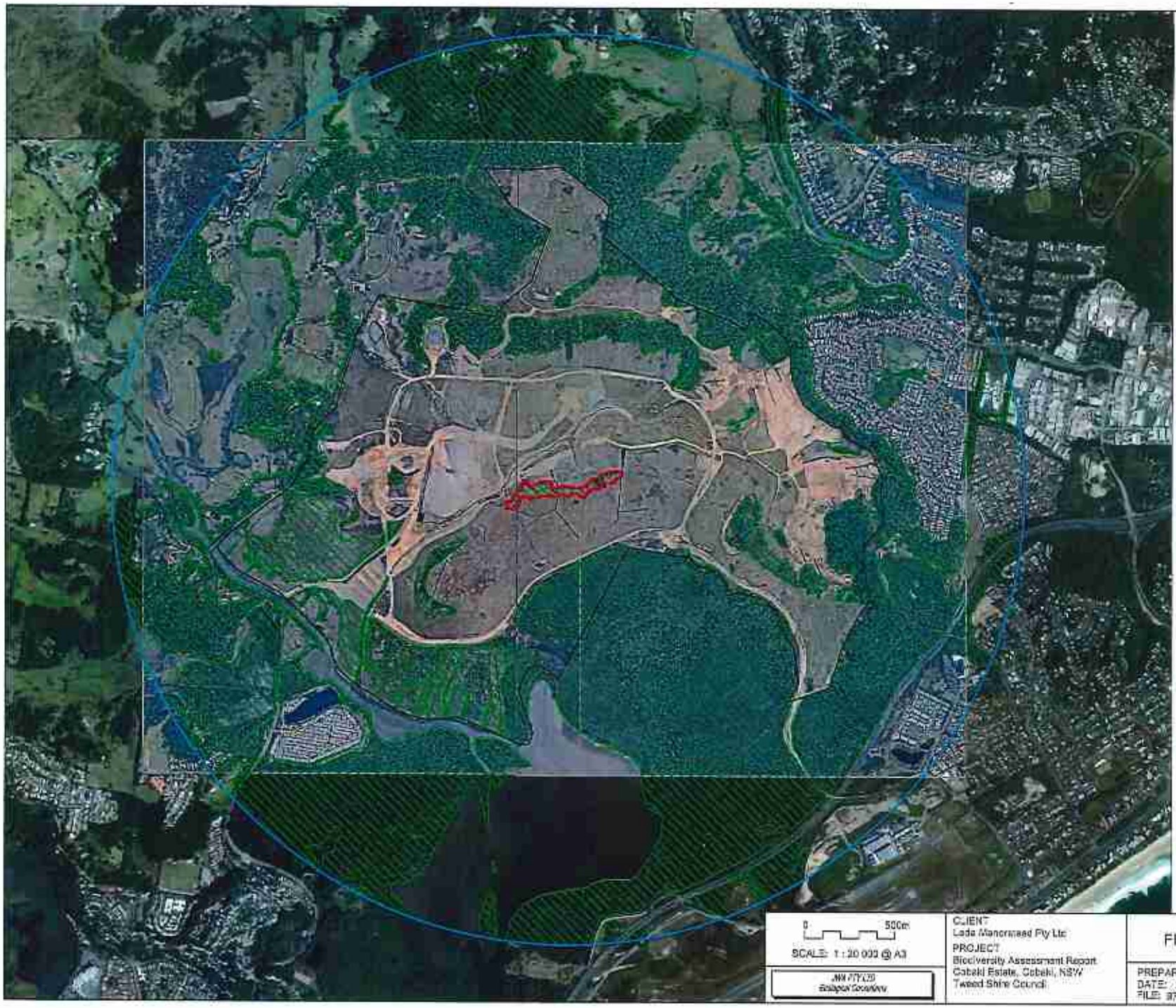
Cobaki Estate, Cobaki, NSW
Tweed Shire Council
FIGURE 8
PREPARED: BW
DATE: 23 May 2017
FILE: 97038_BAR_Base.dwg
TITLE
IBRA SUBREGIONS & MITCHELL LANDSCAPES


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. sideroxylon +/- 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 (Weed land)
Community 5 - Mid-high open woodland (Mixed rainforest species)
Community 6 - Mid-high open woodland (E. robusta)
Community 7 - Mid-high open woodland (E. resinifera)
Community 8 - Mid-high open woodland (E. sideraphloia)
Community 9 - Low closed forest (Revegetation areas +/- Mixed Eucalyptus species)
Community 10 - Low closed grassland with scattered trees (Pasture grasses +/- 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
Assessment Area
Site Outline
SOURCE:
Vegetation - LWA Pty Ltd July/Sept 2007, May 2008 & March 2016
Aerial - Near Map 2016
0
500m
SCALE: 1 : 12,500 @ A3
CLIENT
Lada Mancrossac Pty Ltd
PROJECT
Biodiversity Assessment Report
Cobaki Estate, Cobaki, NSW
Tweed Shire Council
FIGURE 9
PREPARED: BW
DATE: 23 May 2017
FILE: 97036_BAR_Base.dwg
TITLE
VEGETATION COMMUNITIES



LEGEND

- Outer Assessment Circle (2000 ha)
- Native vegetation
- Assessment Area
- Site Outline

SOURCE:
Aerial - NSW Globe May 2012

0 500m

SCALE: 1 : 20 000 @ A3

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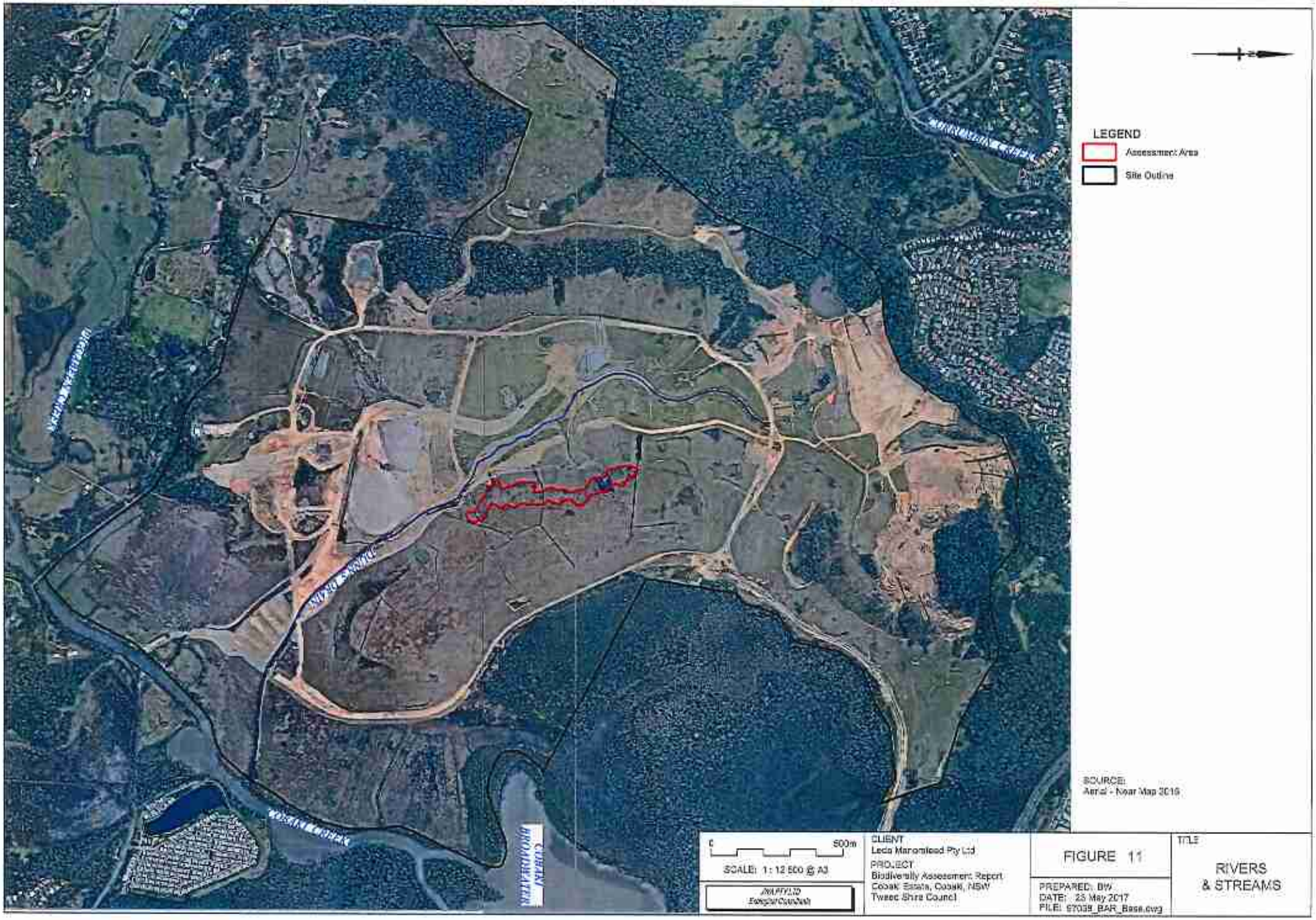
Cobaki Estate, Cobaki, NSW
Tweed Shire Council

FIGURE 10

PREPARED: SW
DATE: 23 May 2017
FILE: 97038_BAR_Base.dwg

TITLE
NATIVE VEGETATION IN OUTER ASSESSMENT CIRCLE


LEGEND
Assessment Area
Site Outline
SOURCE:
Aerial - Nearmap 2016
0
500m
SCALE: 1:12 500 @ A3
CLIENT
Leda Manorlead Pty Ltd
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Biodiversity Assessment Report
Cobaki Estate, Cobaki, NSW
Tweed Shire Council
FIGURE 11
PREPARED: BW
DATE: 25 May 2017
FILE: 97039_BAR_Base.cwg
TITLE
RIVERS
& STREAMS

2.5 Wetlands on and Adjacent to the Development Site

SEPP 14 Wetlands occur adjacent to the development site (**FIGURE 3**). Wetland communities including freshwater wetland, saltmarsh and mangrove forest occur in the central and southern portions of the Cobaki Estate site (i.e. vegetation communities 11, 12 & 13 in **FIGURE 9**).

2.6 State, Regional and Local Biodiversity Links (Corridors)

The assessment area does not occur within a state or regionally significant biodiversity link as defined in the FBA (**TABLE 2**).

TABLE 2
DEFINING CRITERIA FOR STATE AND REGIONAL BIODIVERSITY LINKS

Biodiversity Link	Defining Criteria
State significant	An area identified as being part of a state significant biodiversity link in a plan approved by the Chief Executive, OEH OR A riparian buffer 50m either side of a 6th order stream or greater OR A riparian buffer 50m around an important wetland or estuarine area
Regionally significant	An area identified as being part of a regionally significant biodiversity link and in a plan approved by the Chief Executive, OEH OR A riparian buffer 20m either side of a 4th or 5th order stream

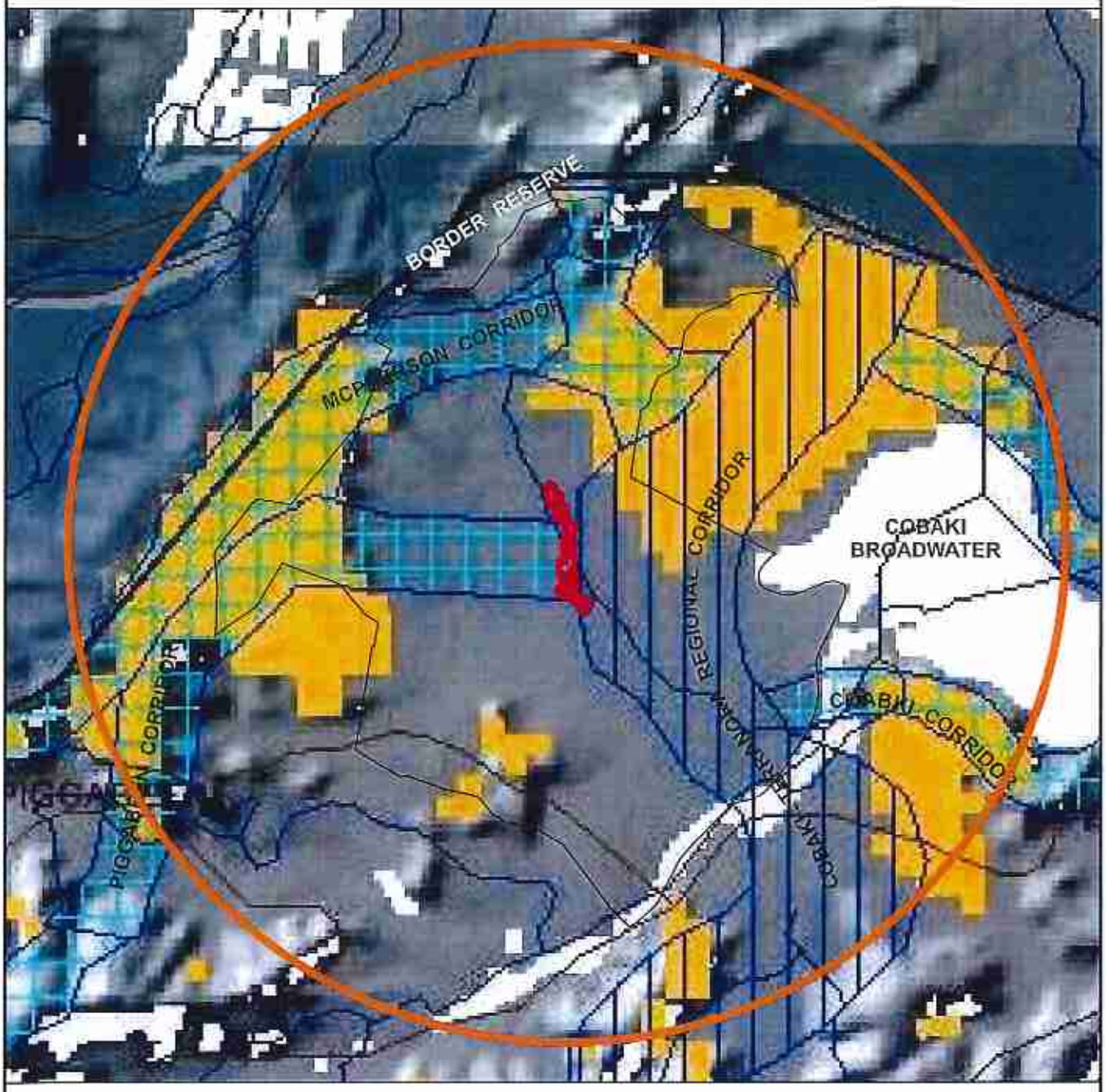
An overlay of the National Parks and Wildlife Service (NPWS) Key Habitats & Corridors map on the Cobaki Estate site is provided in **FIGURE 12A.** This overlay shows the extent of mapped regional and subregional corridors occurring on and adjacent to the site and within the outer assessment circle. It can be seen that the assessment area is situated within the identified Piggabeen subregional corridor. However, it can be seen that this corridor is predominantly comprised of cleared land on the Cobaki Estate site (**FIGURE 12B**).

2.7 Landscape Value Components and Score

2.7.1 Introduction

This calculation involved the application of the site-based method for determining landscape value. The following landscape attributes were assessed:

- Percent native vegetation cover in the landscape (current and future)
- Connectivity value
- Patch size



Legend

- Regional Corridor
- Subregional Corridor
- Key Habitat
- Outer Assessment Circle (2000 ha)
- Assessment Area
- Site Outline

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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FIGURE 12A

PREPARED: BW
DATE: 23 May 2017
FILE: 97038_BAR_Corridors.cdr

TITLE

NPWS KEY HABITATS & CORRIDORS

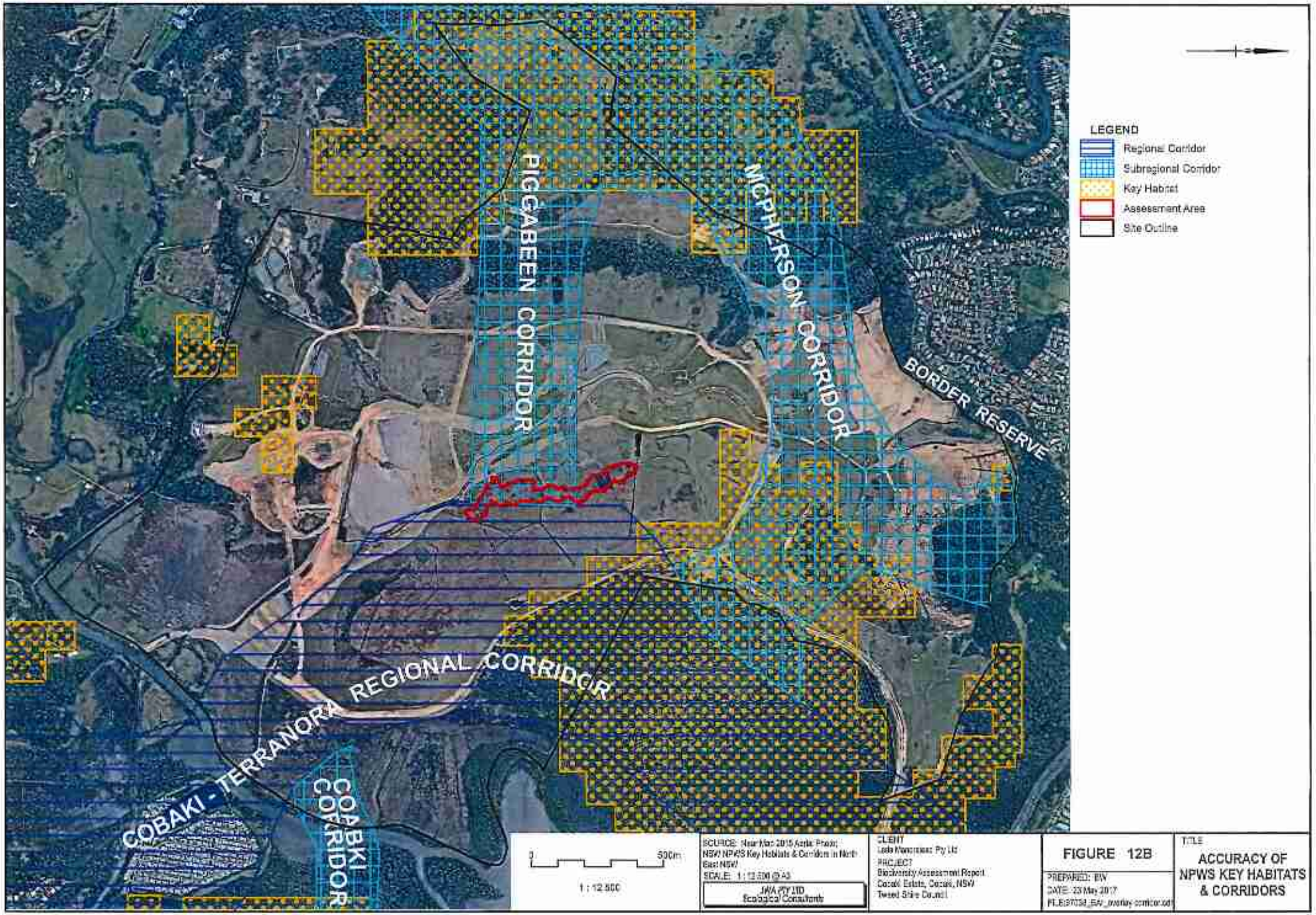
LEGEND
Regional Corridor
Subregional Corridor
Key Habitat
Assessment Area
Site Outline
PIGGABEEN CORRIDOR
MCPHERSON CORRIDOR
BORDER RESERVE
COBAKI - TERRANORA REGIONAL CORRIDOR
COBAKI CORRIDOR
0
500m
1 : 12,500
SOURCE: Near Map 2015 Aerial Photo; NSW NPWS Key Habitats & Corridors in North East NSW
SCALE: 1 : 12,500 @ A3
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FIGURE 12B
PREPARED: BW
DATE: 23 May 2017
FILE:97058_BAR_overlay_corridor.cdr
TITLE
ACCURACY OF NPWS KEY HABITATS & CORRIDORS

2.7.2 *Percent Native Vegetation Cover*

The current and future (after development) extent of native vegetation cover within the outer and inner assessment circles was calculated and is shown in **TABLE 3.** This equates to a Percent Native Vegetation score of 0.00 in the BBCC.

TABLE 3
PERCENT NATIVE VEGETATION COVER

Native Vegetation Cover	Before Development (ha)	%	After Development (ha)	%
Outer Assessment Circle	822.90	41-45	819.10	41-45
Inner Assessment Circle	34.42	16-20	30.62	11-15

2.7.3 *Connectivity Value*

No connecting links are considered to occur within the assessment area. Therefore, there will be no impact on any connectivity value classes. The resulting score for connectivity value is 0.00.

2.7.4 *Patch Size*

The majority of the development site occurs within the Mitchell landscape *Byron-Tweed Alluvial Plains*. The patch size is 3.80 ha. The patch is comprised only of the Swamp mahogany community as it is separated by a distance of >100m to other woody vegetation types and >30m to non-woody vegetation types. The resulting score for patch size is 1.

2.7.5 *Landscape Value Score*

The overall landscape value score, calculated by the BBCC, is 1.00.

3 NATIVE VEGETATION IN ASSESSMENT AREA

3.1 Introduction

This section identifies the native vegetation extent within the assessment area. The vegetation is described in relation to its class, type, area, species occurrence, Endangered Ecological Community (EEC) status and condition.

3.2 Vegetation Communities

Vegetation mapping completed for the Cobaki Estate site is provided in **FIGURE 9.** Endangered Ecological Communities occurring on the site are shown in **FIGURE 13.** One (1) vegetation community occurs within the assessment area as described below. A complete list of species recorded within this community is provided in **APPENDIX 1.**

Community 6 - Mid-high open woodland (*Eucalyptus robusta*)

Location and area

This community occurs in the central portion of the Cobaki Estate site and covers an area of approximately 3.80 hectares.

Description

In accordance with the VIS Classification Database (OEH) the Vegetation Class of this community is Coastal Swamp Forests. This community is considered to be consistent with Plant Community Type (PCT) ID 1230 (Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion) due to the presence of analogous species in the upper and ground stratum.

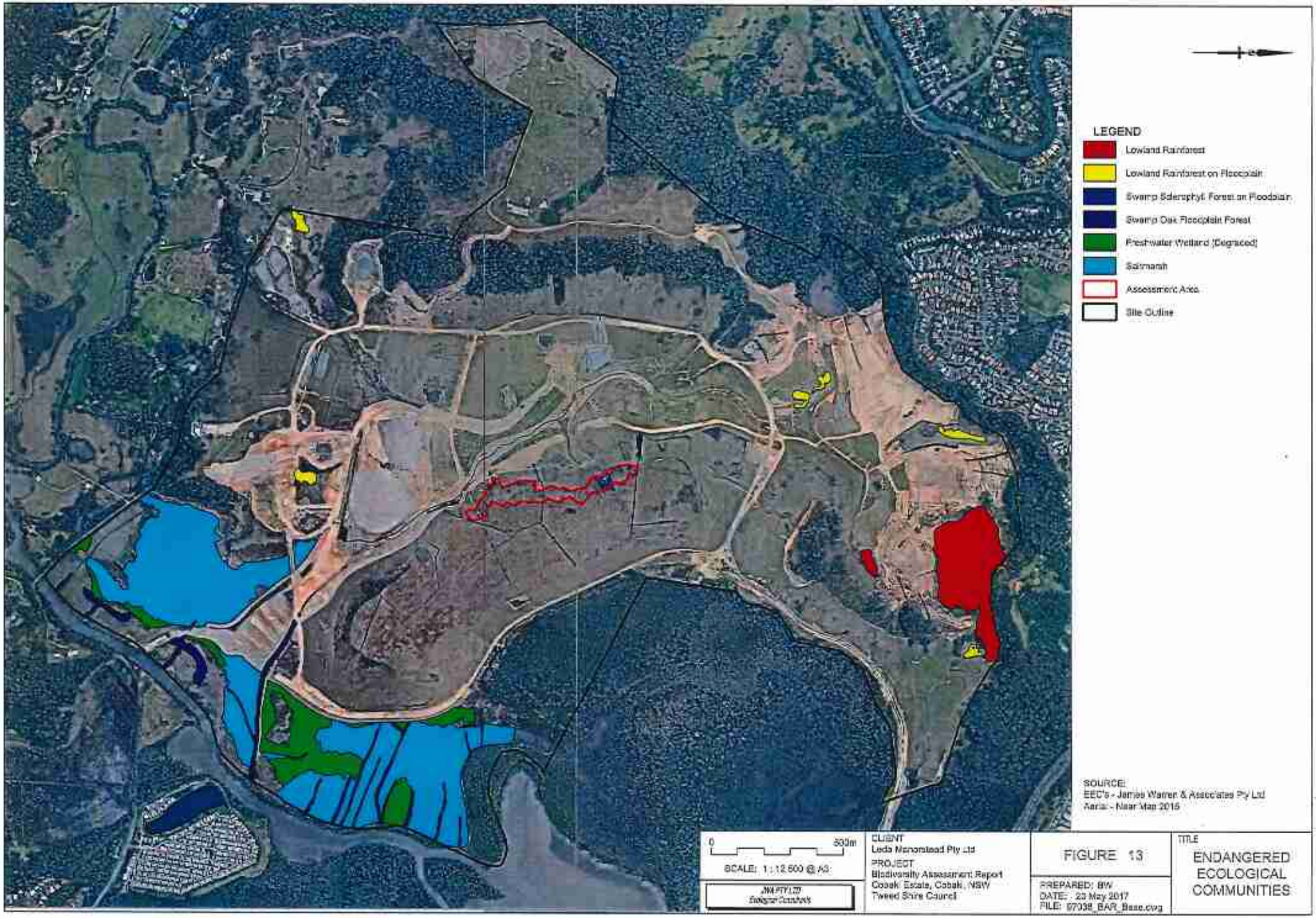
The canopy of this community is well separated and is dominated by Swamp mahogany (*Eucalyptus robusta*). One (1) Red mahogany (*E. resinifera*) is also present in the canopy. Canopy trees have been accurately surveyed and are shown in **FIGURE 14.**

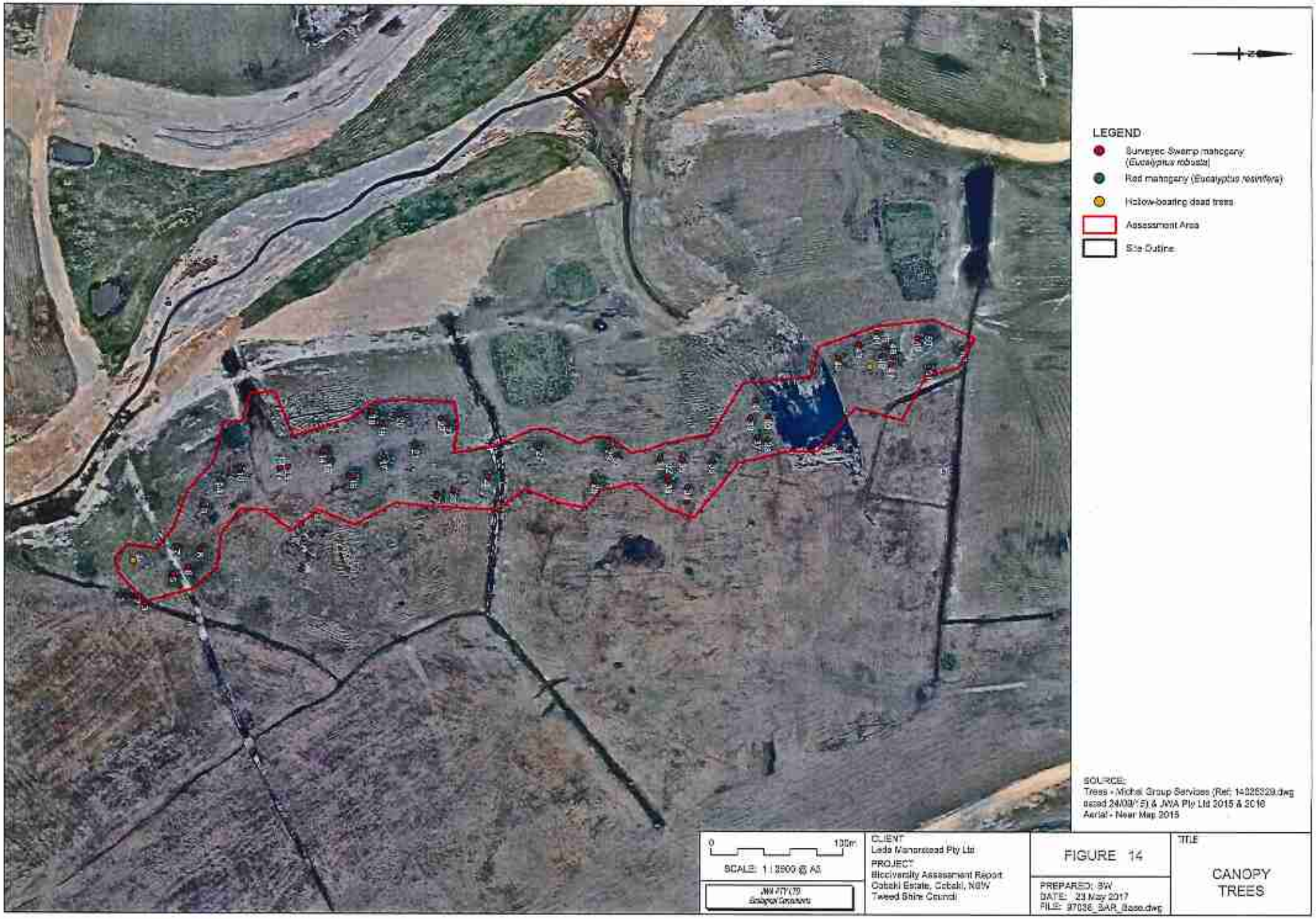
The midstorey is absent, and the ground cover is regularly slashed. The ground cover consists of various species to approximately fifty (50) centimetres in height, including Swamp selaginella (*Selaginella uliginosa*), Bunchy sedge (*Cyperus polystachyos*), *Baloskion tetraphyllum*, Bracken fern (*Pteridium esculentum*), Curly sedge (*Caustis recurvata*), Foxtails (*Caustis blakei*), Saw sedge (*Gahnia aspera*), Whisky grass (*Andropogon virginicus*), Blady grass (*Imperata cylindrica*), Mat rushes, (*Lomandra hystrix, L. longifolia, L. multiform*), Flax lily (*Dianella* sp.) and various regenerating heath species.

Conservation status

The closest analogue to this community considered in the Regional Forestry Agreement (RFA) report is Forest Ecosystem 142 (Swamp mahogany). The RFA document provides the following data on this ecosystem:

- 578 hectares of this ecosystem type remains within the upper north-east section of the NSW North Coast Bioregion. The original extent (i.e. pre-1750) was approximately 695 hectares.


LEGEND
Lowland Rainforest
Lowland Rainforest on Floodplain
Swamp Sclerophyll Forest on Floodplain
Swamp Oak Floodplain Forest
Freshwater Wetland (Degraded)
Saltmarsh
Assessment Area
Site Outline
SOURCE:
EEC's - James Warren & Associates Pty Ltd
Aerial - Near Map 2015
0
500m
SCALE: 1:12,500 @ A3
CLIENT
Leda Manorstead Pty Ltd
PROJECT
Biodiversity Assessment Report
Cobaki Estate, Cobaki, NSW
Tweed Shire Council
FIGURE 13
PREPARED: BW
DATE: 23 May 2017
FILE: 97038_BAR_Base.cwg
TITLE
ENDANGERED ECOLOGICAL COMMUNITIES


N
LEGEND
Surveyed Swamp mahogany (Eucalyptus robusta)
Red mahogany (Eucalyptus resinifera)
Hollow-bearing dead trees
Assessment Area
Site Outline
SOURCE:
Trees - Michel Group Services (Ref: 14026329.dwg dated 24/03/15) & JWA Pty Ltd 2015 & 2016
Aerial - Near Map 2015
0
100m
SCALE: 1:2500 @ A3
JWA PTY LTD
Ecological Consultants
CLIENT
Leda Manorstead Pty Ltd
PROJECT
Biodiversity Assessment Report
Cobaki Estate, Cobaki, NSW
Tweed Shire Council
FIGURE 14
PREPARED: SW
DATE: 23 May 2017
FILE: 97036_BAR_Base.dwg
TITLE
CANOPY TREES

- The ecosystem is considered to be Rare.
- 39.5% of the total forest ecosystem area is within the Comprehensive, Adequate and Representative (CAR) reserve system including 25.7% in dedicated reserves and 12.3% in informal reserves. A further 1.4% is protected by tabulated prescriptions.
- Swamp mahogany communities have been identified as a priority for conservation on private land.

Under the Tweed Vegetation Management Strategy (Ecograph 2004) this ecosystem is classified as Sclerophyll forest/woodlands on sand substrates and alluvium - 305 Coastal Swamp mahogany open forest to woodland. The Tweed Vegetation Management Strategy (Ecograph 2004) provides the following data on this ecosystem:

This ecosystem covers an area of approximately 170 hectares (vegetated land), which is approximately 0.25 % of the vegetated land in the Shire and 0.13 % of the Shire;

- Inadequately conserved over all its range.
- Note: This community is indicative of the EEC Swamp sclerophyll forest on coastal floodplain as listed by the NSW Scientific Committee on the 17/12/04.

However, JWA completed a detailed assessment of the designation of this vegetation community as an EEC. This assessment reviewed the Scientific Determination and its implications for this designation. The following issues were critically analysed:

1. the soil land zone on which the community occurs; and
2. the location of the community in relation to the 1 in 100-year flood recurrence line.

It was discovered that:

1. the soil land zone type on which the trees occurred was not consistent with flood plain soils as required by the Scientific Determination; and
2. the community did not occur at or below the 1 in 100-year recurrence line as is required by the Scientific Determination.

This community is therefore not considered to be representative of the EEC Swamp sclerophyll forest on coastal floodplain. The conservation values of this community are reduced, due to previous clearing and current regular slashing, which has eliminated the midstorey and reduced the understorey to common regenerating species. This community is considered to have low-moderate conservation value.

3.3 Site Value (Vegetation Condition) Score

3.3.1 Introduction

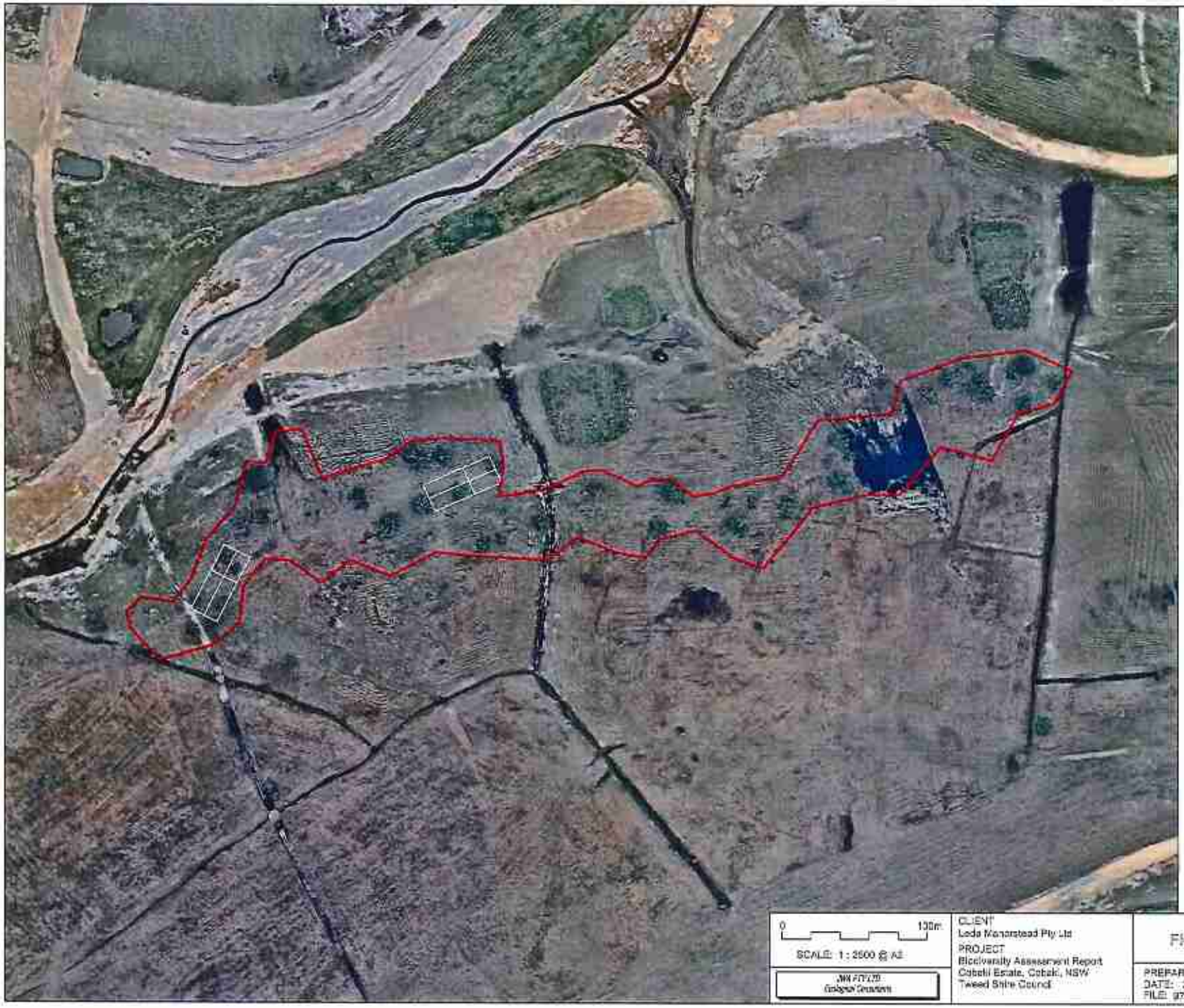
This section provides the methodology used to assess the site value of the Swamp mahogany community and the results of the assessment.

3.3.2 Methodology

The Swamp mahogany community was assessed using plot and transect surveys to obtain a quantitative measure of each of the ten (10) site attributes listed **TABLE 4.** Two (2) plot and transect surveys were completed in February 2016 in accordance with the minimum requirement provided in the FBA. The location of the survey sites was selected randomly and is shown in **FIGURE 15.** In order to ensure the accuracy of the data collected, these survey sites were assessed again on 16th May 2017 utilising the same methodology.

TABLE 4
SCORING AND WIEGHTING OF SITE ATTRIBUTES

Site attribute	Site attribute score				Weighting for attribute score
	0	1	2	3	
Native plant species richness	0	>0 - <50% of benchmark	50% - <100% benchmark	≥ benchmark	25
Native over-storey cover	0 - 10% or >200% of benchmark	>10 - <50% or >150 - 200% of benchmark	50 - <100% or >100 - 150% of benchmark	within benchmark	10
Native mid-storey cover	0 - 10% or >200% of benchmark	>10 - <50% or >150 - 200% of benchmark	50 - <100% or >100 - 150% of benchmark	within benchmark	10
Native ground cover (grasses)	0 - 10% or >200% of benchmark	>10 - <50% or >150 - 200% of benchmark	50 - <100% or >100 - 150% of benchmark	within benchmark	2.5
Native ground cover (shrubs)	0 - 10% or >200% of benchmark	>10 - <50% or >150 - 200% of benchmark	50 - <100% or >100 - 150% of benchmark	within benchmark	2.5
Native ground cover (other)	0 - 10% or >200% of benchmark	>10 - <50% or >150 - 200% of benchmark	50 - <100% or >100 - 150% of benchmark	within benchmark	2.5
Exotic plant cover	>66%	>33 - 66%	>5 - 33%	0 - 5%	5
Number of trees with hollows	0	>0 - <50% of benchmark	50% - <100% of benchmark	≥ benchmark	20
Proportion of over-storey trees occurring as regeneration	0	>0 - <50%	50 - <100%	100%	12.5
Total length of fallen logs	0 - 10% of benchmark	>10% - <50% of benchmark	50 – <100% of benchmark	≥ benchmark	10



LEGEND

Plot and Transect Survey Site

Assessment Area

SOURCE:
Survey - JWA Pty Ltd 2016
Aerial - Near Map 2016

0 100m

SCALE: 1 : 2500 @ A3

JWA PTY LTD
Ecological Consultants

CLIENT
Leda Manorstead Pty Ltd

PROJECT
Biodiversity Assessment Report
Cobaki Estate, Cobaki, NSW
Tweed Shire Council

FIGURE 15

PREPARED: BW
DATE: 23 May 2017
FILE: 97038_SAR_Base.dwg

TITLE
LOCATION OF SITE VALUE SURVEY

3.3.3 Results

The data obtained during the 2016 plot and transect surveys are provided in **TABLES 5 & 6** below. The BBCC converts this data to a site value score out of 100. The Swamp mahogany community achieved a site value score of **51.33 / 100.**

TABLE 5
2016 SURVEY RESULTS FOR PLOT & TRANSECT 1

Attribute	Benchmark	Site results	Site attribute score	Weighting
a) Native plant species richness	>=24	18	2	25
b) Native over-storey cover	10 - 70%	26%	3	10
c) Native mid-storey cover	10 - 60%	0%	0	10
d) Native ground cover (grasses)	2 - 80%	8%	3	2.5
e) Native ground cover (shrubs)	0 - 70%	2%	3	2.5
f) Native ground cover (other)	0 - 90%	22%	3	2.5
g) Exotic plant cover	-	>66%	0	5
h) Number of trees with hollows	>0	0	0	20
i) Proportion of over-storey species occurring as regeneration	1	0.5	2	12.5
j) Total length of fallen logs	>=5	6	3	10

TABLE 6
2016 SURVEY RESULTS FOR PLOT & TRANSECT 2

Attribute	Benchmark	Site results	Site attribute score	Weighting
a) Native plant species richness	>=24	22	2	25
b) Native over-storey cover	10 - 70%	21%	3	10
c) Native mid-storey cover	10 - 60%	0%	0	10
d) Native ground cover (grasses)	2 - 80%	5%	3	2.5
e) Native ground cover (shrubs)	0 - 70%	0%	3	2.5
f) Native ground cover (other)	0 - 90%	62%	3	2.5
g) Exotic plant cover	-	>33 - 66%	1	5
h) Number of trees with hollows	>0	0	0	20
i) Proportion of over-storey species occurring as regeneration	1	0.5	2	12.5
j) Total length of fallen logs	>=5	0	0	10

The data obtained during the 2017 plot and transect surveys are provided in **TABLES 7 & 8** below. This equates to a current site value score of **49.33 / 100** which is comparable to the 2016 survey. As there is little variation in the 2016 and 2017 site value scores, the original 2016 site value score has been used in the BBCC, and following sections of this BAR, to assess biodiversity values and credit requirements.

TABLE 7
2017 SURVEY RESULTS FOR PLOT & TRANSECT 1

Attribute	Benchmark	Site results	Site attribute score	Weighting
a) Native plant species richness	>=24	19	2	25
b) Native over-storey cover	10 - 70%	21.5%	3	10
c) Native mid-storey cover	10 - 60%	0%	0	10
d) Native ground cover (grasses)	2 - 80%	4%	3	2.5
e) Native ground cover (shrubs)	0 - 70%	2%	3	2.5
f) Native ground cover (other)	0 - 90%	62%	3	2.5
g) Exotic plant cover	-	74%	0	5
h) Number of trees with hollows	>0	0	0	20
i) Proportion of over-storey species occurring as regeneration	1	1	3	12.5
j) Total length of fallen logs	>=5	0	0	10

TABLE 8
2017 SURVEY RESULTS FOR PLOT & TRANSECT 2

Attribute	Benchmark	Site results	Site attribute score	Weighting
a) Native plant species richness	>=24	25	3	25
b) Native over-storey cover	10 - 70%	10.5%	3	10
c) Native mid-storey cover	10 - 60%	0%	0	10
d) Native ground cover (grasses)	2 - 80%	0%	0	2.5
e) Native ground cover (shrubs)	0 - 70%	2%	3	2.5
f) Native ground cover (other)	0 - 90%	62%	3	2.5
g) Exotic plant cover	-	62%	1	5
h) Number of trees with hollows	>0	0	0	20
i) Proportion of over-storey species occurring as regeneration	1	1	3	12.5
j) Total length of fallen logs	>=5	0	0	10

4 THREATENED SPECIES ANALYSIS

4.1 Introduction

This section provides an assessment of the threatened flora and fauna species predicted by the BBCC to occur in the assessment area. This includes both species credit species and ecosystem credit species. Details are also provided of targeted surveys completed for species credit species including technique, effort, timing and weather conditions.

4.2 Species Credit Species

4.2.1 Introduction

The following species credit species have been derived from the BBCC:

- Australian fritillary (*Argyreus hyperbius*)
- Eastern chestnut mouse (*Pseudomys gracilicaudatus*)
- Eastern pygmy-possum (*Cercartetus nanus*)
- Koala (*Phascolarctos cinereus*)
- Long-nosed potoroo population, Cobaki Lakes and Tweed Heads West (Long-nosed potoroo - endangered population)
- Red goshawk (*Erythrotriorchis radiatus*)
- Regent honeyeater (*Anthochaera phrygia*)
- Ripple-leaf muttonwood (*Myrsine richmondensis*)
- Squirrel glider (*Petaurus norfolcensis*)
- Water nutgrass (*Cyperus aquatilis*)
- White-eared monarch (*Carterornis leucotis*)

Targeted surveys were completed for these species between 29th February and 4th March 2016. The methodology and results of these surveys are provided in **APPENDIX 2.** Two (2) additional threatened species were recorded within the assessment area during these surveys:

- Wallum froglet (*Crinia tinnula*); and
- Little bent-wing bat (*Miniopterus australis*)

All species credit species derived from the BBCC and observed during targeted surveys are addressed in the following sections.

4.2.2 Australian fritillary (Argyreus hyperbius)

Habitat Requirement - QLD DEHP (2011)

Most specimens have been collected from river estuaries or swampy coastal areas at or near sea level. The Australian fritillary butterfly is restricted to open, swampy, coastal

areas where the larval food plant, *Viola betonicifolia*, grows as a small, insignificant ground herb in association with *Lomandra longifolia* (long leaved matrush) and grasses, especially the grass *Imperata cylindrica* (blady grass). This habitat is called Melaleuca wetlands, although the larval food plant does not occur in all sub-types of this plant community. It is also sometimes found in disturbed areas (e.g. the drainage ditches of sugarcane farms) or in association with water course plant communities when its food plant *Viola betonicifolia* is present.

The Australian fritillary butterfly has been recorded in south-eastern Queensland and north-eastern New South Wales between Gympie and Port Macquarie.

Occurrence of Suitable Habitat in the Assessment Area
Suitable habitat does not occur in the Swamp mahogany community. The groundcover community has been historically highly disturbed by cattle grazing and slashing. The critical food plant *Viola betonicifolia* is not present.

Survey Effort and Results
A number of detailed flora and fauna assessments have been completed on the Cobaki Estate site over the last thirty-five (35) years (**APPENDIX 3**). A detailed survey of the plant species occurring in association with the Swamp mahogany community was completed in 2014 (**APPENDIX 1**).

Targeted threatened species surveys were completed as part of the current assessment between 29th February and 4th March 2016. This included intensive searches within the assessment area for the Australian fritillary and its food plant *Viola betonicifolia*. The methodology and results of these surveys are provided in **APPENDIX 2**.

Neither the Australian fritillary or the critical food plant *Viola betonicifolia* has ever been recorded on the Cobaki Estate site or within the Swamp mahogany community.

Likelihood of Occurrence
Very Low.

4.2.3 Eastern chestnut mouse (Pseudomys gracilicaudatus)

Habitat Requirement - NSW OEH (2015)
In NSW the Eastern Chestnut Mouse is mostly found, in low numbers, in heathland and is most common in dense, wet heath and swamps.

Optimal habitat appears to be in vigorously regenerating heathland burnt from 18 months to four years previously. By the time the heath is mature, the larger Swamp Rat becomes dominant, and Eastern Chestnut Mouse numbers drop again.

Feeds at night via runways through the grassy and sedge understorey, within an area of less than half a hectare. It has a broad diet of grass stems, invertebrates, fungi and seeds, with the relative significance of each component varying seasonally.

Up to three litters are produced from spring to autumn; this strategy allows rapid build-up of numbers in years following fire.

Occurrence of Suitable Habitat in the Assessment Area
Suitable habitat does not occur in the Swamp mahogany community. The groundcover stratum has been historically highly disturbed by cattle grazing and slashing. The eastern chestnut mouse requires dense groundcover.

Survey Effort and Results
A number of detailed fauna surveys have been completed on the Cobaki Estate site over the last thirty-five (35) years (**APPENDIX 3**). The Eastern chestnut mouse has never been recorded in that time.

Targeted threatened species surveys were completed as part of the current assessment between 29th February and 4th March 2016. The methodology and results of these surveys are provided in **APPENDIX 2.** This species was not recorded during the targeted surveys.

Likelihood of Occurrence
Very low.

4.2.4 Eastern pygmy-possum (Cercartetus nanus)

Habitat Requirement - NSW OEH (2014)
Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest.

Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable.

Also feeds on insects throughout the year; this feed source may be more important in habitats where flowers are less abundant such as wet forests.

Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum (*Pseudocheirus peregrinus*) dreys or thickets of vegetation, (e.g. grass-tree skirts); nest-building appears to be restricted to breeding females; tree hollows are favoured but spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks.

Occurrence of Suitable Habitat in the Assessment Area
Suitable habitat is rainforest in north-eastern NSW. Swamp mahogany would provide forage habitat during flowering. The assessment area is significantly constrained by its long term isolation.

Survey Effort and Results
A number of detailed fauna surveys have been completed on the Cobaki Estate site over the last thirty-five (35) years (**APPENDIX 3**). The eastern pygmy possum has never been recorded over this time period.

Targeted threatened species surveys were completed as part of the current assessment between 29th February and 4th March 2016. The methodology and results of these surveys are provided in **APPENDIX 2.** This species was not recorded during the targeted surveys.

Likelihood of Occurrence
Very low.

4.2.5 Koala (Phascolarctos cinereus)

Habitat Requirement - NSE OEH (2015)
Inhabit eucalypt woodlands and forests.

Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. In the Northern rivers region, Swamp mahogany is one of its preferred food tree species. Swamp mahogany occurs in low dense mixed forests of eucalypts and paperbarks typically 15 to 20 m tall with minimal shrub cover and dense graminoid groundcover. Development of a sclerophyllous shrub understorey depends on density of the tree canopy. The boggy ground is heavily clothed in leaf litter, interspersed with patches of sedges and ferns, temporary pools of water and bare ground.

Occurrence of Suitable Habitat in the Assessment Area
Suitable habitat does occur in the Swamp mahogany community. Swamp mahogany is a preferred food tree for the Koala in northern NSW.

Survey Effort and Results
A number of detailed fauna surveys have been completed on the Cobaki Estate site. A very detailed koala survey and habitat assessment was completed on the site in 2011 as part of a SEPP 44 - Koala Habitat Protection assessment (**APPENDIX 4**).

Koalas have consistently been recorded in low numbers on the Cobaki Estate site. Records occur for the western (elevated) portions of the site. Koalas (or signs of them) have never been recorded in the Swamp mahogany community in the lower lying eastern portion of the site.

Targeted threatened species surveys were completed as part of the current assessment between 29th February and 4th March 2016. The methodology and results of these surveys are provided in **APPENDIX 2.** Koalas or signs of koala activity (i.e. faecal pellets) were not recorded during the targeted surveys.

Likelihood of Occurrence
Low.

4.2.6 Little bent-wing bat (Miniopterus australis)

Habitat Requirement - NSW OEH 2014

Inhabits moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas.

Little bent-wing bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.

Occurrence of Suitable Habitat in the Assessment Area

Suitable forage habitat does occur in the Swamp mahogany community

Survey Effort and Results

Targeted threatened species surveys were completed as part of the current assessment between 29th February and 4th March 2016. The methodology and results of these surveys are provided in **APPENDIX 2.** This species was identified by analysis of ANABAT recordings.

Likelihood of Occurrence

Confirmed. A species polygon has been prepared for the Little bent-wing bat and is provided in **FIGURE 16.** The species polygon is considered to be inclusive of the entire Swamp mahogany community (i.e. 3.80 ha).

4.2.7 Long-nosed potoroo population, Cobaki Lakes and Tweed Heads West (Long-nosed potoroo - endangered population)

Habitat Requirement - NSW OEH 2014

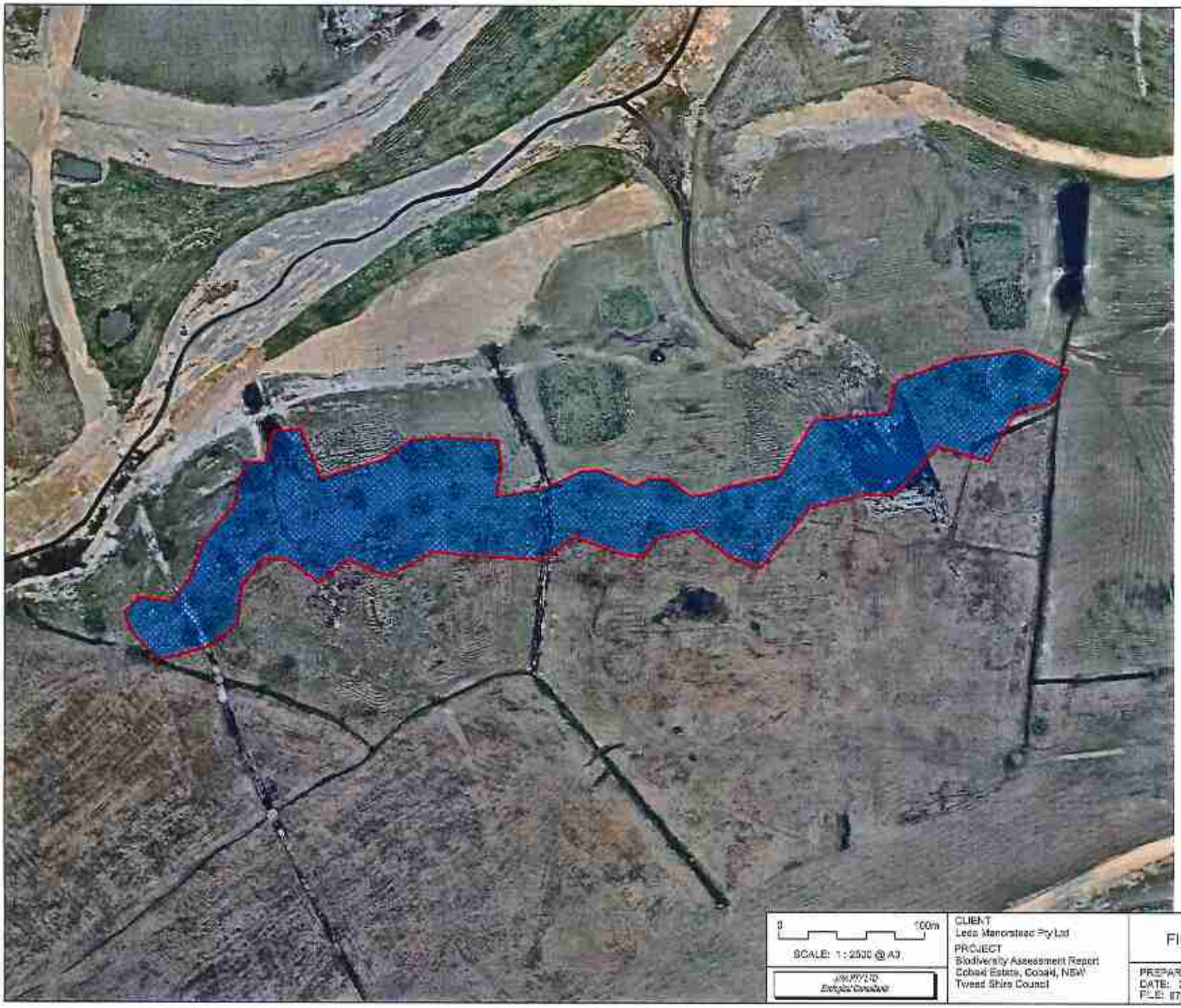
Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature.

The fruit-bodies of hypogeous (underground-fruiting) fungi are a large component of the diet of the Long-nosed Potoroo. They also eat roots, tubers, insects and their larvae and other soft-bodied animals in the soil.

Occurrence of Suitable Habitat in the Assessment Area

Long-nosed Potoroo habitat is characterised by dense groundcover for shelter in proximity to small open areas for foraging. At Cobaki, potoroos appear to prefer Scribbly Gum Heathland, although they have been recorded in a variety of other vegetation communities, including Scribbly Gum/Swamp Mahogany Forest, Tree Broom Heath, Scribbly Gum Forest, Black She-oak Heath and Swamp Mahogany Forest (James Warren *pers. comm.* 2017).

Suitable habitat does not occur in the assessment area. The groundcover stratum has been historically highly disturbed by cattle grazing and slashing. The Long-nosed potoroo requires dense groundcover.



LEGEND

- Potential Little bent-wing bat (*Miniopterus australis*) habitat 2016
- Assessment Area
- Site Outline

SOURCE:
Records & Habitat - JWA Pty Ltd 2016
Aerial - Near Map 2016

0 100m

SCALE: 1 : 2500 @ A3

APPROVED
Ecological Consultants

CLIENT
Leda Manorstead Pty Ltd

PROJECT
Biodiversity Assessment Report
Cobaki Estate, Cobaki, NSW
Tweed Shire Council

FIGURE 16

PREPARED: BW
DATE: 22 May 2017
FILE: 87033_BAR_Base.dwg

TITLE
LITTLE BENT-WING BAT SPECIES POLYGON

Survey Effort and Results

The Long-nosed potoroo population at Cobaki has been the subject of much study since its discovery in 1992. All records for the population occur on Crown Land adjacent to the Cobaki Estate site. There are no records of the species on the Cobaki Estate site.

Targeted threatened species surveys were completed as part of the current assessment between 29th February and 4th March 2016. The methodology and results of these surveys are provided in **APPENDIX 2**. This species was not recorded during the targeted surveys.

Likelihood of Occurrence
Very Low.

4.2.8 Red goshawk (Erythrotriorchis radiatus)

Habitat Requirement - NSW OEH 2014
Red Goshawks inhabit open woodland and forest, preferring a mosaic of vegetation types, a large population of birds as a source of food, and permanent water, and are often found in riparian habitats along or near watercourses or wetlands. In NSW, preferred habitats include mixed subtropical rainforest, *Melaleuca* swamp forest and riparian *Eucalyptus* forest of coastal rivers.

Red Goshawks mainly eat medium to large birds, including species as large as Australian Brush-turkeys, Kookaburras, Tawny Frogmouths, Sulphur-crested Cockatoos and Rainbow Lorikeets, but they also take mammals, reptiles and insects.

The breeding behaviour of Red Goshawks is not well known. Breeding is likely to be in spring and summer in southern Queensland and NSW. The birds lay clutches of 1-2 eggs between July and September, in a stick nest in a tall tree (>20 m tall) within 1 km of a watercourse or wetland. Young fledge around November and December.

Occurrence of Suitable Habitat in the Assessment Area
The assessment area may form a small part of the very large home range of this species. However, no suitable breeding habitat is considered to occur within the assessment area.

Survey Effort and Results
A number of detailed fauna surveys have been completed on the Cobaki Estate site over the last thirty-five (35) years (**APPENDIX 3**). In particular, a number of surveys were completed by Dr Stephen Debus in 1997. The Red goshawk has never been recorded over this time period.

Targeted threatened species surveys were completed as part of the current assessment between 29th February and 4th March 2016. The methodology and results of these surveys are provided in **APPENDIX 2**. This species was not recorded during the targeted surveys.

Likelihood of Occurrence
Very low.

4.2.9 Regent honeyeater (Anthochaera phrygia)

Habitat Requirement - NSW OEH (2015)

The Regent Honeyeater is a flagship threatened woodland bird whose conservation will benefit a large suite of other threatened and declining woodland fauna. The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She-oak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes.

Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests, particularly on the central coast and occasionally on the upper north coast. Birds are occasionally seen on the south coast.

In the last 10 years Regent Honeyeaters have been recorded in urban areas around Albury where woodlands tree species such as Mugga Ironbark and Yellow Box were planted 20 years ago.

The Regent Honeyeater is a generalist forager, although it feeds mainly on the nectar from a relatively small number of eucalypts that produce high volumes of nectar. Key eucalypt species include Mugga Ironbark, Yellow Box, White Box and Swamp Mahogany. Other tree species may be regionally important. For example, the Lower Hunter Spotted Gum forests have recently been demonstrated to support regular breeding events. Flowering of associated species such as Thin-leaved Stringybark *Eucalyptus eugenioides* and other Stringybark species, and Broad-leaved Ironbark *E. fibrosa* can also contribute important nectar flows at times. Nectar and fruit from the mistletoes *Amyema miquelii*, *A. pendula* and *A. cambagei* are also utilised. When nectar is scarce lerp and honeydew can comprise a large proportion of the diet. Insects make up about 15% of the total diet and are important components of the diet of nestlings.

Occurrence of Suitable Habitat in the Assessment Area

Suitable forage habitat does occur in the Swamp mahogany community. Breeding habitat is not known from the north coast of NSW.

Survey Effort and Results

A number of detailed fauna assessments have been completed on the Cobaki Estate site over the last thirty-five (35) years (**APPENDIX 3**). In particular, a number of surveys were completed by Dr Stephen Debus in 1997. The regent honeyeater has never been recorded on the Cobaki Estate site.

Targeted threatened species surveys were completed as part of the current assessment between 29th February and 4th March 2016. The methodology and results of these surveys are provided in **APPENDIX 2.** This species was not recorded during the targeted surveys.

Likelihood of Occurrence

Very low.

4.2.10 Ripple-leaf muttonwood (Myrsine richmondensis)

Habitat Requirement
Subtropical and dry rainforest and swamp forest on creek flats and slopes on basalt derived soil and alluvial deposits.

Flowers have been recorded in October and November, fruits have been observed from December to March.

Occurrence of Suitable Habitat in the Assessment Area
Marginal habitat occurs in the Swamp mahogany community.

Survey Effort and Results
A number of detailed flora assessments have been completed on the Cobaki Estate site over the last thirty-five (35) years (**APPENDIX 3**). A detailed survey of the plant species occurring in association with the Swamp mahogany community was completed in 2014 (**APPENDIX 1**). Ripple-leaf muttonwood has never been recorded on the Cobaki Estate site.

This species was not recorded during the current assessment despite extensive searches within the assessment area.

Likelihood of Occurrence
Very low.

4.2.11 Squirrel glider (Petaurus norfolcensis)

Habitat Requirement
Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas.

Prefers mixed species stands with a shrub or Acacia mid-storey.

Live in family groups of a single adult male one or more adult females and offspring.

Require abundant tree hollows for refuge and nest sites.

Diet varies seasonally and consists of Acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein.

Occurrence of Suitable Habitat in the Assessment Area
Suitable forage habitat does occur in this community but other habitat requirements are not met i.e. there are no hollows suitable for denning.

Survey Effort and Results
A number of detailed fauna assessments have been completed on the Cobaki Estate site over the last thirty-five (35) years (**APPENDIX 3**). Squirrel gliders have never been recorded on the Cobaki Estate site.

Targeted threatened species surveys were completed as part of the current assessment between 29th February and 4th March 2016. The methodology and results of these surveys are provided in **APPENDIX 2.** This species was not recorded during the targeted surveys.

Likelihood of Occurrence
Very low.

4.2.12 Wallum froglet (Crinia tinnula)

Habitat Requirement - NSW OEH (2015)
Wallum Froglets are found in a wide range of habitats, usually associated with acidic swamps on coastal sand plains. They typically occur in sedgelands and wet heathlands. They can also be found along drainage lines within other vegetation communities and disturbed areas, and occasionally in swamp sclerophyll forests.

The species breeds in swamps with permanent water as well as shallow ephemeral pools and drainage ditches. Breeding is thought to peak in the colder months, but can occur throughout the year following rain. Eggs of 1.1-1.2mm are deposited in water with a pH of <6 and tadpoles take 2-6 months to develop into frogs.

Wallum Froglets shelter under leaf litter, vegetation, other debris or in burrows of other species. Shelter sites are wet or very damp and often located near the water's edge.

Occurrence of Suitable Habitat in the Assessment Area
Suitable forage habitat does occur in the Swamp mahogany community, particularly in association with drainage lines and low-lying areas with suitable vegetation (i.e. sedges and wet heathland vegetation).

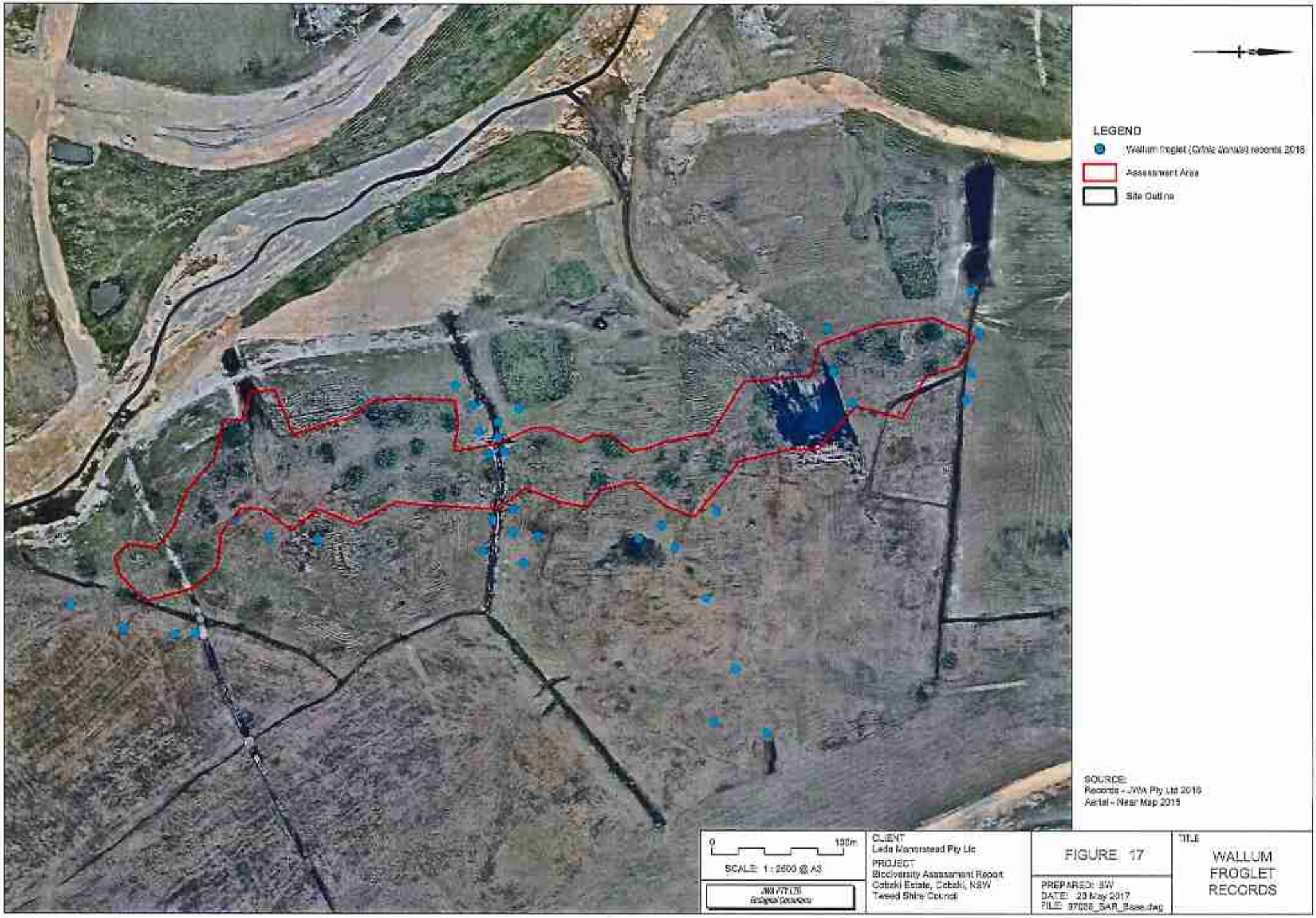
Survey Effort and Results
Targeted threatened species surveys were completed as part of the current assessment between 29th February and 4th March 2016. The methodology and results of these surveys are provided in **APPENDIX 2.** This species was recorded by call recognition during the targeted surveys. The location of records is provided in **FIGURE 17.**

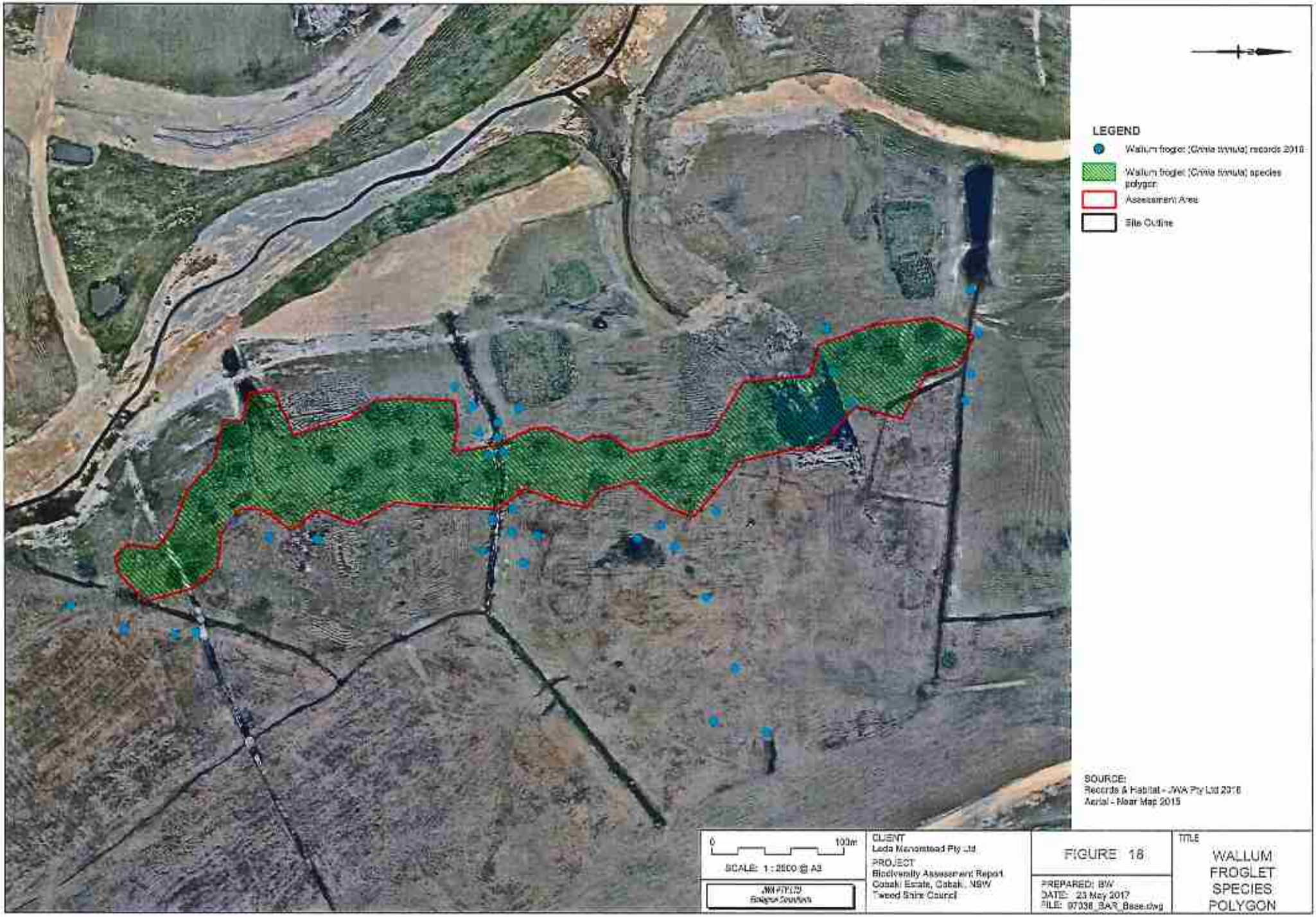
Likelihood of Occurrence
Confirmed. A species polygon has been prepared for the Wallum froglet and is provided in **FIGURE 18.** The species polygon is considered to be inclusive of the entire Swamp mahogany community (i.e. 3.80 ha).

4.2.13 Water nutgrass (Cyperus aquatilis)

Habitat Requirement - NSW OEH 2012
Grows in ephemerally wet sites, such as roadside ditches and seepage areas from small cliffs, in sandstone areas.

Occurrence of Suitable Habitat in the Assessment Area
Ephemerally wet areas occur within the assessment area.


LEGEND
Wallum froglet (Crinia tinnula) records 2016
Assessment Area
Site Outline
SOURCE:
Records - JWA Pty Ltd 2016
Aerial - Near Map 2015
0
100m
SCALE: 1 : 2500 @ A3
CLIENT
Lede Homestead Pty Ltd
PROJECT
Biodiversity Assessment Report
Cobaki Estate, Cobaki, NSW
Tweed Shire Council
FIGURE 17
PREPARED: SW
DATE: 23 May 2017
FILE: 97036_SAR_Base.dwg
TITLE
WALLUM FROGLET RECORDS


LEGEND
Wallum froglet (Crinia tinnula) records 2016
Wallum froglet (Crinia tinnula) species polygon
Assessment Area
Site Outline
SOURCE:
Records & Habitat - JWA Pty Ltd 2016
Aerial - Nearmap 2015
0
100m
SCALE: 1 : 2500 @ A3
JWA PTY LTD
Ecological Consultants
CLIENT
Leda Manorstead Pty Ltd
PROJECT
Biodiversity Assessment Report
Cobaki Estate, Cobaki, NSW
Tweed Shire Council
FIGURE 18
PREPARED: BW
DATE: 23 May 2017
FILE: 97336_BAR_Base.dwg
TITLE
WALLUM FROGLET SPECIES POLYGON

Survey Effort and Results
A number of detailed flora assessments have been completed on the Cobaki Estate site over the last thirty-five (35) years (**APPENDIX 3**). A detailed survey of the plant species occurring in association with the Swamp mahogany community was completed in 2014 (**APPENDIX 1**). Water nutgrass has never been recorded on the Cobaki Estate site.

This species was not recorded during the current assessment despite extensive searches within the assessment area.

Likelihood of Occurrence
Very low.

4.2.14 White-eared monarch (Carterornis leucotis)

Habitat Requirement - NSW OEH (2012)
In NSW, White-eared Monarchs occurs in rainforest, especially drier types, such as littoral rainforest, as well as wet and dry sclerophyll forests, swamp forest and regrowth forest.

They appear to prefer the ecotone between rainforest and other open vegetation types or the edges of rainforest, such as along roads.

They are highly active when foraging, characteristically sallying, hovering and fluttering around the outer foliage of rainforest trees. They are usually observed high in the canopy or sub-canopy.

They eat insects, but their diet is not well studied.

They breed from about September to March, usually nesting high in the canopy, and often at the edge of patches of rainforest.

Occurrence of Suitable Habitat in the Assessment Area
Suitable habitat does not occur in the Swamp mahogany community. There is no rainforest or wet/dry sclerophyll forest. The Swamp mahogany trees do not reach a standard of Swamp forest although Swamp mahogany is a component of Swamp forest.

Survey Effort and Results
A number of detailed fauna assessments have been completed on the Cobaki Estate site over the last thirty-five (35) years (**APPENDIX 3**). In particular, a number of surveys were completed by Dr Stephen Debus in 1997. The white-eared monarch has never been recorded on the Cobaki Estate site.

Targeted threatened species surveys were completed as part of the current assessment between 29th February and 4th March 2016. The methodology and results of these surveys are provided in **APPENDIX 2**. This species was not recorded during the targeted surveys.

Likelihood of Occurrence
Low.

4.3 Ecosystem Credit Species

4.3.1 Introduction

The following ecosystem credit species have been derived from the BBCC:

- Common blossom bat (*Synconycteris australis*)
- Glossy black-cockatoo (*Calyptorhynchus lathami*)
- Greater broad-nosed bat (*Scoteanax rueppellii*)
- Little eagle (*Hieraaetus morphnoides*)
- Little lorikeet (*Glossopsitta pusilla*)
- New Holland mouse (*Pseudomys novaehollandiae*)
- Square-tailed kite (*Lophoictinia isura*)
- Swift parrot (*Lathamus discolor*)
- Yellow-bellied sheathtail-bat (*Saccolaimus flaviventris*)

The Glossy black-cockatoo was removed from further assessment in the BBCC and is addressed in the following section. This species was removed from further assessment as none of the necessary habitat components (i.e. breeding, foraging or roosting habitat) are present in the assessment area. All other species listed above have been assessed in the BBCC as having one or more habitat components present within the assessment area.

4.3.2 Glossy black-cockatoo (Calyptorhynchus lathami)

Habitat Requirement - NSW OEH (2015)

Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black sheoak (*Allocasuarina littoralis*) and Forest sheoak (*A. torulosa*) are important foods.

Feeds almost exclusively on the seeds of several species of she-oak (*Casuarina* and *Allocasuarina* species), shredding the cones with the massive bill.

Dependent on large hollow-bearing eucalypts for nest sites. A single egg is laid between March and May.

Occurrence of Suitable Habitat in the Assessment Area

Suitable habitat does not occur in the Swamp mahogany community. Feed trees (i.e. *Casuarina* and *Allocasuarina* species) do not occur within the assessment area. There are no trees with large hollows suitable for nest sites.

Likelihood of Occurrence

Very low.

5 IMPACT ASSESSMENT AND CREDIT REQUIREMENT

5.1 Introduction

This section provides an assessment of the impacts of the proposed development on the assessment area along with the future site value score and change in landscape value score. It also provides the number of ecosystem credits and/or species credits required to offset the impacts of the proposed development.

5.2 Impact on Assessment Area

5.2.1 Site Value and Landscape Value Score

The proposed development will result in the complete removal of the Swamp mahogany community occurring within the assessment area. This will reduce the site value score from 51.33 to 0 and there will be a loss in landscape value of 1.00 (Biodiversity Credit Report available on request).

5.2.2 Impact on Biodiversity Links

The removal of the Swamp mahogany community will not impact on any state or regional biodiversity links.

5.2.3 Impact on Threatened Species Habitat

The removal of the Swamp mahogany community will result in the loss of approximately 3.80 ha of potential habitat for the Little bent-wing bat (*Miniopterus australis*) (**FIGURE 16**) and 3.80 ha of potential habitat for the Wallum froglet (*Crinia tinnula*) (**FIGURE 18**).

5.3 Number of Credits Required for Impact of Development

5.3.1 Ecosystem Credits

One-hundred and twenty-eight (128) ecosystem credits are required to offset the loss of 3.80 ha of Swamp mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion (NR254). By applying the credit converter[1], the area required to offset this impact is fourteen (14) hectares (Biodiversity Credit Calculator Report available on request).

5.3.2 Species Credits

Forty-nine (49) species credits are required to offset the loss of 3.80 ha of potential Little bent-wing bat habitat as a result of the removal of the Swamp mahogany community. By applying the credit converter[1], the area required to offset this impact is eight (8) hectares.

Forty-nine (49) species credits are required to offset the loss of 3.80 ha of potential Wallum froglet habitat as a result of the removal of the Swamp mahogany community. By applying the credit converter[1], the area required to offset this impact is eight (8) hectares.

[1] The credit converter is used to convert the quantity of ecosystem or species credits into hectares of land required for offset area.

5.3.3 Combining Offset Areas

Ecosystem credits and species credits can occur over the same offset area i.e. if an ecosystem credit offset area provides habitat for a species credit species, this area is considered to satisfy both the ecosystem credit requirement as well as the species credit species' habitat requirement.

Accordingly, if the area proposed to offset the loss of Swamp mahogany forest (NR254) contains Little bent-wing bat and/or Wallum froglet habitat, then the species credit offset requirements will be reduced by the number of credits provided for these species i.e. if the 14 ha Swamp mahogany forest offset also contains 8 ha of Little bent-wing habitat and 8 ha of Wallum froglet habitat, no more than the 14 ha would be required to satisfy both the ecosystem or species credit species offset.

REFERENCES

Office of Environment and Heritage (2012 - 2015) Threatened species profiles.

Queensland Department of Environment and Heritage Protection (2011) - Species profiles

Strahler, A.N. (1952) Hypsometric (area-altitude) analysis of erosional topology. *Geological Society of America Bulletin* 63 (11): 1117-1142

Woodward-Clyde (1997) Species Impact Statement - Cobaki Lakes Development. A report to Cardno & Davies.

APPENDIX 1 - PLANT SPECIES LIST

Botanical name	Common name	Life Form
Acacia ulicifolia	Prickly moses	Small shrub
*Andropogon virginicus**	Whisky grass	Grass
Aotus lanigera	Golden candlesticks	Small shrub
Austromyrtus dulcis	Midgen berry	Small shrub
Baeckea frutescens	Weeping baeckea	Small shrub
Baloskion pallens	Didgery sticks	Rush
Baloskion tetraphyllum	Tassel cord rush	Rush
Blechnum indicum	Swamp water fern	Fern
Breynia oblongifolia	Coffee bush	Shrub
Bromus sp.*		Grass
Caustis blakei		Sedge
Caustis recurvata		Sedge
*Cinnamomum camphora**	Camphor laurel	Tree
*Cuphea carthagenensis**	Columbian wax weed	Herb
Cyperus difformis	Dirty dora	Sedge
Cyperus polystachyos	Bunchy sedge	Sedge
Dianella caerulea	Blue flax lily	Herb
Drosera spatulata	A sundew	Herb
Elaeocarpus reticulatus	Blueberry ash	Shrub or small tree
Eleocharis sp.		Sedge
Eucalyptus resinifera	Red mahogany	Tree
Eucalyptus robusta	Swamp mahogany	Tree. Also recorded as seedling i.e. regenerating
Fimbristylis nutans		Sedge
Gahnia aspera	Rough saw-sedge	Sedge
Gahnia clarkei	Tall saw-sedge	Sedge
Gleichnia dicarpa	Pouched coral fern	Fern
Gonocarpus micranthus		Herb
Hardenbergia violacea	Purple coral pea	Climbing or prostrate subshrub
Hibbertia scandens	Climbing guinea flower	Climber
Homoranthus virgatus		Small shrub
Hovea sp.		Small shrub
Imperata cylindrica	Blady grass	Grass
Kennedia rubicunda	Dusky coral pea	Climber
Lomandra hystrix		Rush
Lomandra longifolia	Spiny-head mat-rush	Rush
Lomandra multiflora	Many-flowered mat-rush	Rush
Lophostemon suaveolens	Swamp box	Tree
Lygodium microphyllum	Climbing snake fern	Fern

Melaleuca quinquenervia	Broad-leaved paperbark	Tree. Also recorded as seedling i.e. regenerating
Parsonsia straminea	Common silkpod	Vine
*Paspalum mandiocanum**	Broadleaf paspalum	Grass
*Pennisetum clandestinum**	Kikuyu grass	Grass
Pimelea linifolia	Slender rice flower	Small shrub
Poa sp.*		Grass
Pomax umbellata		Herb
Pteridium esculentum	Common bracken	Fern
Selaginella uliginosa	Swamp selaginella	Clubmoss
*Senecio madagascariensis**	Fireweed	Forb
*Sisyrinchium rosulatum**	Scourweed	Herb
*Sporobolus africanus**	Paramatta grass	Grass
Xyris juncea	Dwarf yellow-eye	Herb

* Introduced species

APPENDIX 2 - TARGETED FAUNA SURVEY METHODOLOGY AND RESULTS

1. Introduction

A comprehensive fauna survey was completed between 29th February and 4th March 2016. Weather conditions were wet and warm during the first days of the survey period with 67mm and 54mm or rain recorded at nearby Coolangatta weather station on the 1st and 2nd of March respectively. Weather conditions were mostly fine and warm for the remainder of the survey period with isolated light showers.

2. Survey Techniques

Fauna survey techniques were designed to target threatened (species credit) species identified in the BioBanking Credit Calculator as potentially occurring in the assessment area. The following survey techniques were implemented:

- **Opportunistic Sightings**

The 'random meander' technique (Cropper 1993) was used to traverse the entire assessment area. All incidental records of fauna utilising the study area were recorded.

- **Active Searching**

Logs, bark and leaves were overturned in search of reptiles and amphibians while incidentally traversing the site. Diggings and signs of droppings were searched for. The site was actively searched for scats and bones. Searches for Koala faecal pellets were completed at the base of all Swamp mahogany trees occurring in the assessment area.

Active observation of bird activity was undertaken at all times during the survey period.

Active searching for the Australian fritillary (*Argyreus hyperbius*) and its food plant *Viola betonicifolia* was completed by traversing the entire assessment area. Searches for the threatened flora species Ripple-leaf muttonwood (*Myrsine richmondensis*) and Water nutgrass (*Cyperus aquatilis*) were also completed utilising this method.

- **Type 'A' Elliott Box Traps**

One (1) line of twenty-five (25) Type 'A' Elliott traps was set for a period of four (4) nights for a total of one-hundred (100) trap nights. This included five (5) arboreal tree-mounted traps. Traps were baited with a mixture of rolled oats, honey, peanut butter and vanilla essence. Arboreal Elliot traps were also baited with apple pieces and a mixture of honey and water sprayed on the trunk of the trees on which they were mounted (i.e. around the entrance of the traps).

- **Cage Traps**

Four (4) cage traps were also deployed for four (4) nights for a total of sixteen (16) trap nights. Traps were baited with a mixture of rolled oats, honey, peanut butter and vanilla essence and apple pieces. Cage traps were placed close to trees where some dense ground cover occurred and were also covered with hessian fabric.

- **Hair Tubes**

Twenty (20) hair tubes were placed on the trap line. Each hair tube was baited with rolled oats, honey, peanut butter and vanilla essence and then set for a period of four (4) nights for a total of eighty (80) trap nights. Hair samples collected were analysed by Barbara Triggs.

- **Diurnal Bird Surveys**

Diurnal birds were surveyed by one (1) scientist by using visual and aural cues, as follows, for a total of four (4) hours (times are EST):

- 1st March: 0600-0700 h (1 hr; wet);
- 2nd March: 0700-0800 h (1 hr; showers);
- 2nd March: 1900-2000 h (1 hr; dry); and
- 3rd March: 0700-0800 h (1 hr; dry)

Birds were also surveyed opportunistically at all other times during the survey period.

- **Anabat Recording**

An Anabat II sonar detector (Titley Electronics) was used to record the ultrasonic calls of Microchiropteran bats. Bat calls were recorded overnight (approx 2000 h to 0800) on 3rd March. A total of twelve (12) hours of recording was undertaken. It was intended to complete Anabat recording over two (2) consecutive nights, however, this was not possible due to equipment failure. Recording times commenced from slightly after dusk. Recording was undertaken by positioning the Anabat II sonar detector facing across a possible bat flyway (**FIGURE 1**). Anabat recordings were analysed by Greg Ford of Balance Environmental.

- **Spotlighting**

Spotlighting was undertaken on two consecutive nights by one (1) scientist for half (0.5) an hour on the 2nd and 3rd March. The weather for the spotlighting surveys was generally fine and warm with some very slight showers on the night of the 2nd March.

Nocturnal fauna was surveyed by spotlight-walking/driving through the entire assessment area. Spotlighting was completed using a 50W spotlight powered by a 12V battery. The observer walked/drove at approximately 1km/h allowing intensive listening as an adjunct to visual detection.

- **Call Playback Techniques**

Call playback was undertaken on two consecutive nights by one (1) scientist for half (0.5) an hour on the 2nd and 3rd March. Locations in which call playback was completed are shown in **FIGURE 1**. Target species included:

- Koala; and
- Squirrel glider

Calls were broadcast for approximately one (1) minute and then followed by a five (5) minute listening period.

3. Summary of Survey Effort

A summary of the survey effort and comparison with the suggested minimum effort detailed in the *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC 2004) is provided in TABLE 1.

TABLE 1
SUMMARY OF SURVEY EFFORT

Method	Survey Effort	Guideline (DEC 2004)
Elliott trapping	100 trap nights	100 trap nights per stratification unit
Cage traps	16 trap nights*	24 trap nights per stratification unit
Hair tubes	80 trap nights	40 trap nights per stratification unit
Call playback	2 nights (1 hr)	5min call broadcast followed by 10min listening period for each target species
Bird survey	Targeted diurnal surveys, 4 days/nights opportunistic records	Not yet resolved but likely that a species-time curve approach should be utilised for surveying diurnal birds.
Anabat (ultrasonic call recording)	1 night (12 hours)	Minimum of four hours for two nights
Spotlighting	2 nights (1 hr)*	2 x 1 hour and 1 x 2 hour search on three separate nights (two scientists)

*This component of the survey was reduced due to the small size of the assessment area, relatively small number of mature trees and lack of suitable habitat features associated with these survey methods (e.g. groundcover and hollow-bearing trees).

4. Results

Summary

Seven (7) mammal species, twenty-four (24) bird species, seven (7) amphibian species and two (2) butterfly species were recorded during the survey period (TABLE 2). No reptiles were observed during the survey.

Elliott/Cage Tapping

Trapping data is provided in TABLE 3. Two (2) introduced species were trapped on the ground in Elliott traps - the House mouse and the Cane toad. No fauna species were recorded in arboreal Elliott traps or cage traps.

Active Searches

No Koalas or signs of Koala activity (i.e. faecal pellets) were observed during the survey period. Neither the Australian fritillary or its food plant *Viola betonicifolia* was observed within the assessment area. Similarly, no Ripple-leaf muttonwood or Water nutgrass plants were observed.

Hair Tubes

Hair samples were collected from five (5) hair tubes. Analysis confirmed that all hair samples were attributable to the introduced House mouse.

Spotlighting and Call Playback

The spotlighting component of the survey revealed a small number of birds roosting in mature trees within the assessment area including Black-shouldered kites, Pied butcherbirds, Noisy miners, Laughing kookaburras and a White-faced heron. There was no response observed to any call playback surveys. A number of the threatened species Grey-headed flying-fox[2] were observed flying over the assessment area during spotlighting surveys.

ANABAT Recording

Analysis of ANABAT recordings (Balance Environmental) revealed four (4) species that were positively identified from 78 good quality calls including one (1) threatened species:

- Little bent-wing bat[3] (*Miniopterus australis*) - 58 calls;
- Little broad-nosed bat (*Scotorepens greyii*) - 2 calls;
- Eastern broad-nosed bat (*Scotorepens orion*) - 4 calls;
- Eastern forest bat (*Vespadelus pumilus*) - 14 calls

An additional 33 calls were of too low quality (brief and/or noisy and/or fragmented) to obtain reliable species identification. These were allocated to the following species groups:

- Gould's wattled bat (*Chalinolobus gouldii*) - 2 weak calls
  - Most likely this species but possibly from a *Mormopterus* (see below)
- Little bent-wing bat[3] or Eastern forest bat - 8 calls
  - Both species also identified positively from better quality calls;
- East coast freetail-bat[3] (*Mormopterus norfolkensis*) or Eastern freetail-bat (*M. ridei*) - 8 calls
  - Flattish pulses around 30 kHz with no clear evidence of alternating frequency, which is diagnostic of *M. norfolkensis*, but calls too brief to be certain of identity
- Eastern bent-wing bat[3] (*Miniopteris schreibersii oceanensis*) or Large forest bat (*Vespadelus darlingtoni*) - 5 calls
  - Steep, curvilinear pulses at 43-45 kHz but mostly weak and erratic so impossible to tell from which of these species they came
- Yellow-bellied sheathtail bat[3] (*Saccolaimus flaviventris*) or Northern free-tailed bat (*Mormopterus lumsdenae*) - 4 calls
  - Almost flat pulses at about 20 kHz, which looked more like *M. lumsdenae* than *S. flaviventris*, but with only a couple of pulses per call it is not possible to provide a reliable identification
- *Scotorepens* spp. or *V. darlingtoni* - 6 calls

[2] Listed as Vulnerable in schedules of the *Threatened Species Conservation Act (1995)* and *Environmental Protection and Biodiversity Conservation Act (1999)*

[3] Listed as Vulnerable in schedules of the *Threatened Species Conservation Act (1995)*

- Steep, curvilinear pulses at approximately 40 kHz, which were most likely from Little or Parnaby's Broad-nosed bats but could have been Large forest bat at lower end of its frequency range

Additional Threatened Fauna Records

Two additional threatened fauna species were recorded during the survey period. One (1) Black-necked stork[4] was observed flying over the assessment area and a number of Wallum froglets[5] were heard calling from within and adjacent to the assessment area (refer **SECTION 4.2.13** of BAR).

TABLE 2
FAUNA SPECIES RECORDED DURING SURVEY PERIOD

Common Name	Scientific Name
Mammals	
Eastern broad-nosed bat	*Scotorepens orion*
Eastern forest bat	*Vespadelus pumilus*
Eastern grey kangaroo	*Macropus giganteus*
Grey-headed flying-fox^	***Pteropus poliocephalus***
Little bent-wing bat	***Miniopterus australis***
Little broad-nosed bat	*Scotorepens greyii*
House mouse*	*Mus musculus*
Birds	
Australian magpie	*Cracticus tibicen*
Australian pied cormorant	*Phalacrocorax varius*
Australian white ibis	*Threskiornis moluccus*
Australian wood duck	*Chenonetta jubata*
Black-necked stork^	***Ephippiorhynchus asiaticus***
Black-shouldered kite	*Elanus axillaris*
Blue-faced honeyeater	*Entomyzon cyanotis*
Grey butcherbird	*Cracticus torquatus*
Intermediate egret	*Ardea intermedia*
Latham's snipe	*Gallinago hardwickii*

[4] Listed as Endangered in schedules of the *Threatened Species Conservation Act (1995)*
[5] Listed as Vulnerable in schedules of the *Threatened Species Conservation Act (1995)*

Common Name	Scientific Name
Laughing kookaburra	*Dacelo novaeguineae*
Masked lapwing	*Vanellus miles*
Noisy friarbird	*Philemon corniculatus*
Noisy miner	*Manorina melanocephala*
Pacific black duck	*Anas superciliosa*
Pied butcherbird	*Cracticus nigrogularis*
Rainbow lorikeet	*Trichoglossus moluccanus*
Spotless crake	*Porzana tabuensis*
Straw-necked ibis	*Threskiornis spinicollis*
Sulfur-crested cockatoo	*Cacatua galerita*
Torresian crow	*Corvus orru*
Welcome swallow	*Hirundo neoxena*
Whistling kite	*Haliastur sphenurus*
White-faced heron	*Egretta novaehollandiae*
Amphibians	
Cane toad*	*Rhinella marina*
Common eastern froglet	*Crinia signifera*
Dainty green tree frog	*Litoria gracilenta*
Eastern dwarf tree frog	*Litoria fallax*
Striped marsh frog	*Limnodynastes peronii*
Tusked frog	*Adelotus brevis*
Wallum froglet	***Crinia tinnula***
Butterflies	
Monarch butterfly	*Danaus plexippus*
Small grass yellow	*Eurema brigitta*

Threatened species in bold text

*Introduced species

^Observed flying over the assessment area

TABLE 3
FAUNA SURVEY TRAPPING DATA

	Survey Date			
Trap No.	01/03/16	02/03/16	03/03/16	04/03/16
Elliott traps (ground)				
1	x	House mouse	x	House mouse
2	House mouse	House mouse	x	x
3	x	x	x	x
4	x	Cane toad	House mouse	x
5	Cane toad	Cane toad	Cane toad	House mouse
6	x	Cane toad	Cane toad	x
7	House mouse	Cane toad	House mouse	House mouse
8	x	x	House mouse	House mouse
9	x	x	x	x
10	Cane toad	x	x	x
11	x	Cane toad	House mouse	x
12	Cane toad	x	x	x
13	x	x	House mouse	x
14	x	x	x	x
15	x	x	x	x
16	x	x	House mouse	House mouse
17	x	Cane toad	x	x
18	x	x	House mouse	House mouse
19	x	House mouse	Cane toad	x
20	Cane toad	x	House mouse	House mouse
Elliott traps (arboreal)				
1	x	x	x	x
2	x	x	x	x
3	x	x	x	x
4	x	x	x	x
5	x	x	x	x
Wire cage traps				
1	x	x	x	x
2	x	x	x	x
3	x	x	x	x
4	x	x	x	x

APPENDIX 3 - FLORA AND FAUNA ASSESSMENTS COMPLETED ON THE COBAKI ESTATE SITE

A significant number of flora and fauna studies have been completed over the last thirty-five (35) years. The list of these studies is included below:

- Cameron McNamara (1983) Cobaki Village Environmental Study. Report prepared for the Bradshaw Group. Includes a 1981 flora and fauna study.
- Winders Barlow and Morrison (1990a) Cobaki Community Project Vegetation Field Study.
- Winders Barlow and Morrison (1990b) Cobaki Community Project Evaluation of Terrestrial Fauna.
- Debus (1994) Bird Survey of the Cobaki Community Project site.
- James Warren Biological and Environmental Consultant (1994) Flora and Fauna Assessment. Bulk earthworks (cut and fill) at Cobaki Lakes.
- James Warren Biological and Environmental Consultant (1994) Flora and Fauna Assessment. Phase 1 Residential Development at Cobaki Lakes.
- Debus (May 1997) Supplementary bird survey on the Cobaki Community Project site.
- Debus (July 1997) Additional owl survey on the Cobaki Community Project site.
- Woodward Clyde (1997) Species Impact Statement - Cobaki Lakes. Prepared for Leda Developments Pty Ltd.
- Parker (1999) Species Impact Statement Cobaki Lakes Project. Prepared for Leda Manorstead Pty Ltd.
- James Warren and Associates (2008) Ecological Assessment. Response to the Director Generals Requirements. Volume 2. A report to Leda Manorstead Pty Ltd.
- JWA (June 2014) Flora survey of the Swamp Mahogany (*Eucalyptus robusta*) community on the Cobaki Estate Site.
- JWA (September 2015) Biodiversity Banking Assessment Methodology assessment and tree survey of the Swamp mahogany community.
- JWA (March 2016) Biodiversity Assessment Report. Cobaki Estate.

APPENDIX 4 - KOALA HABITAT ASSESSMENT

JAMES WARREN & Associates Pty Ltd

ENVIRONMENTAL CONSULTANTS

KOALA HABITAT ASSESSMENT

IN ACCORDANCE WITH STATE ENVIRONMENTAL PLANNING POLICY No. 44 (SEPP 44)

COBAKI ESTATE

DECEMBER 2011

A REPORT TO LEDA MANORSTEAD PTY LTD

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TABLE OF CONTENTS

1. INTRODUCTION

1.1 Background

James Warren & Associates (JWA) have been engaged by LEDA Manorstead Pty Ltd to complete a Koala Habitat Assessment of the Cobaki Estate site in accordance with the requirements of State Environmental Planning Policy No. 44 (SEPP 44).

The Minister for Planning approved a Concept Plan for the Cobaki Estate site in December 2010. Development Applications have subsequently been approved by Tweed Shire Council for the first stages of development i.e. Precincts 1, 2 and 6.

Subsequent to the Concept Approval the Tweed Coast Koala Habitat Study (Biolink 2011) has been released. This report describes the results of a koala habitat and population assessment for the coastal portion of the Tweed LGA. In recent comments on the submitted Development Applications for the first stages of Cobaki Estate, TSC has referenced the Tweed Coast Koala Habitat Study and requested a further detailed Koala habitat assessment of the site.

1.2 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, off Pigabeen Road, Tweed Heads. The site covers an area of approximately 605 hectares and is shown in **FIGURE 1.**

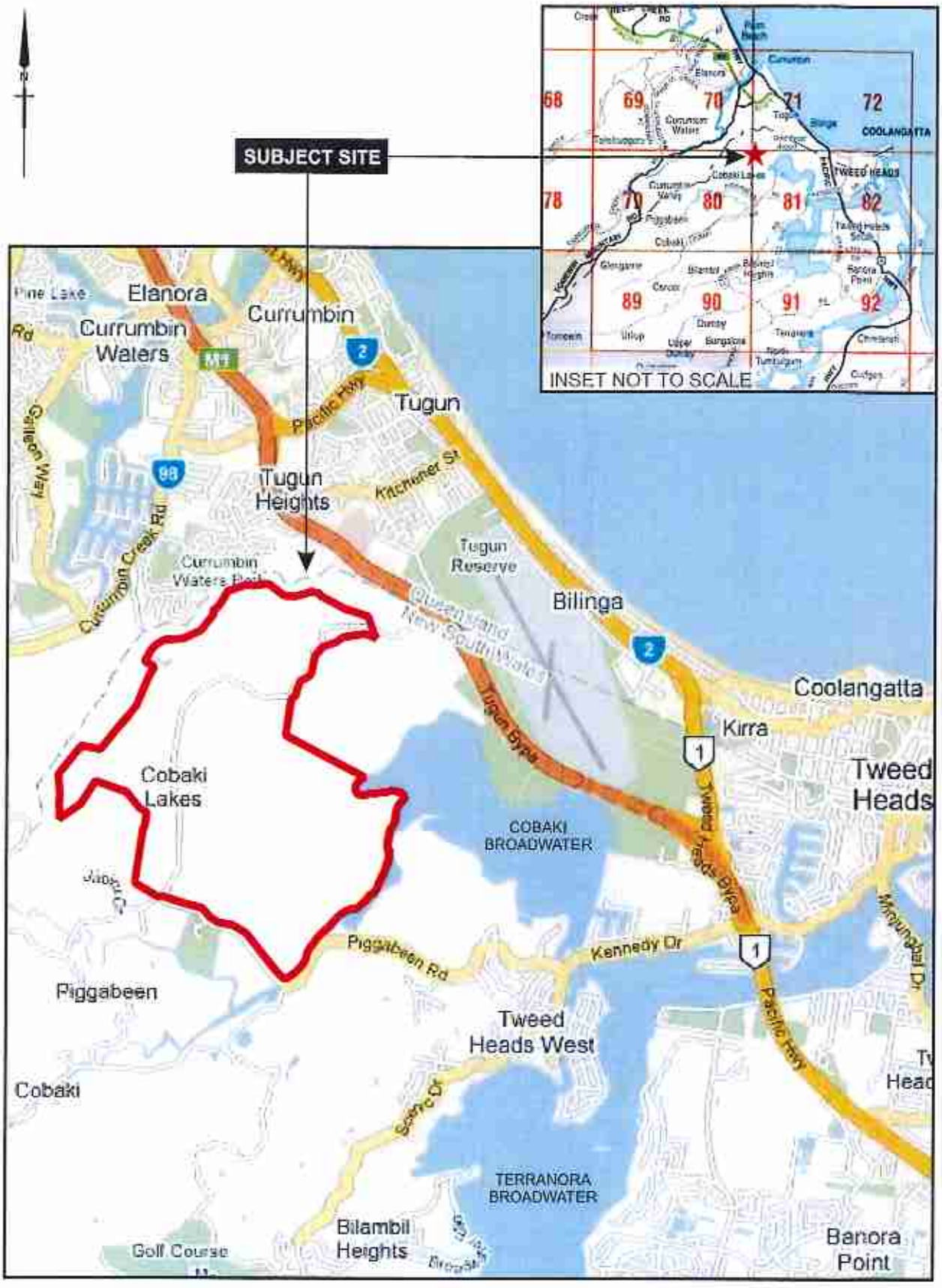
The site lies adjacent to private landholdings to the north-west and south-east, and comprises a large portion of land cleared for agricultural purposes (i.e. grazing) throughout which a number of vegetation communities occur. Extensive clearing and subsequent slashing over the drainage basin has resulted 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 Estate site.

FIGURE 2 shows a recent aerial photograph of the site.

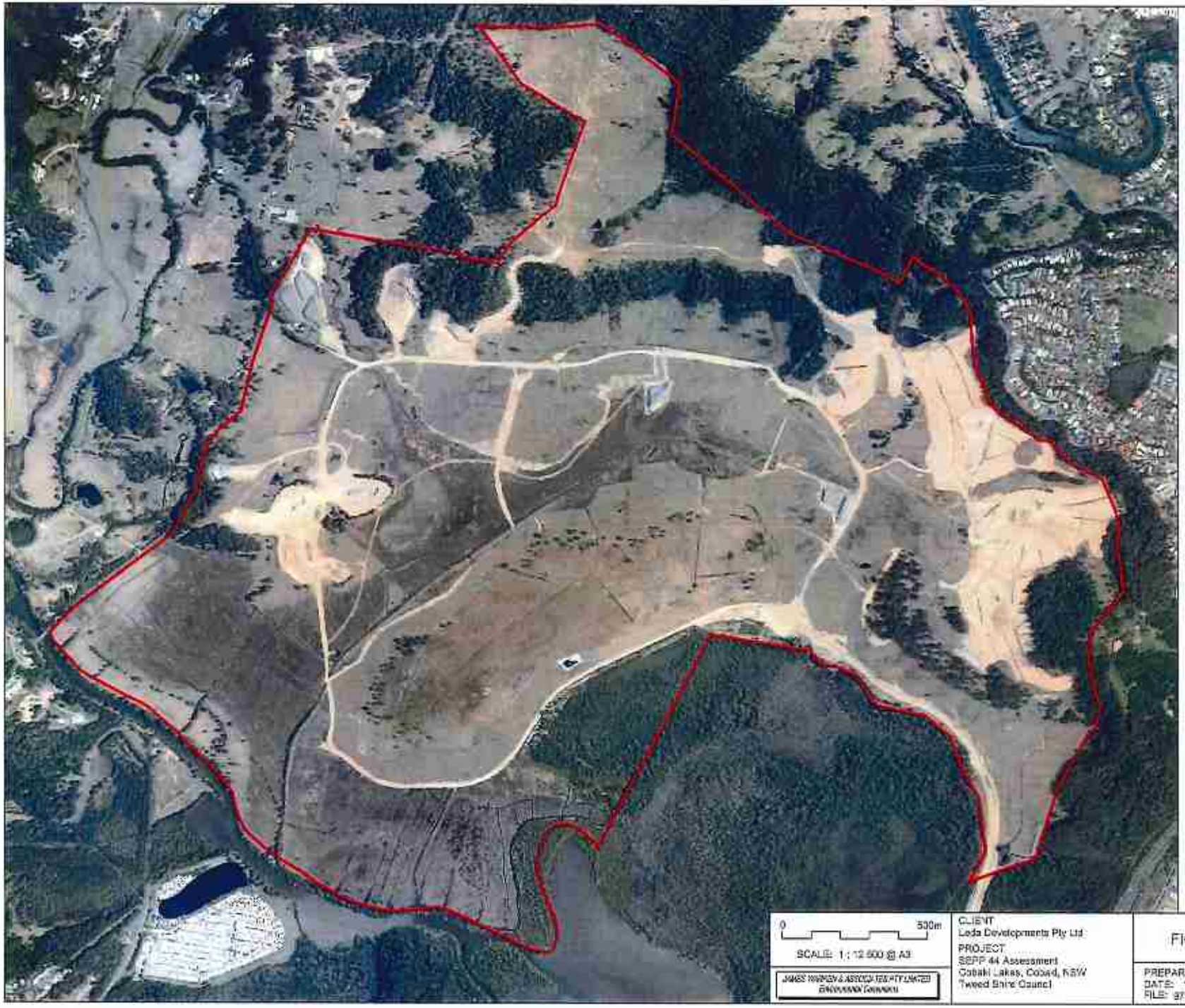
1.3 Aims & Objectives

The aim of this report is to provide a detailed and comprehensive assessment of the Koala habitat values of the Cobaki Estate site and the use of the site by any local population of Koalas. The objectives of the report to achieve this aim are as follows:

1. Provide a summary of the Koala habitat assessments and surveys completed on the Cobaki Estate site to date;
2. Review existing data available on Koala habitat and Koala records for the locality;



SOURCE: Google Maps SCALE: 1 : 50 000 @ A4 JAMES WARREN & ASSOCIATES PTY LIMITED Environmental Consultants	CLIENT Leda Developments Pty Ltd PROJECT SEPP 44 Assessment Cobaki Lakes, Cobaki, NSW Shire of Tweed	**FIGURE 1** PREPARED: BW DATE: 19 December 2011 FILE: 9/038_Locality.cdr	TITLE **LOCALITY PLAN**



LEGEND

Site Outline

SOURCE:
Aerial - Near Map 21 Sept 2011 Aerial Photograph

0 500m

SCALE: 1 : 12,500 @ A3

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PROJECT
SEPP 44 Assessment
Cobaki Lakes, Cobaki, NSW
Tweed Shire Council

FIGURE 2

PREPARED: SW
DATE: 19 December 2011
FILE: 97038_Base.dwg

TITLE

AERIAL PHOTOGRAPH

3. Complete a detailed and comprehensive assessment of Koala habitat on the site and Koala usage of the site using the Spot Assessment Technique (SAT) (Phillips and Callaghan 2011); and
4. Based on the results of the site assessment, complete an assessment in accordance with the requirements of SEPP 44.

2. HISTORY OF KOALA ASSESSMENTS AT COBAKI ESTATE

2.1 Background

The Cobaki Estate site has been comprehensively studied over the last thirty (30) years. Assessments of the site and surrounds that are relevant to the Koala and its habitat include, but are not limited to, the following:

- Cameron McNamara (1983) Cobaki Village Environmental Study (Report Prepared for the Bradshaw Group);
- WBM (1991) 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);
- Woodward-Clyde (1997) Species Impact Statement - AGC Woodward-Clyde Pty Ltd;
- Parker (1999) A Species Impact Statement for the Cobaki Lakes Project;
- EcoPro Pty Ltd (2004) Tugun Bypass: Species Impact Statement (SIS). A report prepared for the Queensland Department of Main Roads;
- JWA (2008a) Cobaki Estate Ecological Assessment - Volumes 1 & 2. Response to the Director General's Environmental Assessment Requirements. May 2008
- JWA (2008b) Cobaki Estate Ecological Assessment - Volumes 1 & 2. Response to the Director General's Environmental Assessment Requirements. As Amended November 2008
- JWA (2009) SEPP 44 Assessment. Cobaki Estate Preferred Project Report. October 2009.
- JWA (2010) Revised Cobaki Estate Ecological Assessment. Cobaki Estate Preferred Project Report. June 2010.

A brief summary of findings that relate to Koalas and their habitats is provided in the following sections.

2.2 Cameron McNamara (1983)

The fauna survey component of this study was carried out by Barry (1981). This survey was mainly restricted to less elevated portions of the site. Barry set a number of trap lines and one drift fence with pits.

No Koalas were reported as occurring on the site, or any comment made on the Koala habitat potential of the site.

2.3 WBM (1991)

The survey (carried out in October and November 1991) centred on the fauna existing in the Crown Reserve area between the QLD - NSW border and the Cobaki property boundary. The survey included day and night observations.

No Koalas were reported as occurring on the site, or any comment made on the Koala habitat potential of the site. It was recorded that a fire that burnt through much of the area of the Crown Reserve two (2) months prior to this survey could have led to an underestimation of the species diversity in the area.

2.4 Warren (1992)

Further survey work was carried out within the Crown reserve in the area of the proposed Boyd Street Extension. This survey targeted a number of Threatened fauna species and included day and night observations.

No Koalas were reported as occurring on the site, or any comment made on the Koala habitat potential of the site.

2.5 Warren (1993)

The area subject of the bulk earthworks (cut and fill) was the subject of an intensive fauna survey in April and May 1993 and again in October and November 1994. The surveys centred on the identification of Threatened fauna given that numerous studies had already been carried out on the site and included spotlighting surveys.

No Koalas were reported as occurring on the site, or any comment made on the Koala habitat potential of the site.

2.6 Warren (1994)

Supplementary work in the proposed cut/fill areas (C5, F8-11) was carried out in September and October 1994. Again this survey work was designed to record Threatened fauna species and included spotlighting surveys.

Approximately 483 trees in the Scribbly gum/Swamp mahogany community, and the Blackbutt community in the Stages 7-10 and SIS Study site 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.

2.7 Woodward-Clyde (1997)

A detail botanical survey was undertaken between April and June 1997. The fauna section of the SIS relied upon the comprehensive fauna study effort which had been previously completed on the site. A complete fauna list from the previous sixteen (16) years of surveys included the Koala.

2.8 Parker (1999)

Parker used the vegetation descriptions from WBM (1991) as a basis of the vegetation assessment. The fauna section of the SIS relies on the comprehensive fauna study effort which has been previously completed on the site. A complete fauna list from the previous eighteen (18) years of surveys included the Koala.

2.9 EcoPro Pty Ltd (2004)

Ten (10) primary survey precincts were selected as being representative of vegetation communities along the proposal corridor. Survey methods involved the use of standardised techniques for fauna. Supplementary sampling included Koala spot assessments (Phillips and Callaghan 1995).

Eleven (11) spot assessment sites were surveyed in total. No Koalas or evidence of Koala activity were recorded. It was concluded that as intensive searches for this species failed to reveal its presence, it was unlikely to occur in the area.

2.10 JWA (2008a)

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 (i.e. scats, scratches) in December 2007. 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.

It was concluded that Koalas may occasionally disperse across the site whilst moving through the locality.

An assessment of potential impacts on Koala habitat was also completed. It was determined that 5.26 hectares of suitable Koala habitat (13.40% of the total available habitat) would be lost from the subject site as a result of the proposed Concept Plan.

2.11 JWA (2008b)

The amened Ecological Assessment calculated impacts based a revised layout and determined that 9.24 hectares of suitable Koala habitat (20.8% of the total available habitat) may potentially be lost from the subject site as a result of the proposed Concept Plan.

2.12 JWA (2009)

Subsequent to the Concept Plan application an assessment of the proposed Concept Plan against the requirements of SEPP 44 was completed to accompany the Preferred Project report.

The exact number and location of trees listed under Schedule 2 which occur on the subject site was determined. In total, four hundred and sixty three (463) Koala food trees listed under Schedule 2 occur on the subject site as follows:

- One hundred and fifty six (156) Forest red gum (*Eucalyptus tereticornis*);
- One hundred and twenty nine (129) Tallowwood (*Eucalyptus microcorys*);
- Seventy three (73) Swamp Mahogany (*Eucalyptus robusta*); and
- One hundred and thirteen (113) Scribbly gum (*Eucalyptus racemosa*).

Although the percentage of Koala food trees on the subject site was not quantitatively assessed, mapping clearly showed that the total number of Koala food trees was unlikely to exceed fifteen per cent (15%) of the total trees present. Therefore, the subject site was not considered to contain core Koala habitat as defined under SEPP 44.

The assessment of SEPP 44 determined that core Koala habitat as defined by SEPP 44 does not occur on the subject site and thus there is no requirement for the preparation of a Koala Plan of Management.

2.13 JWA (2010)

The amened Ecological Assessment calculated impacts based a revised layout and determined that 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 occurred within portions of the site with existing development approval.

3. REVIEW OF AVAILABLE KOALA HABITAT DATA & RECORDS

3.1 Introduction

The following sections provide a review of the various assessments of available Koala habitat in the Cobaki Estate area as well as know Koala records in the locality of the site.

3.2 Koala habitat values on the Cobaki Estate site

3.2.1 Tweed Coast Koala Habitat Atlas (Australian Koala Foundation 1996)

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 objectives of the AKF study were as follows:

a. to quantify tree preferences and habitat utilisation;

b. to delineate areas of Primary and Secondary Koala Habitat;

c. to examine the relationship of this information in terms of State Environmental Planning Policy No 44 (Koala Habitat);

d. to identify threatening processes; and

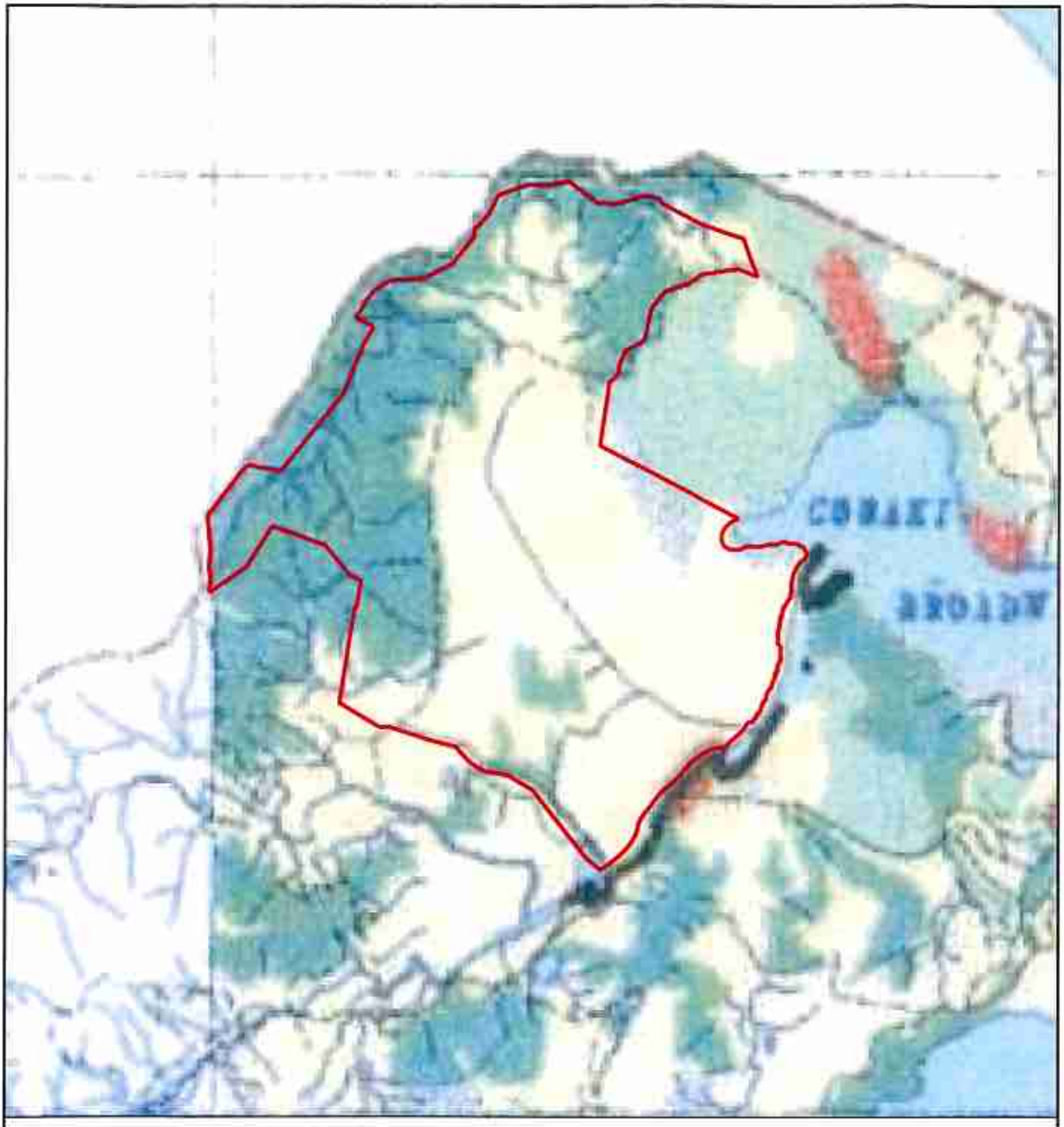
e. to recommend measures to provide Koala populations with a measure of long term viability.

The Tweed Coast Koala atlas maps parts of the Cobaki Estate site as Secondary Habitat (**FIGURE 3**). However, clearing activities have occurred since the preparation of this mapping. Large areas of vegetation mapped as secondary habitat are now open grassland with scattered trees. In particular, 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.

3.2.2 Tweed Coast Koala Habitat Study (Biolink 2011)

This report describes the results of a koala habitat and population assessment for the coastal portion of the Tweed LGA. The study area covered the coastal strip from Queensland border at Tweed Heads to the Byron Shire Council Border south of Wooyung. The study area included lands surrounding the Cobaki Broadwater with six (6) field sites occurring within or immediately adjacent to the Cobaki Estate site (**FIGURE 4**).

The vegetation mapping work of Kingston et al. (2004) provided the basis for koala habitat classifications. Vegetation communities were categorised in accord with the



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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Environmental Consultants

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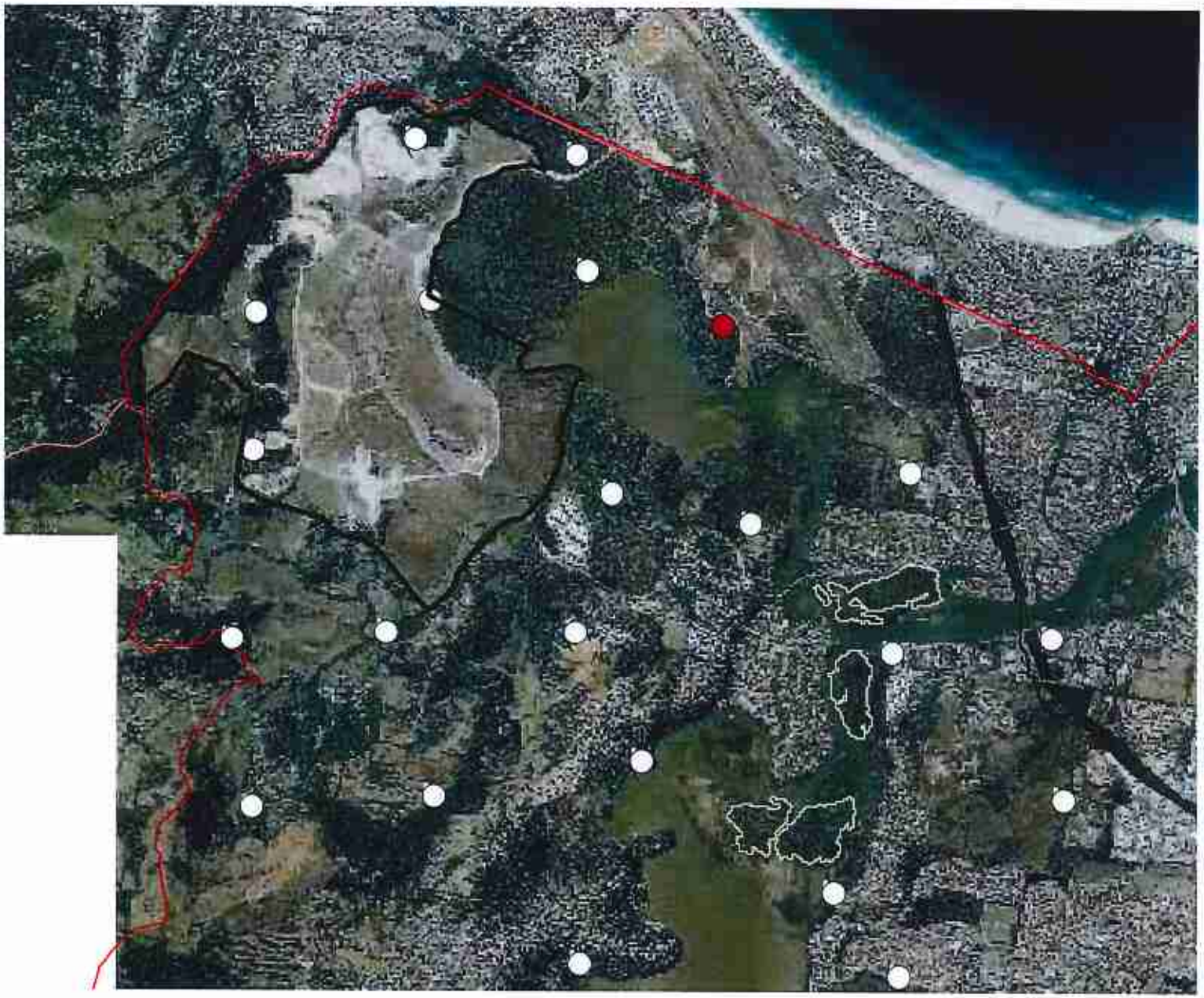
Leda Developments Pty Ltd
PROJECT
SEPP 44 Assessment
Cobaki Lakes, Cobaki, NSW
Shire of Tweed

FIGURE 3

PREPARED: BW
DATE: 19 December 2011
FILE: 97038_Tweed Koala Atlas.cdr

TITLE
TWEED COAST KOALA HABITAT ATLAS



LEGEND
- Active Field Sites
- Inactive Field Sites
- Nature Reserve
- Study Area Boundary
- LGA Boundary
- Subject Site

0 750m
1 : 30 000

SOURCE: Biolink Ecological Consultants - Tweed Coast Koala Habitat Study (2011) - Figure 3.1
SCALE: 1 : 30 000 @ A3
JAMES WARREN & ASSOCIATES PTY LIMITED Environmental Consultants

CLIENT
Lida Developments Pty Ltd
PROJECT
SEPP 44 Assessment
Cobaki Lakes, Cobaki, NSW
Shire of Tweed

FIGURE 4

PREPARED: BW
DATE: 19 December 2011
FILE: JW38_Philips Survey.cdr

TITLE
LOCATION OF ACTIVE & INACTIVE FIELD SITES

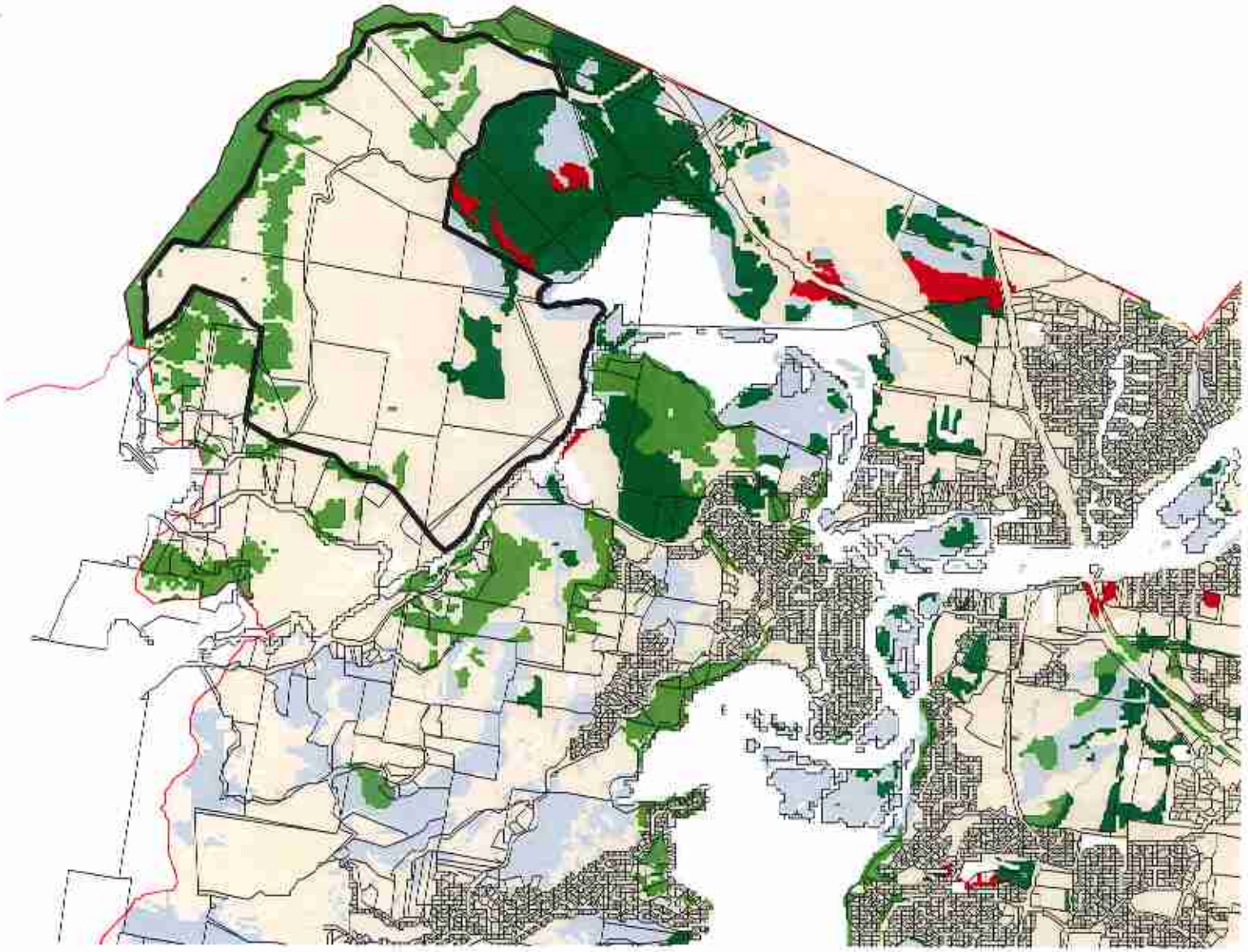
definitions detailed below; such ecologically-based determinations considered to better reflect the extent of *potential koala habitat* for the purposes of SEPP 44 than that otherwise obtained using the 15% rule (see SEPP 44, Part 1, 4 Definitions). The terms "Primary", "Secondary" and "Supplementary" food tree species are outlined below:

- **Primary Habitat** - areas of forest and/or woodland wherein primary food tree species comprise the dominant or co-dominant (i.e. ≥ 50%) overstorey tree species.
- **Secondary (Class A) Habitat** - areas of forest and/or woodland wherein primary food tree species are present but not dominant or co-dominant and usually (but not always) growing in association with one or more secondary food tree species.
- **Secondary (Class B) Habitat** - areas of forest and/or woodland wherein primary food tree species are absent, habitat containing secondary and/or supplementary food tree species only.

The Tweed Coast Koala Habitat Study maps the majority of the vegetated areas of the Cobaki Estate site as Secondary (Class B) Habitat (**FIGURE 5**). An area of Primary Habitat is mapped as occurring in the eastern portion of the site.

A review of the Tweed Coast Koala Habitat Study mapping of the site has revealed the following:

1. Areas of Sub-tropical rainforest in the northern portion of the site associated with Mount Woodgee have been mapped as Secondary (Class B) Habitat. Whilst scattered Brushbox (*Lophostemon confertus*) occur in this area, and this species was indicated as a Preferred Koala food tree in the study albeit with a relatively low 'strike-rate', Koalas are not generally known to inhabit rainforest communities, and the definition of Other in the habitat categorisation section of the report includes rainforests.
2. A relatively large area of Primary Koala habitat mapped in the eastern portion of the subject site is comprised of scattered mature Scribbly gum (*Eucalyptus racemosa*). This species is listed as a Preferred Koala food tree within Schedule 2 of SEPP 44 and received a moderate 'strike-rate' in the study. However it is worth noting that in this instance these trees occur as an isolated stand in a cleared grazing land environment.
3. Similar isolated stands of Schedule 2 Koala food trees which received a much higher 'strike-rate' in the study (i.e. *Eucalyptus robusta, Eucalyptus tereticornis*) occur on the site and have been included in the Secondary (Class B) Habitat mapping.



SOURCE: Biolink Ecological Consultants - Tweed Coast Koala Habitat Study (2011) Figure 4.5

SCALE: 1 : 30 000 @ A3

JAMES WARREN & ASSOCIATES PTY LIMITED
Environmental Consultants

CLIENT
Leda Developments Pty Ltd

PROJECT
SEPP 44 Assessment
Cobaki Lakes, Cobaki, NSW
Shire of Tweed

FIGURE 5

PREPARED: SW
DATE: 16 December 2011
FILE: 07035_Phillips Habitat.cdr

TITLE
POTENTIAL KOALA HABITAT

3.3 Koala records

3.3.1 BioNet Atlas of NSW Wildlife

A search for Koala records within 10km of the Cobaki Estate site was completed on the 24th November 2011 utilising the BioNet Atlas of NSW Wildlife. The search returned twenty-two (22) records within 10km of the site, including two (2) records from the subject site between 2004 and 2006 (**FIGURE 6**) i.e.:

- A record from approximately the centre of the site; and
- A record from a small patch of vegetation in the southern portion of the site abutting Piggabeen Road.

Other nearby records occur near Jabiru Drive approximately 1km to the south-west of the site, approximately 250m to the south-east over Cobaki Creek, and adjacent to the eastern site boundary surrounding Cobaki Broadwater. Interestingly a number of records occur within Cobaki Broadwater itself, highlighting the inevitable error associated with mapping public records and at such a large scale.

3.3.2 Tweed Coast Koala Habitat Study (Biolink 2011)

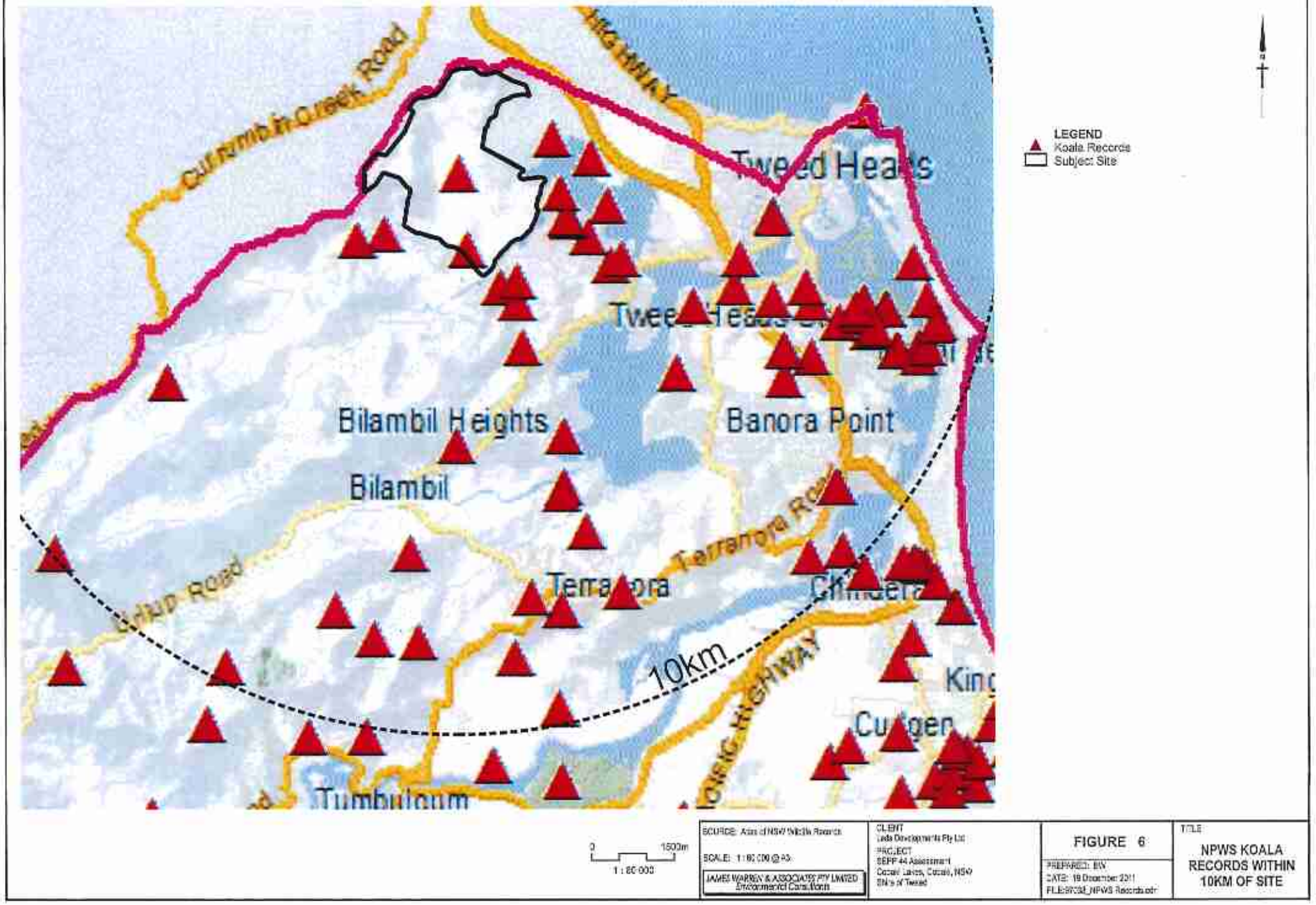
Detailed koala population assessments in the Tweed Coast Study Area involved application of a systematic sampling strategy primarily reliant on Spot Assessment Technique (SAT) methodology (Phillips & Callaghan 2011) to gather data on koala presence and absence, food tree preferences, koala density and activity. Collectively, 134 field sites were sampled comprising 85 primary and 49 supplementary field sites, the latter focused around areas of significant koala activity.

Six (6) field sites occurring within or immediately adjacent to the Cobaki Estate site (**FIGURE 4**). No Koala activity was recorded in the field sites on or immediately surrounding the Cobaki Estate (**FIGURE 4**). The closest recorded activity was approximately 2.5 km away on the eastern side of the Cobaki Broadwater (**FIGURE 4**).

The study concluded that north of the Tweed River, Koala activity data indicates the persistence of small relic populations in the Terranora-Bilambil Heights and Tweed Heads South areas, however the short to medium-term viability of these populations is considered low in the absence of recruitment and the escalation of threatening processes arising from ongoing development.

3.3.3 Targeted surveys on and adjacent to the Cobaki Estate site

Section 2 provided a brief summary of findings from various studies completed at the site over the past 30 years. The results of targeted Koala assessments can be further summarised as follows:

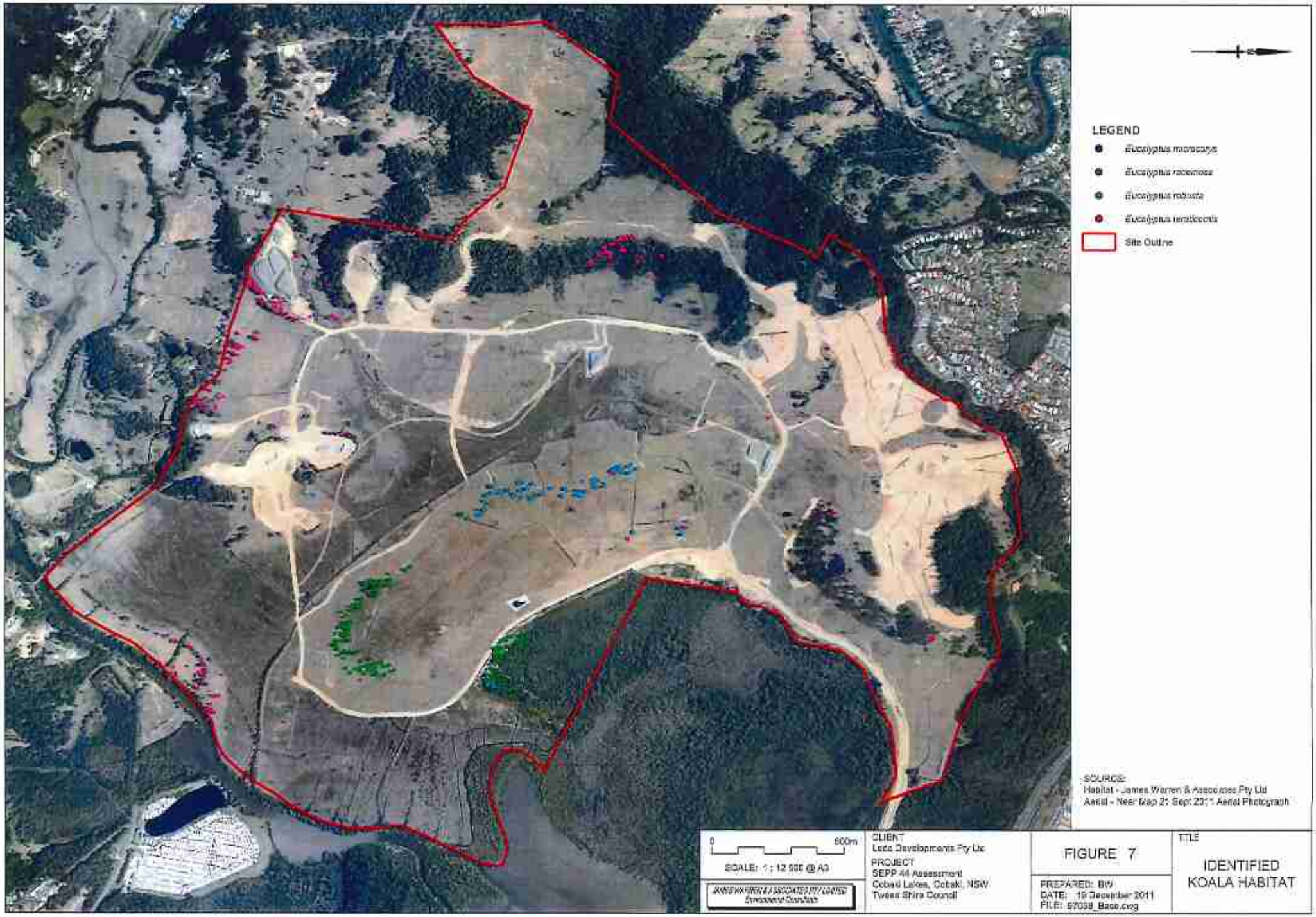

Tweed Heads
Bilambil Heights
Bilambil
Banora Point
Terranora
Chinderah
Cudgen
Tumbulgum
10km
Terranora Road
Kirkwood Road
Pacific Highway
LEGEND
Koala Records
Subject Site
0
1500m
1 : 80 000
SOURCE: Atlas of NSW Wildlife Records
SCALE: 1:80 000 @ A3
JAMES WARREN & ASSOCIATES PTY LIMITED
Environmental Consultants
CLIENT
Leda Developments Pty Ltd
PROJECT
SEPP 44 Assessment
Cudgen Lakes, Cudgen, NSW
Shire of Tweed
FIGURE 6
PREPARED: BN
DATE: 19 December 2011
TITLE
NPWS KOALA RECORDS WITHIN 10KM OF SITE

- Approximately 483 trees 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.

- Ten (10) primary survey precincts were selected along the proposal corridor.
- Supplementary sampling included Koala spot assessments (Phillips and Callaghan 1995).
- Eleven (11) spot assessment sites were surveyed in total.
- No Koalas or evidence of Koala activity was recorded.
- It was concluded that as intensive searches for this species failed to reveal its presence, it was unlikely to occur in the area.

- A search was completed for evidence of Koalas with areas containing preferred Koala food trees (i.e. Swamp mahogany, Forest red gum, Tallowwood, Grey gum, Scribbly gum).
- Approximately 12 person-hours were spent looking for Koalas, scats and/or tree scratches.
- A further eight (8) hours person-hours was spent on a nocturnal survey that including spotlighting and call playback techniques.
- No Koalas were sighted and no scats were found.

- Subsequent to the Concept Plan application an assessment of the proposed Concept Plan against the requirements of SEPP 44 was completed to accompany the Preferred Project report.
- In total, four hundred and sixty three (463) Koala food trees listed under Schedule 2 were mapped on the subject site as follows (**FIGURE 7**):
    - One hundred and fifty six (156) Forest red gum (*Eucalyptus tereticornis*);


LEGEND
Eucalyptus microcorys
Eucalyptus racemosa
Eucalyptus robusta
Eucalyptus tereticornis
Site Outline
SOURCE:
Habitat - James Warren & Associates Pty Ltd
Aerial - Near Map 21 Sept 2011 Aerial Photograph
0
600m
SCALE: 1 : 12 500 @ A3
JAMES WARREN & ASSOCIATES PTY LIMITED
Environment Consultants
CLIENT
Leda Developments Pty Ltd
PROJECT
SEPP 44 Assessment
Cobaki Lakes, Cobaki, NSW
Tweed Shire Council
FIGURE 7
PREPARED: BW
DATE: 19 December 2011
FILE: 57039_Base.cvg
TITLE
IDENTIFIED
KOALA HABITAT

- One hundred and twenty nine (129) Tallowwood (*Eucalyptus microcorys*);
- Seventy three (73) Swamp Mahogany (*Eucalyptus robusta*); and
- One hundred and thirteen (113) Scribbly gum (*Eucalyptus signata*).

- The assessment of SEPP 44 determined that core Koala habitat as defined by SEPP 44 does not occur on the subject site and thus there was no requirement for the preparation of a Koala Plan of Management.

4. SITE ASSESSMENT

4.1 Introduction

A realistic and thorough assessment of habitat occupied by free-ranging Koalas should employ a number and variety of techniques. This section provides details of a recent targeted Koala survey at Cobaki Estate utilising the following techniques:

- Preliminary site assessment;
- SAT (Spot Assessment Technique) analysis (Phillips & Callaghan 2011);
- Diurnal surveys for roosting Koalas;
- Diurnal searches for evidence of Koala activity (i.e. scats & scratches);
- Spotlighting surveys; and
- Call playback technique.

The results of the assessment are also discussed.

4.2 Methodology

4.2.1 Preliminary site assessment

A preliminary site assessment was completed in September 2011 to ground-truth existing vegetation mapping and verify the location and extent of identified potential Koala habitat areas on the site.

Opportunistic searches for Koalas and/or evidence of Koala activity (i.e. sctas) were completed whilst traversing the site.

4.2.2 Spot Assessment Technique (SAT)

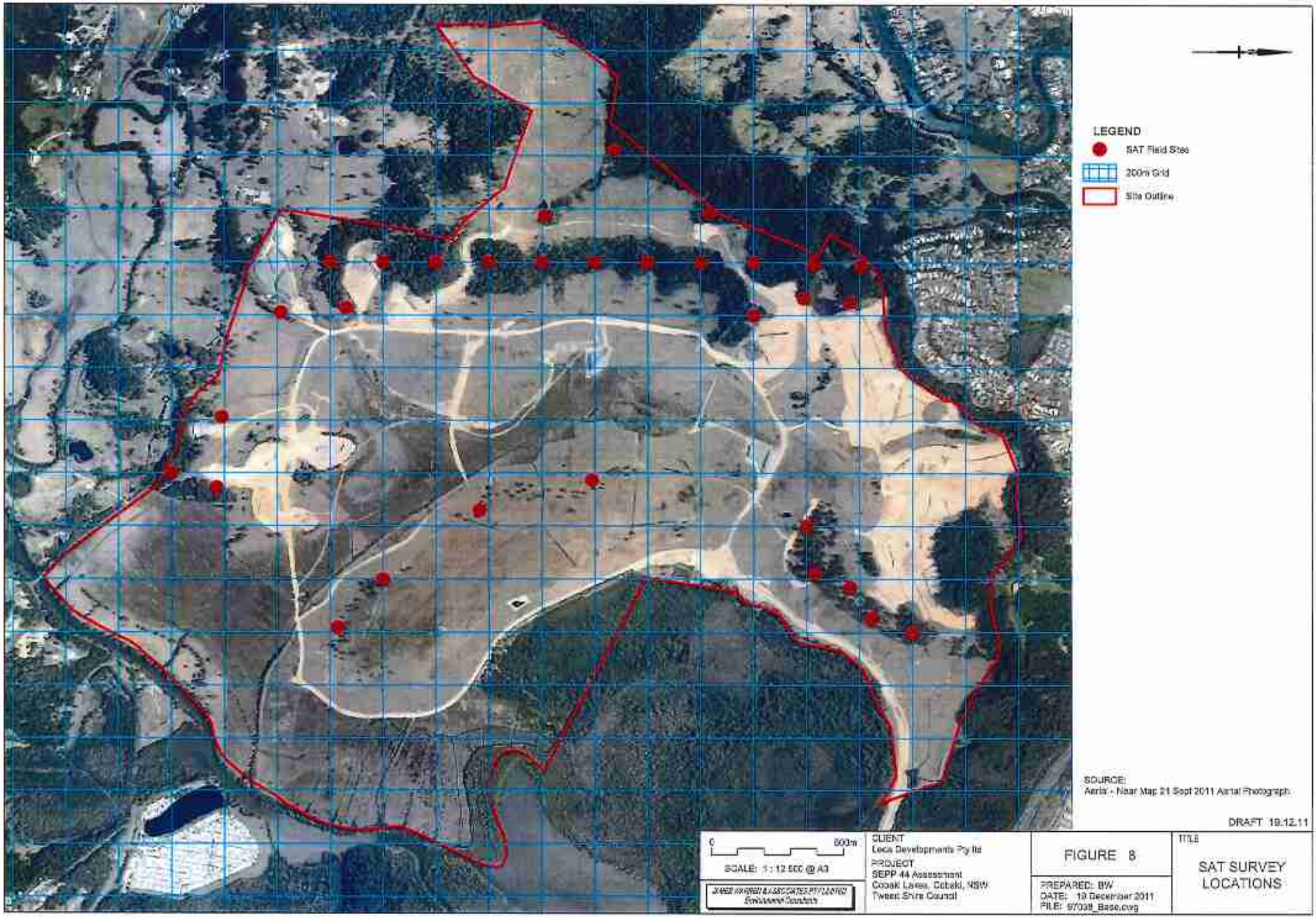
The Spot Assessment Technique (SAT) developed by Stephen Phillips and John Callaghan describes a point-based tree sampling methodology that utilizes the presence/absence of Koala faecal pellets (scats) within a prescribed search area around the base of trees to derive a measure of Koala activity. Confidence intervals associated with Koala activity data from 405 randomly selected field plots within which faecal pellets were recorded have been utilised to assign threshold values for three population density/habitat biomes in eastern Australia.

To ensure a uniform and unbiased survey effort across the Cobaki Estate site, a 200m grid was overlaid on an aerial photograph of the site. Grid points, where they

intersected vegetated areas, were then used as field sites. In instances where the grid points fell on a cleared area adjacent to discrete vegetation patches, the site was relocated accordingly. Thirty-one (31) field sites were identified and surveyed **(FIGURE 8)**. Details of the location of each field site are provided in **TABLE 1.**

TABLE 1
FIELD SITE LOCATIONS

Field site no.	GPS		Brief description
	Easting	Northing	
1	547467	6884784	Blackbutt forest with maintained midstorey & groundcover - ridge top
2	547413	6884631	Blackbutt forest with maintained midstorey & groundcover - ridge top
3	547297	6884549	Blackbutt forest (+/- Grey gum) with maintained midstorey & groundcover - moderately steep westerly aspect
4	547247	6884415	Blackbutt forest (+/- Brushbox) with maintained midstorey & groundcover - ridge top
5	547067	6884384	Blackbutt forest with maintained midstorey & groundcover - moderately steep south-easterly aspect
6	546891	6883573	Swamp mahogany woodland with maintained midstorey & groundcover - on flat sand plain
7	547006	6883149	Swamp mahogany woodland with maintained midstorey & groundcover - on flat sand plain
8	547267	6882784	Scribbly gum woodland with maintained midstorey & groundcover - on flat sand plain
9	547448	6882612	Scribbly gum woodland with maintained midstorey & groundcover - on flat sand plain
10	546867	6881984	Blackbutt forest - steep south-westerly aspect
11	546920	6882154	Blackbutt forest (+/- Brushbox) - steep easterly aspect
12	546653	6882174	Blackbutt forest and adjacent scattered Forest red gum
13	546255	6882398	Linear stand of old growth Forest red gum
14	546237	6882644	Blackbutt forest (+/- Brushbox) with maintained midstorey & groundcover - moderately steep easterly aspect
15	546067	6882584	Blackbutt forest (+/- Brushbox) with maintained midstorey & groundcover - steep southerly aspect


LEGEND
SAT Field Sites
200m Grid
Site Outline
SOURCE:
Aerial - Near Map 21 Sept 2011 Aerial Photograph
DRAFT 19.12.11
0
800m
SCALE: 1 : 12 500 @ A3
JAMES WARREN & ASSOCIATES PTY LIMITED
Environmental Consultants
CLIENT
Leca Developments Pty ltd
PROJECT
SEPP 44 Assessment
Cobaki Lakes, Cobaki, NSW
Tweed Shire Council
FIGURE 8
PREPARED: BW
DATE: 19 December 2011
FILE: 97039_Base.cvg
TITLE
SAT SURVEY LOCATIONS

Field site no.	GPS		Brief description
16	546067	6882784	Blackbutt forest (+/- Brushbox) with maintained midstorey & groundcover - gentle north-easterly aspect
17	546067	6882984	Blackbutt forest (+/- Brushbox) at the top of a very steep rock ridgeline
18	546067	6883184	Blackbutt forest (+/- Brushbox) - moderately steep south-easterly aspect
19	546067	6883384	Blackbutt forest (+/- Brushbox) - very steep easterly aspect
20	546067	6883584	Blackbutt forest (+/- Brushbox) - steep easterly aspect
21	546067	6883784	Brushbox forest - steep northerly aspect
22	546067	6883984	Blackbutt forest in steep eastern facing gully
23	546267	6884184	Blackbutt forest (+/- Grey gum) - steep southerly aspect
24	546201	6884373	Blackbutt forest - steep westerly aspect
25	546215	6884550	Brushbox forest - moderately steep easterly aspect
26	546082	6884589	Blackbutt forest - steep south-easterly aspect
27	546073	6884412	Very tall Flooded gum forest in easterly facing gully
28	546067	6884184	Brushbox forest in steep northern facing gully
29	545882	6884015	Brushbox forest in steep gully
30	545645	6883657	Blackbutt forest - gentle easterly aspect
31	545891	6883395	**Brief description:** Regrowth - gentle westerly aspect

The Spot Assessment Technique (SAT) was then applied at each of the thirty-one (31) field sites by two (2) scientists on the 15th, 16th and 17th November 2011.

Within each field site Koala "activity" was assessed within the immediate area by first selecting and marking an important or centre tree using the following criteria:

- a tree of any species beneath which one or more Koala faecal pellets have been observed; and/or
- a tree in which a Koala has been observed; and/or
- any other tree known or considered to be potentially important for Koalas, or for other assessment purposes.

The twenty-nine (29) closest trees were then similarly marked. For the purposes of the SAT analysis, a tree is defined as a "*live woody stem of any plant species except cycads, palms, tree ferns and grass trees*" (Phillips & Callaghan 2011).

A systematic search for Koala faecal pellets beneath each of the marked trees was completed. Firstly a quick inspection of the undisturbed ground surface within 100cm from the base of each tree then a more thorough inspection involving disturbance of the leaf litter and ground cover. The search under each tree was concluded when either a single pellet was detected or when two (2) minutes expired.

This process was repeated until each of the 30 trees in the site was assessed. Where the location of faecal pellets falls within overlapping search areas (i.e. two or more trees growing in close proximity to each other) both were positively scored for the pellets. Further details such as the site's location, selection criteria for the centre and the tree species were also recorded.

The activity level for each site is expressed as a proportion of surveyed trees within the site that have a positive koala scat record. For example, if 15 trees out of the 30 surveyed record scat(s) then the resulting activity level is 50%. Sites were then categorised as 'active or 'inactive'.

4.2.3 Diurnal surveys for roosting Koalas

All trees surveyed during the SAT analysis were also searched for roosting Koalas. Each tree was viewed from several different angles as roosting Koalas can often be inconspicuous.

Searches were also completed opportunistically whilst moving on foot between SAT analysis field sites.

A pair of binoculars was utilised during searches.

4.2.4 Diurnal searches for evidence of Koala activity (i.e. scats & scratches)

Additional to the scat searches completed during the SAT analysis, searches for scats were completed opportunistically whilst moving on foot between SAT analysis field sites. Preferred Koala food tree species were randomly selected and the same methodology applied as during the SAT analysis (i.e. searches within 100cm of the base of the tree for a maximum of 2 minutes).

4.2.5 Spotlighting surveys

At night, predetermined routes on the Cobaki Estate site were driven in a four-wheel drive vehicle at approximately 10km/h. A large spotlight was used to detect 'eye-shine' from nocturnal fauna. If fauna could not be identified from the vehicle, it was

necessary to approach them on foot with a handheld spotlight and to identify them with binoculars.

'On foot' spotlighting was also undertaken regularly during spotlighting surveys to access the gullies on the subject site.

Spotlighting surveys were completed by two (2) JWA scientists on the nights of the 15th, 16th and 17th November 2011. A total of eighteen (18) person hours of survey was completed over three (3) nights.

4.2.6 Call playback technique

Koalas were targeted using a 'Call Playback' system. The calls of a male Koala were broadcast from a CD player through a loudspeaker at various locations adjacent to potential habitat. A pause of five (5) minutes was maintained between each series of calls to provide an opportunity for the scientists to listen for a response and to spotlight for the presence of the target species.

4.3 Results

4.3.1 Preliminary site assessment

The preliminary site assessment confirmed the previous vegetation and Koala habitat mapping over the site.

A small number of fresh scats were recorded from a single location on the subject site (**FIGURE 9**).

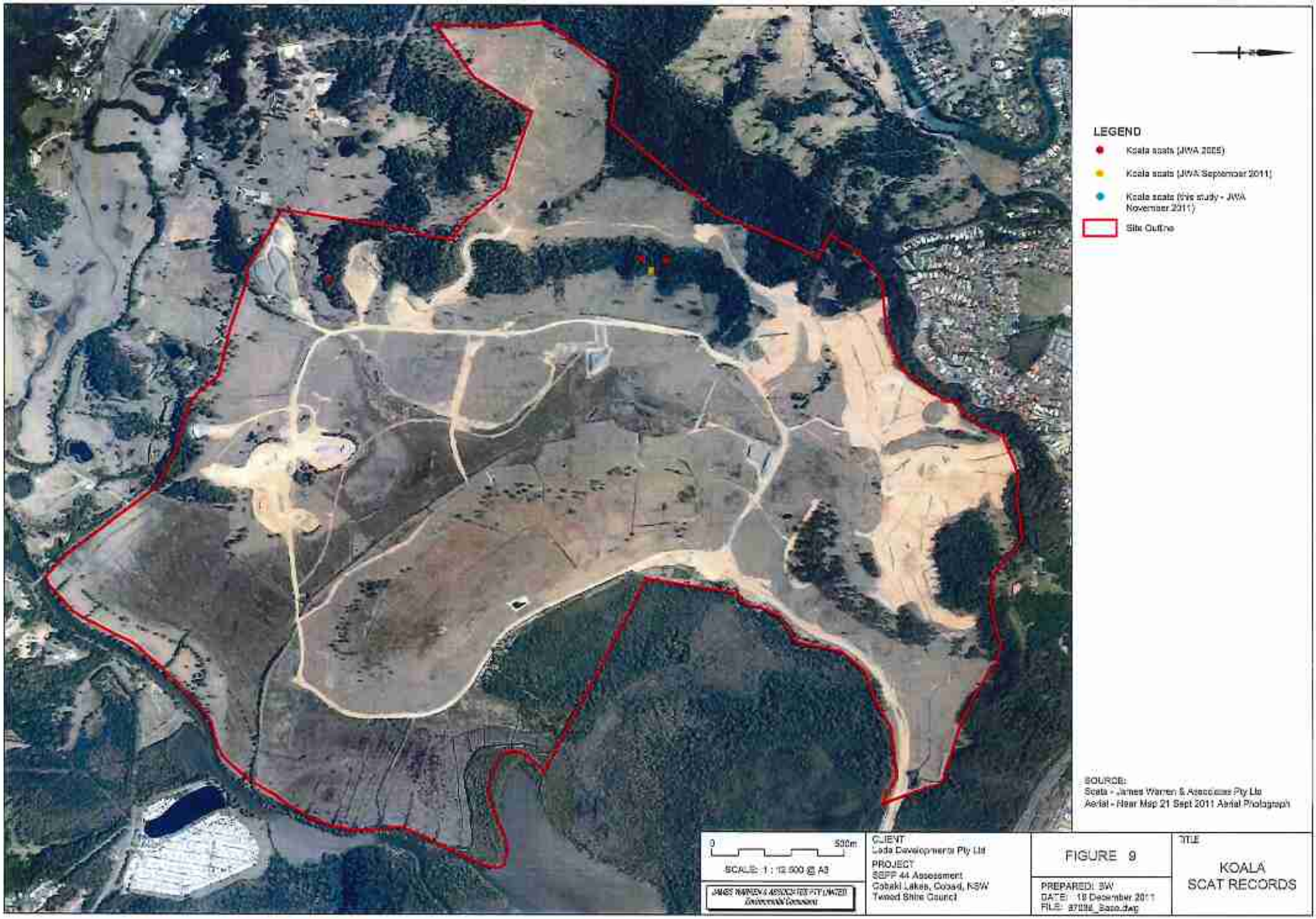
4.3.2 Spot Assessment Technique (SAT)

The SAT was applied at thirty-one (31) field sites, totalling nine-hundred and thirty (930) trees, and failed to record a single scat. Therefore, all field sites were classed as inactive.

Survey sheets for each field site are contained in **APPENDIX 1.**

4.3.3 Diurnal surveys for roosting Koalas

Searches for Koalas in each tree at each SAT field site, as well as opportunistically whilst moving between each SAT field site, failed to locate any Koalas.


LEGEND
Koala scats (JWA 2005)
Koala scats (JWA September 2011)
Koala scats (this study - JWA November 2011)
Site Outline
SOURCE:
Scats - James Warren & Associates Pty Ltd
Aerial - Near Map 21 Sept 2011 Aerial Photograph
0
500m
SCALE: 1 : 12,500 @ A3
JAMES WARREN & ASSOCIATES PTY LIMITED
Environmental Consultants
CLIENT
Lada Developments Pty Ltd
PROJECT
SEPP 44 Assessment
Cobaki Lakes, Cobaki, NSW
Tweed Shire Council
FIGURE 9
PREPARED: SW
DATE: 19 December 2011
FILE: 3703d_Scats.dwg
TITLE
KOALA
SCAT RECORDS

4.3.4 Diurnal searches for evidence of Koala activity (i.e. scats & scratches)

Additional to the scat searches completed during the SAT analysis, searches for scats were completed opportunistically whilst moving on foot between SAT analysis field sites.

A small number of Koala scats were recorded at a single location on the site (**FIGURE 9**). This record generally corresponds with the locations of historical records of low level Koala activity on the site (**FIGURE 9**).

4.3.5 Spotlighting surveys

Spotlighting surveys on the site failed to locate any Koalas. Spotlighting surveys on the night of 17th November particularly focused on the area where a small number of scats were recorded.

4.3.6 Call playback technique

Call playback surveys on the site failed to record any Koalas.

5. STATE ENVIRONMENTAL PLANNING POLICY NO. 44 - KOALA HABITAT PROTECTION

In response to the state wide decline of Koala populations, the DoP has legislated State Environmental Planning Policy No. 44 - Koala Habitat Protection (SEPP 44). The aim of the policy is to "encourage the proper conservation and management of areas 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."

The following questions are posed in order to assess if the SEPP 44 applies to the Cobaki estate.

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

Yes.

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?

Yes. Relatively small and isolated areas of Cobaki Estate support Schedule 2 food trees. An assessment of Koala habitat was completed by JWA in the EA as part of the Preferred Project Report submitted to the NSW Department of Planning (DoP) in 2010 (JWA 2010). Five vegetation communities constitute Koala habitat as follows:

- A Mid-high open woodland in the eastern portion of the site of which 95% of the total number of trees in the upper strata are *Eucalyptus robusta* (Swamp mahogany).
- A Mid-high open woodland in the south eastern portion of the site of which 95% of the total number of trees in the upper strata are *Eucalyptus signata* (Scribbly gum).
- A Very tall open/closed sclerophyll forest in the western portion of the site of which at least 15% of the total number of trees in the upper strata are *E. microcorys* (Tallowwoods).

- A Tall open sclerophyll forest in the south of the site of which *E. tereticornis* (Forest red gums) constitute at least 15% of the total number of trees in the upper strata.

- A Tall open/closed sclerophyll forest in the north west of the site dominated by Grey gum (*E. propinqua*).

Swamp mahogany, Scribbly gum, Tallowwood and Forest red gum are all listed in Schedule 2 of the SEPP 44 and vegetation dominated by these species is considered as potential Koala habitat. The Grey gum is not a Schedule 2 SEPP 44 listed food tree but is recognised in the Approved Recovery Plan for the Koala as a secondary Koala food tree on the north coast of NSW. Therefore, vegetation dominated by this species is also considered as potential Koala habitat.

No. Where potential habitat is identified, the area must be investigated for core koala habitat. Core Koala habitat is defined in Section 2.1 of Circular No. B35 (DoP 1995) as 'an area of land with a resident breeding population of koalas, evidenced by attributes such as breeding females and recent sightings and historical records of a population'.

The results of this assessment, and previous assessments on the subject site, have indicated that the site does not support core Koala habitat. Whilst the site may be utilised occasionally by one or two Koalas, a resident breeding population of Koalas is not considered to occur.

6. DISCUSSION AND CONCLUSIONS

The assessment resulted in a record of low level Koala activity on the subject site. A small number of scats were found in a single location on the site.

Phillips & Callaghan (2011) state that low activity levels recorded in what might otherwise be medium-high carrying capacity Koala habitat may be a result of contemporary population dynamics, landscape configuration and/or historical disturbances including logging, mining, fire, agricultural activities and/or urban development. Further, it is suggested that low activity levels are also associated with low density Koala populations. Stable, low density Koala populations occur naturally in some areas and generally reflect the absence of primary Koala food tree species and reliance by the population on secondary food tree species only.

Where the results of the of a SAT site returns an activity level within the low use range, the level of use by Koalas is likely to be transitory (Phillips & Callaghan 2011).

Surveys of the Cobaki Estate site over the past thirty (30) years have not recorded a significant population of Koalas on the site. Sporadic records of a small number of Koala scats exist for the site and similar results were again recorded during this assessment.

Whilst several small and isolated patches of primary (SEPP 44 - Schedule 2) Koala food trees occur it is considered that the subject site generally represents secondary habitat for the Koala. Historical evidence of low level activity suggests that a low density Koala population may be present within the vicinity of the site, likely within the vegetated lands to the west. It would appear that the site has over time provided, and continues to provide, forage resources for one (1) or possibly two (2) Koalas as they move through the locality.

The results of the SEPP 44 assessment indicates that the site does not support core Koala habitat.

REFERENCES

Australian Koala Foundation (1996) Tweed Coast Koala Habitat Atlas. Prepared for Tweed Shire Council

Biolink (2011) Tweed Coast Koala Habitat Study. Prepared for Tweed Shire Council

Cameron McNamara (1983) Cobaki Village Environmental Study. Report Prepared for the Bradshaw Group

Department of Planning (1995) Department of Planning 'Circular No B35'. State Environmental Planning Policy No 44 - Koala Habitat Protection. Department of Planning, Sydney.

EcoPro Pty Ltd (2004) Tugun Bypass: Species Impact Statement (SIS). A report prepared for the Queensland Department of Main Roads

JWA (2008a) Cobaki Estate Ecological Assessment - Volumes 1 & 2. Response to the Director General's Environmental Assessment Requirements. May 2008

JWA (2008b) Cobaki Estate Ecological Assessment - Volumes 1 & 2. Response to the Director General's Environmental Assessment Requirements. As Amended November 2008

JWA (2009) SEPP 44 Assessment. Cobaki Estate Preferred Project Report. October 2009

JWA (2010) Revised Cobaki Estate Ecological Assessment. Cobaki Estate Preferred Project Report. June 2010

M.B. Kingston, J.W. Turnbull and P.W. Hall (2004) Tweed Vegetation Management Strategy. Prepared for Tweed Shire Council

Parker, P. (1999) A Species Impact Statement for the Cobaki Lakes Project

Phillips, S. and Callaghan, J. (2011) The Spot Assessment Technique: a tool for determining localised levels of habitat use by Koalas *Phascolarctos cinereus*

Warren, J.V. (1992) Fauna Impact Assessment of the Proposed Boyd Street Access

Warren, J.V. (1993) Flora and Fauna survey of proposed cut/fill areas at Cobaki Lakes development (Unpublished Report)

Warren, J.V. (1994) Flora and Fauna survey of the Cobaki Lakes development site (Unpublished Report)
WBM (1991) Flora and Fauna Studies, Proposed Boyd Street Extension to Cobaki
Woodward-Clyde (1997) Species Impact Statement. AGC Woodward-Clyde Pty Ltd

APPENDIX 1 - FIELD DATA SHEETS

Field Site No: 1					
GPS: 547467; 6884784					
Brief description: Blackbutt forest with maintained midstorey & groundcover - ridge top					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Secondary feed tree species)	*Eucalyptus pilularis*	15m	35cm	0	
2	*E. siderophloia*	19m	42cm	0	
3	*E. pilularis*	21m	40cm	0	
4	*E. pilularis*	22m	45cm	0	
5	*E. pilularis*	21m	44cm	0	
6	*E. siderophloia*	20m	48cm	0	
7	*E. pilularis*	24m	58cm	0	
8	*E. pilularis*	25m	62cm	0	
9	*E. pilularis*	25m	60cm	0	
10	*E. pilularis*	26m	59cm	0	
11	*E. pilularis*	23m	40cm	0	
12	*E. pilularis*	23m	38cm	0	
13	*E. pilularis*	24m	57cm	0	
14	*E. pilularis*	22m	42cm	0	
15	*E. pilularis*	18m	54cm	0	
16	*E. pilularis*	22m	30cm	0	
17	*E. pilularis*	24m	43cm	0	
18	*E. pilularis*	21m	56cm	0	
19	*E. pilularis*	18m	31cm	0	
20	*E. pilularis*	19m	44cm	0	
21	*E. pilularis*	23m	55cm	0	
22	*E. pilularis*	22m	60cm	0	
23	*E. pilularis*	24m	52cm	0	
24	*E. pilularis*	24m	58cm	0	
25	*E. pilularis*	21m	30cm	0	
26	*E. pilularis*	24m	44cm	0	
27	*E. pilularis*	24m	42cm	0	
28	*E. pilularis*	25m	46cm	0	
29	*E. pilularis*	21m	44cm	0	
30	*E. pilularis*	25m	45cm	0	

Field Site No: 2					
GPS: 547413; 6884631					
Brief description: Blackbutt forest with maintained midstorey & groundcover - ridgetop					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Secondary feed tree species)	*Eucalyptus pilularis*	23m	49cm	0	
2	*E. pilularis*	14m	54cm	0	
3	*E. pilularis*	22m	40cm	0	
4	*E. pilularis*	24m	56cm	0	
5	*E. pilularis*	24m	52cm	0	
6	*E. pilularis*	25m	54cm	0	
7	*E. pilularis*	24m	60cm	0	
8	*E. pilularis*	24m	66cm	0	
9	*E. pilularis*	23m	58cm	0	
10	*E. pilularis*	25m	56cm	0	
11	*E. pilularis*	25m	60cm	0	
12	*Schefflera actinophylla*	8m	50cm	0	
13	*E. pilularis*	25m	54cm	0	
14	*E. pilularis*	26m	46cm	0	
15	*E. pilularis*	25m	64cm	0	
16	*E. pilularis*	24m	62cm	0	
17	*E. pilularis*	23m	55cm	0	
18	*E. pilularis*	24m	53cm	0	
19	*E. pilularis*	23m	48cm x (2)	0	Twin trunk
20	*E. pilularis*	26m	58cm	0	
21	*E. pilularis*	26m	49cm	0	
22	*E. pilularis*	25m	57cm	0	
23	*E. pilularis*	26m	50cm	0	
24	*E. pilularis*	23m	45cm	0	
25	*E. pilularis*	12m	40cm	0	Crown snapped off
26	*E. pilularis*	22m	45cm	0	
27	*E. pilularis*	16m	42cm	0	
28	*E. pilularis*	22m	44cm	0	
29	*E. pilularis*	22m	56cm	0	
30	*E. pilularis*	24m	60cm	0	

Field Site No: 3					
GPS: 547297; 6884549					
Brief description: Blackbutt forest (+/- Grey gum) with maintained midstorey & groundcover - moderately steep westerly aspect					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Secondary feed tree species)	*Eucalyptus propinqua*	23m	57cm	0	
2	*E. siderophloia*	25m	52cm	0	
3	*E. siderophloia*	21m	42cm	0	
4	*E. propinqua*	25m	45cm	0	
5	*E. propinqua*	15m	36cm	0	
6	*E. pilularis*	24m	52cm	0	
7	*E. microcorys*	19m	46cm	0	
8	*E. pilularis*	22m	56cm	0	
9	*E. pilularis*	25m	62cm	0	
10	*E. pilularis*	26m	58cm	0	
11	*E. pilularis*	26m	55cm	0	
12	*E. pilularis*	23m	51cm	0	
13	*E. pilularis*	27m	66cm	0	
14	*E. pilularis*	22m	40cm	0	
15	*E. pilularis*	25m	46cm	0	
16	*E. pilularis*	23m	65cm	0	
17	*E. propinqua*	23m	44cm	0	
18	*E. pilularis*	24m	64cm	0	
19	*E. pilularis*	24m	59cm	0	
20	*E. propinqua*	20m	40cm	0	
21	*E. pilularis*	21m	40cm	0	
22	*E. pilularis*	24m	49cm	0	
23	*E. pilularis*	26m	71cm	0	
24	*E. pilularis*	25m	57cm	0	
25	*Corymbia intermedia*	19m	44cm	0	
26	*E. pilularis*	17m	42cm	0	
27	*Lophostemon confertus*	22m	28cm	0	
28	*E. propinqua*	28m	55cm	0	
29	*E. propinqua*	26m	54cm	0	
30	*L. confertus*	10m	40cm	0	Crown snapped off

Field Site No: 4					
GPS: 547247; 6884415					
Brief description: Blackbutt forest (+/- Brushbox) with maintained midstorey & groundcover - ridgetop					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Primary feed tree species)	*Eucalyptus microcorys*	22m	90cm	0	
2	*E. pilularis*	24m	120cm	0	Old growth tree with numerous hollows
3	*E. microcorys*	12m	28cm	0	
4	*Corymbia intermedia*	12m	22cm	0	
5	*E. siderophloia*	8m	15cm	0	
6	*E. microcorys*	22m	38cm	0	
7	*E. microcorys*	23m	36cm	0	
8	*E. pilularis*	17m	20cm	0	
9	*Lophostemon confertus*	7m	12cm	0	
10	*C. intermedia*	9m	15cm	0	
11	*E. microcorys*	17m	30cm	0	
12	*E. pilularis*	16m	25cm	0	
13	*E. pilularis*	26m	45cm	0	
14	*E. pilularis*	16m	30cm	0	
15	*E. siderophloia*	29m	60cm	0	
16	*C. intermedia*	27m	57cm	0	
17	*E. pilularis*	18m	31cm	0	
18	*E. pilularis*	10m	16cm	0	
19	*E. pilularis*	16m	25cm	0	
20	*E. pilularis*	28m	43cm	0	
21	*E. pilularis*	26m	42cm	0	
22	*E. pilularis*	24m	48cm	0	
23	*L. confertus*	13m	30cm	0	
24	*L. confertus*	16m	36cm	0	
25	*C. intermedia*	26m	65cm	0	Basal hollow
26	*E. pilularis*	15m	38cm	0	
27	*L. confertus*	13m	42cm	0	
28	*Acacia melanoxylon*	8m	15cm	0	
29	*C. intermedia*	7m	10cm	0	
30	*L. confertus*	8m	16cm	0	Crown snapped off

Field Site No: 5					
GPS: 547067; 6884384					
Brief description: Blackbutt forest with maintained midstorey & groundcover - moderately steep south-easterly aspect					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Secondary feed tree species)	*Eucalyptus pilularis*	23m	130cm	0	Old growth tree with numerous hollows
2	*E. pilularis*	17m	65cm	0	
3	*E. microcorys*	6m	15cm	0	
4	*Lophostemon suaveolens*	8m	22cm	0	
5	*E. pilularis*	26m	60cm	0	
6	*E. pilularis*	26m	68cm	0	
7	*Corymbia intermedia*	21m	40cm	0	
8	*L. suaveolens*	12m	35cm	0	
9	*E. siderophloia*	13m	30cm	0	
10	*C. intermedia*	19m	51cm	0	
11	*E. pilularis*	25m	42cm	0	
12	*E. pilularis*	29m	72cm	0	
13	*E. siderophloia*	25m	52cm	0	
14	*L. suaveolens*	14m	25cm	0	
15	*E. pilularis*	23m	33cm	0	
16	*E. siderophloia*	24m	36cm	0	
17	*C. intermedia*	7m	25cm	0	
18	*E. siderophloia*	21m	36cm	0	
19	*E. siderophloia*	22m	34cm	0	
20	*E. pilularis*	25m	58cm	0	
21	*L. confertus*	16m	42cm (x2)	0	Twin trunk
22	*E. siderophloia*	23m	46cm	0	
23	*E. pilularis*	19m	78cm	0	
24	*L. confertus*	15m	58cm	0	
25	*L. confertus*	19m	52cm	0	
26	*E. pilularis*	21m	59cm	0	
27	*E. pilularis*	22m	58cm	0	
28	*E. propinqua*	23m	100cm	0	Old growth tree with numerous hollows + Osprey nest
29	*E. pilularis*	18m	60cm	0	
30	*E. pilularis*	18m	56cm	0	

Field Site No: 6					
GPS: 546891; 6883573					
Brief description: Swamp mahogany woodland with maintained midstorey & groundcover - on flat sandplain					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Primary feed tree species)	*Eucalyptus robusta*	14m	55cm	0	
2	*E. robusta*	10m	54cm	0	
3	*E. robusta*	14m	55cm	0	
4	*E. robusta*	16m	56cm	0	
5	*E. robusta*	15m	45cm	0	
6	*E. robusta*	15m	52cm	0	
7	*E. robusta*	15m	54cm	0	
8	*E. robusta*	17m	61cm	0	
9	*E. robusta*	15m	60cm	0	
10	*E. racemosa*	16m	57cm	0	
11	*E. robusta*	17m	56cm	0	
12	*E. robusta*	14m	36cm	0	
13	*E. robusta*	14m	34cm	0	
14	*L. suaveolens*	7m	20cm	0	
15	*E. robusta*	16m	52cm	0	
16	*E. robusta*	16m	61cm	0	
17	*E. robusta*	16m	48cm	0	
18	*E. robusta*	13m	40cm	0	
19	*E. robusta*	12m	44cm	0	
20	*E. robusta*	14m	49cm	0	
21	*E. robusta*	16m	56cm	0	
22	*E. robusta*	10m	32cm	0	
23	*E. robusta*	18m	60cm	0	
24	*E. robusta*	15m	62cm	0	
25	*Melaleuca quinquenervia*	6m	15cm	0	
26	*E. robusta*	10m	32cm	0	
27	*E. robusta*	12m	34cm	0	
28	*E. robusta*	14m	39cm	0	
29	*E. robusta*	15m	46cm	0	
30	*E. robusta*	12m	32cm	0	

Field Site No: 7					
GPS: 547006; 6883149					
Brief description: Swamp mahogany woodland with maintained midstorey & groundcover - on flat sandplain					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Primary feed tree species)	*Eucalyptus robusta*	17m	49cm	0	
2	*E. robusta*	5m	22cm	0	
3	*E. robusta*	5m	18cm	0	
4	*E. robusta*	3m	18cm	0	
5	*E. robusta*	4m	16cm	0	
6	*E. robusta*	5m	18cm	0	
7	*Melaleuca quinquenervia*	5m	22cm	0	
8	*E. robusta*	5m	24cm	0	
9	*E. robusta*	4m	12cm	0	
10	*E. racemosa*	5m	25cm	0	
11	*M. quinquenervia*	7m	31cm	0	
12	*E. robusta*	5m	18cm	0	
13	*M. quinquenervia*	5m	14cm	0	
14	*E. robusta*	17m	40cm	0	
15	*E. racemosa*	19m	79cm	0	Old growth tree with numerous hollows
16	*E. robusta*	14m	40cm	0	
17	*E. robusta*	13m	35cm	0	
18	*E. robusta*	16m	42cm	0	
19	*E. robusta*	17m	56cm	0	
20	*E. robusta*	17m	61cm	0	
21	*E. robusta*	14m	40cm	0	
22	*E. robusta*	14m	34cm	0	
23	*M. quinquenervia*	14m	36cm	0	
24	*E. robusta*	15m	66cm	0	
25	*E. robusta*	16m	35cm	0	
26	*E. robusta*	17m	48cm	0	
27	*E. robusta*	17m	38cm	0	
28	*E. robusta*	15m	45cm	0	
29	*E. robusta*	14m	40cm	0	
30	*E. robusta*	18m	60cm	0	

Field Site No: 8					
GPS: 547267; 6882784					
Brief description: Scribbly gum woodland with maintained midstorey & groundcover - on flat sandplain					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Primary feed tree species)	*Eucalyptus racemosa*	15m	62cm	0	Hollow-bearing tree
2	*Elaeocarpus reticulatus*	6m	20cm	0	Hollow-bearing tree
3	*E. racemosa*	17m	81cm	0	Hollow-bearing tree
4	*E. racemosa*	18m	62cm	0	Hollow-bearing tree
5	*E. racemosa*	19m	71cm	0	
6	*E. racemosa*	14m	52cm	0	Hollow-bearing tree
7	*E. racemosa*	12m	91cm	0	
8	*E. racemosa*	14m	59cm	0	Hollow-bearing tree
9	*E. racemosa*	17m	64cm	0	Hollow-bearing tree
10	*E. racemosa*	17m	79cm	0	
11	*E. racemosa*	18m	81cm	0	Crown snapped off
12	*E. racemosa*	10m	110cm	0	Hollow-bearing tree
13	*E. racemosa*	19m	100cm	0	Hollow-bearing tree
14	*E. racemosa*	18m	90cm	0	Hollow-bearing tree
15	*E. racemosa*	18m	90cm	0	
16	*E. racemosa*	19m	58cm	0	Hollow-bearing tree
17	*E. racemosa*	20m	120cm	0	Hollow-bearing tree
18	*E. racemosa*	20m	79cm	0	Hollow-bearing tree
19	*E. racemosa*	19m	84cm	0	
20	*E. racemosa*	17m	48cm	0	Hollow-bearing tree
21	*E. racemosa*	18m	82cm	0	Hollow-bearing tree
22	*E. racemosa*	16m	74cm	0	Hollow-bearing tree
23	*E. racemosa*	19m	61cm	0	Hollow-bearing tree
24	*E. racemosa*	19m	58cm	0	Hollow-bearing tree
25	*E. racemosa*	19m	65cm	0	Hollow-bearing tree
26	*E. racemosa*	14m	72cm	0	Hollow-bearing tree
27	*Lophostemon confertus*	10m	30cm	0	
28	*E. racemosa*	16m	56cm	0	Hollow-bearing tree
29	*E. racemosa*	18m	58cm	0	Hollow-bearing tree
30	*E. racemosa*	18m	88cm	0	Hollow-bearing tree

Field Site No: 9

GPS: 547448; 6882612					
Brief description: Scribbly gum woodland with maintained midstorey & groundcover - on flat sandplain					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Primary feed tree species)	*Eucalyptus racemosa*	16m	66cm	0	Hollow-bearing tree
2	*E. racemosa*	17m	72cm	0	Hollow-bearing tree
3	*E. racemosa*	18m	61cm	0	Hollow-bearing tree
4	*E. racemosa*	18m	68cm	0	Hollow-bearing tree
5	*E. racemosa*	17m	100cm	0	Hollow-bearing tree
6	*E. racemosa*	17m	65cm	0	Hollow-bearing tree
7	*E. racemosa*	18m	62cm	0	Hollow-bearing tree
8	*E. racemosa*	17m	78cm	0	Hollow-bearing tree
9	*E. racemosa*	16m	74cm	0	Hollow-bearing tree
10	*E. racemosa*	18m	85cm	0	Hollow-bearing tree
11	*E. racemosa*	20m	90cm	0	Hollow-bearing tree
12	*E. racemosa*	20m	110cm	0	Hollow-bearing tree
13	*E. racemosa*	16m	62cm	0	Hollow-bearing tree
14	*E. racemosa*	18m	72cm	0	Hollow-bearing tree
15	*E. racemosa*	18m	78cm	0	Hollow-bearing tree + Boobook owl roosting + Sulphur-crested cockatoo nesting
16	*E. resinifera*	17m	51cm	0	
17	*E. racemosa*	16m	56cm	0	
18	*E. resinifera*	19m	54cm	0	
19	*E. racemosa*	13m	55cm	0	
20	*E. racemosa*	16m	110cm	0	Hollow-bearing tree
21	*E. racemosa*	20m	75cm	0	Hollow-bearing tree
22	*E. racemosa*	21m	90cm	0	Hollow-bearing tree
23	*E. racemosa*	16m	84cm	0	Hollow-bearing tree + Wood duck nesting
24	*Corymbia intermedia*	16m	45cm	0	
25	*E. racemosa*	11m	110cm	0	Hollow-bearing tree
26	*C. intermedia*	16m	44cm	0	
27	*Lophostemon confertus*	18m	71cm	0	Hollow-bearing tree
28	*E. racemosa*	19m	76cm	0	Hollow-bearing tree
29	*E. racemosa*	14m	34cm	0	
30	*E. racemosa*	16m	58cm	0	

Field Site No: 10					
GPS: 546867; 6881984					
Brief description: Blackbutt forest - steep south-westerly aspect					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Secondary feed tree species)	*Eucalyptus pilularis*	25m	48cm	0	
2	*Allocasuarina torulosa*	12m	20cm	0	
3	*A. torulosa*	10m	10cm	0	
4	*Cinnamomum camphora*	4m	8cm	0	
5	*C. camphora*	7m	14cm	0	
6	*Daviesia arborea*	6m	24cm	0	
7	*E. pilularis*	23m	38cm	0	
8	*E. pilularis*	20m	36cm	0	
9	*E. pilularis*	6m	16cm	0	
10	*E. pilularis*	23m	36cm	0	
11	*E. pilularis*	24m	34cm	0	
12	*E. pilularis*	21m	46cm	0	
13	*E. pilularis*	7m	17cm	0	
14	*E. pilularis*	12m	22cm	0	
15	*E. pilularis*	26m	36cm	0	
16	*E. pilularis*	25m	42cm	0	
17	*E. pilularis*	14m	18cm	0	
18	*E. pilularis*	18m	34cm	0	
19	*E. pilularis*	17m	28cm	0	
20	*D. arborea*	12m	38cm	0	
21	*C. camphora*	11m	29cm	0	
22	*E. pilularis*	20m	33cm	0	
23	*Callistemon* sp.	11m	21cm	0	Twin trunk
24	*E. pilularis*	16m	28cm	0	
25	*E. pilularis*	30m	92cm	0	
26	*A. torulosa*	12m	12cm	0	
27	*E. pilularis*	28m	30cm	0	
28	*E. pilularis*	29m	89cm	0	
29	*Callistemon* sp.	14m	18cm	0	
30	*D. arborea*	6m	18cm	0	

Field Site No: 11					
GPS: 546920; 6882154					
Brief description: Blackbutt forest (+/- Brushbox) - steep easterly aspect					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Secondary feed tree species)	*Eucalyptus pilularis*	30m	60cm	0	
2	*E. microcorys*	10m	20cm	0	
3	*Lophostemon confertus*	10m	10cm	0	
4	*Daviesia arborea*	4m	15cm	0	
5	*E. pilularis*	31m	58cm	0	
6	*Cinnamomum camphora*	6m	15cm	0	
7	*E. pilularis*	29m	62cm	0	
8	*L. confertus*	9m	10cm	0	
9	*L. confertus*	8m	12cm	0	
10	*L. confertus*	10m	15cm	0	
11	*E. pilularis*	28m	51cm	0	
12	*D. arborea*	6m	20cm	0	
13	*E. microcorys*	9m	16cm	0	
14	*E. pilularis*	28m	71cm	0	
15	*C. camphora*	5m	10cm	0	
16	*E. pilularis*	15m	26cm	0	
17	*E. pilularis*	28m	54cm	0	
18	*E. pilularis*	27m	52cm	0	
19	*C. camphora*	6m	14cm	0	
20	*E. pilularis*	19m	32cm	0	
21	*D. arborea*	4m	8cm	0	
22	*E. pilularis*	29m	86cm	0	
23	*L. confertus*	18m	38cm	0	Twin trunk
24	*L. confertus*	6m	10cm	0	
25	*C. camphora*	5m	10cm	0	
26	*L. confertus*	12m	11cm	0	
27	*L. confertus*	12m	10cm	0	
28	*L. confertus*	12m	15cm	0	
29	*L. confertus*	16m	20cm	0	
30	*E. pilularis*	24m	22cm	0	

Field Site No: 12					
GPS: 546653; 6882174					
Brief description: Blackbutt forest and adjacent scattered Forest red gum					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Secondary feed tree species)	*Eucalyptus pilularis*	27m	95cm	0	Old growth trees with hollows
2	*E. tereticornis*	24m	70cm	0	
3	*E. tereticornis*	26m	62cm	0	
4	*E. tereticornis*	28m	60cm	0	
5	*E. tereticornis*	26m	60cm	0	
6	*Corymbia intermedia*	17m	52cm	0	Hollows
7	*Ficus watkinsiana*	6m	10cm	0	
8	*E. pilularis*	28m	100cm	0	
9	*E. microcorys*	16m	45cm (x2)	0	Twin trunk
10	*E. siderophloia*	26m	44cm	0	
11	*E. tereticornis*	26m	54cm	0	
12	*E. siderophloia*	27m	58cm	0	
13	*E. pilularis*	29m	72cm	0	
14	*E. pilularis*	29m	68cm	0	
15	*E. pilularis*	24m	44cm	0	
16	*E. pilularis*	27m	42cm (x2)	0	Twin trunk
17	*E. pilularis*	28m	56cm	0	
18	*E. pilularis*	29m	62cm	0	
19	*E. siderophloia*	24m	55cm	0	
20	*Lophostemon suaveolens*	14m	30cm	0	
21	*E. pilularis*	26m	56cm	0	
22	*E. tereticornis*	25m	60cm	0	
23	*E. tereticornis*	26m	51cm	0	
24	*E. tereticornis*	28m	71cm	0	
25	*E. siderophloia*	24m	49cm	0	
26	*E. pilularis*	28m	58cm	0	
27	*E. siderophloia*	26m	49cm	0	
28	*E. tereticornis*	26m	47cm	0	
29	*E. pilularis*	28m	81cm	0	
30	*C. intermedia*	16m	29cm	0	

Field Site No: 13					
GPS: 546255; 6882398					
Brief description: Linear stand of old growth Forest red gum					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Primary feed tree species)	*Eucalyptus tereticornis*	30m	75cm	0	Old growth tree
2	*Lophostemon suaveolens*	22m	42cm	0	
3	*E. tereticornis*	28m	87cm	0	Old growth tree
4	*Corymbia intermedia*	22m	36cm	0	
5	*L. suaveolens*	14m	55cm	0	
6	*C. intermedia*	14m	32cm	0	
7	*E. tereticornis*	26m	60cm	0	
8	*E. tereticornis*	29m	120cm	0	Old growth tree
9	*E. tereticornis*	9m	26cm	0	
10	*E. tereticornis*	8m	30cm	0	
11	*E. tereticornis*	6m	22cm	0	
12	*E. tereticornis*	6m	20cm	0	
13	*E. tereticornis*	24m	70cm	0	Old growth tree
14	*E. tereticornis*	21m	50cm	0	
15	*C. intermedia*	21m	36cm	0	
16	*C. intermedia*	15m	28cm (x2)	0	Twin trunk
17	*E. tereticornis*	30m	86cm	0	Old growth tree
18	*E. tereticornis*	30m	76cm	0	Old growth tree
19	*L. suaveolens*	14m	29cm	0	
20	*L. suaveolens*	14m	32cm	0	
21	*E. tereticornis*	30m	130cm	0	Old growth tree
22	*E. tereticornis*	30m	92cm	0	Old growth tree
23	*E. tereticornis*	30m	68cm	0	
24	*L. suaveolens*	10m	30cm	0	
25	*L. suaveolens*	14m	30cm	0	
26	*E. tereticornis*	30m	70cm	0	
27	*Melaleuca quinquenervia*	24m	45cm	0	
28	*M. quinquenervia*	24m	52cm	0	
29	*L. suaveolens*	9m	36cm	0	
30	*E. tereticornis*	30m	96cm	0	Old growth tree

Field Site No: 14					
GPS: 546237; 6882644					
Brief description: Blackbutt forest (+/- Brushbox) with maintained midstorey & groundcover - moderately steep easterly aspect					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Primary feed tree species)	*Eucalyptus microcorys*	22m	68cm	0	
2	*Lophostemon confertus*	22m	48cm	0	
3	*E. microcorys*	24m	78cm	0	
4	*E. microcorys*	4m	10cm	0	
5	*E. microcorys*	5m	12cm	0	
6	*Corymbia intermedia*	6m	18cm	0	
7	*L. confertus*	3m	6cm	0	
8	*Eucalyptus pilularis*	15m	34cm	0	
9	*C. intermedia*	22m	42cm	0	
10	*E. microcorys*	24m	45cm	0	
11	*L. confertus*	9m	13cm	0	
12	*C. intermedia*	21m	32cm	0	
13	*L. confertus*	15m	26cm	0	
14	*L. confertus*	19m	32cm (x2)	0	Twin trunk
15	*L. confertus*	16m	32cm	0	
16	*L. confertus*	5m	6cm	0	
17	*L. confertus*	17m	24cm	0	
18	*C. intermedia*	18m	29cm	0	
19	*L. confertus*	18m	24cm	0	
20	*L. confertus*	19m	33cm	0	
21	*L. confertus*	19m	28cm	0	
22	*Eucalyptus pilularis*	9m	12cm	0	
23	*L. confertus*	20m	36cm	0	
24	*L. confertus*	21m	41cm	0	
25	*L. confertus*	10m	12cm	0	
26	*C. intermedia*	21m	27cm	0	
27	*E. pilularis*	10m	16cm	0	
28	*C. intermedia*	18m	48cm	0	
29	*E. pilularis*	25m	45cm	0	
30	*L. confertus*	22m	42cm	0	

Field Site No: 15					
GPS: 546067; 6882584					
Brief description: Blackbutt forest (+/- Brushbox) with maintained midstorey & groundcover - steep southerly aspect					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Primary feed tree species)	*Eucalyptus microcorys*	23m	42cm	0	
2	*Cinnamomum camphora*	3m	5cm	0	
3	*E. microcorys*	25m	56cm	0	
4	*Lophostemon confertus*	23m	31cm (x2)	0	Twin trunk
5	*E. pilularis*	12m	14cm	0	
6	*Glochidion ferdinandi*	3m	8cm	0	
7	*Notelaea* sp.	2m	6cm	0	
8	*L. confertus*	10m	12cm	0	
9	*L. confertus*	10m	10cm	0	
10	*Corymbia intermedia*	23m	48cm	0	
11	*C. intermedia*	26m	62cm	0	
12	*L. confertus*	7m	9cm	0	
13	*C. camphora*	2m	5cm	0	
14	*Trochocarpa laurina*	2m	6cm	0	
15	*C. camphora*	6m	11cm	0	
16	*E. pilularis*	28m	78cm	0	
17	*E. microcorys*	20m	28cm	0	
18	*C. intermedia*	24m	61cm	0	
19	*C. camphora*	3m	6cm	0	
20	*Acacia longissima*	4m	7cm	0	
21	*C. intermedia*	5m	8cm	0	
22	*L. confertus*	20m	40cm	0	
23	*E. pilularis*	26m	50cm	0	
24	*E. pilularis*	28m	54cm	0	
25	*L. confertus*	16m	28cm (x2)	0	Twin trunk
26	*L. confertus*	15m	32cm	0	
27	*C. intermedia*	21m	33cm	0	
28	*C. intermedia*	24m	38cm	0	
29	*L. confertus*	11m	12cm	0	
30	*L. confertus*	13m	21cm	0	

Field Site No: 16					
GPS: 546067; 6882784					
Brief description: Blackbutt forest (+/- Brushbox) with maintained midstorey & groundcover - gentle north-easterly aspect					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Secondary feed tree species)	*Corymbia intermedia*	24m	44cm	0	
2	*Eucalyptus pilularis*	6m	16cm	0	
3	*E. pilularis*	28m	81cm	0	
4	*E. pilularis*	27m	67cm	0	
5	*Eucalyptus siderophloia*	23m	42cm	0	
6	*E. pilularis*	6m	11cm	0	
7	*Lophostemon confertus*	4m	8cm	0	
8	*L. confertus*	4m	7cm	0	
9	*L. confertus*	4m	7cm	0	
10	*E. pilularis*	4m	6cm	0	
11	*E. pilularis*	6m	10cm	0	
12	*E. pilularis*	6m	18cm	0	
13	*E. pilularis*	5m	10cm	0	
14	*E. pilularis*	4m	12cm	0	
15	*E. pilularis*	6m	12cm	0	
16	*E. pilularis*	4m	15cm	0	
17	*E. pilularis*	4m	12cm	0	
18	*E. pilularis*	5m	10cm	0	
19	*E. pilularis*	6m	11cm	0	
20	*E. pilularis*	4m	6cm	0	
21	*E. pilularis*	3m	7cm	0	
22	*E. pilularis*	3m	6cm	0	
23	*E. pilularis*	7m	12cm	0	
24	*E. pilularis*	7m	18cm	0	
25	*C. intermedia*	4m	11cm	0	
26	*E. pilularis*	28m	42cm	0	
27	*E. pilularis*	26m	40cm	0	
28	*E. pilularis*	30m	58cm	0	
29	*E. pilularis*	30m	62cm	0	
30	*E. pilularis*	30m	56cm	0	

Field Site No: 17					
GPS: 546067; 6882984					
Brief description: Blackbutt forest (+/- Brushbox) at the top of a very steep rock ridgeline					
Tree	**Species**	**Height**	**DBH**	**Scats (1 = yes; 0 = no)**	**Notes**
Centre tree (Reason for choice: Secondary feed tree species)	*Eucalyptus pilularis*	16m	35cm	0	
2	*Allocasuarina torulosa*	8m	15cm	0	
3	*Lophostemon confertus*	14m	22m	0	
4	*A. torulosa*	4m	10cm	0	
5	*Eucalyptus siderophloia*	7m	12cm	0	
6	*E. pilularis*	18m	33cm	0	
7	*A. torulosa*	5m	12cm	0	
8	*A. torulosa*	6m	13cm	0	
9	*A. torulosa*	8m	13cm	0	
10	*A. torulosa*	9m	17cm	0	
11	*E. siderophloia*	13m	19cm	0	
12	*A. torulosa*	10m	16cm	0	
13	*E. siderophloia*	8m	12cm	0	
14	*Corymbia intermedia*	5m	7cm	0	
15	*A. torulosa*	6m	7cm	0	
16	*C. intermedia*	9m	11cm	0	
17	*L. confertus*	8m	11cm	0	
18	*C. intermedia*	7m	7cm	0	
19	*L. confertus*	14m	20cm	0	
20	*E. pilularis*	13m	17cm	0	
21	*A. torulosa*	6m	12cm	0	
22	*E. pilularis*	18m	31cm	0	
23	*E. siderophloia*	20m	33cm (x2)	0	Twin trunk
24	*C. intermedia*	16m	34cm	0	
25	*L. confertus*	13m	21cm	0	
26	*L. confertus*	12m	16cm	0	
27	*E. pilularis*	16m	15cm	0	
28	*E. pilularis*	14m	21cm	0	
29	*E. pilularis*	14m	16cm	0	
30	*E. pilularis*	18m	28cm	0	

Field Site No: 18					
GPS: 546067; 6883184					
Brief description: Blackbutt forest (+/- Brushbox) - moderately steep south-easterly aspect					
Tree	**Species**	**Height**	**DBH**	**Scats (1 = yes; 0 = no)**	**Notes**
Centre tree (Reason for choice: Secondary feed tree species)	*Eucalyptus pilularis*	25m	50cm	0	
2	*Corymbia intermedia*	21m	36cm	0	
3	*E. pilularis*	7m	12cm	0	
4	*Acacia longissima*	8m	14cm	0	
5	*Lophostemon confertus*	6m	7cm	0	
6	*Persoonia stradbrokensis*	4m	7cm	0	
7	*L. confertus*	3m	5cm	0	
8	*Allocasuarina torulosa*	6m	11cm	0	
9	*L. confertus*	5m	7cm	0	
10	*A. torulosa*	6m	10cm	0	
11	*C. intermedia*	7m	11cm	0	
12	*E. siderophloia*	16m	32cm	0	
13	*L. confertus*	4m	6cm	0	
14	*L. confertus*	4m	5cm	0	
15	*L. confertus*	7m	6cm	0	
16	*L. confertus*	3m	5cm	0	
17	*L. confertus*	4m	5cm	0	
18	*L. confertus*	5m	7cm	0	
19	*L. confertus*	4m	6cm	0	
20	*C. intermedia*	8m	14cm	0	
21	*E. pilularis*	24m	59cm	0	
22	*L. suaveolens*	14m	55cm	0	Numerous hollows
23	*E. pilularis*	13m	16cm	0	
24	*C. intermedia*	18m	38cm	0	
25	*C. intermedia*	18m	31cm	0	
26	*E. siderophloia*	20m	35cm	0	
27	*E. pilularis*	24m	49cm	0	
28	*L. confertus*	6m	7cm	0	
29	*L. confertus*	6m	11cm	0	
30	*L. confertus*	7m	8cm	0	

Field Site No: 19					
GPS: 546067; 6883384					
Brief description: Blackbutt forest (+/- Brushbox) - very steep easterly aspect					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Secondary feed tree species)	*Corymbia intermedia*	16m	35cm	0	
2	*Eucalyptus pilularis*	15m	32cm	0	
3	*C. intermedia*	5m	10cm	0	
4	*Lophostemon confertus*	5m	11cm	0	
5	*Guioa semiglauca*	7m	7cm	0	
6	*Jagera pseudorhus*	7m	10cm	0	
7	*C. intermedia*	13m	20cm	0	
8	*Alphitonia excelsa*	6m	12cm	0	
9	*E. pilularis*	5m	4cm	0	
10	*L. confertus*	10m	11cm	0	
11	*Allocasuarina torulosa*	6m	24cm	0	
12	*A. torulosa*	12m	31cm	0	
13	*L. suaveolens*	12m	19cm	0	
14	*L. suaveolens*	10m	14cm	0	
15	*C. intermedia*	22m	35cm	0	
16	*C. intermedia*	9m	14cm	0	
17	*E. pilularis*	11m	13cm	0	
18	*G. semiglauca*	9m	11cm	0	
19	*E. pilularis*	14m	21cm	0	
20	*L. suaveolens*	6m	10cm	0	
21	*E. pilularis*	15m	19cm	0	
22	*E. pilularis*	21m	40cm	0	Numerous hollows
23	*C. intermedia*	20m	34cm	0	
24	*E. pilularis*	25m	42cm	0	
25	*Acacia longissima*	8m	9cm	0	
26	*L. suaveolens*	16m	36cm	0	
27	*A. torulosa*	4m	11cm	0	
28	*L. confertus*	4m	6cm	0	
29	*L. confertus*	6m	12cm	0	
30	*L. confertus*	5m	12cm	0	

Field Site No: 20					
GPS: 546067; 6883584					
Brief description: Blackbutt forest (+/- Brushbox) - steep easterly aspect					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Primary feed tree species)	*Eucalyptus tereticornis*	26m	60cm	0	
2	*Lophostemon suaveolens*	17m	28cm	0	
3	*E. siderophloia*	24m	35cm	0	
4	*L. confertus*	6m	10cm	0	
5	*L. confertus*	4m	6cm	0	
6	*L. confertus*	3m	12cm	0	
7	*L. confertus*	3m	6cm	0	
8	*L. confertus*	6m	12cm	0	
9	*Schefflera actinophylla*	7m	12cm	0	
10	*L. confertus*	16m	30cm (x2)	0	Twin trunk
11	*Corymbia intermedia*	18m	34cm	0	
12	*Guioa semiglauca*	4m	6cm	0	
13	*E. siderophloia*	18m	38cm	0	
14	*L. confertus*	10m	28cm	0	
15	*L. confertus*	8m	11cm	0	
16	*E. tereticornis*	21m	36cm	0	
17	*L. confertus*	10m	14cm	0	
18	*E. pilularis*	6m	11cm	0	
19	*L. suaveolens*	15m	32cm	0	
20	*L. confertus*	21m	48cm	0	
21	*E. pilularis*	14m	24cm	0	
22	*E. pilularis*	16m	31cm	0	
23	*L. suaveolens*	14m	30cm	0	Twin trunk
24	*E. tereticornis*	25m	60cm	0	
25	*L. confertus*	6m	14cm	0	
26	*L. confertus*	7m	12cm	0	
27	*L. confertus*	6m	14cm	0	
28	*L. confertus*	6m	13cm	0	
29	*Allocasuarina torulosa*	5m	9cm	0	
30	*L. confertus*	6m	10cm	0	

Field Site No: 21					
GPS: 546067; 6883784					
Brief description: Brushbox forest - steep northerly aspect					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Primary feed tree species)	*Eucalyptus microcorys*	24m	42cm	0	
2	*Lophostemon confertus*	13m	15cm	0	
3	*L. confertus*	13m	15cm	0	
4	*L. confertus*	12m	10cm	0	
5	*L. confertus*	10m	11cm	0	
6	*L. confertus*	9m	6cm	0	
7	*L. confertus*	9m	7cm	0	
8	*Allocasuarina torulosa*	12m	10cm	0	
9	*E. siderophloia*	26m	35cm	0	
10	*L. confertus*	5m	6cm	0	
11	*A. torulosa*	6m	7cm	0	
12	*L. confertus*	9m	11cm	0	
13	*L. confertus*	6m	16cm	0	
14	*Corymbia intermedia*	15m	35cm	0	
15	*L. confertus*	24m	46cm	0	
16	*L. confertus*	25m	42cm	0	
17	*C. intermedia*	21m	28cm	0	
18	*L. confertus*	5m	5cm	0	
19	*Acacia melanoxylon*	4m	5cm	0	
20	*Diploglottis cunninghamii*	5m	6cm	0	
21	*L. confertus*	9m	11cm	0	
22	*E. siderophloia*	19m	34cm	0	
23	*A. torulosa*	3m	4cm	0	
24	*A. torulosa*	10m	16cm (x2)	0	Twin trunk
25	*E. pilularis*	15m	21cm	0	
26	*E. pilularis*	14m	16cm	0	
27	*L. confertus*	13m	19cm	0	
28	*A. torulosa*	7m	17cm	0	
29	*E. tereticornis*	8m	11cm	0	
30	*C. intermedia*	26m	36cm	0	

Field Site No: 22					
GPS: 546067; 6883984					
Brief description: Blackbutt forest in steep eastern facing gully					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Secondary feed tree species)	*Eucalyptus propinqua*	21m	32cm	0	
2	*Corymbia intermedia*	26m	42cm	0	
3	*Guioa semiglauca*	6m	7cm	0	
4	*Macaranga tanarius*	6m	11cm	0	
5	*C. intermedia*	10m	12cm	0	
6	*C. intermedia*	9m	17cm	0	
7	*C. intermedia*	9m	8cm	0	
8	*C. intermedia*	10m	10cm	0	
9	*E. pilularis*	12m	12cm	0	
10	*C. intermedia*	18m	36cm	0	
11	*C. intermedia*	24m	41cm	0	
12	*Glochidion ferdinandi*	8m	17cm	0	
13	*G. ferdinandi*	6m	10cm	0	
14	*G. ferdinandi*	5m	8cm	0	
15	*G. ferdinandi*	5m	8cm	0	
16	*G. ferdinandi*	4m	8cm	0	
17	*Rhodamnia rubescens*	6m	11cm	0	
18	*R. rubescens*	4m	5cm	0	
19	*R. rubescens*	6m	5cm	0	
20	*R. rubescens*	5m	5cm	0	
21	*R. rubescens*	4m	5cm	0	
22	*R. rubescens*	3m	10cm	0	
23	*Lophostemon confertus*	15m	24cm	0	
24	*L. confertus*	26m	48cm	0	
25	*C. intermedia*	25m	42cm	0	
26	*Allocasuarina torulosa*	5m	6cm	0	
27	*G. ferdinandi*	5m	10cm	0	
28	*C. intermedia*	10m	10cm	0	
29	*A. torulosa*	10m	11cm	0	
30	*E. propinqua*	21m	34cm	0	

Field Site No: 23					
GPS: 546267; 6884184					
Brief description: Blackbutt forest (+/- Grey gum) - steep southerly aspect					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Secondary feed tree species)	*Eucalyptus propinqua*	25m	41cm	0	
2	*Corymbia intermedia*	25m	36cm	0	
3	*C. intermedia*	24m	32cm	0	
4	*Lophostemon confertus*	10m	12cm	0	
5	*L. confertus*	8m	12cm	0	
6	*L. confertus*	8m	6cm (x2)	0	Twin trunk
7	*L. confertus*	4m	10cm	0	
8	*L. confertus*	8m	10cm	0	
9	*L. confertus*	4m	6cm	0	
10	*L. confertus*	6m	6cm	0	
11	*L. confertus*	10m	10cm	0	
12	*L. confertus*	11m	10cm	0	
13	*L. confertus*	12m	15cm	0	
14	*E. pilularis*	27m	44cm	0	
15	*E. pilularis*	15m	8cm	0	
16	*E. pilularis*	15m	15cm	0	
17	*E. pilularis*	15m	17cm	0	
18	*E. pilularis*	27m	46cm	0	
19	*E. pilularis*	25m	42cm	0	
20	*E. pilularis*	10m	15cm	0	
21	*E. siderophloia*	16m	28cm	0	
22	*Guioa semiglauca*	10m	15cm	0	
23	*Trochocarpa laurina*	4m	8cm	0	
24	*Schefflera actinophylla*	6m	15cm (x2)	0	Twin trunk
25	*Acacia melanoxylon*	14m	15cm	0	
26	*L. confertus*	22m	31cm	0	
27	*E. propinqua*	22m	32cm	0	
28	*E. propinqua*	19m	22cm	0	
29	*C. intermedia*	21m	32cm	0	
30	*E. siderophloia*	21m	29m	0	

Field Site No: 24					
GPS: 546201; 6884373					
Brief description: Blackbutt forest - steep westerly aspect					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Secondary feed tree species)	*Eucalyptus pilularis*	26m	35cm	0	
2	*Lophostemon confertus*	3m	4cm	0	
3	*Acacia longissima*	9m	20cm	0	
4	*Corymbia intermedia*	22m	34cm	0	
5	*E. pilularis*	17m	20cm	0	
6	*E. pilularis*	24m	37cm	0	
7	*E. pilularis*	26m	80cm	0	
8	*L. confertus*	9m	10cm (x2)	0	Twin trunk
9	*L. confertus*	5m	5cm	0	
10	*A. lonmgissima*	3m	3cm	0	
11	*E. pilularis*	25m	42cm	0	
12	*A. lonmgissima*	10m	25cm	0	
13	*A. lonmgissima*	4m	15cm	0	
14	*E. pilularis*	24m	40cm	0	
15	*E. pilularis*	26m	64cm	0	
16	*L. confertus*	19m	32cm	0	
17	*L. confertus*	11m	19cm	0	
18	*L. confertus*	8m	11cm	0	
19	*L. confertus*	8m	8cm	0	
20	*L. confertus*	5m	6cm	0	
21	*E. pilularis*	22m	34cm	0	
22	*E. pilularis*	26m	41cm	0	
23	*L. confertus*	5m	4cm	0	
24	*L. confertus*	4m	3cm	0	
25	*L. confertus*	8m	10cm	0	
26	*L. confertus*	11m	14cm	0	
27	*L. confertus*	10m	15cm	0	
28	*L. confertus*	9m	10cm	0	
29	*L. confertus*	10m	8cm	0	
30	*L. confertus*	8m	15cm	0	

Field Site No: 25					
GPS: 546215; 6884550					
Brief description: Brushbox forest - moderately steep easterly aspect					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Secondary feed tree species)	*Lophostemon confertus*	16m	48cm	0	
2	*L. confertus*	18m	41cm	0	
3	*L. confertus*	18m	32cm	0	
4	*Cinnamomum camphora*	10m	10cm	0	
5	*L. confertus*	20m	32cm	0	
6	*Syzygium* sp.	5m	7cm	0	
7	*Syzygium* sp.	6m	5cm	0	
8	*Syzygium* sp.	4m	5cm	0	
9	*Syzygium* sp.	3m	4cm	0	
10	*Syzygium* sp.	4m	6cm	0	
11	*Syzygium* sp.	4m	6cm	0	
12	*C. camphora*	6m	15cm	0	
13	*L. confertus*	12m	10cm	0	
14	*L. confertus*	15m	20cm	0	
15	*L. confertus*	15m	15cm	0	
16	*Glochidion ferdinandi*	5m	14cm	0	
17	*L. confertus*	16m	20cm	0	
18	*L. confertus*	15m	10cm	0	
19	*L. confertus*	10m	10cm	0	
20	*L. confertus*	15m	15cm	0	
21	*L. confertus*	14m	10cm	0	
22	*Syzygium* sp.	6m	6cm	0	
23	*Syzygium* sp.	4m	10cm	0	
24	*Syzygium* sp.	4m	5cm	0	
25	*Syzygium* sp.	5m	4cm	0	
26	*Syzygium* sp.	4m	6cm	0	
27	*Syzygium* sp.	3m	6cm	0	
28	*Corymbia intermedia*	21m	30cm	0	
29	*C. intermedia*	17m	26cm	0	
30	*L. confertus*	21m	34cm (x2)	0	Twin trunk

Field Site No: 26					
GPS: 546082; 6884589					
Brief description: Blackbutt forest - steep south-easterly aspect					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Secondary feed tree species)	*Eucalyptus pilularis*	25m	51cm	0	
2	*Trochocarpa laurina*	3m	4cm	0	
3	*Syzygium* sp.	2m	2cm	0	
4	*Syzygium* sp.	2m	2cm	0	
5	*Syzygium* sp.	3m	3cm	0	
6	*Syzygium* sp.	2m	2cm	0	
7	*Syzygium* sp.	3m	2cm	0	
8	*Syzygium* sp.	3m	4cm	0	
9	*Notelaea* sp.	2m	2cm	0	
10	*Jagera pseudorhus*	12m	33cm (x2)	0	Twin trunk
11	*E. pilularis*	21m	36cm	0	
12	*Glochidion ferdinandi*	9m	22cm (x2)	0	Twin trunk
13	*Flindersia* sp.	6m	14cm	0	
14	*Acronychia oblongifolia*	6m	16cm	0	
15	*E. pilularis*	20m	35cm	0	
16	*Acacia melanoxylon*	6m	16cm	0	
17	*J. pseudorhus*	11m	19cm	0	
18	*E. pilularis*	12m	15cm	0	
19	*E. pilularis*	14m	16cm	0	
20	*E. pilularis*	20m	31cm	0	
21	*E. pilularis*	14m	14cm	0	
22	*T. laurina*	2m	2cm	0	
23	*Cinnamomum camphora*	10m	20cm	0	
24	*G. ferdinandi*	4m	11cm	0	
25	*T. laurina*	4m	4cm	0	
26	*T. laurina*	5m	15cm (x2)	0	Twin trunk
27	*E. pilularis*	27m	100cm	0	
28	*C. intermedia*	16m	28cm	0	
29	*Cryptocarya glaucescens*	2m	3cm	0	
30	*C. glaucescens*	4m	4cm	0	

Field Site No: 27					
GPS: 546073; 6884412					
Brief description: Very tall Flooded gum forest in easterly facing gully					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Secondary feed tree species)	*Eucalyptus grandis*	38m	45cm	0	
2	*L. confertus*	22m	34cm	0	
3	*E. grandis*	32m	32cm	0	
4	*Cryptocarya glaucescens*	3m	3m	0	
5	*Schefflera actinophylla*	5m	8cm	0	
6	*Cinnamomum camphora*	3m	4cm	0	
7	*Guioa semiglauca*	9m	14cm	0	
8	*E. grandis*	35m	65cm	0	
9	*L. confertus*	20m	34cm	0	
10	*E. grandis*	32m	40cm	0	
11	*Notelaea* sp.	3m	5cm	0	
12	*E. grandis*	34m	60cm	0	
13	*Wilkaea* sp.	3m	4cm	0	
14	*C. camphora*	10m	17cm	0	
15	*L. confertus*	15m	15cm	0	
16	*Homalanthus populifolius*	5m	10cm	0	
17	*C. camphora*	7m	11cm	0	
18	*H. populifolius*	6m	10cm	0	
19	*Eupomatia laurina*	2m	3cm	0	
20	*L. confertus*	16m	22cm	0	
21	*E. grandis*	32m	51cm	0	
22	*E. grandis*	35m	60cm	0	
23	*E. grandis*	35m	52cm	0	
24	*L. confertus*	5m	10cm	0	
25	*L. confertus*	6m	9cm	0	
26	*L. confertus*	6m	11cm	0	
27	*L. confertus*	7m	17cm	0	
28	*G. semiglauca*	12m	8cm	0	
29	*Mallotus philippensis*	2m	2cm	0	
30	*L. confertus*	14m	11cm	0	

Field Site No: 28					
GPS: 546067; 6884184					
Brief description: Brushbox forest in steep northern facing gully					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Primary feed tree species)	*Eucalyptus microcorys*	16m	30cm	0	
2	*Corymbia intermedia*	9m	9cm	0	
3	*Alphitonia excelsa*	4m	4cm	0	
4	*Lophostemon confertus*	4m	5cm	0	
5	*C. intermedia*	24m	38cm	0	
6	*L. confertus*	13m	15cm	0	
7	*L. confertus*	5m	4cm	0	
8	*L. confertus*	4m	4cm	0	
9	*L. confertus*	5m	6cm	0	
10	*L. confertus*	8m	18cm	0	
11	*L. confertus*	7m	12cm	0	
12	*L. confertus*	4m	10cm	0	
13	*L. confertus*	3m	5cm	0	
14	*L. confertus*	4m	5cm	0	
15	*L. confertus*	5m	5cm	0	
16	*E. microcorys*	21m	28cm	0	
17	*L. confertus*	14m	10cm	0	
18	*L. confertus*	12m	8cm	0	
19	*E. microcorys*	16m	25cm	0	
20	*L. confertus*	10m	10cm	0	
21	*Acacia melanoxylon*	10m	15cm	0	
22	*Eucalyptus propinqua*	26m	61cm	0	
23	*C. intermedia*	25m	49cm	0	
24	*L. confertus*	10m	10cm	0	
25	*L. confertus*	12m	10cm	0	
26	*L. confertus*	4m	6cm	0	
27	*L. confertus*	6m	15cm	0	
28	*L. confertus*	7m	15cm	0	
29	*L. confertus*	10m	10cm	0	
30	*L. confertus*	4m	6cm	0	

Field Site No: 29					
GPS: 545882; 6884015					
Brief description: Brushbox forest in steep gully					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Secondary feed tree species)	*Eucalyptus propinqua*	25m	50cm	0	
2	*Corymbia intermedia*	23m	40cm	0	
3	*E. propinqua*	23m	31cm	0	
4	*Lophostemon confertus*	10m	20cm	0	
5	*L. confertus*	9m	19cm	0	
6	*L. confertus*	7m	19cm	0	
7	*L. confertus*	5m	10cm	0	
8	*L. confertus*	7m	5cm	0	
9	*L. confertus*	5m	10cm	0	
10	*L. confertus*	10m	10cm	0	
11	*L. confertus*	12m	15cm	0	
12	*L. confertus*	14m	21cm	0	
13	*L. confertus*	10m	10cm	0	
14	*L. confertus*	7m	10cm	0	
15	*Syzygium* sp.	7m	11cm	0	
16	*Syzygium* sp.	5m	5cm	0	
17	*Notelaea* sp.	4m	4cm	0	
18	*Flindersia* sp.	5m	5cm	0	
19	*E. propinqua*	26m	32cm	0	
20	*Allocasuarina torulosa*	5m	10cm	0	
21	*E. propinqua*	25m	35cm	0	
22	*E. propinqua*	26m	41cm	0	
23	*L. confertus*	22m	32cm	0	
24	*L. confertus*	20m	35cm	0	
25	*L. confertus*	18m	32cm	0	
26	*L. confertus*	22m	41cm	0	
27	*L. confertus*	26m	54cm	0	
28	*A. torulosa*	6m	21cm	0	
29	*E. propinqua*	12m	16cm	0	
30	*Acacia melanoxylon*	6m	10cm	0	

Field Site No: 30					
GPS: 545645; 6883657					
Brief description: Blackbutt forest - gentle easterly aspect					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Primary feed tree species)	*Eucalyptus microcorys*	17m	32cm	0	
2	*Callistemon* sp.	16m	35cm	0	
3	*Eucalyptus pilularis*	24m	61cm	0	
4	*Corymbia intermedia*	25m	56cm	0	
5	*C. intermedia*	22m	48cm	0	
6	*C. intermedia*	25m	47cm	0	
7	*E. pilularis*	27m	85cm	0	
8	*Lophostemon confertus*	9m	15cm	0	
9	*E. pilularis*	26m	58cm	0	
10	*L. confertus*	6m	6cm	0	
11	*L. confertus*	4m	4cm	0	
12	*L. confertus*	3m	4cm	0	
13	*L. confertus*	6m	3cm	0	
14	*L. confertus*	5m	5cm	0	
15	*L. confertus*	5m	10cm	0	
16	*E. pilularis*	25m	35cm	0	
17	*E. pilularis*	25m	40cm	0	
18	*E. pilularis*	24m	48cm	0	
19	*E. pilularis*	26m	41cm	0	
20	*E. pilularis*	28m	30cm	0	
21	*E. pilularis*	26m	38cm	0	
22	*E. pilularis*	23m	41cm	0	
23	*E. pilularis*	25m	28cm	0	
24	*E. pilularis*	21m	29cm	0	
25	*C. intermedia*	24m	35cm	0	
26	*L. confertus*	6m	15cm	0	
27	*L. confertus*	10m	15cm	0	
28	*L. confertus*	11m	10cm	0	
29	*L. confertus*	4m	5cm	0	
30	*L. confertus*	3m	5cm	0	

Field Site No: 31					
GPS: 545891; 6883395					
Brief description: Regrowth forest - gentle westerly aspect					
Tree	Species	Height	DBH	Scats (1 = yes; 0 = no)	Notes
Centre tree (Reason for choice: Secondary feed tree species)	*Eucalyptus pilularis*	9m	15cm	0	
2	*E. pilularis*	6m	5cm	0	
3	*E. pilularis*	4m	6cm	0	
4	*E. pilularis*	5m	6cm	0	
5	*E. pilularis*	2m	4cm	0	
6	*E. pilularis*	5m	7cm	0	
7	*E. pilularis*	7m	8cm	0	
8	*Corymbia intermedia*	6m	10cm	0	
9	*E. pilularis*	6m	8cm	0	
10	*E. pilularis*	6m	6cm	0	
11	*E. pilularis*	4m	4cm	0	
12	*E. pilularis*	3m	4cm	0	
13	*E. pilularis*	6m	3cm	0	
14	*E. pilularis*	5m	5cm	0	
15	*C. intermedia*	5m	10cm	0	
16	*C. intermedia*	5m	5cm	0	
17	*Lophostemon confertus*	5m	4cm	0	
18	*L. confertus*	4m	8cm	0	
19	*L. confertus*	6m	4cm	0	
20	*L. confertus*	8m	9cm	0	
21	*E. pilularis*	6m	8cm	0	
22	*E. pilularis*	3m	4cm	0	
23	*E. pilularis*	5m	8cm	0	
24	*E. pilularis*	2m	2cm	0	
25	*E. pilularis*	4m	5cm	0	
26	*E. pilularis*	6m	5cm	0	
27	*E. pilularis*	5m	7cm	0	
28	*E. pilularis*	6m	5cm	0	
29	*E. pilularis*	4m	5cm	0	
30	*E. pilularis*	3m	5cm	0	