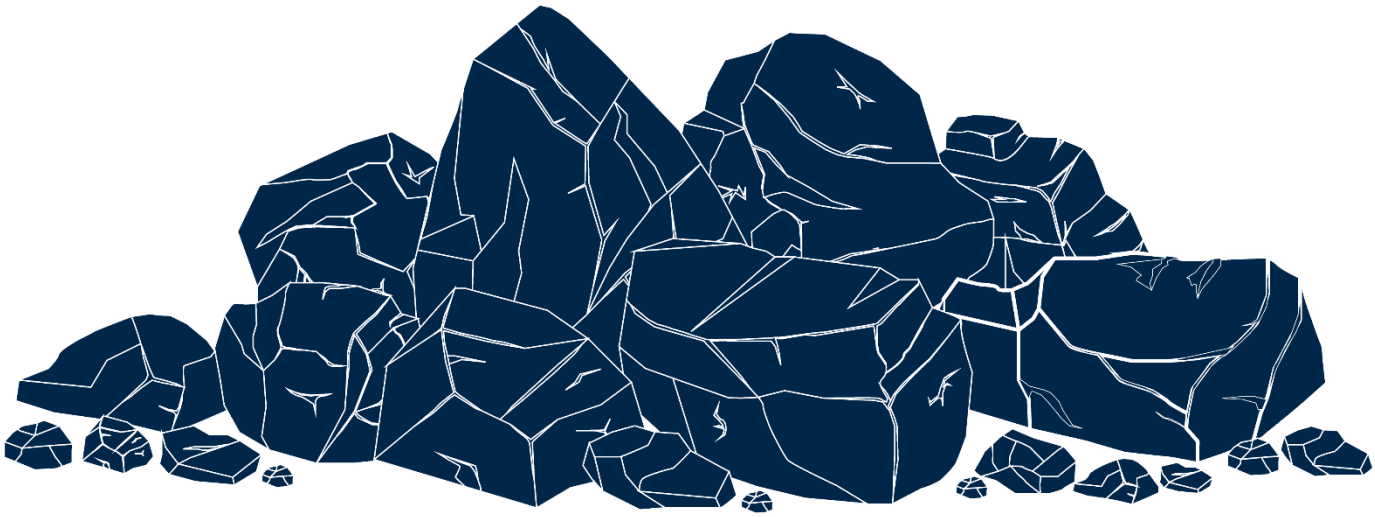
Karuah East Quarry
ABN: 80 141 505 035
Karuah East Quarry Pty Limited
Blue Rock Close, Karuah NSW 2324

W: www.hunterquarries.com.au
E: admin@hunterquarries.com.au
T: 02 4050 0304
P: PO Box 3284, Thornton NSW 2322

Karuah East Quarry

Biodiversity Offset Strategy

February 2026



Revision History

Version	Date Reviewed	Author	Status	Amendment Details
1	July 2013	ELA	Endorsed by GLC and OEH.	Original Biodiversity Offset Strategy developed to satisfy Schedule 3, Condition 28 of the Project Approval and Condition 7 & 8 of the EPBC Approval.
2A	September 2025	KEQPL	Draft for Consultation	Comprehensive review following receipt of EPBC Approvals (EPBC 2014/7272 – Variation 2 and EPBC 2022/9164) for the KEQ MOD10 Stockpile Extension Project.
2B	October 2025	KEQPL	Draft for Submission	Updated following consultation with the CPHR Group within the NSW DCCEEW (PAE-93287988) and MidCoast Council (PAE-93287986).
2C	February 2026	KEQPL	Draft for Submission	Updated for NSW Planning comments.

Contents

Terms, Definitions and Abbreviations

Abbreviation / Term	Meaning
BBAM	Biobanking Assessment Methodology (former)
BC Act	NSW *Biodiversity Conservation Act 2016*
BCF	Biodiversity Conservation Fund
BDAR	Biodiversity Development Assessment Report
BOS	Biodiversity Offset Strategy
BSA	Biodiversity Stewardship Agreement
Commonwealth DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water
CPHR	Conservation Programs, Heritage and Regulation Group within the NSW DCCEEW
EA	Environmental Assessment
EBOA	Eastern Biodiversity Offset Area
EIS	Environmental Impact Statement
ELA	EcoLogical Australia
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
GLC	Great Lakes Council (former)
Ha	Hectare
HME	Heavy Mining Equipment
IPC	NSW Independent Planning Commission
KEQ	Karuah East Quarry
KEQ BOA	Original Karuah East Quarry Biodiversity Offset Area
KEQPL	Karuah East Quarry Pty Limited
KLF	Kleinfelder
LGA	Local Government Area
MCC	MidCoast Council
MNES	Matters of National Environmental Significance
MOD1	Modification 1 to the NSW Project Approval
MOD2	Modification 2 to the NSW Project Approval
MOD10	Modification 10 to the NSW Project Approval
NSW BCT	NSW Biodiversity Conservation Trust
NSW BOS	NSW Biodiversity Offset Scheme
NSW DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water
NSW Planning	NSW Department of Planning, Housing and Infrastructure
NSW OEH	NSW Office of Environment and Heritage (former)
PCT	Plant Community Type
tpa	tonnes per annum
TSC Act	NSW *Threatened Species Conservation Act 1995* (former)
Variation 1	Variation 1 to the Commonwealth EPBC Approval (EPBC 2014/7282)
Variation 2	Variation 2 to the Commonwealth EPBC Approval (EPBC 2014/7282)
WBOA	Western Biodiversity Offset Area

1.0 Introduction

Karuah East Quarry Pty Limited (KEQPL) has prepared this Biodiversity Offset Strategy (BOS) for the Karuah East Quarry (KEQ) to satisfy the requirements outlined in Schedule 3, Condition 28 of the Project Approval (MP09_0175).

1.1 Overview

KEQPL operates the KEQ site, located approximately 5 km northeast of the township of Karuah, in the MidCoast Council (MCC) Local Government Area (LGA). KEQ supplies hard rock quarry products to the construction, infrastructure and land development industries, within the Greater Newcastle, Hunter Valley and Mid-North Coast regions.

Project Approval (MP09_0175) was granted for the KEQ on 17 June 2014 by the Independent Planning Commission (IPC) (formerly the NSW Planning Assessment Commission) on behalf of the Minister for Planning and Public Spaces (formerly Minister for Planning).

Commonwealth Approval (EPBC 2014/7282) was originally granted for KEQ under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 20 March 2015. This was subsequently varied (Variation 2) on 07 May 2025 to facilitate the KEQ MOD10 Stockpile Extension Project (MOD10) which was subject to an additional Controlled Action with subsequent EPBC Approval (EPBC 2022/9164) being granted on 02 July 2025.

The KEQ site has approval to extract, process, stockpile and transport up to 1.5 million tonnes of andesite material annually until 2034.

1.2 Project Site

The KEQ site is located off the Pacific Highway (via Blue Rock Close) and is situated on the following lands:

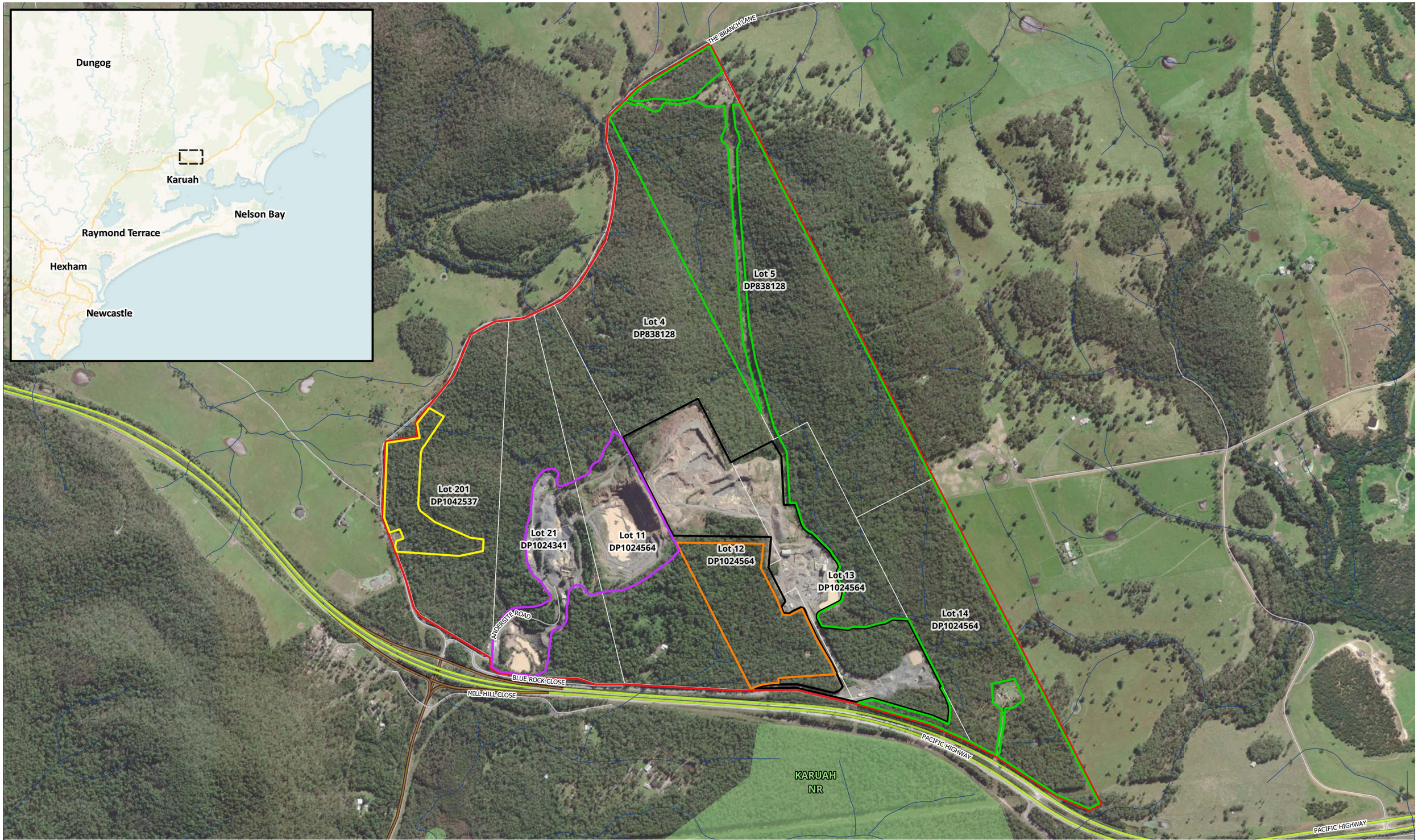
- Lot 12 (Lot 12) and 13 DP1024564 (Lot 13) consisting of the KEQ site;
- Lot 14 (Lot 14) and part Lot 13 DP1024564 (Lot 13) and Lot 5 DP838128 (Lot 5) consisting of the Eastern Biodiversity Offset Area (EBOA); and
- Part Lot 201 DP1042537 (Lot 201) consisting of the Western Biodiversity Offset Area (WBOA).

Figure 1 illustrates the site locality and regional context whilst **Figure 2** illustrates the KEQ site along with the associated EBOA and WBOA.

1.3 Summary of the NSW Project Approval (MP09_0175)

The key features of the Project Approval include the following key elements:

- The extraction (excluding overburden), processing, stockpiling, and transport of quarry products is limited to 1.5 million tonnes in any calendar year;
- Quarrying operation is permitted on the site until 31 December 2034;
- Establishment and use of quarry plant and associated infrastructure;
- Vegetation removal;
- A total permitted disturbance area of 40.18 ha on Lots 12 and 13 DP 1024564;
- Roadworks to secure access to the site including upgrade and extension of Blue Rock Close, realignment of the Andersite Road and Blue Rock Close intersection and adjust road markings at Branch Lane and Andersite Road intersection;
- Establishment of a biodiversity offset area;
- Conditions apply to manage / mitigate potential impacts associated with a range of environmental conditions including noise, blasting, air quality, soil and water, transport, biodiversity, heritage, emergency and hazards management and waste; and
- Progressive rehabilitation of the subject site.



- Karuah Quarry Complex Site Boundary
- Karuah Hard Rock Quarry (DA 26-10-265)
- Karuah Hard Rock Quarry Conservation Offset Area
- Karuah East Quarry (MP09_0175_MOD10)
- Karuah East Quarry Eastern Biodiversity Offset Area
- Karuah East Quarry Western Biodiversity Offset Area
- Cadastre
- National Park
- Watercourse
- Primary Road
- Arterial Road
- Local Road

Figure 1: Regional Context and Site Locality Plan

0.25 0.5 0.75 1 km

WEDGETAIL
PROJECT CONSULTING PTY LTD

Map Produced: 10/02/2026
Produced By: Keryn Dowling
GDA2020 / MGA zone 56

Karuah Quarry Complex Site Boundary

Karuah East Quarry (MP09_0175_MOD10)

Karuah East Quarry Eastern Biodiversity Offset Area

Karuah East Quarry Western Biodiversity Offset Area

Plant Community Types

PCT 3174: Northern Turpentine-Brush Box Wet Forest

PCT 3248: Northern Blackbutt-Turpentine Shrub Forest

PCT 3433: Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest

PCT 3581: Hunter Coast Foothills Apple Forest

PCT 3581: Hunter Coast Foothills Apple Forest (Sydney Peppermint Variant)

Trail / Cleared

Dam

Watercourse

Figure 2: KEQ & BOA Site Locality Plan

0.25 0.5 0.75 1 km

WEDGETAIL PROJECT CONSULTING PTY LTD

Map Produced: 10/02/2026
Produced By: Keryn Dowling
GDA2020 / MGA zone 56

1.4 Modifications to the NSW Project Approval (MP09_0175)

The Project Approval has been modified five times as summarised by **Table 1**.

Table 1 Summary of Modifications to the Project Approval.

MOD	Approval Date	Summary
1	27/04/2018	MOD 1 approved a nominal expansion to the approved area of disturbance by 2,500 m² to allow for improved vehicle manoeuvring in proximity of the crushing plant and processing area.
2	19/12/2018	MOD 2 approved a 1.133 Ha increase to the site disturbance area to allow for improved environmental management and improved operational safety (for quarry vehicles).
3 – 7 withdrawn		
8	22/12/2020	MOD 8 approved revised operational acoustic criteria in line with the *NSW Noise Policy for Industry 2017.* MOD 8 also formalised a number of industry best practice acoustic mitigation measures that have been installed at the quarry. No change to disturbance footprint occurred.
9	02/12/2021	MOD 9 extended the approved operating hours of the KEQ. No change to disturbance footprint occurred.
10	18/05/2023	MOD 10 provides approval to increase the disturbance area of the KEQ by 7.17 Ha (bringing the total disturbance area of the KEQ to 40.18 Ha). The purpose of MOD 10 was to increase the approved disturbance area to establish additional stockpiling areas, facilitate improved surface water management, construct a new administrative building and expand the vehicle manoeuvring and parking at site.

1.5 Commonwealth EPBC Approvals

EPBC 2014/7282

KEQPL received the original EPBC Approval (EPBC 2014/7282) on 20 March 2015 and has subsequently been subject to two variations to date, as summarised by **Table 2**.

Table 2 Summary of Variations to the Commonwealth EPBC Approval (EPBC 2014/7282).

MOD	Approval Date	Summary
–	20/03/2015	Original approval granted for the site under Commonwealth Environment Protection and Biodiversity Conservation Act 1999.
1	04/10/2018	Variation 1 was required as a result of MOD1 to the NSW Project Approval which impacted upon 0.25 Ha of native vegetation.
NOTE: MOD2, MOD8 and MOD9 to the NSW Project Approval did not necessitate any variations due to: ▪ MOD2 did not disturb any Matters of National Environmental Significance (MNES); and ▪ MOD8 and MOD9 did not change the KEQ disturbance footprint.		
2	07/05/2025	Variation 2 was required as a result of MOD10 to the NSW Project Approval which consisted of 7.17 Ha increase in land disturbance and associated clearing of 6.98 Ha of native vegetation from an existing Biodiversity Offset Area.

EPBC 2022/9164

The KEQ MOD10 Stockpile Extension Project (MOD10) was approved under the Bilateral Agreement between the NSW Government and the Commonwealth Government following confirmation from the Commonwealth DCCEEW that MOD10 was a Controlled Action on 13 May 2022.

EPBC Approval (EPBC 2022/9164) was then subsequently granted on 02 July 2025 authorising additional disturbance of 7.17 Ha and associated clearing of 6.98 Ha of native vegetation.

1.6 Agency Consultation for this Strategy

This BOS for the Karuah East Quarry has been prepared in accordance with the requirements of the Project Approval, including the requirement for consultation with MidCoast Council (MCC) and the Conservation Programs, Heritage and Regulation Group (CPHR) of the NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW).

MidCoast Council

Consultation with MCC regarding this BOS was completed on 08 September 2025 via the NSW Major Projects Planning Portal (PAE-93287986). The consultation submission was acknowledged by MCC's representative at the KEQ Community Consultative Committee meeting on 22 September 2025; with a response being provided via email on 04 November 2025 (**Appendix A**).

MCC requested the draft BOS be updated to include discussion regarding the application of local offsetting opportunities within the local area (i.e. the Port Stephens – Karuah River catchment area or within the MCC Local Government Area [LGA]). This has been updated by the inclusion of details provided by **Section 6.0** and summarised by **Table 3**.

NSW Conservation Programs, Heritage and Regulation Group

Consultation with CPHR regarding this BOS was completed on 08 September 2025 via the NSW Major Projects Planning Portal (PAE-93287988). The consultation submission was acknowledged by CPHR on 29 September 2025 with an Extension of Time request until 20 October 2025; however, no final response or comments were received (**Appendix A**).

NSW Department of Planning, Housing and Infrastructure

Following completion of agency consultation, this BOS document was submitted to the NSW Department of Planning, Housing and Infrastructure (NSW Planning) on 24 October 2025 for approval by the NSW Planning Secretary (or delegate).

NSW Planning provided the following commentary on 27 January 2026 as summarised by **Table 3**.

Table 3 Summary of Agency Consultation.

Agency	Date	Agency Comment	KEQPL Response
MidCoast Council	08/09/2025	Submission of BOS document to MCC via NSW Major Projects Planning Portal for agency consultation.	
	22/09/2025	Acknowledgement of the consultation submission was provided by MCC's representative at the KEQ Community Consultative Committee meeting.	
	04/11/2025	*We request that the Draft BOS not be finalised until such time as it has been amended to include discussion as to whether there are local offsetting opportunities and how these opportunities have been researched.*	**Section 6.0** included to address application of local offsetting opportunities.
CPHR	08/09/2025	Submission of BOS document to CPHR via NSW Major Projects Planning Portal for agency consultation.	
	29/09/2025	Acknowledgement of the consultation submission was provided with CPHR extending the consultation period until 20 October 2025. However, no response was subsequently received.	
NSW Planning	24/10/2025	Submission of BOS document to NSW Planning via NSW Major Projects Planning Portal following completion of the extended agency consultation period.	
	04/11/2025	Provision of advice received from MCC to NSW Planning via email.	
	27/01/2026	▪ *update the cross-references in the third column of Table 3 to refer to the correct sections within the Strategy*;	**Table 4** (previously Table 3) has been updated to reflect cross-references to the appropriate document section.
		▪ *update the header in Table 11 to refer to species credits (not ecosystem credits);*	Typographical error in the caption for **Table 12** (previously Table 11) has been corrected.
		▪ *update the vegetation mapping on Figure 3 and Figure 4 to show all dams. Note the dam located within the area mapped as PCT 3581 and the dam to the north-east of the processing plant within the area mapped as PCT 3248 within the Eastern Biodiversity Offset Area;*	**Figure 3** and **Figure 4** have been updated to more clearly identify farm dams that remain within the EBOA and WBOA.
		▪ *update the native vegetation areas listed in Table 8 to account for the additional dams to be shown on Figure 3 and Figure 4;*	**Table 9** (previously Table 8) has been updated to reflect vegetation areas provided by **Figure 3** and **Figure 4**.
		▪ *update the Strategy to address any feedback received from Mid-Coast Council or the Conservation Programs, Heritage and Regulation Group since the document was lodged with the Department for review and approval.*	Additional information provided by **Section 6.0** and summarised by this table, **Table 3**.

2.0 Regulatory Requirements

2.1 Requirements of the NSW Project Approval (MP09_0175)

The requirements of the Project Approval are summarised by **Table 4**.

Table 4 Summary of Relevant Conditions of the Project Approval.

<table>
<tr><th>No</th><th>Requirements</th><th>Section</th></tr>
<tr><td colspan="3">Schedule 3 – Environmental Performance Conditions</td></tr>
<tr><td rowspan="4">Condition 28</td><td><u>Biodiversity Offset Strategy</u>
The Applicant must, prior to the commencement of vegetation clearing activities for Modification 10, finalise the Biodiversity Offset Strategy, as described in documents listed in Condition 2 of Schedule 2, summarised in Table 10 and Table 11 and shown conceptually in Figure 1 of Appendix 4, in consultation with BCD and Council, and to the satisfaction of the Planning Secretary.</td><td>Whole Document</td></tr>
<tr><td>Table 10: Biodiversity Offset Strategy – land-based offsets
<table>
<tr><th>Area</th><th>Offset Type</th><th>Minimum Size</th></tr>
<tr><td>Offset Area</td><td>Existing vegetation to be managed and enhanced</td><td>130.36 Ha</td></tr>
</table></td><td>Section 4.2</td></tr>
<tr><td>Table 11: Biodiversity Offset Strategy – ecosystem and species credit requirements
<table>
<tr><th>Credit Type</th><th>Credits Required</th></tr>
<tr><td colspan="2">Ecosystem Credits</td></tr>
<tr><td>PCT 1619: Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands</td><td>188</td></tr>
<tr><td>PCT 695: Blackbutt – Turpentine – Tallowwood shrubby open forest of the coastal foothills of the central NSW North Coast Bioregion</td><td>7</td></tr>
<tr><td>Total:</td><td>195</td></tr>
<tr><td colspan="2">Species Credits</td></tr>
<tr><td>Tetratheca juncea (Black-eyed Susan)</td><td>260</td></tr>
<tr><td>Grevillea parviflora subsp. Parviflora (Small-flower Grevillea)</td><td>250</td></tr>
<tr><td>Squirrel Glider (Petaurus norfolcensis)</td><td>260</td></tr>
<tr><td>Southern Myotis (Myotis Macropus)</td><td>107</td></tr>
<tr><td>Total:</td><td>195</td></tr>
</table>
NOTES:
1. The Biodiversity Offset Strategy must direct that the land proposed as the Offset Area must be free of any dwelling-houses and associated sheds, bushfire asset protection zones and other related utilities or structures so as to preserve the integrity and function of that offset area. The Biodiversity Offset Strategy must provide details of the revegetation of any parts of the offset area that are cleared of native vegetation or are in an otherwise substantially modified state, other than required management trails and boundary fencing buffer distances.
2. Credits required for impacts to EPBC Act listed species and associated habitats must be like-for-like.

The Applicant must implement the strategy as approved by the Planning Secretary.</td><td>Section 5.0</td></tr>
<tr><td><u>Long Term Security of Offsets</u>
The long-term security of the offset area listed in Table 10 and the retirement of credits listed in Table 11 must be carried out prior to the commencement of vegetation clearing activities for Modification 10, in consultation with BCD and in accordance with the Biodiversity Offset Scheme of the BC Act, or other agreed security mechanism, to the satisfaction of the BCT.</td><td>Section 4.1</td></tr>
</table>

2.2 Requirements of the Commonwealth EPBC Approvals

The requirements of the Commonwealth EPBC Approvals are summarised by **Table 5** and **Table 6** for the 2014 and 2022 EPBC Approvals respectively.

Table 5 Requirements of the 2014 Commonwealth EPBC Approval (EPBC 2014/7282).

No	Requirements	Section
	Offsets	
Condition 7	*The person taking the action must comply with the offset conditions set out in the **NSW Project Approval**.*	**Section 4.0 & Section 5.0**
Condition 8	*Prior to the **commencement of construction**, to compensate for the impact to **Trailing Woodruff** and habitat for the **Koala**, the person undertaking the action must secure suitable offset sites consistent with the **Karuah East Quarry EPBC Act Assessment Report**. In the case that the offsets for **Trailing Woodruff** or habitat for the **Koala** consistent with those set out in the **Karuah East Quarry EPBC Act Assessment Report** cannot be secured, alternate offset sites must be secured, consistent with the **EPBC Act Offsets Policy**.*	**Section 4.0**
Condition 9A	*To compensate for the excised area, in accordance with the Memo at Annexure B, of part of the offset site provided in accordance with condition 8), the person taking the Action must within 24 months of the date of this variation decision, **secure** a replacement offset site (the 'western offset site') in accordance with the terms of the Memo at Annexure B and meeting the requirements of the **EPBC Act Offsets Policy** to the satisfaction of the **Minister**. The person taking the Action must not excise any part of the offset site provided in accordance with condition 8), unless the **Minister** has advised in writing that the western offset site meets the requirements of the **EPBC Act Offsets Policy** to the satisfaction of the **Minister**.*	**Section 4.2 & Section 4.3**

Table 6 Requirements of the 2022 Commonwealth EPBC Approval (EPBC 2022/9164).

No	Requirements	Section
	Offsets	
Condition 3	*To compensate for impacts to **protected matters**, the approval holder must **retire biodiversity credits**, in accordance with Schedule 3, condition 28 and 29 of the **State development consent**, to the extent that these conditions relate to **protected matters**.*	**Section 5.0**

3.0 History of Approvals and Biodiversity Offset Obligations

3.1 Original Karuah East Quarry Project

Approved Impacts

The approved KEQ Project authorised land disturbance of 31.64 Ha that impacted upon 28.09 Ha of native vegetation as outlined by the Preferred Project Report (RPS, 2013), that consisted of:

- 20.38 Ha of Spotted-gum ironbark forest,
- 7.31 Ha of Smooth-barked apple forest, and
- 0.40 Ha of Dry rainforest.

RPS (2013) also identified threatened flora species, including:

- 243 individuals of *Tetratheca juncea* (Black-eyed Susan) to be directly impacted; and
- 9 patches of *Grevillea parviflora subsp. parviflora* (Small-flower Grevillea) within the study area but not directly impacted.

Further surveys by ELA (2013) for the Commonwealth EPBC Assessment Report identified additional impacts to threatened species, including:

- 60 individuals of *Asperula asthenes* (Trailing Woodruff); and
- 24.04 Ha of Koala (*Phascolarctos cinereus*) habitat.

These impacts resulted in the generation of offset obligations within both NSW and Commonwealth legislative frameworks under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and Commonwealth EPBC Act respectively.

NSW Biodiversity Offset Strategy

At the NSW level, the project was proposed to be offset through the provision of an on-site Biodiversity Offset Area (KEQ BOA) consisting of a minimum of 129.32 Ha of similar vegetation located across Lot 5, part Lot 13 and Lot 14, representing an "offsetting ratio" of 4.6:1 compensating for the loss of native vegetation (ELA, 2013).

It should be noted, whilst the KEQ BOA did not directly offset the Dry Rainforest component of the impacted vegetation, 30.77 Ha of moist forest of other types were included in the offset package which was subsequently supported by the former NSW Office of Environment & Heritage (OEH) at the time of approval in correspondence dated 23 September 2015.

In relation to threatened flora species, additional offset allowances were made for threatened species, in accordance with the BBAM Calculator that was in-force at the time for *Tetratheca juncea* (Black-eyed Susan) and *Grevillea parviflora subsp. parviflora* (Small-flower Grevillea).

This original Biodiversity Offset Strategy (BOS) was developed to satisfy the requirements of Schedule 3, Condition 28 of the Project Approval and was endorsed by the OEH on 23 September 2015 and by the former Great Lakes Council (GLC) on 01 October 2015. A copy is provided by **Appendix D** for further details.

Commonwealth EPBC Assessment Report

In similar fashion, the Commonwealth EPBC Assessment Report (ELA, 2014) considered the adequacy of proposed offsets contained in the KEQ BOA for MNES, in accordance with the EPBC Offsets Calculator that was in-force at the time.

This assessment and calculations considered the proposed KEQ BOA, inclusive of Lot 5, provided adequate offsets for the following threatened species:

- *Asperula asthenes* (Trailing Woodruff);
- *Tetratheca juncea* (Black-eyed Susan); and
- Koala (*Phascolarctos cinereus*).

The Commonwealth EPBC Approval (EPBC 2014/7282) was then subsequently approved on 20 March 2015.

3.2 KEQ MOD1 Project – Minor Additional Disturbance

The KEQ MOD1 Project consisted of minor additional disturbance of 2,500 m^2 to improve the area available for the safe manoeuvrability of Heavy Mining Equipment (HME) and other quarry vehicles into and out of the operational plant and processing area.

This additional disturbance area consisted of native vegetation that included MNES (i.e. 13x individuals of *Tetratheca juncea*) and therefore triggered additional biodiversity offset obligations as outlined and calculated by the Flora and Fauna Assessment (Kleinfelder, 2017) that was used to support the Modification Application to the Project Approval. An extract of this assessment consisting of the biodiversity offset calculations are provided by **Appendix C**.

However, the original KEQ BOA consisting of native vegetation across Lot 5, part Lot 13 and Lot 14, was resurveyed increasing the protected area to be conserved and additional *Tetratheca juncea* clumps and *Asperula asthenes* individuals were identified during secondary surveys by KLF (2016) following the finalisation of the acquisition of Lot 5 and formal inclusion within the KEQ BOA. Therefore, the additional offsetting obligations were able to be accommodated by the existing KEQ BOA without any material changes.

Application of these calculations increased the required area of the KEQ BOA from 129.32 to 130.36 Ha under Schedule 3, Condition 28 of the Project Approval using the existing "offsetting ratio" of 4.6:1; and necessitated a variation (Variation 1) consisting of minor mapping updates to the 2014 EPBC Approval.

3.3 KEQ MOD2 Project – Minor Additional Disturbance

The KEQ MOD2 Project consisted of minor additional disturbance of 1.133 Ha to facilitate the development of a dedicated light vehicle access road from the existing weighbridge to the quarry site office that was separated from the original main haul road used by HME's, other quarry-vehicles and heavy road transport vehicles.

The additional land disturbance required for the project consisted largely of land that was historically cleared, whilst the remaining area of 0.57 Ha consisted of highly degraded and managed vegetation that was below the native vegetation clearing threshold of 1.00 Ha was in force at the time for the KEQ site. Additionally, no Commonwealth MNES were impacted by the project (Kleinfelder, 2018).

Therefore, the project did not trigger the need for any additional biodiversity offsets at either NSW or Commonwealth levels.

3.4 KEQ MOD10 Project – Stockpile Extension

The KEQ MOD10 Project consisted of addition disturbance of 7.17 Ha to facilitate the development of an extended stockpile area to support the continued growth of the Hunter Quarries' business, across three distinct areas, including:

- Northern Disturbance Area, consisting of 0.17 Ha of unencumbered land;
- Central Disturbance Area, consisting of 4.91 Ha of land within the existing KEQ BOA; and
- Southern Disturbance Area, consisting of 2.09 Ha of land within the existing KEQ BOA.

In total, this additional land disturbance consists of 6.98 Ha of native vegetation, of which 6.81 Ha is from within the existing KEQ BOA (i.e. Central and Southern Disturbance Areas), triggering the requirement for both additional and replacement biodiversity offsets at both NSW and Commonwealth levels.

The treatment of these biodiversity offset obligations is separated between new clearing under the current legislative frameworks currently in force and replacement offsets aimed at maintaining compliance with previous offset commitments outlined in **Section 3.1** and **Section 3.2**.

Firstly, additional biodiversity offsets for 'new' clearing will be secured through the retirement of biodiversity offset credits in accordance with the NSW Biodiversity Conservation Act 2016 (BC Act) and NSW Biodiversity Offsets Scheme (NSW BOS), as summarised by **Section 5.0**.

Secondly, a replacement biodiversity offset area will be established as the Western Biodiversity Offset Area (WBOA) on part Lot 201 with equivalent (or greater) biodiversity values determined on a 'like-for-like' basis to ensure compliance with previous offset commitments established under both NSW and Commonwealth levels as outlined by the MOD10 Biodiversity Development Assessment Report (BDAR) (Kleinfelder, 2023).

The replacement biodiversity values for native vegetation and threatened species are summarised below in **Table 7** and **Table 8** respectively.

Table 7 Replacement Biodiversity Values for Native Vegetation under NSW Obligations.

Level	Vegetation Community	Vegetation Area	Replacement Offset
NSW	*PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands*	6.51 Ha	minimum of 6.81 Ha of similar vegetation communities.
	PCT 695: Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central NSW North Coast Bioregion	0.30 Ha	

Table 8 Replacement Biodiversity Values for Species under NSW and Commonwealth Obligations.

Species	Replacement Offset Values
Tetratheca juncea (Black-eyed Susan)	2,730 individuals
Asperula asthenes (Trailing Woodruff)	No change
Grevillea parviflora subsp. parviflora (Small-flower Grevillea)	18 individuals
Koala (*Phascolarctos cinereus*)	0.82 Ha

4.0 Land-Based Offsets

4.1 Long-term Security Mechanism

In accordance with Schedule 3, Condition 28 of Project Approval, KEQPL is required to provide 130.36 Ha of native vegetation divided between the EBOA and the WBOA.

The mechanism to secure both the EBOA and WBOA in the long-term will be through the implementation of Biodiversity Stewardship Agreements (BSA) in accordance with the provisions of the BC Act.

Consultation with the NSW BCT was undertaken in November and December 2020 and NSW Planning in September 2023 with both agencies confirming support for this mechanism in accordance with Schedule 3, Condition 29 of the Project Approval.

4.2 Vegetation Communities

In accordance with Schedule 3, Condition 28 and Figure 1 of Appendix 4 within the Project Approval, KEQPL is required to conserve a minimum of 130.36 Ha of native vegetation. A summary of vegetation communities, as classified by the Plant Community Types (PCT) released in December 2023 (version C2.0), is provided by **Table 9** that confirms compliance with the total size of the obligated combined biodiversity offset areas.

Table 9 Vegetation Communities within the EBOA and WBOA.

Site	PCT	Vegetation Community	Vegetation Area	Total Native Vegetation
EBOA	PCT3174	Northern Turpentine - Brush Box Wet Forest	2.69 Ha	123.24 Ha
	PCT3248	Northern Blackbutt – Turpentine Shrub Forest	26.83 Ha	
	PCT3433	Hunter Coast Foothills Spotted Gum – Ironbark Grassy Forest	68.63 Ha	
	PCT3581	Hunter Coast Foothills Apple Forest	21.50 Ha	
	PCT3581	Hunter Coast Foothills Apple Forest (Sydney Peppermint Variant)	3.59 Ha	
WBOA	PCT3433	Hunter Coast Foothills Spotted Gum – Ironbark Grassy Forest	0.84 Ha	8.12 Ha
	PCT3581	Hunter Coast Foothills Apple Forest	7.27 Ha	
Total Biodiversity Offset Area:			**131.35 Ha**	
Total Biodiversity Offset Obligation:			**130.36 Ha**	
Compliance:			**Yes**	

Note: each BOA contains small areas of non-native vegetation, management trails and former farm dams. The total area of the EBOA is 124.46 Ha, and includes 0.62 Ha of Dams, and 0.60 Ha of Trails and/or Cleared Land. The total area of the WBOA is 8.28 Ha, and includes 0.07 Ha of Dams, and 0.09 Ha of Exotic Grassland.

4.3 Threatened Species

In accordance with the commitments made for the original KEQ Project (inclusive of the MOD1 amendments), as summarised by **Table 10**, it is confirmed that the layout of the EBOA and WBOA provides sufficient offsets for threatened species required under both NSW and Commonwealth levels.

NOTE – for the purposes of this assessment, the number of surveyed individuals of each flora species that was conserved by previous commitments have been used as the metric to consider the adequacy of the new offset arrangements, including secondary surveys by KLF (2016) following the finalisation of the acquisition of Lot 5 and formal inclusion within the KEQ BOA. This method ensures a conservative approach is undertaken to maintain the surpluses of conserved biodiversity values in the previous calculations associated with the former BBAM and EPBC credit calculators.

Table 10 Summary of Threatened Species within the EBOA and WBOA (NSW & Commonwealth Obligations).

Species	Offset Commitments		Total Offset Commitment (including MOD1)	Impact of KEQ MOD10 Project	Implemented Offsets (post-MOD10)			Compliance
	Part Lot 13 & Lot 14 (ELA, 2014)	Lot 5 (KLF, 2016)			EBOA	WBOA	Total Combined Offset	
Tetratheca juncea (Black-eyed Susan)	6,324 clumps	583 clumps	**6,907 clumps**	**2,730 clumps**	4,213 clumps	2,753 clumps	**6,966 clumps**	**Yes (Increased)**
Asperula asthenes (Trailing Woodruff)	120 individuals	279 individuals	**399 individuals**	–	399 individuals	–	**399 individuals**	**Yes (No change)**
Grevillea parviflora subsp. *parviflora* (Small-flower Grevillea)	100 stems (at least)	–	**100 stems (at least)**	**18 stems**	388 stems	117 stems	**505 stems**	**Yes (Increased)**
Koala (*Phascolarctos cinereus*)	86.29 Ha	–	**86.29 Ha**	**0.82 Ha**	85.47 Ha	0.84 Ha	**86.31 Ha**	**Yes (Increased)**

Karuah Quarry Complex Site Boundary

Karuah East Quarry (MP09_0175_MOD10)

Karuah East Quarry Eastern Biodiversity Offset Area

Karuah East Quarry Western Biodiversity Offset Area

Threatened Flora Species

- *Asperula asthenes*
- *Grevillea parviflora* subsp. *parviflora*
- *Tetratheca juncea*

Plant Community Type

- PCT 3174: Northern Turpentine-Brush Box Wet Forest
- PCT 3248: Northern Blackbutt-Turpentine Shrub Forest
- PCT 3433: Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest
- PCT 3581: Hunter Coast Foothills Apple Forest
- PCT 3581: Hunter Coast Foothills Apple Forest (Sydney Peppermint Variant)

Trail / Cleared

Dam

HydroLine

Figure 3: KEQ BOA Threatened Flora Species Surveyed Individuals Plan

0.25 0.5 0.75 1 km

WEDGETAIL PROJECT CONSULTING PTY LTD

Map Produced: 10/02/2026
Produced By: Keryn Dowling
GDA2020 / MGA zone 56

Karuah Quarry Complex Site Boundary

Karuah East Quarry (MP09_0175_MOD10)

Karuah East Quarry Eastern Biodiversity Offset Area

Karuah East Quarry Western Biodiversity Offset Area

Koala Habitat

Plant Community Type

PCT 3174: Northern Turpentine-Brush Box Wet Forest

PCT 3248: Northern Blackbutt-Turpentine Shrub Forest

PCT 3433: Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest

PCT 3581: Hunter Coast Foothills Apple Forest

PCT 3581: Hunter Coast Foothills Apple Forest (Sydney Peppermint Variant)

Trail / Cleared

Dam

HydroLine

Figure 4: KEQ BOA Threatened Fauna Species Habitat Plan

0.25 0.5 0.75 1 km

WEDGETAIL PROJECT CONSULTING PTY LTD

Map Produced: 10/02/2026
Produced By: Keryn Dowling
GDA2020 / MGA zone 56

5.0 Credit-Based Offsets

Biodiversity offsets for the 'new' direct impacts of the KEQ MOD10 Stockpile Extension Project will be secured by retiring biodiversity offset credits in accordance the NSW Biodiversity Offsets Scheme established under the NSW *Biodiversity Conservation Act 2016* (BC Act).

Retirement of credits will be completed prior to the commencement of any land clearing with the MOD10 disturbance area in accordance with the Schedule 3, Condition 28 of the Project Approval and Condition 3 of the 2022 EPBC Approval.

The credit obligations will be retired by way of purchase from the market or through contributions to the Biodiversity Conservation Fund (BCF), to the satisfaction of the NSW Biodiversity Conservation Trust (BCT).

A summary of the retirement of credits is provided by **Table 11** and **Table 12** for ecosystem and species obligations respectively.

Table 11 Summary of Retired Ecosystem Credit Obligations.

PCT ID	Vegetation Type	Credit Obligation	Retirement Status
PCT 1619	Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands	188	^Contribution to the BCF
PCT 695	Blackbutt – Turpentine – Tallowwood shrubby open forest of the coastal foothills of the central NSW North Coast Bioregion	7	^Contribution to the BCF

Notes:
^ at the time of writing, contributions to the BCF have been finalised with s6.33 certificates issued.

Table 12 Summary of Retired Species Credit Obligations.

Species	Credit Obligation	Retirement Status
Tetratheca juncea (Black-eyed Susan)	260	#*On-going sourcing
Grevillea parviflora subsp. parviflora (Small-flower Grevillea)	250	*On-going sourcing
Squirrel Glider (*Petaurus norfolcensis*)	260	+Credit Sales Agreement
Southern Myotis (*Myotis macropus*)	107	#Secured from market

Notes:
#at the time of writing, credits have been secured from the market;
+at the time of writing, credit sale agreements have been executed; and
**at the time of writing, sourcing of credits to meet the obligation remains on-going.*

6.0 Application of Local Offsetting Obligations

As part of agency consultation, MCC have requested that opportunities for local offsets be investigated when fulfilling the credit obligation generated as part of the KEQ MOD10 Stockpile Extension Project. MCC described local offsetting opportunities as the retirement of credits generated within the Port Stephens – Karuah River catchment area or within the MCC LGA.

In accordance with Schedule 3, Condition 29 of the Project Approval, prior to the commencement of vegetation clearing activities, KEQPL will retire all biodiversity credits required for the project in accordance with the NSW BOS, where by like-for-like credits will be retired.

It is noted that the like-for-like offsetting rules under the NSW BOS do allow offsetting to occur in a broader area than the Port Stephens – Karuah River catchment area or within the MCC LGA. However, KEQPL are committed to identifying local offsets, where practicable. As such, when identifying potential credits for purchase on the market, preference will be given to those occurring within the local area.

7.0 References

- ADW Johnson (2013). Environmental Assessment Report – Proposed Karuah East Hard Rock Quarry prepared by ADW Johnson Pty Ltd dated 31 January 2013.
- ADW Johnson (2018). Karuah East Quarry Section 75W Application (MOD 1) Minor Increase to Approved Disturbance Area prepared by ADW Johnson Pty Ltd dated March 2018;
- ADW Johnson (2018). Karuah East Quarry 75W Application (MOD 2) Minor Increase to Approved Disturbance Area prepared by ADW Johnson Pty Ltd dated August 2018;
- ADW Johnson (2022). Karuah East Quarry s4.55(2) Modification Report Proposed Increase to Approved Disturbance Area Modification 10 (MOD 10). Prepared by ADW Johnson Pty Ltd June 2022 (referred to as MOD 10).
- EcoLogical Australia (ELA) (2013). *Karuah East Quarry Biodiversity Offset Strategy*. Prepared for Karuah East Quarry Pty Ltd, July 2013.
- EcoLogical Australia (ELA) (2014). *EPBC Act Assessment Report: Karuah East Quarry – EPBC 2014/7282*. Prepared for Karuah East Quarry Pty Ltd, October 2014.
- Kleinfelder (2017). Flora and Fauna Impact Assessment Karuah East Quarry Project 09_0175 Modification 1 Application. Report Prepared for Karuah East Quarry Pty Ltd, October 2017.
- Kleinfelder (2018). Flora and Fauna Impact Assessment Karuah East Quarry Project 09_0175 Modification 2 Application. Report Prepared for Karuah East Quarry Pty Ltd, September 2018.
- Kleinfelder (2023). Biodiversity Development Assessment Report – Karuah East Quarry – MP 09_0175 Modification 10 Application. Prepared by Kleinfelder, May 2023.
- RPS Australia Pty Ltd (2013). *Terrestrial Ecology Survey and Assessment Report: Karuah East Quarry, Karuah NSW*. Prepared for Karuah East Quarry Pty Ltd, July 2013.

Appendix A: Agency Consultation (MidCoast Council & NSW CPHR)

MIDCOAST council

Internal Memo

Review of Draft Biodiversity Offset Strategy for Karuah East Quarry

Prepared by Mat Bell (Senior Ecologist)

20 October 2025

Background

This memo comments on the Draft Biodiversity Offset Strategy for the Karuah East Quarry. The Draft Strategy was prepared by Hunter Quarries and is dated September 2025.

The Draft Biodiversity Offset Strategy was prepared to address the requirements of Schedule 3 Condition 28 of the Project Approval MP09_0175. The Karuah East Quarry has approval to extract, process, stockpile and transport up to 1.5M tonnes of andesite material annually until 2034.

The Karuah East Quarry site comprises the extraction and processing area, as well as an Eastern Biodiversity Offset Area and a Western Biodiversity Offset Area (see below).

Karuah East Quarry Modification 10 was approved (NSW) on the 18 May 2023. It increased the disturbance area by 7.17-ha (6.98-ha of which contained native vegetation, and which was located within a Biodiversity Offset Area). EPBC Act approval was granted on 2 July 2025.

Schedule 3 Condition 28 of the NSW project approval required that prior to vegetation clearance activities, a Biodiversity Offset Strategy be finalised to address specified ecosystem and species credit requirements:

- PCT1619 – 188 credits
- PCT695 – 7 credits
- *Tetratheca juncea* – 260 credits
- *Grevillea parviflora* subsp *parviflora* – 250 credits
- Squirrel glider – 260 credits
- Southern myotis – 107 credits

The offset area must be appropriately secured prior to vegetation clearing. The existing offsets are secured as Biodiversity Stewardship Agreement (BSA) sites).

Consultation with MidCoast Council about the Biodiversity Offset Strategy is required under Condition 28.

The 2014 EPBC Act approval required compensating impacts to *Asperula asthenes* and koala habitat (Condition 8) and the 2022 approval required compliance with Condition 28 of the NSW approval.

The Draft BOS has identified that the offsets for the "new" direct impacts will be secured by retiring biodiversity offset credits under the NSW Biodiversity Offsets Scheme. This is via contribution to the Biodiversity Conservation Fund, Credit Sales Agreement, etc, as per:

- PCT1619 – 188 credits – contribution to the BCF
- PCT695 – 7 credits – contribution to the BCF
- *Tetratheca juncea* – 260 credits – in progress
- *Grevillea parviflora* subsp *parviflora* – 250 credits – in progress
- Squirrel glider – 260 credits – credit sales agreement
- Southern myotis – 107 credits – credits have been secured from the market

This Submission

This memo provides a review of the Draft Biodiversity Offset Strategy for the Karuah East Quarry.

Discussion

Firstly, we recognise that payment to the Biodiversity Conservation Fund is a legitimate form of offsetting under the current framework.

However, MidCoast Council has routinely asserted that biodiversity offsets for developments should be achieved proactively, strategically and locally. Our experience has been that most developments achieve their statutory offsetting requirements via payment to the BCF. However, to our knowledge, the agencies administering the BCF have never strategically invested into threatened species or PCT conservation anywhere on the MidCoast. The net effect is that there is biodiversity decline from the MidCoast, and conservation investment benefits are transferred to other regions. Recent reviews of the biodiversity offset scheme in NSW have identified payment to the BCF as a particular problem.

Council has consistently advocated that KEQ offsets be delivered locally. And KEQ has established and managed BSA areas on the site.

This Draft BOS for the Karuah East Quarry seeks to deliver most of the statutory offset requirements through contribution to the BCF.

Council believes that there are likely to be novel approaches to strategic local offsetting that are available. These could expand local conservation areas / reserves and / or deliver on regional connectivity priorities. The Draft BOS has not evaluated or discussed the availabilities or opportunities for local outcomes. It does not appear to have considered novel opportunities.

We request that the Draft BOS not be finalised until such time as it has been amended to include discussion as to whether there are local offsetting opportunities and how these opportunities have been researched.

Council has identified a range of local opportunities and is willing to work proactively to evaluate these opportunities with Hunter Quarries.

From: no-reply@majorprojects.planning.nsw.gov.au
Sent: Monday, 29 September 2025 2:04 PM
To: Scott Ellerton
Subject: Karuah East Quarry Project MP09_0175-PA-65 - PAE-93287988 - Change in due date

Dear Scott Ellerton,

Biodiversity and Conservation Division has changed the due date of the request for advice for the project Karuah East Quarry Project. Additional time is required to review the documents submitted and provide advice back to you.

The new due date for this task is 20/10/2025 .

Please access your profile for details of this update.

If you have any enquiries, please contact Biodiversity and Conservation Division through the Major Projects Portal in the first instance.

If you need to contact an officer, please contact Hunter Central Coast Mailbox on 0249273248 /at rog.hcc@environment.nsw.gov.au

To sign in to your account click here or visit the Major Projects Website.

Please do not reply to this email.

Kind regards

The Department of Planning and Environment

NSW GOVERNMENT

Subscribe to our newsletter

Appendix B: Correspondence with NSW Planning

Department of Planning, Housing and Infrastructure

Our ref: MP09_0175-PA-65

Scott Ellerton
Environment and Development Manager
Karuah East Quarry Pty Limited
PO Box 23
Karuah, NSW, 2324

12/02/2026

Subject: Biodiversity Offset Strategy – Karuah East Quarry

Dear Mr Ellerton

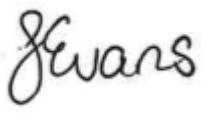
I refer to the Biodiversity Offset Strategy submitted in accordance with Condition 28, Schedule 3 of the consent for the Karuah East Quarry Project (MP09_0175). I also acknowledge your response to the Department's review comments and request for additional information.

The Department has carefully reviewed the document and is satisfied that it meets the requirements of the relevant conditions of consent. Accordingly, as nominee of the Planning Secretary, I approve the Biodiversity Offset Strategy (version 2C, dated February 2026).

You are reminded that if there are any inconsistencies between the Strategy and the conditions of consent, the conditions prevail.

Please ensure you make the document publicly available on the project website at the earliest convenience. If you wish to discuss the matter further, please contact James McDonough on 02 9585 6313.

Yours sincerely



Jessie Evans
Director, Resource Assessments
Resource Assessments

As nominee of the Planning Secretary

Appendix C: KEQ MOD1 Project – Biodiversity Offset Calculations

5.1 KARUAH EAST QUARRY BIODIVERSITY OFFSETS

Vegetation

Schedule 3, Condition 33 of the Project Approval for the Karuah East Quarry required a total of 129.32 ha of 'existing vegetation' to be managed as an offset for impacts on 28.09 ha of vegetation. This generates an offset to impact ratio of 4.60 to 1.

Following Project Approval, a survey of the Biodiversity Offset Area boundaries was conducted by a surveyor (data provided by ADW Johnson), and the final area of the offset was determined to be 138.22 ha, of which 131.44 ha is native vegetation (Kleinfelder, 2015).

Within the inclusion of the additional impact area for the modification, 0.25 ha, the total impact area of the Karuah East Quarry will be 28.34 ha. With the total native vegetation within the offset area being 131.44 ha, this equates to an offset to impact ratio of 4.64 to 1. As such the offset to impact ratio of the original approval will be maintained.

Tetratheca juncea

State Offset Calculations

The Karuah East Quarry project directly impacted on a total of 243 individual *T. juncea* clumps, which generated a total of 3,574 species credits. The Biodiversity Offset Area was initially assessed as containing 6,324 clumps, which generated a total of 37,994 species credits. As such there was a positive balance (surplus) of 34,420 species credits when assessing direct impacts.

When assessing both direct and indirect impacts at the time of the original application, the proposal impacted on a total of 1,575 individuals, which generated a total of 23,162 species credits. With consideration of the indirectly impacted clumps, the offset area contains a total of 4,992 clumps, generating a total of 29,952 species credits. This produces a positive balance (surplus) of 6,790 species credits, when assessing both direct and indirect impacts.

A further 583 clumps were subsequently identified by Kleinfelder (2016) within Lot 5, once it was acquired by the proponent (not previously surveyed for threatened species). As such this positive credit balance (surplus) is currently larger than initially assessed.

Under the BBAM calculator used for the original proposal, *T. juncea* generated 14.71 credits per clump at the impact site and 6 credits per clump at the offset site. The additional impacts of the modification; that is, direct impacts on 13 clumps and combined direct and indirect impacts on 29 clumps, would increase the species credits generated through direct impacts by

191.23 species credits, and both direct and indirect impacts by 426.59 species credits. As such, the positive balance (surplus) of species credits generated by the offset site, when assessing both direct and indirect impacts, would accommodate for these additional impacts on *T. juncea* due to the proposed modification.

Federal Offset Calculations

Eco Logical prepared an EPBC Act Assessment Report (2014), which included an assessment of the impacts on *T. juncea* using the EPBC Act offset calculator, required as part of the EPBC approval process for the original application (EPBC 2014/7282). This assessment concluded that the original approved project would fulfil 106.76% of the offset requirements for the impacts to *T. juncea* within the original impact area (**Table 2**). An assessment of the modification (including the original impact to 243 individuals) has also been conducted, to ensure the offset area would fulfil the offsetting requirements under the EPBC Act. This assessment used the same assumptions as used in the original Eco Logical report (2014), and includes the additional 583 *T. juncea* individuals identified within Lot 5 of the offset area. This assessment identified that the offset area would fulfil 104.72% of the offsetting requirements for the Karuah East Quarry, including the proposed modification area (**Table 2**).

Table 2: EPBC Act Offset calculations for *Tetratheca juncea*

Impact Calculator Attribute	Approved Project Offsets Calculations (Eco Logical, 2014)		Offsets Calculations including Modification	
	Impact Calculator Input	Notes	Impact Calculator Input	Notes
Number Impacted	243	-	256	-
Proposed Offset	6,324	Does not include Lot 5	6,907	Including counts within Lot 5
Risk Horizon	20 years	-	20 years	-
Start Value	6,324 individuals	-	6,907 individuals	-
Future Value without Offset	6,324 individuals	Assumed 3% decline (200 individuals)	6,700 individuals	Assumed 3% decline (207 individuals)
Future Value with Offset	6,424 individuals	Assumed 1.5% increase (100 individuals)	7,010 individuals	Assumed 1.5% increase (103 individuals)
Raw gain	300 individuals	As per Calculator	310 individuals	As per Calculator
Adjusted Gain	270 individuals	As per Calculator	279 individuals	As per Calculator
Net Present Value	259.42 individuals	As per Calculator	268.07 individuals	As per Calculator
Total % Residual impact offset	106.76%	As per Calculator	104.72%	As per Calculator

Based on the above calculations, the surplus biodiversity credits available within the established offset site can adequately accommodate the credits generated by the proposed modification at a state and Federal level.

Appendix D: Original KEQ Biodiversity Offset Strategy

Karuah East Quarry Biodiversity Offset Strategy

Prepared for
Karuah East Quarry Pty Ltd

July 2013

DOCUMENT TRACKING

ITEM	DETAIL
Project Name	Karuah East Quarry Biodiversity Offset Strategy
Project Number	13SYDENV-0002
Prepared by	Gordon Patrick, Dan McKenzie and Joanne Daley
Approved by	David Bonjer
Status	Final
Version Number	2
Last saved on	30 July 2013
Cover photo	Karuah East Quarry offset site – photos by GP & DM of ELA

This report should be cited as 'ELA 2013. *Karuah East Quarry Biodiversity Offset Strategy*. Prepared for Karuah East Quarry Pty Ltd by Eco Logical Australia.

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd.

Contents

List of Figures

List of Tables

Abbreviations

ABBREVIATION	DESCRIPTION
APZ	Asset Protection Zone
BAMCCOM	BioBanking Assessment Methodology and Credit Calculator Operational Manual
BBAM	BioBanking Assessment Methodology
BOS	Biodiversity Offset Strategy
CMA	Catchment Management Authority
DECC	Department of Environment & Climate Change (now OEH)
DP	Development Plan
EEC	Endangered Ecological Community
ELA	Eco Logical Australia Pty Ltd
GIS	Geographic Information System
GLC	Great Lakes Council
GPS	Global Positioning System
KEQ	Karuah East Quarry
LGA	Local Government Area
LEP	Local Environmental Plan
MZ	Management Zone
OEH	NSW Office of Environment and Heritage
SSD	State Significant Development
VZ	Vegetation Zone

1 Introduction

1.1 BACKGROUND AND PURPOSE OF THE OFFSET STRATEGY

Karuah East Quarry Pty Ltd (KEQ) propose to construct a quarry at Karuah in Great Lakes Local Government Area. The proposal is being assessed as a transitional Part 3A project under the provisions of the Environmental Planning and Assessment Act 1979.

To offset the biodiversity impacts of the quarry the proponent has committed to improve the condition and protect in perpetuity an area of 129 hectares of vegetation and habitat for threatened species on land adjoining the impact site. This Offset Strategy describes the land, its ecological values and the management strategies for its improvement.

The NSW Biobanking Assessment Methodology (BBAM) has been used to describe the site and quantify the ecological benefits of its conservation. The mechanism proposed to ensure protection and management of the site is a Conservation Agreement under the National Parks and Wildlife Act 1974.

1.2 OFFSET SITE LOCATION

The proposed KEQ offset site consists of three land parcels: Part Lot 13 DP 1024564 and Lot 14 DP 1024564 – Pacific Highway, Karuah in addition to Lot 5 DP 838128 The Branch Lane, Karuah. All three Lots are located in the Great Lakes Local Government Area (LGA). Lots 13 and 14 are in the ownership of KEQ. An option over Lot 5 is currently being negotiated by the proponent and the owner of Lot 5, and this is expected to be finalised in the very near future. At this time, the NSW DoPI will be notified in writing.

Access to Lot 5 is primarily from the north via The Branch Lane, while both Lots 13 and 14 are accessed by gated vehicular tracks from the Pacific Highway in the south. The combined site covers an area of 135.57 ha comprising both the 129 ha of remnant native vegetation and approximately 6.5 ha of cleared and modified lands that contain two existing dwellings, access roads and infrastructure.

1.3 BIOPHYSICAL CHARACTERISTICS OF THE OFFSET SITE

The site is located on the Lower North Coast of NSW. The site is overall undulating, but varies in slope and aspect considerably. Numerous steep, sometimes rocky, slopes and creek gullies are evident, particularly in the southern and central portions of Lot 5. The site has generally much lower relief in the southern section (Lots 13 and 14) which is generally sloping toward the Pacific Highway in the south with a more meandering watercourse and drainage line system. One main geology type occurs within and surrounding the site. The site is situated on the Nerong Volcanics which is dominated by rhyodacitic ignimbrite and comprises ignimbrite interbedded with tuffaceous sandstone and conglomerate. This soil landscape is characterised by colluvial (steeper slopes and ridgelines) and alluvial (lower elevations and watercourses) areas. The distribution of the dominant vegetation types supported in the site is closely related to the distribution of these two soil landscapes.

The site provides part of a contiguous patch of vegetation that provides as an important habitat corridor and habitat area to the north of and adjacent to Karuah Nature Reserve. The linkages are disturbed in the south by the upgraded Pacific Highway and to a lesser extent in the north and west by The Branch

Lane. Vegetation links to the east are present although the remnant vegetation is fragmented through the presence of pastures for grazing, although remnant vegetation is present along major watercourses. Several drainage lines intersect the site, generally flowing either from north to south-east in the southern portion of site and from south to north in the northern section of site (Lot 5). Hollow-bearing trees are scattered across the site, particularly along the larger watercourses where large hollows are evident. Larger hollows in living trees and stags were more commonly encountered in Lot 5 than in the other two lots. Fallen trees and timber are relatively common across all parts of the combined site, providing high quality habitat for ground-dwelling fauna.

A higher abundance and diversity of weed species occurs in the eastern portion of the site (mainly pasture grasses) adjacent to the grazing lands. Weed species also occur in high densities along the north-south power easement alignment and along some vehicle tracks. Other woody weeds (e.g. *Lantana camara*) are generally widely, but sporadically disbursed across the site, although at times becoming more dense in gullies and within and adjacent to watercourses. No obvious evidence of use of the site by feral animals was observed, although it is anticipated that species such as rabbits and foxes may be present in the vicinity.

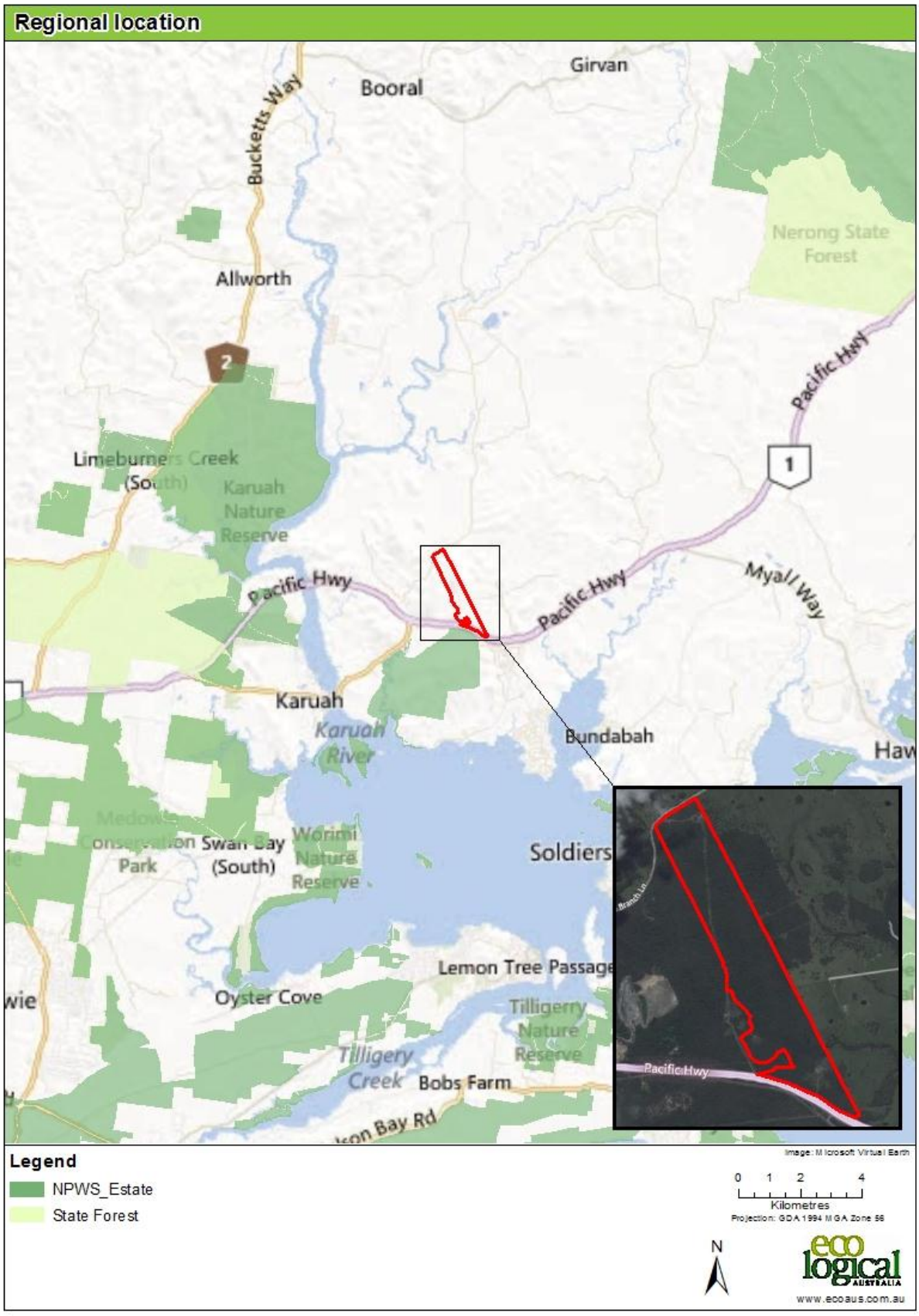


Figure 1: Study Area

Figure 2: Offset Site Boundary

1.4 LAND USE ZONING

The land use zoning of the proposed Offset site is currently 1(a) Rural Zone. Under the Draft Great Lakes Local Environmental Plan (LEP), 2013 the site is proposed to be zoned RU2 Rural Landscape. Within the RU2 zone, the following uses are proposed to be permitted with consent:

> *Agriculture; Airports; Airstrips; Animal boarding or training establishments; Backpackers' accommodation; Bed and breakfast accommodation; Boat launching ramps; Boat sheds; Camping grounds; Caravan parks; Cellar door premises; Cemeteries; Charter and tourism boating facilities; Child care centres; Community facilities; Correctional centres; Crematoria; Depots; Dual occupancies (attached); Dwelling houses; Eco-tourist facilities; Educational establishments; Environmental facilities; Environmental protection works; Exhibition homes; Extractive industries, Farm buildings; Farm stay accommodation; Flood mitigation works; Forestry; Hazardous storage establishments; Helipads; Heliports; Home-based child care; Home businesses; Hotel or motel accommodation; Industrial training facilities; Industries; Information and education facilities; Jetties; Kiosks; Landscaping material supplies; Marinas; Mooring pens; Moorings; Offensive storage establishments; Places of public worship; Plant nurseries; Public administration buildings; Recreation areas; Recreation facilities (indoor); Recreation facilities (major); Recreation facilities (outdoor); Registered clubs; Research stations; Roads; Roadside stalls; Rural industries; Rural supplies; Secondary dwellings; Sewerage systems; Signage; Transport depots; Truck depots; Veterinary hospitals; Water recreation structures; Water supply systems; Wharf or boating facilities*

1.5 SITE HISTORY AND CURRENT USES OF PROPERTY

The site was previously subject to logging / timber getting and cattle grazing regimes, although both practices have ceased on all three lots. Lots 13 and 14 are currently owned and managed by Karuah East Quarry, with Lot 5 currently in separate private ownership. Lots 14 and 5 both have residences with vehicle access to adjacent roads. Lot 5 also contains a power easement servicing the residence near The Branch Lane, running north-south and bisecting the lot. A network of old logging and fire trails are evident across all lots.

1.6 SURROUNDING LAND USES

The site is bounded by rural grazing properties to the north and east, where much of the remnant native vegetation has been removed, leaving primarily vegetation dominated by pasture grasses. To the south the upgraded Pacific Highway borders the site with Karuah Nature Reserve and other vegetated properties located beyond. Adjacent to the west is the existing Karuah hard rock quarry on Lots 11 and 21 (DP 1024341). Lot 21 is owned by KEQ and Lot 11 is privately owned rural property, including a single dwelling. To the northwest privately owned and naturally vegetated land is present on both sides of The Branch Lane (**Figure 2**). The vegetation in the site provides habitat connectivity to other patches of native vegetation.

1.7 IMPACTS OF QUARRY

The construction and development of the proposed new quarry and associated infrastructure is likely to directly disturb and permanently modify 28.09 ha of native vegetation occurring in Lots 12 and 13. The vegetation communities present in the development area and their equivalent biometric communities represented in the adjacent offset area are presented in **Table 1** and is based on information in RPS (2013). Note that ecological survey of the impact site did not include biometric data collection as this was not a requirement in the DGRs.

Table 1: Vegetation type within the development area (based on RPS, 2013)

VEGETATION COMMUNITY	EQUIVALENT BIOMETRIC VEGETATION TYPE	IMPACT AREA (HA)
Eucalyptus propinqua – Eucalyptus acmenoides – Corymbia maculata – Eucalyptus paniculata subsp paniculata Moist Sclerophyll Open Forest	Spotted Gum – Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin	20.38
Angophora costata – Corymbia gummifera - Eucalyptus capitellata Dry Sclerophyll Open Forest	Sydney Peppermint – Smooth barked Apple shrubby open forest on coastal hills and plains of the southern North Coast and northern Sydney Basin.	7.31
Backhousia myrtifolia Rainforest	Shatterwood-Giant Stinging Tree – Yellow Tulipwood dry rainforest of the North Coast and northern Sydney Basin	0.4
Total		**28.09**

Two threatened flora species have been recorded as occurring within or adjacent to the proposed development area, namely *Grevillea parviflora* subsp. *parviflora* and *Tetratheca juncea*. RPS (2013) states that there will be direct impact to 243 clumps of *Tetratheca juncea* but no direct impact to the *Grevillea parviflora*. RPS also state that there may be indirect impact to threatened flora within a 50m 'edge effects zone' due to weed invasion and changes in micro-climates such as dust associated with the operation of the quarry (**Table 2**)**.**

Whilst this Biodiversity Offset Strategy assesses the direct and indirect impacts as described in RPS (2013), ELA believes that the impacts are likely to be less than assumed by RPS. ELA understands that the haul road running past the main areas of *Tetratheca juncea* will be sealed and the crushing plant will be housed within an enclosed building thus significantly limiting the dispersion of dust. In terms of weed invasion a VMP is proposed to be prepared as part of this BOS and will include annual monitoring and weed management in the areas near the operational footprint. Hydrological changes are also not expected to be significant as stormwater will not be discharged into the *Tetratheca juncea* and nor will surface hydrology of the *Tetratheca juncea* habitat be significantly altered.

Table 2: Threatened flora species within the development area and edge effects zone (based on RPS, 2013)

THREATENED FLORA SPECIES	DIRECT IMPACT	POTENTIAL INDIRECT IMPACT	TOTAL POTENTIAL IMPACT
Tetratheca juncea (clumps)	243	1332	1575
Grevillea parviflora subsp. *Parviflora (stems)*	0	32	32

1.8 OVERVIEW OF APPROACH TO MANAGEMENT

The site will be managed using standard management actions, although several additional management actions will be required for the site, i.e. Cat and/or Fox control, exclude miscellaneous species, feral and/or native herbivore control, maintain flow regimes and control feral pigs (if present).

Management of the site includes actions required to initially bring the site to a maintenance level, as well as those actions that will be required in future years, including ongoing monitoring and maintenance.

The site will be fenced to exclude inappropriate activities such as rubbish dumping, grazing and vehicle access. Information signs at all entry points to the site will provide information on the use of the site as a Offset site. Other initial management tasks may include minor drainage line restoration, native vegetation planting, fire trail upgrades and Asset Protection Zone (APZ) slashing near existing residences.

Ongoing management costs address site maintenance (weed control, feral animal control, trail maintenance, APZ maintenance, rubbish removal and ecological burns) as well as monitoring (vegetation condition, ecological burn results and feral animal abundance).

2 Assessment of Proposed Offset Site

2.1 INTRODUCTION

This chapter provides an overview of the methods used to assess the offset site and the results of the Biobanking Assessment Methodology which were used to quantify the conservation outcomes of managing the offset site for conservation in-perpetuity. Whilst this BOS occasionally describes the Offset site as a 'Biobank site' this is done to enable ease of understanding how the Biobanking Assessment Methodology has been applied, however as described in section 3 it is proposed to use a Conservation Agreement under the NP&W Act to secure the conservation outcomes rather than actually Biobanking the site.

2.2 LANDSCAPE VALUES ASSESSMENT

2.2.1 Assessment Circles

The amount of vegetation currently within the 100 ha and 1000 ha assessment circles was calculated using ArcGIS at a scale of 1:10,000 **(Figure 3**). The amount of vegetation in the circles once the Offset site is established, and managed into the future, was also estimated in ArcGIS. The area of vegetation cover in hectares was calculated then converted to a percentage for each circle.

Table 3 summarises the results of the assessment for each circle. Both the 1000 ha and 100 ha assessment circles remain within the same native vegetation cover class before and after conservation of the offset site, at 71-80% and 91-100% respectively.

Table 3: Area of Vegetation in Each Assessment Circle Before and After the Offset Site

CIRCLE No.	CIRCLE TYPE	BEFORE BIOBANK	AFTER BIOBANK
1	1000 ha	720ha (71-80%)	725ha (71-80%)
	100 ha	91ha (91-100%)	92ha (91-100%)

2.2.2 Connectivity Assessment

A connectivity assessment was conducted for the site using the technique outlined in the Biobanking Assessment Methodology. The following aspects were considered:

- The width of the current and future connecting link
- The condition of the current and future connecting link (over-storey and mid-storey/ground cover)

The site lies within a large patch of vegetation that connects between the north-west (off site) and the south (on site) (**Figure 4**). The connecting vegetation is considered to be much the same as that found on site (i.e. moderate to good). The vegetation within the vegetation corridor is primarily in private land although a small portion (adjacent to The Branch Lane) is council owned land.

To the south the upgraded Pacific Highway borders the site with Karuah Nature Reserve and other vegetated properties located beyond. Adjacent to the west is the existing hard rock quarry and a privately owned rural property, including a single dwelling. The vegetation in the site is part of a large island patch of remnant vegetation directly connected to the adjacent bushland to the north-west and west, supporting habitat connectivity.

The area immediately surrounding the Offset site comprises both vegetated and cleared / modified lands, all within privately owned lands (with the exception of the GLC managed The Branch Lane. patches is for the most part vegetated, although cleared patches in private land exist north and west of the site. Between 61-70% of the 1000 ha surrounding the site retains over-storey vegetation. Whilst it is not possible to accurately extrapolate vegetation condition across land management boundaries (in this case different landholders), the vegetation observed in areas surrounding the Offset site appeared to be in moderate to good condition. The cleared areas observed in adjacent properties were observed to be highly modified and primarily used for grazing purposes.

Connectivity Width Assessment

The narrowest point of the current vegetated connection is identified in **Figure 4**, and occurs to the south-east of the proposed Biobank site along a watercourse. GIS analysis has identified the minimum width of the current connection at approximately 30 to 40 m, placing it into the **>30-100m** connectivity width category. As the most limiting connection occurs outside the Offset site, the score for connectivity width will remain >30-100m (**Table 4**: Width Classes Before and After Biobank).

Table 4: Width Classes Before and After Biobank

	WIDTH CLASS (BEFORE BIOBANK)	WIDTH CLASS (AFTER BIOBANK)
Connectivity Value (Width)	>30-100m	>30-100m

Connectivity Condition Assessment

The vegetation within the 'connection' (including the offset site) is at benchmark for over-storey cover, mid-storey and groundcover (**Table 5**).

The average condition of the vegetation will not change after the offset site is established. Therefore, the condition classes allocated after offset do not change from those allocated before offset.

Table 5: Condition Classes Before and After Offset

STRATA	CONDITION CLASS (BEFORE BIOBANK)	CONDITION CLASS (AFTER BIOBANK)
Connectivity Value (Over-storey Condition)	PFC at benchmark	PFC at benchmark
Connectivity Value (Mid-storey/Ground Cover Condition)	PFC at benchmark	PFC at benchmark

2.2.3 Adjacent Remnant Area and Mitchell Landscape

The entire site is situated within the Newcastle Coastal Ramp Mitchell Landscape (**Figure 5**). The Mitchell Landscapes Version 3 layer was used for this assessment.

The area surrounding the offset site consists primarily of a dense native canopy cover with a predominately native understorey. These areas are therefore considered to be in moderate to good

condition, and link with surrounding areas. These linkages of moderate to good condition vegetation result in a **Patch Size of 501 ha** for all patches, and an **Adjacent Remnant Area of 501 ha** for the moderate to good condition vegetation on-site.

2.2.4 CMA Region and CMA Subregion

The Offset site occurs entirely within the Hunter-Central Rivers CMA region and within the Karuah Manning subregion.

Figure 3: Assessment Circles

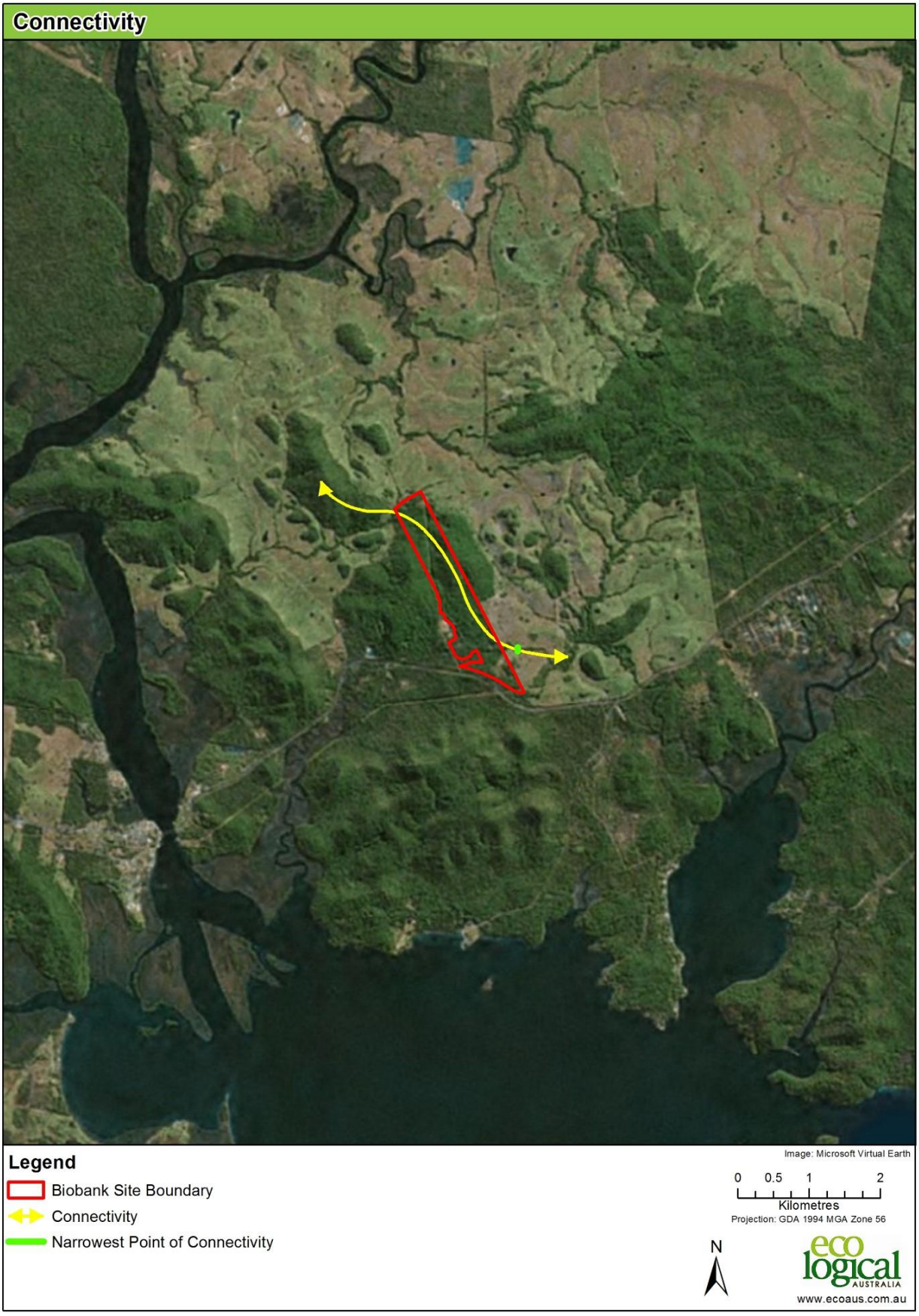


Figure 4: Connectivity

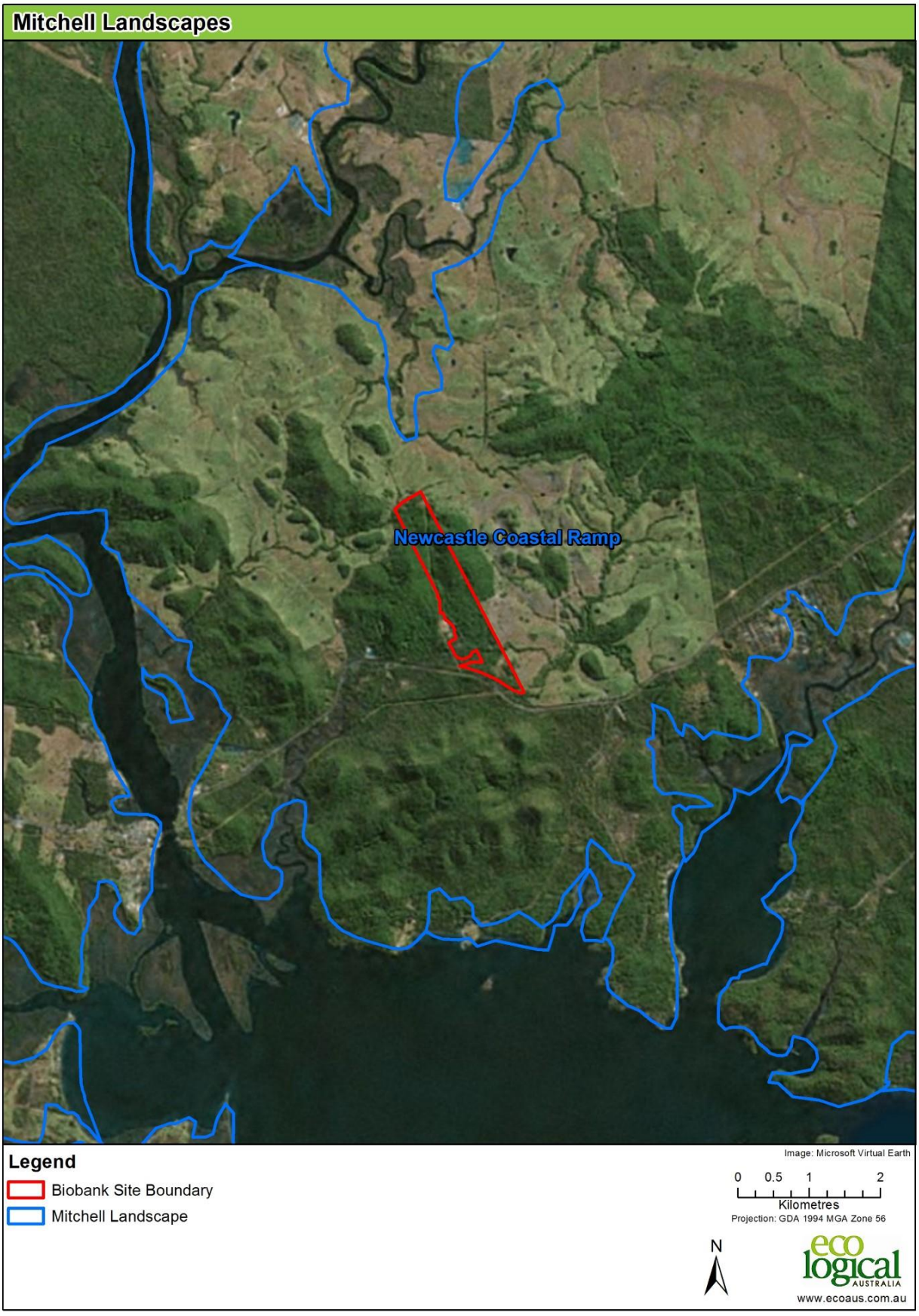


Figure 5: Mitchell Landscapes

2.3 GEOGRAPHIC AND HABITAT FEATURES

The following questions were asked in Step 2 of the calculator **(Table 6**). The default answer for these questions is "Yes", however an answer of "No" was given where evidence suggested that this was the correct answer.

Table 6: Geographic and Habitat Questions and Answers

QUESTION	ANSWER
Dry sclerophyll woodland and forest with a predominantly grassy understorey.	Yes
heath on sandy soils, or moist areas in open forest	Yes
heath or eucalypt forest on sandstone with a build-up of litter or other debris and containing, or within 40 m of, ephemeral or intermittent drainage lines	Yes
Hollow-bearing trees, bridges, caves or artificial structures within 200 m of riparian zone	Yes
land below 1000 m in altitude and within 40 m of rainforest or eucalypt forest with deep leaf litter	Yes
land containing caves or similar structures	No
land containing escarpments, cliffs, caves, deep crevices, old mine shafts or tunnels	Yes
land within 1 km of rock outcrops or cliff-lines	Yes
land within 100 m of emergent aquatic or riparian vegetation	Yes
land within 100 m of permanent rocky streams with thick fringing vegetation	No
land within 100 m of semi-permanent or ephemeral ponds or depressions containing leaf litter	Yes
land within 40 m of fresh/brackish/saline waters of larger rivers or creeks; estuaries, coastal lagoons, lakes and/or inshore marine waters	No
land within 40 m of rainforest, coastal scrub, riparian or estuarine communities	Yes
land within 40 m of watercourses, containing hollow-bearing trees, loose bark and/or fallen timber	Yes
Occurs from 10-40 m a.s.l. in grassy woodland or occasionally derived grassland in well-drained clay loam or shale derived soils. The vegetation type in which the majority of populations occur (including the largest colony) is a Spotted Gum - Ironbark For	Yes
rainforest or tall open wet forest with understorey and/or leaf litter and within 100 m of streams	Yes
rainforest, eucalypt forest, heathland, marshland, grassland or rocky areas	Yes
Sheltered areas such as gullies and southerly slopes in tall open forest on well-drained gravelly soil at elevations of 10-200 m	Yes
swamps, swamp margins or creek edges	Yes

2.4 VEGETATION TYPES

Two previous vegetation maps were reviewed in the initial desktop survey to indicate the vegetation types potentially present at the site:-

- Hunter Native Vegetation Mapping OEH (Roff *et al*. 2011);

- House, S (2003). Lower Hunter & Central Coast Regional Biodiversity Conservation Strategy, Technical Report, Digital Aerial Photo Interpretation & Updated Extant Vegetation Community Map. Report to Lower Hunter & Central Coast Regional Environmental Management Strategy, NSW, May 2003.

The site assessment confirmed that both these vegetation maps had inaccuracies at a site level, and identified five natural vegetation types within the site. The boundaries for these vegetation types were assessed during the site assessment and any previous mapping boundaries were disregarded.

The five biometric vegetation types within the site are:

- *'Spotted Gum – Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin'* occurring on the upper slopes, particularly in Lot 5
- *'Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin*' present on the southern gently undulating areas, particularly near the Pacific Highway
- *'Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central North Coast'* occurring generally along the more sheltered mid to lower slopes of the southern half of the site
- *'Sydney Peppermint - Smooth-barked Apple shrubby open forest on coastal hills and plains of the southern North Coast and Northern Sydney Basin'* located in the sheltered southern portion of site in the vicinity of the Pacific Highway
- *'Brush Box – Turpentine shrubby open forest of the coastal ranges of the North Coast'* located as part of the riparian vegetation along two south facing slopes and associated watercourses in the southern half of the site

An additional category of 'cleared / modified lands' is also present and comprises of access tracks and roads, power easements and areas immediately surrounding dwellings. Little or no native vegetation is present in these areas.

The five vegetation types have been mapped into seven distinct vegetation zones for the assessment. The *'Spotted Gum – Grey Ironbark open forest'* on the site is all moderate/good condition but is represented by a modified / regrowth variation in one location in the southern portion of the site near the residence on Lot 14. The *'Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin'* is also present in a moderate/good condition for the majority of its distribution but is represented by a modified / regrowth variation in two locations in the southern portion of the site near the residence on Lot 14 and one section centrally in Lot 13. The distribution of these vegetation types is shown in **Figure 6**.

The proposed Offset site generates **912** ecosystem credits at an average of 7 credits/ha, reflecting the biometric moderate-good condition of the site. **Table 7** provides a summary, with details provided in **Section 3**. 38,544 species credits were also generated for *Tetratheca juncea* and *Grevillea parviflora* subsp. *parviflora* on the site. There is potential for some indirect impacts on the offset site. If indirect impacts described in RPS (2013) occurred, the credits generated by the offset site would be 30,360. Note however that ELA does not believe the indirect impacts would be as great as assumed by RPS (see section 1.7 of this report).

Table 7: Summary of ecosystem credits generated

VEGETATION TYPE	AREA (HA)	CREDITS GENERATED	CREDITS/HA
Spotted Gum – Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin (good)	67.03	526	8
Spotted Gum – Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin (modified regrowth)	0.83		
Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin (good)	23.71	180	7
Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin (modified regrowth)	3.02		
Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central North Coast (good)	28.17	163	6
Sydney Peppermint - Smooth-barked Apple shrubby open forest on coastal hills and plains of the southern North Coast and Northern Sydney Basin (good)	3.96	22	6
Brush Box - Turpentine shrubby open forest of the coastal ranges of the North Coast (good)	2.60	21	8
Total	**129.32**	**912**	**7**

2.4.1 Justification for selection of Biometric vegetation types

The dominant species in each stratum is listed in **Table 8** to indicate the justification for the vegetation type selection and mapping. It was difficult to uniquely ascertain each vegetation type as the site effectively consists of numerous divergent ecotones between two and often three vegetation types. The boundaries were distinguished where there was a change in dominance of primary canopy species. The condition categories were distinguished based on structure of midstorey and groundcover including abundance of weed species.

Table 8: Dominant species in each vegetation type

VEGETATION TYPE	DOMINANT SPECIES
Spotted Gum – Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin (good)	Canopy: *Corymbia maculata* (Spotted Gum), *Eucalyptus paniculata* subsp. *paniculata* (Grey Ironbark), *Eucalyptus fibrosa* (Broad-leaved Ironbark), *Eucalyptus canaliculata* (Large-fruited Grey Gum), *Eucalyptus acmenoides* (White Mahogany) Midstorey: *Allocasuarina torulosa* (Forest Oak) Groundcover: *Imperata cylindrica* var. *major* (Blady Grass), *Themeda australis* (Kangaroo Grass)
Spotted Gum – Grey Ironbark open forest on the	Canopy: *C. maculata, E. fibrosa, E. paniculata* subsp.

foothills of the Central Coast, Sydney Basin (modified regrowth)	*paniculata* Midstorey: *Allocasuarina torulosa* Groundcover: *Imperata cylindrica* (Blady Grass), *Setaria sphacelata** (South African Pigeon Grass), *Andropogon virginicus** (Whisky Grass)
Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin (good)	Canopy: *Angophora costata* (Smooth-barked Apple), *Corymbia gummifera* (Red Bloodwood), Eucalyptus microcorys (Tallowwood) *Eucalyptus pilularis,*(Blackbutt) Midstorey: *Allocasuarina littoralis* (Black She-oak), Groundcover: *Imperata cylindrica*, *Entolasia stricta* (Wiry Panic), *Doryanthes excelsa* (Gymea Lily)
Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin (modified regrowth)	Canopy: *Angophora costata*, *Corymbia gummifera Eucalyptus pilularis* Midstorey: *Allocasuarina littoralis* (Black She-oak), Groundcover: *Imperata cylindrica*, *Entolasia stricta* (Wiry Panic), *Themeda australis*
Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central North Coast (good)	Canopy: *Eucalyptus pilularis, Eucalyptus microcorys, Syncarpia glomulifera* (Turpentine), *Angophora costata* Midstorey: *Allocasuarina torulosa* Groundcover: *Themeda australis, Poa affinis, Imperata cylindrica* var. *major, Doryanthes excels*
Sydney Peppermint - Smooth-barked Apple shrubby open forest on coastal hills and plains of the southern North Coast and Northern Sydney Basin (good)	Canopy: *Eucalyptus piperita* (Sydney Peppermint), *Angophora costata*, *Corymbia gummifera* Midstorey: *Allocasuarina littoralis* Groundcover: *Imperata cylindrica*, *Entolasia stricta*, *Themeda australis*
Brush Box - Turpentine shrubby open forest of the coastal ranges of the North Coast (good)	Canopy: *Lophostemon confertus (Brush Box), Syncarpia glomulifera* Midstorey: *Melaleuca styphelioides* (Prickly Paperbark) *Glochidion ferdinandi* (Cheese Tree), *Livistona australis* (Cabbage Tree Palm) Groundcover: *Lomandra longifolia* (Spiny-headed Mat-rush), *Doodia aspera* (Rasp Fern), *Lantana camara** (Lantana)

* Denotes an introduced species

2.4.2 Targeted Threatened Species Survey and Predicted Threatened Species

Previous targeted flora surveys and subsequent opportunistic surveys and incidental observations have identified that there are currently known to be approximately 55 individuals of *Asperula asthenes*, 185 individual stems of *Grevillea parviflora* subsp. *parviflora* and 6,085 clumps of *Tetratheca juncea* within the site. It must be noted that targeted flora surveys will be carried out for the species during the prime flowering period. Species credits have been generated for these species based on current observations (**Figure 8**).

2.5 VEGETATION ZONES

Vegetation zones are defined as areas of the same vegetation type and condition and have been mapped for the Offset site. ELA have assigned condition categories to all vegetation, all of which meet the definition of moderate/good condition as defined by the Biobanking Assessment Methodology.

In total there are seven vegetation zones within the site, consisting of five vegetation types. The area of each vegetation zone is provided in **Figure 6**.

Table 9: Vegetation Zones

VEG ZONE ID	BIOMETRIC VEGETATION TYPE	CONDITION	ANCILLARY CODE	CHARACTERISTICS OF VEGETATION ZONE	AREA (HA)
1	Spotted Gum – Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin	Moderate/good condition	Good	Remnant open forest, with a distinct sub-canopy and an understorey, scattered shrubs and predominantly native perennial grasses and forbs.	67.03
1a	Spotted Gum – Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin	Moderate/good condition	modified regrowth	Previously cleared regrowth open forest with young saplings and taller shrubs to 3 - 5 m and sparsely scattered larger remnant trees. More dense shrub layer and primarily native grasses as a ground cover, although introduced grasses are well represented and established.	0.83
2	Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin	Moderate/good condition	Good	Remnant open forest with some large mature trees. Generally comprising a sparse sub-canopy and a variable shrub layer (often quite dense) and a grass dominated understorey predominantly native perennial grasses and forbs.	23.71
2a	Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin	Moderate/good condition	modified regrowth	Previously cleared regrowth open forest with young saplings to 5 m and sparsely scattered larger trees. More dense shrub layer and primarily native grasses as a ground cover, although introduced grasses can be well represented and established.	3.02
3	Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central North Coast	Moderate/good condition	Good	Remnant moderately tall moist open forest to forest vegetation including some areas of younger growth. A distinct but generally sparse sub-tree layer, as well as an often sparse shrub layer. Groundcover comprised of a combination of grasses and various herbaceous species.	28.17

4	Sydney Peppermint - Smooth-barked Apple shrubby open forest on coastal hills and plains of the southern North Coast and Northern Sydney Basin	Moderate/good condition	Good	Remnant open forest vegetation with a sparse sub-canopy. A distinct but variable shrub layer was present, sometimes moderately dense. The groundcover layer was generally dominated by native grass species.	3.96
7	Brush Box - Turpentine shrubby open forest of the coastal ranges of the North Coast	Moderate/good condition	Good	Remnant and regrowth of moderately tall open forest to forest, comprising a distinct sub-canopy of small trees (mesic). Numerous climbers and twiners throughout. A dense understorey of ferns, rushes, grasses and various herbs.	2.6
Total					**129.32**

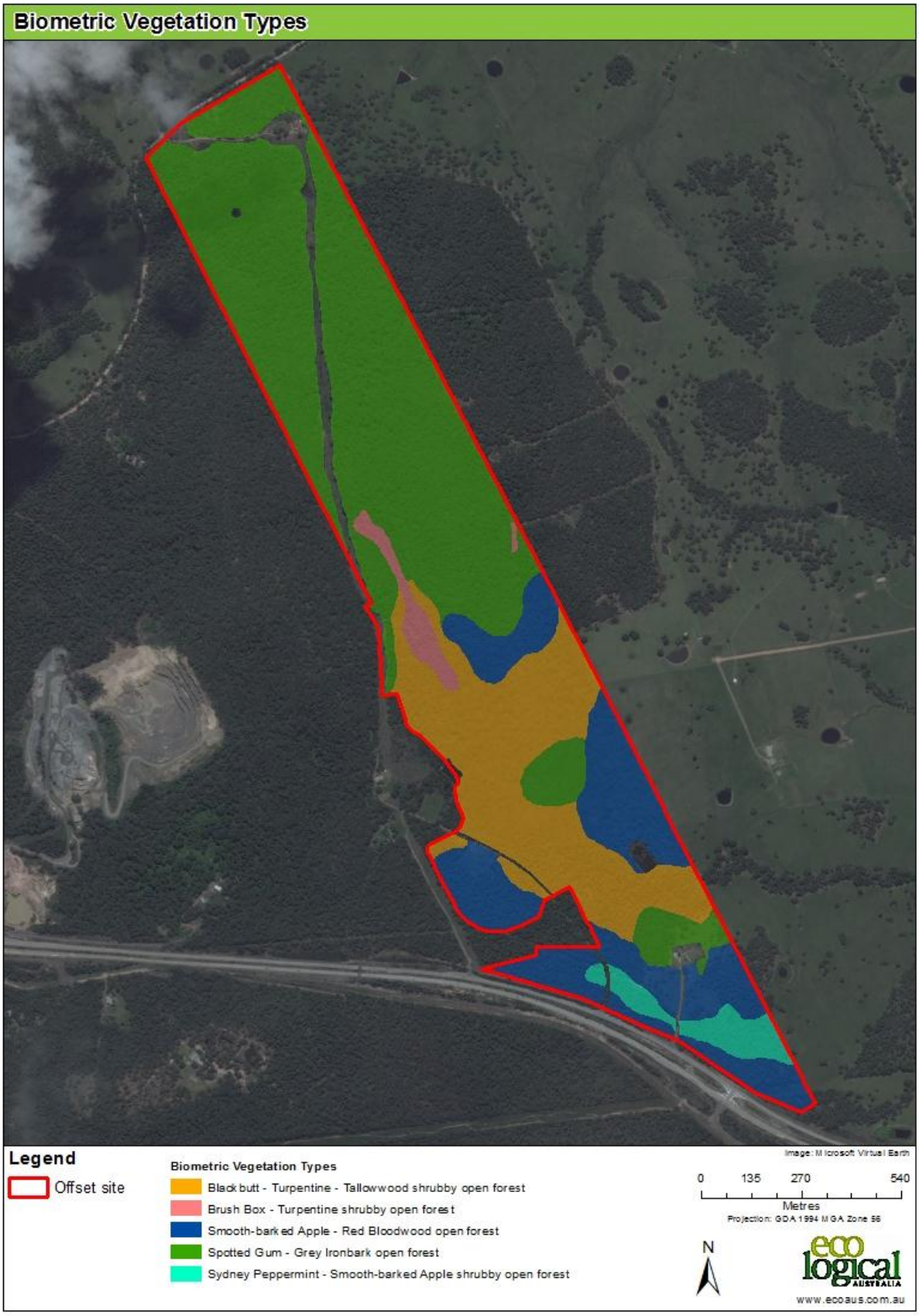


Figure 6: Vegetation Communities

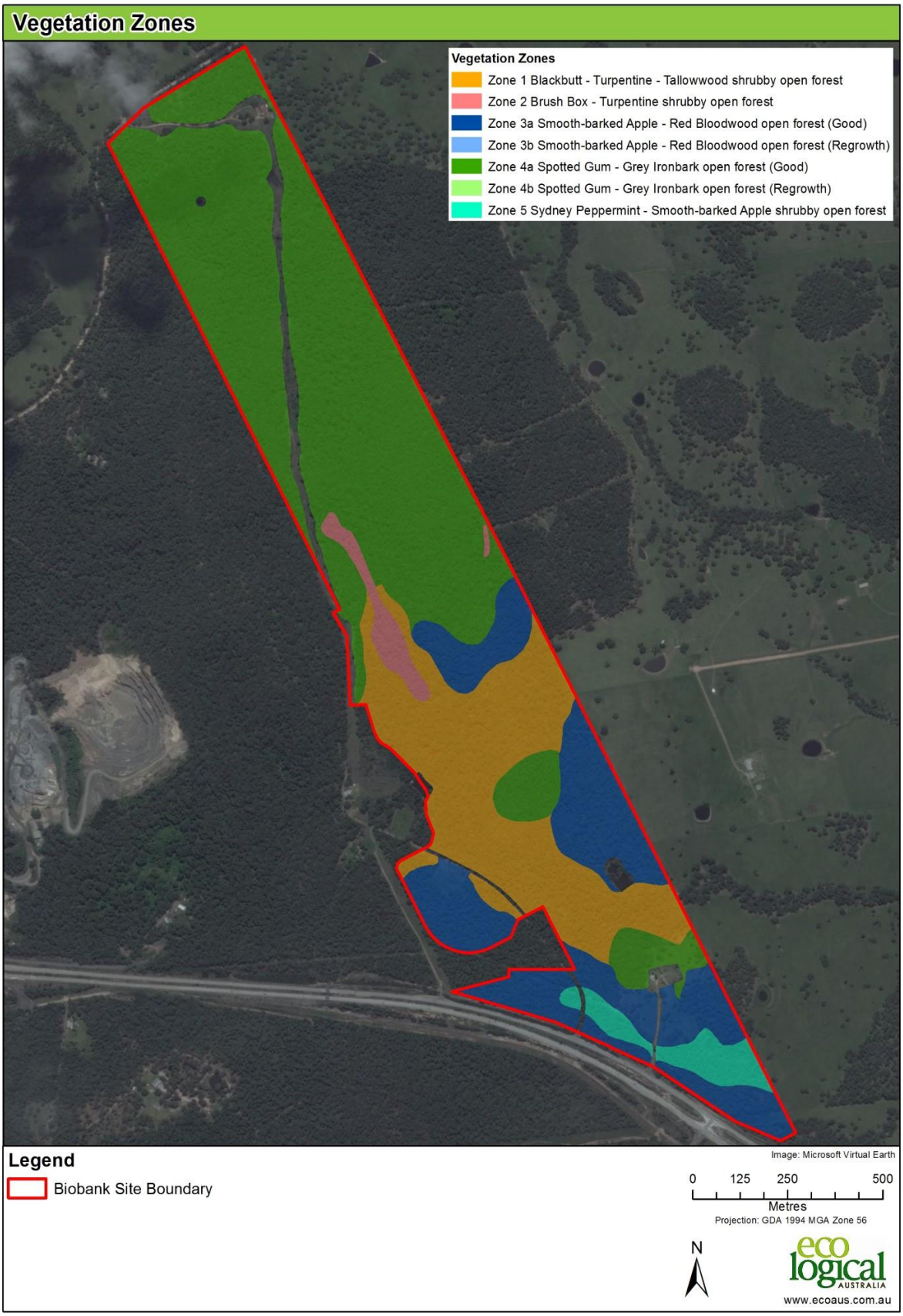


Figure 7: Management Zones

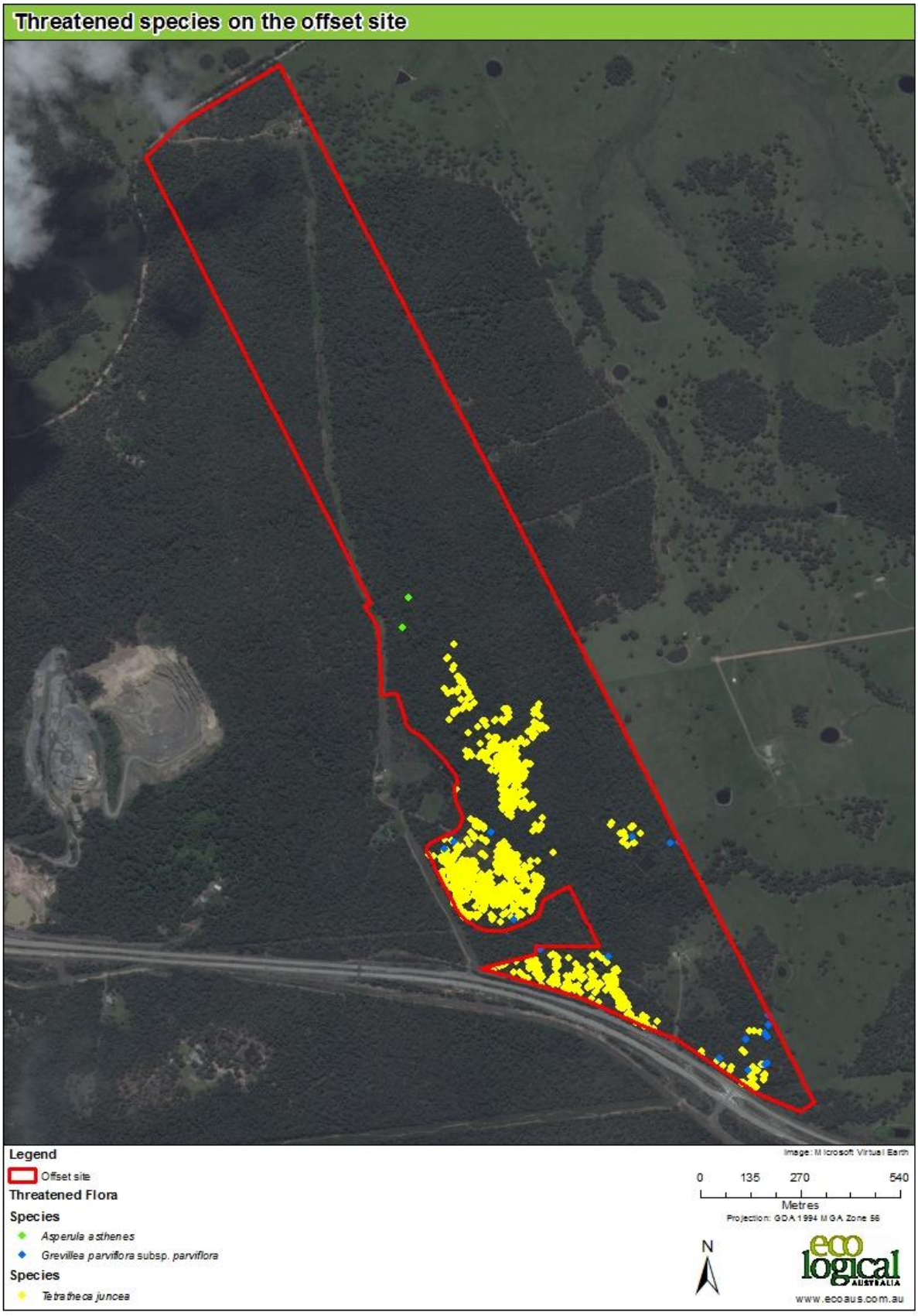


Figure 8: Threatened flora records for the offset site

2.6 VEGETATION TYPES PLOTS

The number of transect/plots undertaken for each vegetation zone is outlined in **Table 10**. Information was collected from the required number of transect/plots for all vegetation zones. All plots were permanently marked with one star-picket to allow for the monitoring of vegetation condition in the future. A star-picket was placed at the beginning of the 50 m line transect and the 0.4 ha plot. The locations of the star-pickets were recorded using GPS co-ordinates in GDA94 datum. Two photographs were taken at the end of each transect, one in portrait and one in landscape. **Figure 9** shows the location of each of the plot/transects and photo points for each vegetation zone (in MGAs), while **Appendix 3** outlines the transect/plot data entered into the tool and **Appendix 1** lists the plant species recorded in each plot. Whilst the total number of plots was less than that required for a formal biobanking assessment, the number of plots undertaken was adequate for the purpose, including having multiple plots in the larger vegetation zones.

Table 10: Transects/Plots Required for Offset Site

VEG ZONE ID	BIOMETRIC VEGETATION TYPE	CONDITION	ANCILLARY CODE	AREA (HA)	PLOTS REQ.	PLOTS COMPLETED
1	Spotted Gum – Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin	Moderate/good condition	Good	67.85	5	4
2	Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin	Moderate/good condition	Good	26.73	4	3
3	Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central North Coast	Moderate/good condition	Good	28.17	4	3
4	Sydney Peppermint - Smooth-barked Apple shrubby open forest on coastal hills and plains of the southern North Coast and Northern Sydney Basin	Moderate/good condition	Good	3.96	2	1
5	Brush Box - Turpentine shrubby open forest of the coastal ranges of the North Coast	Moderate/good condition	Good	2.60	2	1
Total				**129.32**	**17**	**12**

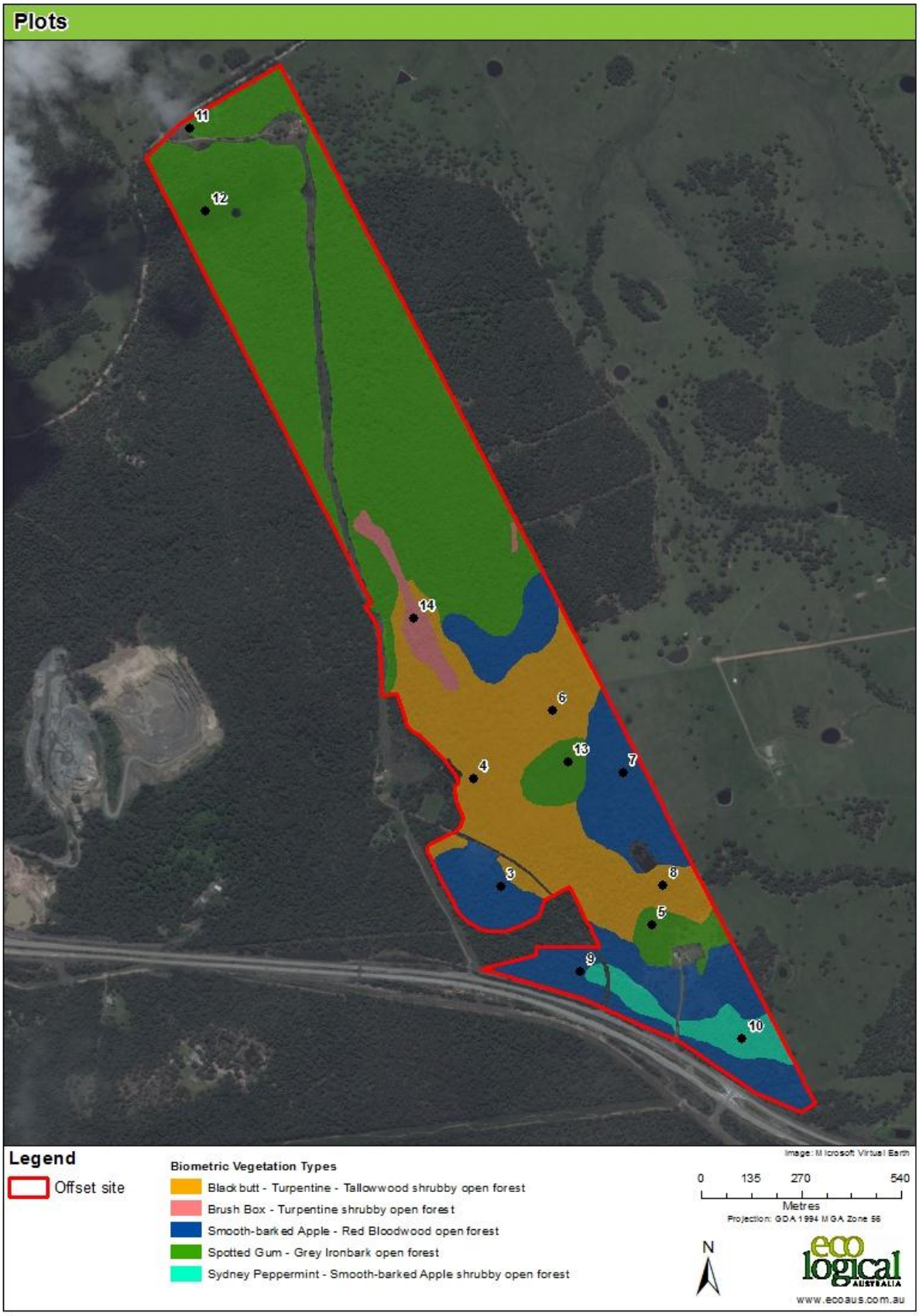


Figure 9: Plots

2.7 BIOBANKING ASSESSMENT - RESULTS

2.7.1 Ecosystem Credits

Table 11 shows the results of the credit calculations, including the number of credits generated and the credit profile information. In total, **912** ecosystem are generated by the offset site.

Table 11: Ecosystem Credits Generated and Credit Profile

VEG ZONE ID	VEGETATION TYPE NAME	AREA (HA)	TOTAL CREDIT GENERATED FOR VEG ZONE	CREDITS GENERATED/ HA	MIN.% SURROUNDING VEGETATION	MINIMUM PATCH SIZE (HA)	CMA SUBREGION
1	Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central North Coast	28.17	163	6	>70%	>100 ha	Karuah Manning
2	Brush Box - Turpentine shrubby open forest of the coastal ranges of the North Coast	2.60	21	8	>70%	>100 ha	Karuah Manning
3	Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin	26.73	180	7	>70%	>100 ha	Karuah Manning
4	Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin	67.86	526	8	>70%	>100 ha	Karuah Manning

VEG ZONE ID	VEGETATION TYPE NAME	AREA (HA)	TOTAL CREDIT GENERATED FOR VEG ZONE	CREDITS GENERATED/ HA	MIN.% SURROUNDING VEGETATION	MINIMUM PATCH SIZE (HA)	CMA SUBREGION
5	Sydney Peppermint - Smooth-barked Apple shrubby open forest on coastal hills and plains of the southern North Coast and northern Sydney Basin	3.96	22	6			Karuah Manning
Total		**129.32**	**912**	**7**	**N/A**	**N/A**	**N/A**

2.8 SPECIES CREDITS

Species credits were generated for two species –*Tetratheca juncea* and *Grevillea parviflora* subsp. *parviflora* - at the Offset site. **Table** 12 shows the results of the species credits generated. Two sets of figure are provided, with the first set assuming no indirect impacts (best case scenario) on the Offset site and the second set assuming mortality of all individuals within 50m of the construction footprint (worst case scenario). As discussed in section 1.7 of this Biodiversity Offset Strategy the worst case scenario is unlikely to eventuate given the mitigation measures proposed.

Table 12: Summary of Species Credits generated

	ASSUMING NO INDIRECT IMPACTS ON THE OFFSET SITE		ASSUMING INDIRECT IMPACTS ON THE OFFSET SITE	
SPECIES NAME	**NUMBER OF INDIVIDUALS PROTECTED**	**CREDITS GENERATED**	**NUMBER OF INDIVIDUALS PROTECTED**	**CREDITS GENERATED**
Grevillea parviflora subsp. *Parviflora(stems)*	100	600	68	408
Tetratheca juncea (clumps)	6,324	37,944	4992	29,952
Total	6,424	38,544	5060	30,360

3 Offset Security and Management

3.1 LEGAL ARRANGEMENT

The conservation of the offset area will be secured via a Conservation Agreement (CA) under Part 4, Division 12 of the National Parks and Wildlife Act 1974. The CA will be negotiated with the NSW Office of Environment and Heritage following approval of the Part 3A Application. The CA will 'run with the land' meaning that it will apply to the owner of the properties and all successors in title and will be registered under the Real Property Act 1990.

Besides the conservation outcomes identified in this strategy, the CA will allow for the continued occupation of the two dwellings currently location on lot 5 and lot 14 and the maintenance of the small area of cleared land surrounding the dwellings and the access tracks (approx. 6.5 ha). If other tracks are required in order to undertake the conservation management, these are to be identified in the CA.

3.2 ON-GROUND WORKS

There are no existing easements covenants or conservation funding arrangements for the property, and the entire offset site.

The site has been categorised into 7 distinct management zones based on the vegetation communities present on site **(Figure 7)**. The major ongoing management issue at the offset site will include the management and control of invasive weed species, in particular woody weeds (almost exclusively *Lantana camara*) and pasture grasses. Pasture grasses are particularly evident in the power easement running north to south and in the east where the site abuts grazing properties. Indicative estimates of time to carry out the weed control activities and fencing maintenance is presented in **Table 13.**

Fencing (including access gates) will need to be maintained to reduce the potential impacts from grazing stock entering the site as this can be quite destructive the environment and additional cost may arise to address the issue and damage. Fencing and associated signage will also be necessary for the control of human access for dumping and destructive recreation purposes (e.g. trail bike riding).

Feral animals are at the present time restricted to minor use of the site by Rabbits and likely transient Foxes and Cats. Although a minor issue currently, there is potential for stringent feral pest control in the future if conditions change.

Monitoring the maintenance process will be required on at least an annual basis. The results of the monitoring will help provide input into the priority areas for the following year or several years.

A Conservation Management Plan will be prepared for the site to guide the implementation of the management practices. The plan will include the restrictions and limitations to the existing two residences on Lot 5 and Lot 14 and will likely need to have specific information and work priorities updated on a three to five year interval as a minimum.

Table 13: Summary of Vegetation Management Zone Issues (Indicative)

MANAGEMENT ZONE	BIOMETRIC TYPE	ANCILLARY CODE	SUM OF HA	MANAGE'T ISSUE	WEED SPECIES	WEEDING APPROACH / TECHNIQUE	PLANTING	ESTIMATE OF PRIMARY WORK (DAYS FOR YEAR 1-5)	FOLLOW UP (YEAR 5-10)	ESTIMATE OF MAINTENANCE (YEAR 10 ONWARDS)
1	Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central North Coast	Moderate to good	28.17	Weeds and Maintained fencing	Scattered patches of Lantana, pasture grass invasion from east	Manual removal/ cut and paint with Glyphosate	Not necessary	5	3	2
1a	Brush Box - Turpentine shrubby open forest of the coastal ranges of the North Coast	Moderate to good	2.60	Weeds	Scattered patches of Lantana	Manual removal/ cut and paint with Glyphosate	Not necessary	4	2	2
2	Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin	Moderate to good	23.71	Weeds and Maintained fencing	Scattered patches of Lantana, pasture grass invasion from east	Manual removal/ cut and paint with Glyphosate	Not necessary	4	2	2

2a	Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin	Moderate to good	3.02	Weeds	Invasion by pasture grasses - Setaria and Whiskey Grass. Minor patches of Lantana	Cut and paint with Glyphosate	Not necessary	2	1	1
3	Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin	Moderate to good	67.03	Weeds and Maintained fencing	Scattered patches of Lantana, pasture grass invasion from east and also along power easement	Cut and paint with Glyphosate. Spray grasses in dense areas	Not necessary	10	8	6
4	Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin	Moderate to good	0.83	Weeds	Invasion by pasture grasses - Setaria and Whiskey Grass. Minor patches of Lantana	Cut and paint with Glyphosate. Spray grasses in dense areas	Not necessary	2	2	2
5	Sydney Peppermint - Smooth-barked Apple shrubby open forest on coastal hills and	Moderate to good	3.96	Weeds and Maintained fencing	Scattered patches of Lantana	Manual removal/ cut and paint	Not necessary	3	2	2

	plains of the southern North Coast and northern Sydney Basin									
Total								30	20	17
Indicative annual labour cost (team of 4 (@$2000 / day)								$60,000 PA	$40,000 PA	$34,000 PA
Material costs						Fence maintenance, bait for ferals, herbicides				

4 Adequacy of Offset

4.1 SUMMARY OF OFFSET

4.1.1 Ecosystems

The Karuah East Quarry will impact on three vegetation communities as described in the RPS (2013) report. The impact of 28.09 hectares of native vegetation will be offset by the conservation management of 129.32 hectares of vegetation similar to that found on the impact site. This provides an offset ratio of around 4.6:1 None of the vegetation communities being impacted by the quarry are EECs and all are in moderate to good condition.

Table 14 Comparison of vegetation impacts and conservation

BIOMETRIC (ELA)	HA IMPACTED	HA CONSERVED
Spotted Gum – Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin	20.38	67.86
Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin		26.73
Shatterwood-Giant Stinging Tree – Yellow Tulipwood dry rainforest of the North Coast and northern Sydney Basin	0.4	0
Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central North Coast		28.17
Brush Box - Turpentine shrubby open forest of the coastal ranges of the North Coast		2.60
Sydney Peppermint - Smooth-barked Apple shrubby open forest on coastal hills and plains of the southern North Coast and northern Sydney Basin	7.31	3.96
Total	28.09	129.32

4.1.2 Species

As the number of threatened species to be impacted has been counted by RPS (2013) it is possible to make a comparison using the BBAM for flora species credits. Calculations have been made for direct impacts (ie, clearing for construction) as well as potential indirect impacts assumed by RPS (2013).

Table 15 shows that a positive credit balance is achieved for *Tetratheca juncea* and *Grevillea parviflora subsp parviflora* when direct impacts are taken into account but no indirect impacts are assumed.

Table 16 shows that in a worst case scenario – ie, total mortality within a 50m edge effect zone, there would still be a positive balance for *Tetratheca juncea*, however *Grevillea parviflora subsp parviflora* would have a credit deficit of 63 credits.

When interpreting these results it is important to note two points:

- Spring survey is likely to identify additional *Tetratheca juncea* – and possibly *Grevillea parviflora* on lot 5 as the RPS report shows many clumps on land adjoining Lot 5; and
- ELA believes the indirect impacts are likely to be significantly less than the worst case scenario assumed in RPS (2013) as discussed in section 1.7 of this report. If for example, indirect impacts occurred to no more than a 20m edge effect, the credit balance for *Grevillea parviflora* would likely be positive and the balance for *Tetratheca juncea* would be even more so.

Table 15: Threatened Species Credit outcome for direct impacts only

SCIENTIFIC NAME	PLANTS IMPACTED	CREDITS REQUIRED	PLANTS CONSERVED	CREDITS GENERATED	BALANCE
Tetratheca juncea(clumps)	243	3,574	6324	37,994	+34,240
Grevillea parviflora subsp. *Parviflora (stems)*	0	0	100	600	+600

Table 16 Threatened species credit outcome for direct and potential indirect impacts

SCIENTIFIC NAME	PLANTS IMPACTED	CREDITS REQUIRED	PLANTS CONSERVED	CREDITS GENERATED	BALANCE
Tetratheca juncea (clumps)	1575	23,162	4992	29,952	+6790
Grevillea parviflora subsp. *Parviflora (stems)*	32	471	68	408	-63

4.2 COMPARISON TO OFFSET PRINCIPLES

The NSW OEH website contains a set of thirteen principles that provide a framework for considering environmental impacts and developing offset proposals. The following table describes how the Karuah offset compares to the thirteen principles for offsetting in NSW.

Table 17: Comparison of the proposed offset to the OEH Principles for biodiversity offsets in NSW

Principle	Karuah East Offset Strategy
1. Impacts must avoided first by using prevention and mitigation measures	The development footprint has undergone significant change in order to avoid impacts on the threatened species *Tetratheca juncea*. This has reduced impact from 2742 individuals down to a direct impact on 243 individuals which is more than a 90% reduction. If worst-case potential indirect impacts are considered the reduction is from 2742 to 1575 which is a

	reduction of 42%.
2. All regulatory requirements must be met	The project is to be assessed as a transitional Part 3A Project under the provisions of the EP&A Act and will therefore meet regulatory requirements. Whilst the offset will have benefits beyond those for biodiversity (eg: a permanent noise buffer from quarry operations) the offset is not proposed as a means of satisfying other regulatory requirements.
3. Offsets must never reward ongoing poor performance	Karuah East Quarry Pty Ltd does not have a record of poor performance. No illegal clearing has occurred on the subject site or offset sites.
4. Offsets should complement other government programs	The proposal to secure the offsets is consistent with the Hunter Central Rivers Catchment Action Plan target to increase the hectares of native vegetation being managed under a Conservation Agreement. The offset will complement the reserve system as it is less than 500m to an existing Nature Reserve.
5. Offsets must be underpinned by sound ecological principles	The offsets will provide for conservation of like-for-like vegetation communities. The size of the offset (129 ha) avoids edge-effects that are a risk with smaller sites and also conserves vegetation in moderate to good condition which reduces the risk often associated with rehabilitation of degraded sites.
6. Offsets should aim to result in a net improvement in biodiversity over time	A Conservation Plan will be prepared and implemented, addressing known issues such as weeds. The offset is low-risk in the sense that it is improving the condition of existing vegetation rather than relying on re-vegetation. Over time, the management of the site will improve its ecological value.
7. Offsets must be enduring and they must offset the impact of the development for the period that the impact occurs	Offsets will be secured via a Conservation Agreement under the NP&W Act or similar. This will be an in-perpetuity agreement that will remain on the title of the property regardless of transfers of ownership.
8. Offsets should be agreed prior to the impact occurring	Offsets are proposed as part of the Environmental Assessment. It is proposed to enter into a Conservation Agreement prior to the commencement of clearing for the quarry.
9. Offsets must be quantifiable and the benefits reliably estimated	The ecological values and condition of the offset site has been assessed and the credit-generating potential of the offset has been calculated using the Biobanking Assessment Methodology. 129 hectares offset will be provided compared to an impact of 29.05 hectares, giving an offset ratio of more than 4:1.

10. Offsets must be targeted	Offsets have targeted the biometric vegetation types that are to be impacted by the quarry. The offset vegetation is therefore 'like for like' with the impacted vegetation.
11. Offsets must be appropriately located	Offsets are located on the same site as the development and the adjoining land.
12. Offsets must be supplementary	No management obligations for these communities currently exist on the site.
13. Offsets and their actions must be enforceable through development consent conditions, license conditions, conservation agreements or a contract.	A Conservation Agreement under the NP&W Act is proposed as a Statement of Commitment in the Environmental Assessment.

4.3 COMPARISON TO OEH INTERIM POLICY FOR MAJOR PROJECTS

OEH have adopted a policy titled *DECCW Interim Policy on Assessing and Offsetting Biodiversity Impacts on Part 3A Developments*. Whilst Part 3A has been repealed, the proposal is being assessed as a transitional Part 3A transitional project. Whilst the interim policy is designed for use where biometric data is available on the impact and offset sites, it is still referenced here even though biometric data is not available for the impact site as it is a means of demonstrating the type of offset being proposed.

The Interim policy classifies impacts and offsets into three categories as shown in **Table 18**. The Karuah East Biodiversity Offset Strategy is likely to result in either a tier 2 No Net Loss or a Tier 3 Mitigated Loss. The uncertainty exists because biometric data was not available for the impact site. The vegetation being offset is 'like for like' with the vegetation being impacted and there are no red flag species or communities being impacted. By providing a 4:1 offset ratio the project will be providing double the offset that is the bare minimum for meeting a Tier 3 Mitigated Loss.

Table 18: Interim policy categories

	Is the vegetation being impacted being offset by the same vegetation or a vegetation type that is allowable under the BBAM ?	**Will Red Flag vegetation or threatened species be impacted ?**	**Are the credit requirements under BBAM fully met ?**
Improve or maintain (tier 1)	Yes	No	Yes
No net loss (tier 2)	Yes	Yes	Yes
Mitigated loss (tier 3)	No: offset vegetation type is different to impact site	Yes	No: Impacts partially offset

Table 19: Karuah East Offset

	Is the vegetation being impacted being offset by the same vegetation or a vegetation type that is allowable under the BBAM ?	Will Red Flag vegetation or threatened species be impacted ?	Are the credit requirements under BBAM fully met ?
Karuah East Offset Strategy	Yes	No	Unknown. Offset will deliver offset ratio of 4:1.

5 Conclusion

The proposed biodiversity offset for the Karuah East Quarry will deliver significant conservation benefits by securing 129.32 hectares of forested lands containing significant numbers of threatened flora and good quality habitat for threatened fauna (Powerful Owl, Glossy-black Cockatoo). The suitability of the offset site for conservation purposes, in relation to the impacted area, is as indicated previously in this report. The offset site provides 100 stems of *Grevillea parviflora* subsp. *parviflora* and 6,324 clumps of *Tetratheca juncea*. Although there will be a direct loss of 243 *Tetratheca juncea* clumps within the impact area the numbers of these species to be conserved within the offset area are extremely high and located within intact high quality habitat. It is likely that the presence of additional threatened flora species will be recorded from the offset site as surveys for *Grevillea parviflora* subsp. *parviflora* and *Tetratheca juncea* are to be undertaken later this year (2013) during the appropriate flowering season for each species.

In addition to the threatened species credits and the actual numbers of threatened species to be conserved there is a significantly large area of intact good quality native vegetation to be retained as part of the offset. A total of 28.09 ha of native vegetation from three different vegetation communities will be removed or modified as part of the project, in return 129.32 ha of remnant vegetation from five different communities is to be retained within the offset. This retention to loss of native vegetation is a direct ratio of approximately 4.6:1 which is just over double the minimal offset requirements stated in the *OEH Interim Policy on Assessing and Offsetting Part 3A Major Development*. The proposed offset is consistent with the 13 offsetting principles published by OEH on their website.

The land is currently zoned 1(a) Rural under the current Great Lakes LEP (1996) and RU2 Rural Landscape under the draft LEP 2013. A significant number of landuses are permitted with consent in these zones. Establishing the site as an offset will eliminate the potential for most of these uses to be undertaken on the site unless they are consistent with the outcomes stated in the Conservation Agreement. The offset will secure the future of the site as a linkage between Karuah Nature reserve to the south and vegetated lands to the north.

References

DECC 2009. *BioBanking Assessment Methodology and Credit Calculator Operational Manual*, Hurstville NSW.

DECCW (2010). Interim Policy on assessing and offsetting biodiversity impacts to Part 3A developments. NSW Department of Environment, Climate Change and Water.

House, S (2003). Lower Hunter & Central Coast Regional Biodiversity Conservation Strategy, Technical Report, Digital Aerial Photo Interpretation & Updated Extant Vegetation Community Map. Report to Lower Hunter & Central Coast Regional Environmental Management Strategy, NSW, May 2003.

Roff, A., Sivertsen, D., Somerville, M and Denholm, B. 2011. *Hunter Native Vegetation Mapping.* Office of Environment and Heritage, Department of Premier and Cabinet, Sydney, Australia

RPS (2013), *Terrestrial Ecology Survey and Assessment Report*, Karuah East Quarry, Karuah NSW.

Appendix 1: Flora species Recorded in each Plot

Note:

1. Families are group under the headings 1. Pteridophytes, 2. Gymnosperms, 3. Dicotyledons, 4. Monocotyledons.

2. An '*' before species indicates exotic species, # indicates non-local native.
3. A sample flora assemblage obtained from a short term survey, such as the present one, cannot be considered comprehensive, but rather indicative of the actual flora assemblage. It can take many years of flora surveys to record all of the plant species occurring within any area, especially species that are only apparent in some seasons.

4. Not all species can be accurately identified to species level due to absence of flowering or fruiting material.

5. **Bold** Denotes Threatened Species

6. Incidental sightings = ^

7. ROTAP = Rare or Threatened Species (Briggs & Leigh 1996)

FAMILY	SPECIES	COMMON NAME	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14
1. Pteridophytes														
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair Fern		*				*						
	Adiantum hispidulum	Rough Maidenhair Fern												*
Blechnaceae	*Doodia aspera*	Prickly Rasp Fern												*

FAMILY	SPECIES	COMMON NAME	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14
Dennstaedtiaceae	*Pteridium esculentum*	Bracken						*	*	*				
Dicksoniaceae	*Calochlaena dubia*	False Bracken		*				*						*
Lindsaeaceae	*Lindsaea linearis*	Screw Fern					*							
	^ *Lindsaea microphylla*	Lacy Wedge-fern												
Pteridaceae	*Cheilanthes sieberi* subsp. *sieberi*	Rock Fern			*						*		*	
2. Gymnosperms	-													
3. Dicotyledons														
Acanthaceae	*Brunoniella pumilio*	Dwarf Blue Trumpet	*	*	*	*	*	*	*				*	
	Pseuderanthemum variabile	Pastel Flower		*	*			*					*	*
Anacardiaceae	*Euroschinus falcatus*	Ribbonwood												*
Apiaceae	*Centella asiatica*	Pennywort				*				*	*	*	*	
	Hydrocotyle geraniifolia											*		
Apocynaceae	*Parsonsia*	Common						*						*

FAMILY		SPECIES	COMMON NAME	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14
		straminea	Silkpod, Monkey Rope												
		Tylophora paniculata	Thin-leaved Tylophora		*										
Araliaceae		*Polyscias sambucifolia* subsp. *sambucifolia*	Elderberry Panax	*	*	*			*	*			*		
Asteraceae	*	*Bidens pilosa*	Cobblers Pegs									*			
	*	*Hypochaeris radicata*	Catsear			*	*				*	*			
	^	*Rhodanthe anthemoides*	Chamomile Sunray												
		Senecio madagascariensis	Fireweed									*			
		Solenogyne belloides	-	*	*	*		*	*	*	*				
		Vernonia cinerea	Vernonia							*	*				
Bignoniaceae		*Pandorea pandorana*	Wonga Vine			*			*				*	*	
Caryopyllaceae		*Stellaria* sp.	-												*
Casuarinaceae		*Allocasuarina littoralis*	Black She-oak	*				*		*				*	
		Allocasuarina	Forest She-oak		*	*	*		*		*	*	*		*

FAMILY	SPECIES	COMMON NAME	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14
	torulosa													
Celastraceae	*Maytenus silvestris*			*										
Clusiaceae	*Hypericum gramineum*	Small St John's Wort									*			
Convolvulaceae	*Convolvulus erubescens*	Blushing Bindweed							*			*		
	Dichondra reprens	Kidney Weed		*							*	*		
Cunoniaceae	*Callicoma serratifolia*	Black Wattle		*				*						
Dilleniaceae	*Hibbertia aspera*	Rough Guinea-flower	*	*	*	*	*	*					*	
	^ *Hibbertia dentata*	Golden Guinea-flower												
	Hibbertia scandens	Twining Guinea-flower		*				*				*		
	Hibbertia sp.		*				*	*						
Elaeocarpaceae	*Elaeocarpus obovatus*	Hard Quandong												*
	Tetratheca juncea	**Black-eyed Susan**							*					
Ericaceae - Styphelioideae	*Acrotriche divaricata*	-		*				*						
	Epacris pulchella									*				

FAMILY	SPECIES	COMMON NAME	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14
	Leucopogon juniperinus	Long-flowered Beard-heath	*	*							*	*		
Euphorbiaceae	*Breynia oblongifolia*	Coffee Bush		*	*			*			*	*	*	*
	Glochidion ferdinandi	Cheese Tree		*				*	*	*	*	*	*	*
	Homolanthus populifolius	Bleeding Heart												*
Fabaceae Faboideae	*Daviesia ulicifolia*	Gorse Bitter-pea	*		*									
	Desmodium rhytidophyllum	Tick-trefoil			*	*		*			*	*		
	Desmodium varians	Small Leaf Tick-trefoil									*	*	*	*
	Dillwynia retorta	Bush Pea											*	
	Glycine clandestina	Twining Glycine	*		*	*	*	*	*	*	*		*	
	Glycine microphylla	Love Creeper							*		*		*	*
	Gompholobium latifolium	Golden Glory Pea					*	*		*				
	Hardenbergia violacea	False Sarsaparilla	*	*				*	*	*	*	*		
	Kennedia	Dusky Coral Pea						*						

FAMILY	SPECIES	COMMON NAME	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14
	rubucunda													
	Pultenaea euchila	Orange Pultenaea	*			*	*	*	*	*				
	Pultenaea paleacea	Chaffy Bush-pea	*	*	*	*	*		*	*				*
	Pultenaea villosa	Hairy Bush-pea	*		*	*			*		*	*		
Fabaceae Mimosoideae	*Acacia implexa*	Hickory Wattle									*			
	Acacia irrorata subsp. *irrorata*	Green Wattle	*	*	*	*	*	*					*	
	Acacia longifolia	Sydney Golden Wattle		*				*				*		
	Acacia myrtifolia	Red-stemmed Wattle	*			*	*	*	*	*				
	Acacia terminalis subsp. *longiaxialis*	Sunshine Wattle								*			*	
	Acacia ulicifolia	Prickly Moses	*		*	*			*		*	*	*	
Goodeniaceae	*Goodenia heterophylla*	-					*	*				*		
	Goodenia paniculata	Swamp Goodenia					*							
Haloragaceae	*Gonocarpus teucrioides*	Raspwort	*		*	*	*				*			

FAMILY	SPECIES	COMMON NAME	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14
Lamiaceae	*Clerodendrum tomentosum*	Hairy Clerodendrum												*
Lauraceae	*Crytocarya glaucescens*	Jackwood												*
Lobeliaceae	*Pratia purpurascens*	Whiteroot	*	*	*	*		*	*	*	*	*	*	*
Loganiaceae	*Logania albiflora*	Logania		*										
Meliaceae	*Synoum glandulosum*	Scentless Rosewood												*
Menisoermaceae	*Sarcopetalum harveyanum*	Pearl Vine												*
Moraceae	*Ficus coronata*	Sandpaper Fig												*
Myrsinaceae	*Myrsine howittiana*	Brush Muttonwood												*
Myrtaceae	*Acmena smihii*	Lilly Pilly		*							*			*
	Angophora costata	Smooth-barked Apple	*			*	*	*	*	*				*
	^ *Backhousia myrtifolia*	Grey Myrtle												
	Callistemon salignus	White Bottlebrush, Pink-tips		*	*			*		*		*		*
	Callistemon sp.	Bottlebrush	*											
	Corymbia	Red Bloodwood	*	*			*		*	*				

FAMILY	SPECIES	COMMON NAME	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14
	gummifera													
	Corymbia maculata	Spotted Gum		*	*						*	*	*	
	Eucalyptus acmenoides	White Mahogany	*			*				*	*			
	Eucalyptus canaliculata	Large-fruited Grey Gum									*	*		*
	Eucalyptus capitellata	Brown Stringybark	*							*				
	Eucalyptus fibrosa	Broad-leaved Ironbark									*			
	Eucalyptus globoidea	White Stringybark							*					*
	Eucalyptus microcorys	Tallowwood		*	*	*		*	*			*	*	
	Eucalyptus paniculata subsp. *paniculata*	Grey Ironbark			*							*	*	
	Eucalyptus pilularis	Blackbutt		*		*	*	*						
	Eucalyptus piperita	Sydney Peppermint							*	*				
	Eucalyptus propinqua											*		*

FAMILY		SPECIES	COMMON NAME	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14
		Eucalyptus resinifera subsp. *resinifera*	Red Mahogany									*	*		
	^	*Eucalyptus siderophloia*	A Grey Ironbark												
		Eucalyptus umbra	Bastard White Mahogany	*		*									
		Leptospermum polygalifolium subsp. *cismontanum*	Tantoon	*	*		*	*	*	*	*			*	
		Lophostemon confertus	Brushbox		*										*
		Melaleuca linariifolia	Snow-in-summer		*	*							*	*	
		Melaleuca styphelioides	Prickly-leaved Tea Tree		*								*		*
		Syncarpia glomulifera	Turpentine				*		*					*	*
Oleaceae		*Notelea longifolia* var. *longifolia*	Large-leaved Mock Olive	*		*				*	*				*
Oxalidaceae		*Oxalis perennans*	Oxalis	*								*		*	
Phyllanthaceae		*Phyllanthus hirtellus*	Thyme Spurge	*		*	*	*	*	*	*	*		*	

FAMILY		SPECIES	COMMON NAME	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14
Pittosporaceae		*Billardiera scandens*	Appleberry, Dumplings, Snotberry	*	*	*	*	*	*	*	*	*	*	*	
		Bursaria spinosa	Native Blackthorn										*		
		Hymenosporum flavum	Native Frangipani												*
		Pittosporum spinescens	Orange Thorn												*
		Pittosporum revolutum	Rough Fruit Pittosporum		*	*			*				*		*
Plantaginaceae	*	*Plantago lanceolata*	Plantain									*			
		Veronica plebia	Creeping Speedwell									*			
Proteaceae		*Banksia oblongifolia*	Fern-leaved Banksia					*							
		Banksia spinulosa subsp. *spinulosa*	Hair-pin Banksia					*	*	*					
		Grevillea parviflora* subsp. *parviflora	**Small-flower Grevillea**								*****				
		Lambertia formosa	Mountain Devils								*				
		Lomatia silaifolia	Crinkle Bush						*	*	*				
		Persoonia laurina	Laurel Geebung	*						*					

FAMILY	SPECIES	COMMON NAME	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14
	Persoonia levis	Broad-leaved Geebung						*	*	*				
	Persoonia linearis	Narrow-leaf Geebung	*		*	*	*	*	*	*	*		*	
Ranunculaceae	*Clematis aristata*	Traveller's Joy, Old Man's Beard											*	*
	Clematis glycinoides			*					*			*		
Rosaceae	*Rubus moluccanus* var. *trilobus*			*										*
Rubiaceae	***Asperula asthenes***	**A Woodruff**												*
	Morinda jasminoides	Morinda										*		*
	Opercularia sp.													
Rutaceae	*Boronia pinnata*	Boronia	*				*							
	Boronia polygalifolia	Dwarf Boronia	*		*		*							
	Melicope micrococca	White Euodia												*
	Zieria smithii	Sandfly Zieria		*										
Sapindaceae	*Alectryon subcinereus*	Native Quince												*

FAMILY		SPECIES	COMMON NAME	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14
		Dodonaea triquetra	Large-leaved Hop-bush							*					
		Guioa semiglauca	Guioa												*
Thymelaeaceae		*Pimelea linifolia* subsp. *linifolia*	Rice Flower	*		*			*		*	*			
Ulmaceae		*Trema tomentosa*	Native Peach			*			*						
Verbenaceae	*	*Lantana camara*	Lantana		*				*				*		*
	*	*Verbena bonariensis*	Purpletop									*			
Violaceae		*Hybanthus monopetalus*	Slender Violet-bush									*			
		Viola betonicifolia	Native Violet	*					*						
		Viola hederacea	Ivy-leaved Violet		*										*
Vitaceae	^	*Clematicissus opaca*	Small-leaved Water Vine												
		Cissus antarctica	Kangaroo Vine												*
		Cissus hypoglauca	Native Grape, Water Vine												*
	^	*Tetrastigma nitens*	-												
4. Monocotyledons															
Anthericaceae		*Arthropodium milleflorum*	Vanilla Lily	*											

FAMILY	SPECIES	COMMON NAME	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14
	Caesia parviflora var. *parviflora*										*			
Araceae	*Gymnostachys anceps*	Settlers' Flax, Settlers' Twine												*
Arecaceae	*Livistona australis*	Cabbage Palm, Cabbage-tree Palm												*
	Archontophoenix cunninghamiana	Bangalow Palm												*
Cyperaceae	*Carex appressa*	Tall Sedge										*		
	Carex inversa					*		*						
	Carex longebrachiata	Sedge		*								*		*
	Fimbristylis dichotoma	Common Fringe Sedge				*					*			
	Gahnia aspera	Rough Saw-sedge									*			
	Gahnia clarkei	A Saw-sedge		*										
	Gahnia sieberiana	Red-fruit Saw-sedge												*
	Gahnia sp.	A Saw-sedge	*				*	*				*		
	Lepidosperma laterale	Variable Sword-sedge	*	*	*	*		*	*	*	*		*	
	Ptilothrix deusta	-				*	*							

FAMILY	SPECIES	COMMON NAME	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14
	Schoenus apogon	Common Bog-rush	*						*		*			
Dioscoreaceae	*Dioscorea transversa*	Native Yam		*				*				*		*
Doryanthaceae	*Doryanthes excelsa*	Gymea Lily	*			*	*	*		*			*	
Iridaceae	*Libertia paniculata*	Branching Grass-flag												*
	Patersonia sericea	Silky Purple-flag					*		*					
Lomandraceae	*Lomandra cylindrica*	Needle Mat-rush								*				
	Lomandra filiformis subsp. *filiformis*	Wattle Mat-rush			*					*				
	Lomandra hystrix	-		*										*
	Lomandra longifolia	Spiny-headed Mat-rush, Honey Reed, Spike Mat-rush	*	*	*	*	*	*	*		*	*	*	*
	^ *Lomandra multiflora*	Many-flowered Mat-rush												
	Lomandra obliqua	Fish-bones	*			*		*	*	*				
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry			*				*		*	*	*	

FAMILY		SPECIES	COMMON NAME	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14
		Geitonoplesium cymosum	Scrambling Lily							*		*	*		*
Orchidaceae		*Acianthus fornicatus*	Pixie Caps		*	*	*		*					*	
	^	*Arthrochilus prolixus* (ROTAP)	Elbow Orchid												
		Corybas aconitiflorus	Spurred Helmut Orchid			*	*		*					*	
		Corybas fimbriatus	Fringed Helmet Orchid											*	
		Cryptostylis subulata	Large Tongue Orchid				*								
		Cymbidium suave	Snake Orchid						*						
		Pterostylis longifolia	Tall Greenhood											*	
		Pterostylis nutans	Nodding Greenhood				*							*	
Phormiaceae		*Dianella caerulea* var. *producta*	Blue Flax-lily	*	*	*	*	*	*	*	*	*	*	*	
Poaceae	*	*Andropogon virginicus*	Whisky Grass				*					*			
		Aristida ramosa	Purple Wiregrass								*	*			
		Aristida vagans	Three-awn Speargrass			*						*		*	

FAMILY		SPECIES	COMMON NAME	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14
	*	*Axonopus fissifolius*	Narrow-leaved Carpet Grass			*									
	*	*Briza maxima*	Quaking Grass									*			
		Cymbopogon refractus	Barbed Wire Grass				*				*	*		*	
		Dichelachne micrantha	Short-hair Plumegrass								*				
		Digitaria sp.	-		*	*	*		*			*		*	
		Echinopogon ovatus	Forest Hedgehog Grass								*	*			
		Entolasia marginata	Bordered Panic								*	*	*	*	
		Entolasia stricta	Wiry Panic	*	*	*	*	*	*	*	*	*		*	
		Eragrostis brownii	Browns Lovegrass								*	*		*	
		Eragrostis leptostachya	Paddock Lovegrass				*					*			
		Imperata cylindrica var. *major*	Blady Grass		*		*		*	*	*	*	*	*	
		Microlaena stipoides	Meadow Rice-grass, Weeping Grass	*					*		*	*		*	
		Oplismenus aemulus	Broad-leaved Basket Grass									*	*	*	

FAMILY		SPECIES	COMMON NAME	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14
		Oplismenus imbecillis	Narrow-leaved Basket Grass		*		*		*						*
		Panicum simile	Two-colour Panic	*			*					*			
		Paspalidium distans	Spreading Panicgrass	*			*								
	* ^	*Paspalum ciliatifolium*	One-spiked Paspalum												
	*	*Paspalum dilatatum*	Paspalum								*				
		Poa labillardierei	Tussock										*	*	
	*	*Setaria sphacelata*	South African Pigeon Grass			*	*				*	*			
		Themeda australis	Kangaroo Grass	*		*	*	*	*		*	*		*	
Ripogonaceae		*Ripogonum album?*													*
Smilacaceae		*Smilax australis*	Lawyer Vine, Native Sarsaparilla		*										*
		Smilax glyciphylla	Sweet Sarsaparilla		*				*						
Uvulariaceae		*Tripladenia cunninghamii*	Tripladenia												*
Xanthorrhoeaceae		*Xanthorrhoea* sp.	Grass Tree	*	*	*		*	*	*	*				
Zingiberaceae		*Alpinia*	Native Ginger												*

FAMILY	SPECIES	COMMON NAME	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14
	arundelliana													

Appendix 2: Species Predicted

Species predicted for ecosystem credits

SCIENTIFIC NAME	COMMON NAME
Burhinus grallarius	Bush Stone-curlew
Calyptorhynchus lathami	Glossy Black-cockatoo
Cercartetus nanus	Eastern Pygmy-possum
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)
Dasyurus maculatus	Spotted-tailed Quoll
Falsistrellus tasmaniensis	Eastern False Pipistrelle
Glossopsitta pusilla	Little Lorikeet
Grantiella picta	Painted Honeyeater
Hoplocephalus stephensii	Stephens' Banded Snake
Kerivoula papuensis	Golden-tipped Bat
Lathamus discolor	Swift Parrot
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)
Miniopterus australis	Little Bentwing-bat
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat
Mormopterus norfolkensis	Eastern Freetail-bat
Myotis macropus (formally Myotis adversus)	Large-footed Myotis
Neophema pulchella	Turquoise Parrot
Ninox connivens	Barking Owl
Ninox strenua	Powerful Owl
Petaurus australis	Yellow-bellied Glider
Petaurus norfolcensis	Squirrel Glider
Petroica boodang	Scarlet Robin
Phascolarctos cinereus	Koala
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)
Potorous tridactylus	Long-nosed Potoroo
Pteropus poliocephalus	Grey-headed Flying-fox
Pyrrholaemus saggitatus	Speckled Warbler

SCIENTIFIC NAME	COMMON NAME
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat
Scoteanax rueppellii	Greater Broad-nosed Bat
Stagonopleura guttata	Diamond Firetail
Tyto novaehollandiae	Masked Owl
Vespadelus troughtoni	Eastern Cave Bat
Xanthomyza phrygia	Regent Honeyeater

Species requiring survey to generate species credits

SPECIES
Acacia bynoeana
Asperula asthenes
Caladenia tessellata
Callistemon linearifolius
Callocephalon fimbriatum
Corybas dowlingii
Cryptostylis hunteriana
Cynanchum elegans
Diuris bracteata
Diuris praecox
Grevillea parviflora subsp. *parviflora*
Hieraaetus morphnoides
Hoplocephalus bitorquatus
Litoria aurea
Litoria brevipalmata
Lophoictinia isura
Macropus parma
Melaleuca biconvexa
Melaleuca groveana
Mixophyes balbus
Mixophyes iteratus
Myotis macropus (formally Myotis adversus)
Pandion haliaetus
Petrogale penicillata
Phascogale tapoatafa
Planigale maculata
Pseudomys gracilicaudatus
Pseudophryne australis
Rutidosis heterogama
Tetratheca juncea

Appendix 3: Plot Data entered into tool

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Longitude	Latitude	Zone	ELA_Veg_Type
3	62	34	6	14	20	62	0	1	1	11	407469	6389149	56	Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin
4	57	40	46	14	12	48	0	0	1	19	407394	6389439	56	Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central North Coast
5	46	44	7.5	50	10	24	0	0	1	33.5	407877	6389046	56	Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin
6	45	53	18.5	72	6	30	0	2	1	28.5	407609	6389626	56	Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central North Coast
7	36	29.5	30.5	44	36	74	0	1	1	15.5	407800	6389458	56	Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin
8	67	59.5	30.5	62	26	36	2	2	1	30	407908	6389153	56	Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central North Coast
9	46	38	30.5	72	28	23	0	0	1	36	407684	6388920	56	Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin
10	50	34.5	8.5	76	4	26	0	0	1	51	408122	6388737	56	Sydney Peppermint - Smooth-barked Apple shrubby open forest on coastal hills and plains of the southern North Coast and Northern Sydney Basin
11	61	42.5	2	58	2	28	2	2	1	5	406627	6391199	56	Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin
12	49	45	45	64	12	16	4	0	1	108	406671	6390977	56	Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin
13	56	51	12.5	50	0	74	0	1	1	25	407651	6389486	56	Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin
14	56	34	61	24	14	76	10	2	1	57	407233	6389874	56	Brush Box - Turpentine shrubby open forest of the coastal ranges of the North Coast

ecological AUSTRALIA

HEAD OFFICE
Suite 4, Level 1
2-4 Merton Street
Sutherland NSW 2232
T 02 8536 8600
F 02 9542 5622

SYDNEY
Level 6
299 Sussex Street
Sydney NSW 2000
T 02 9993 0566
F 02 9993 0573

ST GEORGES BASIN
8/128 Island Point Road
St Georges Basin NSW 2540
T 02 4443 5555
F 02 4443 6655

CANBERRA
Level 2
11 London Circuit
Canberra ACT 2601
T 02 6103 0145
F 02 6103 0148

NEWCASTLE
Suite 17, Level 4
19 Bolton Street
Newcastle NSW 2300
T 02 4910 0125
F 02 4910 0126

NAROOMA
5/20 Canty Street
Narooma NSW 2546
T 02 4476 1151
F 02 4476 1161

COFFS HARBOUR
35 Orlando Street
Coffs Harbour Jetty NSW 2450
T 02 6651 5484
F 02 6651 6890

ARMIDALE
92 Taylor Street
Armidale NSW 2350
T 02 8081 2681
F 02 6772 1279

MUDGEE
Unit 1, Level 1
79 Market Street
Mudgee NSW 2850
T 02 4302 1230
F 02 6372 9230

PERTH
Suite 1 & 2
49 Ord Street
West Perth WA 6005
T 08 9227 1070
F 08 9322 1358

WOLLONGONG
Suite 204, Level 2
62 Moore Street
Austinmer NSW 2515
T 02 4201 2200
F 02 4268 4361

GOSFORD
Suite 5, Baker One
1-5 Baker Street
Gosford NSW 2250
T 02 4302 1220
F 02 4322 2897