Redgum Ridge Western Precinct (part Lots 815 DP1193843 and 1801 DP1223063) Biodiversity Certification:

Biodiversity Conservation Strategy

Final Report (Version 4)

Prepared for Edenvell Pty Ltd

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- Edenvell Pty Ltd: Richard Clifford
- MMJ Wollongong: Luke Rollinson
- Wollongong City Council: David Green, Kathryn Adams, John Wood, Brett Morrisey
- NSW Office of Environment and Heritage: Chris Page, Daniel Robson, Jedda Lemmon

Biosis staff involved in this project were:

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Glossary

APZ	Asset Protection Zone
BAR	Biodiversity Assessment Report
BCAA	Biodiversity Certification Assessment Area
BCS	Biodiversity Conservation Strategy
BVT	Biometric Vegetation Type
CAP	Catchment Action Plan
CMA	Catchment Management Area
DECCW	NSW Department of Environment, Climate Change and Water (now OEH)
DP	Deposited Plan
DPE	Department of Planning and Environment
E4	Environmental Living zoning under the Wollongong LEP
EEC	Endangered Ecological Community
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
ha	Hectares
LEP	Local Environmental Plan
LGA	Local Government Area
OEH	NSW Office of Environment and Heritage
RU2	Rural Landscape zoning under the Wollongong LEP
SRCMA	Southern Rivers Catchment Management Area
TEC	Threatened Ecological Community
TSC Act	NSW *Threatened Species Conservation Act 1995*
WCC	Wollongong City Council

Executive summary

MMJ Wollongong, on behalf of Edenvell Pty Ltd, is co-ordinating a Planning Proposal with Wollongong City Council for the rezoning of land at Figtree in order to facilitate low density residential development within the western precinct of the Redgum Ridge Estate.

The 1998 Commission of Inquiry recognised that the partially cleared ridge plateau has potential for limited low density residential development, provided that the matter of vegetation management within the site can be satisfactorily achieved. More recent biodiversity assessments and investigations of the site identified that the centralised plateau was generally cleared and maintained, whilst the vegetated ridge side slopes possessed high biodiversity values, including threatened species and ecological communities

Based on these investigations Edenvell Pty Ltd proposes to rezone the centralised ridge plateau from RU2 Rural Landscape to E4 Environmental Living under the Wollongong Local Environmental Plan 2009 (LEP) to facilitate low density residential development. Areas of high biodiversity value on side slopes will be retained within an expanded E2 Environmental Conservation zone. This E2 zone will be retained and managed for conservation under a BioBanking Agreement (Agreement 221) and dedication of the land as a BioBank site. These two zones form the Biodiversity Certification Assessment Area (BCAA). Land proposed for future development will be biodiversity certified, with the BioBank site identified as retained land.

This Biodiversity Conservation Statement (BCS) assesses both the 'development' and 'conservation' area in one assessment. Credits required by the development will be offset through the retention and management of a conservation area within the Biobank site.

The BCAA supports three vegetation types, with land proposed for certification supporting a modified form of two communities including 3.15 hectares of *Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion* (SR652) and 1.44 hectares of *Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion* (SR545). Vegetation in the land proposed for biodiversity certification (Biocertification) is disturbed through regular slashing of the ground and midstory vegetation layers under a regrowth canopy. Areas where the tree canopy does not exist are dominated by exotic grasses.

No land is proposed for conservation measures as a part of the application for biocertification. Edenvell Pty Ltd have obtained a BioBanking Agreement to establish a BioBank site on land supporting high biodiversity value within the northern and southern sections of the BCAA (Agreement 221). To offset the impacts of conferral of biodiversity certification, the acquisition and retirement of biodiversity credits from within the BCAA is proposed via the biodiversity register.

The proposed low density residential development and retention of areas of high biodiversity value within a BioBank site are consistent with the outcomes of the 1998 Commission of Inquiry and associated *Illawarra Escarpment Strategic Management Plan* (WCC 2015), and the *Illawarra-Shoalhaven Regional Plan* (DPE 2015) and will assist Wollongong City Council, the NSW Office of Environment and Heritage (OEH) and Local Land Services in meeting the objectives of the *Illawarra Biodiversity Strategy* (WCC et al., 2011a, 2011b), the Southern Rivers Catchment Management Authority (SRCMA) *Catchment Action Plan* (CAP) 2006 to 2016, and the current SRCMA CAP 2013 – 2023 (SRCMA 2013).

Wollongong City Council, as the planning authority, will be submitting the application for biodiversity certification of a portion of the BCAA to OEH on behalf of Edenvell Pty Ltd. Once biodiversity certification is conferred Edenvell Pty Ltd will retire the required credits from the BioBank site within the BCAA and sell any

remaining credits on the BioBanking register. This will enable the long term conservation and management of this BioBank site. Long term, the BioBank site is proposed to be dedicated to Council.

The biodiversity certification of the development will enable the proposed low density residential development of the Western Precinct of the Redgum Ridge Estate, with development restricted to areas previously disturbed through regular slashing. From a conservation perspective, the Biocertification of this area will ensure all impacts resulting from the development are offset and enable the protection, long term conservation and management of areas of high biodiversity value through the establishment of a BioBank site. In turn, this will assist in meeting key objectives of the strategies and plans outlined above, resulting in an improved outcome for biodiversity.

1. Introduction

1.1 Strategic context

1.1.1 Planning proposal

MMJ Wollongong, on behalf of Edenvell Pty Ltd, is co-ordinating a Planning Proposal with Wollongong City Council (WCC) for the rezoning of land at Figtree in order to facilitate low density residential development.

The subject land is located between the Village of Mt Kembla to the west, the urban precinct of Figtree to the east, and the urban precinct of Cordeaux Heights to the south. It is located within the lower slopes of the Illawarra Escarpment to the west and is adjoined by the highly urbanised areas of the coastal plain to the east and south. The subject land is the remainder of the landholding recently residentially developed by the Redgum Ridge Estate to the east, which is accessed from O'Briens Road (via George Fuller Drive and Redgum Forest Way) (Figure 1). It is described as part of Lots 815 in Deposited Plan (DP) 1193843 and 1801 DP1223063 as having an area of approximately 55 hectares and is bounded to the north by Brandy and Water Creek, and to the south by American Creek, Cordeaux Road and adjacent rail line (Figure 2). The subject land is known as the Western Precinct of the Redgum Ridge Estate.

The long-term land use strategy for the subject land is guided by the site's existing topography and environmental qualities. The densely vegetated ridge side slopes possess high biodiversity values for ongoing conservation management, whilst the generally cleared centralised ridge plateau provides an opportunity to complement the "Redgum Ridge" Estate development by the addition of large lot low density residential development. Thus, the Planning Proposal seeks to rezone the centralised ridge plateau from RU2 Rural Landscape to E4 Environmental Living under the Wollongong Local Environmental Plan 2009 (LEP) to facilitate low density residential development (Figure 2).

Previous assessments (Biosis 2011, 2014) have identified that land to the north and south of the proposed development area support significant biodiversity values, including two threatened ecological communities (TECs) and one threatened flora species (White-flowered Wax Plant *Cynanchum elegans*) listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). These lands will be retained in an expanded E2 Environmental Conservation zone (including APZ's and easements), and the biodiversity values managed in perpetuity for conservation purposes under the BioBanking Agreement (Agreement 221). This area has been designated as a BioBank site (Figure 2).

On 15 December 2014, WCC resolved to submit the draft Planning Proposal (MMJ 2014) to the NSW Department of Planning and Environment (DPE) seeking a Gateway Determination. The draft Planning Proposal was submitted to DPE in January 2015 and the Gateway Determination was granted in March 2015. The draft Planning Proposal was exhibited between 16 March and 17 April 2015. On 14 December 2015, WCC considered a report on the submissions, resolving to support a pathway for a BioBanking Agreement and Biodiversity Certification covering a larger area, and to finalise the Planning Proposal in two parts.

1.1.2 Biodiversity Certification Assessment Area

The Biodiversity Certification Assessment Area (BCAA) includes all land proposed for biodiversity certification, as well as retained land (including easements and a BioBank site) as shown in Figure 3.

Land identified for biodiversity certification includes land proposed to be zoned E4 Environmental Living and subject to future residential development. This area is 8.11 hectares and is identified as 'Land proposed for biodiversity certification' in Figure 3. Long term, this land will be subdivided for residential development, with

the creation of approximately 27 residential lots, asset protections zones (APZs), roads and other associated infrastructure (Figure 3). Lots will range in size from 1,229m² to 1.1 hectares. Access to these allotments will be gained via a public road to be constructed along the ridge line (adjacent to the 24 metre wide gas pipeline easement), which will be an extension of Redgum Forest Way servicing the Estate to the east. The internal road network will consist of a perimeter road to control bushfire hazard management considerations within BCAA. Full urban reticulation services will be provided from the existing service network within the Redgum Ridge Estate.

The BCAA contains several gas, water and energy transmission easements, totalling 5.31 hectares, identified as 'Retained land – Easement' in Figure 3. These easements are not proposed for biodiversity certification or subject to proposed conservation measures. The features of these areas are not discussed further.

No land is proposed for conservation measures as a part of the application for biodiversity certification. Edenvell Pty Ltd will conserve and manage land within the BCAA under a BioBanking Agreement over land to the north and south of land subject to future residential development (Agreement 221). This land, totalling 46.82 hectares, has been dedicated as a BioBank site and is identified as 'Retained land – BioBank site' in Figure 3. Biodiversity credits required to offset the area proposed for certification and to achieve the 'improve or maintain' outcome required under BCAM will be sourced from this BioBank site. The features of the BioBank site are outlined in Biosis (2015).

The BCAA incorporates part of the lower section of a ridge that extends from the Illawarra Escarpment before dropping onto the coastal plain nearby to the east. There is a moderate level of canopy connectivity between the BCAA and the Illawarra Escarpment State Conservation Area less than 2 kilometres to the west. Much of the higher ridge and upper moderate slopes, proposed for future residential development, has been cleared of native vegetation and is characterised by scattered individuals or stands of remnant and regrowth native trees. These open grassy woodland areas are being managed by regular slashing and are grazed by feral animals. Remnant and regrowth native vegetation is present over the mid to lower northern and southern slopes within the BioBank site. The condition of the native vegetation varies from relatively intact and weed-free to areas of remnant canopy with an understorey dominated by Lantana *Lantana camara*. Woody weeds, including Lantana, are being controlled in places.

Further discussion of the BCAA is provided in Section 2.2.

1.1.3 Term of biodiversity certification

This Biodiversity Conservation Strategy (BCS) seeks biodiversity certification of all land proposed for biodiversity certification within the BCAA in perpetuity.

1.1.4 Strategic context of the proposal

Wollongong Local Environmental Plan 2009

The principle planning instrument for land use control within the City of Wollongong is the Wollongong LEP 2009. As identified within Section 1.1.1, the centralised ridge plateau and western section of the northern slopes are currently zoned RU2 Rural Landscape, which has the following objectives:

- To encourage sustainable primary production by maintaining and enhancing the natural resource base.
- To maintain the rural landscape character of the land.
- To provide for a range of compatible land uses, including extensive agriculture.
- To encourage the retention, management or restoration of native vegetation.

It is considered that this current RU2 zone does not reflect the highest and best long-term use of the site, as agricultural activities are not in demand or economically viable within the site, primarily due to the fact that the allotment size and topography are not well suited to such activities. Given the presence of endangered ecological communities (EECs), any further traditional agricultural uses (such as cattle grazing) may threaten the long term conservation and management of the identified vegetation. The Planning Proposal argued that the densely vegetated areas containing EECs would be best conserved and managed for the long term in accordance with the E2 Environmental Conservation zoning, and protected under a Biodiversity management plan. The objectives of the E2 Environmental Conservation zone are as follows:

- To protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values.
- To prevent development that could destroy, damage or otherwise have an adverse effect on those values.
- To retain and enhance the visual and scenic qualities of the Illawarra Escarpment.
- To maintain the quality of the water supply for Sydney and the Illawarra by protecting land forming part of the Sydney drinking water catchment (within the meaning of State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011) to enable the management and appropriate use of the land by Water NSW.

The BCAA and proposed biodiversity certification area includes areas of land mapped as Clause 7.2 Natural resource sensitivity - biodiversity of the Wollongong LEP 2009. The objective of Clause 7.2 is 'to protect, maintain or improve the diversity and condition of the native vegetation and habitat' including:

- Protecting biological diversity of native flora and fauna.
- Protecting the ecological processes necessary for their continued existence.
- Encouraging the recovery of threatened species, communities, populations and their habitats.

In contrast to the densely vegetated ridge side slopes, to be retained and managed as a BioBank site, the majority of the area that is proposed for rezoning from RU2 to E4 and certification is not mapped as Clause 7.2. Future rezoning and subsequent development applications resulting in a loss of a limited area mapped as Clause 7.2 would not be inconsistent with the objectives or further intent of Clause 7.2. In addition, the rezoning of the western section of the northern slopes from RU2 to E2, will provide a closer alignment of objectives for the retained areas of Clause 7.2 than is currently the case.

The majority of the BCAA, including the entire proposed biodiversity certification area, is mapped as Clause 7.8 Illawarra Escarpment area conservation of the Wollongong LEP 2009. The objective of this clause is to provide specific controls to protect, conserve and enhance the Illawarra Escarpment. Future rezoning of RU2 land to proposed E4 and E2 and subsequent development applications will result in a modification of defining attributes of the Illawarra Escarpment over a limited area. However this outcome is not considered to be inconsistent with the objectives or full intent of Clause 7.8.

Biodiversity certification provides for a strategic assessment including consideration, amendment and incorporation of local planning controls. In summary, it is considered that the proposed biodiversity certification aligns with environmental and conservation outcomes sought by the Wollongong LEP 2009 in the planning and development application process. The environmental and conservation outcomes accompanying a conferral of biodiversity certification would have otherwise been achieved through the alternative biodiversity assessment and approval pathways.

Commission of inquiry into the long term planning and management of the Illawarra Escarpment

The environmental planning and management functions associated with the Illawarra Escarpment within the City of Wollongong were examined in 1998 by a Commission of Inquiry (Simpson 1999) which, in addition to an extensive range of matters, considered numerous submissions associated with specific landholdings. The subject land, together with the adjoining Redgum Ridge Estate development, was one of the specific submissions considered and, in this regard, the following comments are relevant:

- The total property had an area of 106 hectares and was zoned 1 (Non Urban) within the Wollongong LEP 1990.
- The submission sought to rezone 44 hectares for the development of 420-440 residential lots and the remaining 66 hectares to be zoned for environmental protection purposes (it should be noted that Redgum Ridge Estate is expected to have a maximum yield of less than 220 residential lots).
- The site contained 22 hectares of moist Red Gum forest, of which 13 hectares will be lost for the residential development.
- The vegetation of the site to be retained should not be further fragmented and should be conserved as a whole with proper management.
- The site has opportunity for urban residential development (some 400 residential allotments) generally in the eastern portion of the site (again, see comment on maximum yield above).
- There appears to be opportunity for rural residential development within the cleared area in the centre of the north-western side of the site (1998 Commission of Inquiry, cited in WCC 2006).

It appears that the Commissioner recognised that the partially cleared ridge plateau had potential for limited low density residential development, provided that the matter of vegetation management within the site could be satisfactorily achieved. Accordingly, it is considered that the Planning Proposal is consistent with the findings of the Commission of Inquiry.

Illawarra Escarpment Strategic Management Plan 2015

Emanating from the Commission of Inquiry, the *Illawarra Escarpment Strategic Management Plan* (WCC 2015) was prepared by WCC to identify environmentally significant areas of the escarpment and foothills, and to identify possible changes to the zoning regime to align conservation requirements and land use zones. The partially cleared ridge plateau identified in the Planning Proposal is primarily mapped as "Landscape Support" which is defined as follows:

> *"Landscape support areas are those areas of land that form a link between core and support areas of the escarpment and foothills with the coastal plain. These areas have some scientific significance, as it relates to corridors and vegetation link, but are fragmented and do not always form contiguous links to core and support land . . ."*
>
> *Landscape support areas have potential for residential development, though these areas are to be determined through a Land Use Review Strategy process . . ."*

The *Illawarra Escarpment Strategic Management Plan* (WCC 2015) was a key planning document used in the determination of land use zones within Wollongong LEP 2009. The majority of the partially cleared ridge plateau is not identified for environmental conservation in either of these local planning instruments. The low density residential development (partially cleared ridge plateau) and environmental conservation (densely vegetated side slopes) envisaged by the Planning Proposal is consistent with the IESMP 2015.

Illawarra Regional Strategy: 2006-31

The *Illawarra Regional Strategy* (Department of Planning 2007) was considered in the development of the Planning Proposal including the following key outcomes:

- To provide 38,000 new dwellings by 2031 to accommodate the additional 47,600 people expected in the Region over the next 25 years.
- To ensure that 50% of new dwellings are provided in the form of detached housing.
- To protect high value environments including vegetation communities and habitat corridors by ensuring that new urban development minimise impacts on these important areas and their catchments.

Illawarra – Shoalhaven Regional Plan

The Illawarra – Shoalhaven Regional Plan (DPE 2015) provides the strategic policy, planning and decision-making framework to guide the region to sustainable growth over the next 20 years. Key principles underpinning the planning framework for this Plan include a range of cultural, economic and environmental considerations such as identifying and protecting land with high environmental value and recognising cultural heritage values. The Regional Plan identifies regional landscape biodiversity values and connections, and management challenges and sets directions for regional growth. In summary it is considered that the Planning Proposal, reliant on the conferral of biodiversity certification, is consistent with the following from the Regional Plan:

- Direction 2.4 Identify and conserve biodiversity values when planning new communities: biodiversity certification is acknowledged as a process to provide planning authorities the option to integrate biodiversity conservation with proposed development outcomes at the strategic planning stage.
- Direction 5.1 Protect the region's environmental values by focusing development in locations with the capacity to absorb development: the Planning Proposal has considered and applied aspects of Action 5.1.1 Avoid, minimise and mitigate the impact of development on significant environmental assets and Action 5.1.3 Protect the region's biodiversity corridors in local planning controls.

Environmental Planning and Assessment Act 1979

In considering the appropriate strategic outcome for the site, the objectives of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) should be considered. In particular:

> *"(a) To encourage:*
>
> > *(i) the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests . . . for the purpose of promoting the social and economic welfare of the community and a better environment.*
> >
> > *(ii) the promotion and co-ordination of the orderly and economic use and development of land . . .*
> >
> > *(iii) the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats;*
> >
> > *(vi) ecologically sustainable development . . ."*

The low density residential development of the partially cleared ridge plateau within the site, together with the conservation outcomes outlined in the Planning Proposal, will result in an environmentally sustainable outcome, in line with the objectives of the EP&A Act.

This outcome will also be consistent with the relevant Ministerial Directions as follows:

- Direction 1.2 Rural Zone –, the site is not suitable for agricultural activities due to allotment size and topography and, therefore, there is no need to protect the rural production value of this land.
- Direction 1.5 Rural Lands – noted as above.
- Direction 2.1 Environment Protection Zone – the environmentally sensitive areas within the site currently zoned for environmental protection will be maintained by this planning proposal and the BioBanking arrangements for the site will significantly enhance and conserve areas of environmental significance.
- Direction 4.4 Planning for Bushfire Protection – this direction has been appropriately addressed within the Bushfire Constraints Assessments (ABPP 2014).
- Direction 5.1 Implementation of Regional Strategies – this proposal will not be inconsistent with the housing and natural environment outcomes/actions contained within the *Illawarra Shoalhaven Regional Plan*.

The proposed residential development of the partially cleared centralised ridge plateau will be used to facilitate the retention, conservation and management of remnant vegetation on the northern and southern slopes within the BioBank site, resulting in a net positive benefit for native vegetation, including:

- Two threatened ecological communities (TECs) (*Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion* and *Illawarra Subtropical Rainforest in the Sydney Basin Bioregion*).
- One threatened species (White-flowered Wax Plant *Cynanchum elegans*).

The dedication of moderate to good condition remnant native vegetation under a conservation covenant would also assist in meeting targets set out under the *Illawarra Biodiversity Strategy* (WCC et al. 2011a, 2011b) and Southern Rivers Catchment Management Authority (SRCMA) *Catchment Action Plan* (CAP) 2006 to 2016, and the current SRCMA CAP 2013 – 2023 (SRCMA, 2013).

Pillar 3: Natural resources – strategies and priorities of SRCMA (2013) has a goal to achieve diverse, healthy, connected and productive natural environments. The objective of the goal is that the health and integrity of natural habitats support people and the environment. The target of the goal is that by 2023 land and water managers are supported to increase the adoption of practices that maintain or improve the:

- Extent and condition of priority habitats where the priorities for action and investment are:
  - Under reserved and threatened vegetation communities.
  - Habitat that supports threatened species.
  - High carbon capture ecosystems.
- Habitats that support connectivity priorities where the priorities for action and investment include State, regional and locally significant corridors.

It is noted that the subject land is mapped as occurring in the Escarpment Moist Forests Corridor (WCC et al., 2011a, 2011b). The identification of regional corridors in the strategy is to:

> *"Highlight those highest priority areas where Councils and other lead agencies should direct scarce resources, and support private land managers to participate in conservation and restoration efforts where resources allow."*

The strategy also states:

"Opportunities for acquisition of lands or rezoning should be guided by the values identified within this Strategy. Information that can be used to this end includes the mapping of regional biodiversity corridors, identification of vegetation priorities, and priority threatened species."

The dedication of the BioBank site for biodiversity conservation would see this strategic land retained for conservation in-perpetuity.

Written advice from OEH (18 February 2014) also acknowledges the potential for net conservation gains of the two TECs; Illawarra Lowlands Grassy Woodland and Illawarra Subtropical Rainforest. In addition to highlighting some of the specific benefits of establishing a BioBank site, OEH note that net gain conservation outcomes would be consistent with the objectives and targets of regional strategies including the *Illawarra Biodiversity Strategy* (WCC et al. 2011a and 2011b) and *Illawarra Regional Strategy: 2006–31* (Department of Planning 2007*),* with a focus on priority vegetation and important habitat corridors.

In view of the above, it is considered that the Planning Proposal is consistent with the relevant current strategic planning relevant to the BCAA.

1.2 Purpose of the document

This Biodiversity Conservation Strategy (BCS), and associated Biodiversity Assessment Report (BAR) (Appendix 1), has been prepared in support of an application to seek biodiversity certification under Section 126H of the TSC Act. This BCS seeks biodiversity certification of land proposed for future residential development within the BCAA (Figure 3).

The following parties have assisted in the preparation of these documents:

- Edenvell Pty Ltd: Richard Clifford
- MMJ Wollongong: Luke Rollinson
- Wollongong City Council: David Green, Kathryn Adams, John Wood and Brett Morrisey
- NSW Office of Environment and Heritage: Chris Page, Daniel Robson and Jedda Lemmon.

The BCS and BAR have been prepared by Nathan Garvey of Biosis Pty Ltd. Nathan is an accredited BioBanking Assessor (No. 0103). Nathan's curriculum vitae is included at Appendix 2.

The following groups are parties to the biodiversity certification:

- Edenvell Pty Ltd as the landowner and proponent for the proposed development.
- WCC as the planning authority lodging the biodiversity certification application.

No other groups are considered parties to the parties to the biodiversity certification.

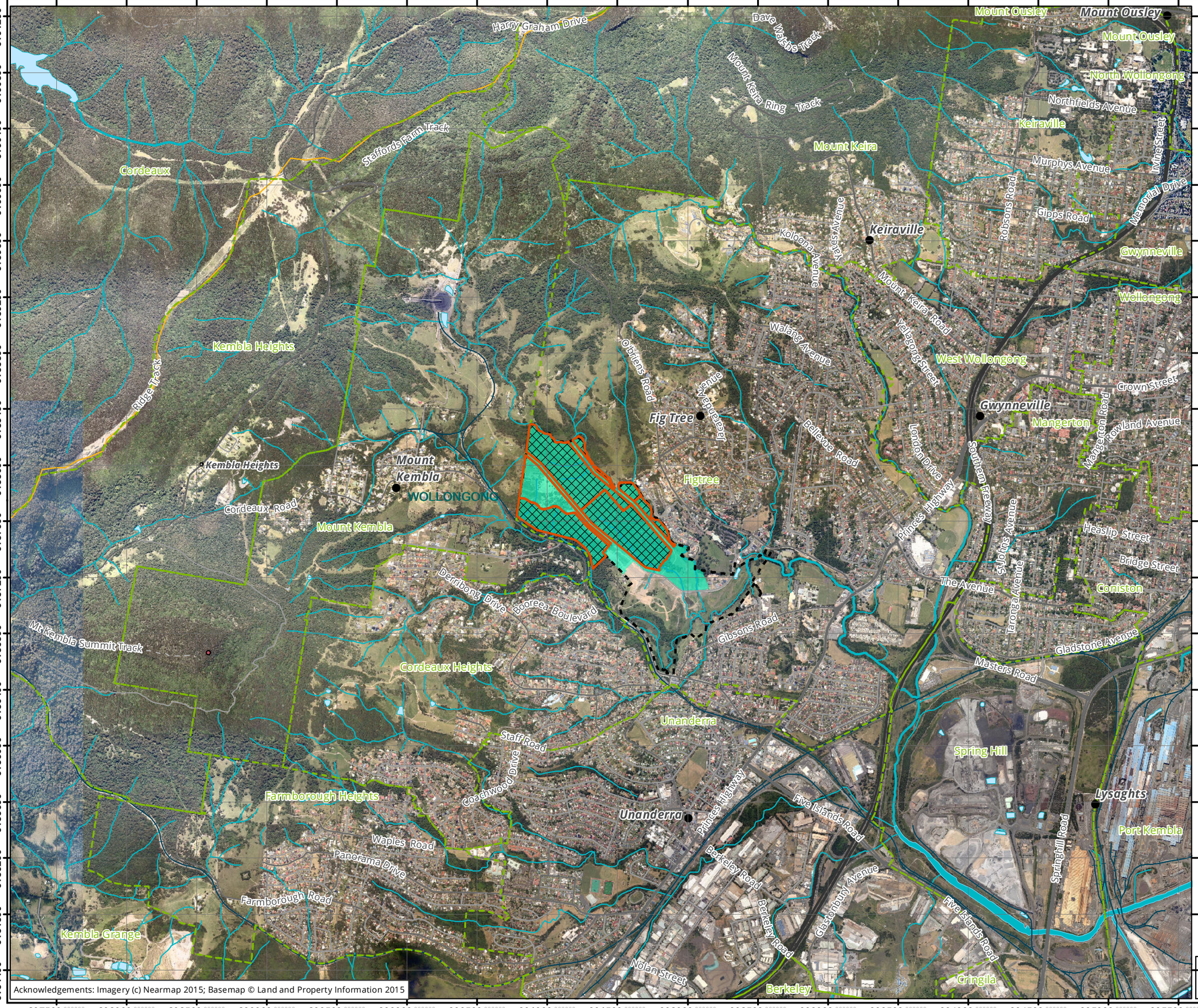
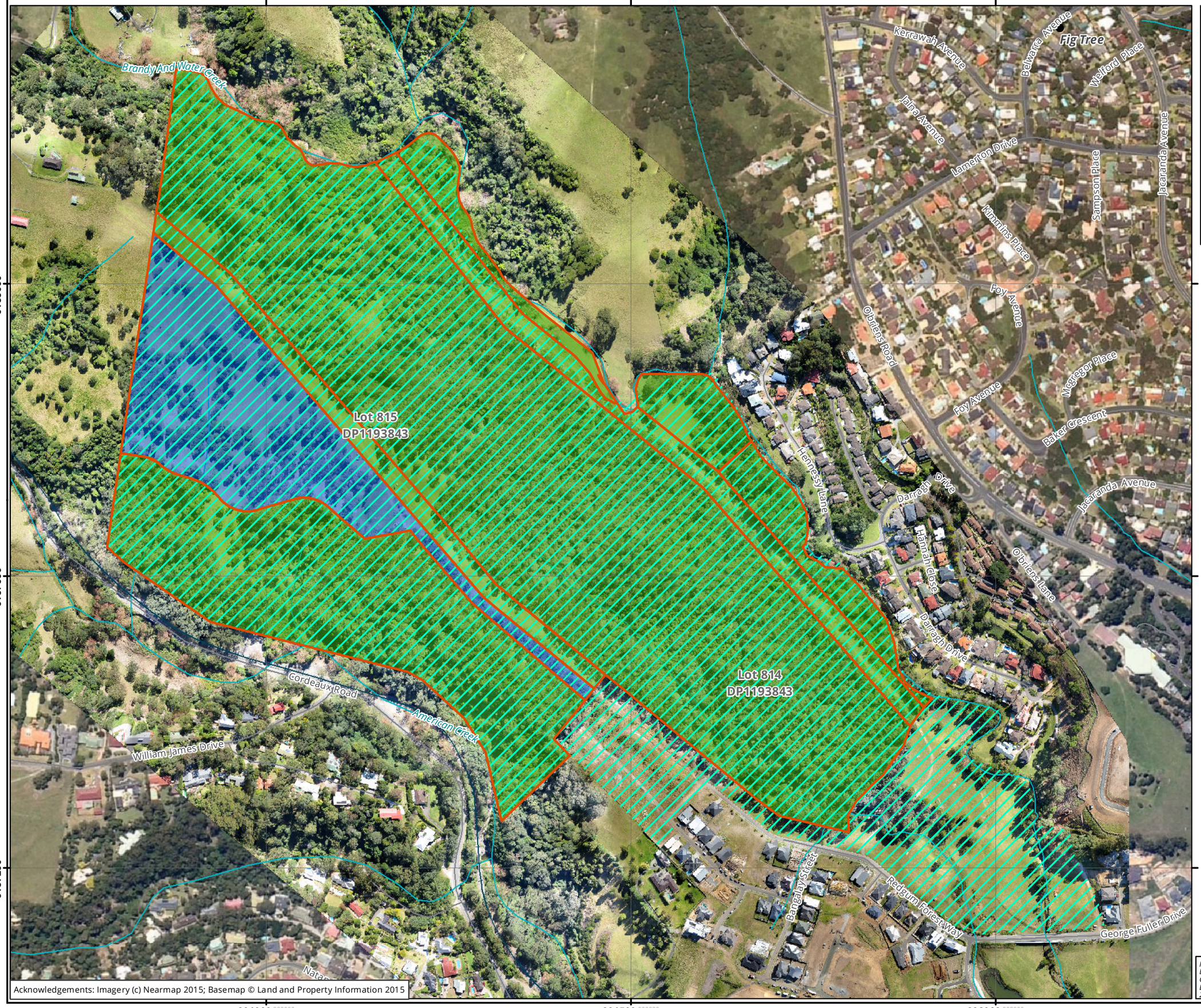


Figure 1: Location of the subject land – Redgum Ridge Estate Western Precinct, Figtree, NSW



Acknowledgements: Imagery (c) Nearmap 2015; Basemap © Land and Property Information 2015

Legend

- Lot 814 and 815 DP1193843
- Biodiversity Certification Assessment Area (BCAA)

Proposed zoning in the BCAA

- E2 - Environmental Conservation
- E4 - Environmental Living

Figure 2: Overview of the subject land – Redgum Ridge Estate Western Precinct, Figtree, NSW

0 40 80 120 160 200

Metres

Scale: 1:4,808 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

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Checked by: NMG, Drawn by: LH, Last edited by: ngarvey
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301000 000000
301500 000000
302000 000000
6188000 000000
6187600 000000
6187200 000000

Brandy And Water Creek
American Creek
Kerrawah Avenue
Jalna Avenue
Lamerton Drive
Foy Avenue
O'briens Road
Hennessy Lane
Darragh Drive
Hannah Close
Cordeaux Road
William James Drive
Gahnia Avenue
Redgum Forest Way

Legend

- Biodiversity Certification Assessment Area (BCAA)

Land within the BCAA

- Land proposed for biodiversity certification
- Retained land - BioBank Site
- Retained land - Easement

Proposed subdivision layout

- Proposed Lots
- Outer APZ
- Inner APZ
- Indicative Building Envelope
- Proposed Road

Figure 3: Overview of the Biodiversity Certification Assessment Area – Redgum Ridge Estate Western Precinct, Figtree, NSW

0 40 80 120 160 200

Metres
Scale: 1:4,059 @ A3
Coordinate System: GDA 1994 MGA Zone 56

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Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

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2. Strategic planning

2.1 Preliminary investigations

2.1.1 Summary of the Biodiversity Assessment Report (Biosis 2017)

Investigations of the BCAA were carried out by Biosis between September 2011 and September 2015, including:

- 2011 – A constraints assessment undertaken to document the flora and fauna habitats within the BCAA, and to inform concept plans for a proposed rezoning and residential development. Field work undertaken included initial mapping of the vegetation communities, random meanders for threatened flora species and assessment of fauna habitat features.
- 2013-2014 – A preliminary BioBanking assessment, including consultation with OEH and Local Land Services, to determine the feasibility of BioBanking or Biocertification of the site. Field work undertaken included confirmation of the vegetation types present and alignment with the NSW Biometric Vegetation Types (BVTs), as well as more detailed assessment of fauna habitat features within the BCAA.
- 2015 – Additional detailed surveys, including refinement of vegetation mapping using Light Detection and Ranging (LiDAR) data to map the tree canopy, ground-truthing to provide detailed mapping of vegetation and targeted surveys for threatened flora species within the BCAA.

The methodology for these assessments is detailed in the BAR (Appendix 1).

Site investigations confirmed that the BCAA supports 51.41 hectares of native vegetation and three vegetation types, with land proposed for biodiversity certification containing 4.59 hectares of native vegetation and two vegetation types (Table 1 and Figure 4).

Table 1 Vegetation types mapped within the BCAA

Vegetation type	Vegetation class	Vegetation formation	Area within land proposed for certification (ha)	Area within retained land (Biobank site) (ha)
SR545 – *Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion*	Coastal Valley Grassy Woodlands	Grassy woodlands	1.44	9.31
SR652 – *Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion*	Southern Escarpment Wet Sclerophyll Forests	Wet sclerophyll forests (shrubby sub-formation)	3.15	26.87
SR662 – Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion	Dry Rainforests	Rainforests	0	10.64

Vegetation in the area proposed for biodiversity certification is disturbed through regular slashing of the ground and midstory vegetation layers under a regrowth canopy. Areas where the tree canopy does not exist are dominated by exotic grasses such as Small-flowered Summer Grass *Digitaria violascens* and Kikuyu *Pennisetum clandestinum*. These areas are not considered native vegetation and are not discussed further. Within the BioBank site, vegetation is largely intact, but subject to varying levels of weed infestation. Vegetation within the BioBank site is discussed in detail in Biosis (2015) and attached in Appendix 1.

Forest Red Gum - Thin-leaved Stringybark grassy woodland (SR545) occurs on the eastern section of the area proposed for biodiversity certification within the BCAA (Figure 4). The canopy is dominated by remnant and regrowth Forest Red Gum from 15 to 25 metres with occasional Coast White Box. This area is lacking midstory species (Plate 1), but contains a groundcover with a moderate diversity of native grasses and native herbs. Common native species include Bushy Hedgehog-grass *Echinopogon caespitosus,* Forest Hedgehog Grass *Echinopogon ovatus, Carex longebrachiata*, Kidney Weed, Climbing Guinea Flower *Hibbertia scandens,* Trailing Speedwell *Veronica plebeia,* Pennywort *Hydrocotyle peduncularis*, Weeping Grass, Whiteroot *Pratia purpurascens,* Slender Tick-trefoil *Desmodium varians* and Bearded Tylophora *Tylophora barbata*. The dominant exotic species include Small-flowered Summer Grass *Digitaria violascens*, Kikuyu *Pennisetum clandestinum,* Cobbler's Pegs *Bidens pilosa*, Spear Thistle *Cirsium vulgare*, Panic Veldtgrass *Ehrharta erecta* and Red-flowered Mallow *Modiola carolinianum*.

Plate 1 Illawarra Lowlands Grassy Woodland in the BCAA, showing disturbance resulting from regular slashing

Sydney Blue Gum X Bangalay - Lilly Pilly Moist Forest (SR652) occurs in the western two thirds of the area proposed for biodiversity certification within the BCAA (Figure 4). Along the western ridge *Eucalyptus saligna* X

botryoides, Blackwood *Acacia melanoxylon* and Cheese Tree *Glochidion ferdinandii* are dominant. Coast White Box *Eucalyptus quandrangulata* and Lilly Pilly *Acmena smithii* become progressively more prominent moving down the southern slope, with Forest Red Gum *Eucalyptus tereticornis* occurring occasionally and increasing to the east in the intergrade to Forest Red Gum - Thin-leaved Stringybark grassy woodland. The midstory and understory are highly modified through regular slashing, with both strata being absent in the higher ridge areas (Plate 2). The groundcover in the slashed areas is a mix of native grasses and vines, and exotic grasses and herbs. Native species include; Milk Vine *Marsdenia rostrata,* Sweet Morinda *Morinda jasminoides,* Blady Grass *Imperata cylindrica, Carex longebrachiata*, Kidney Weed *Dichondra repens*, Weeping Grass *Microlaena stipoides* var. *stipoides* and *Oplismenus aemulus*, whilst dominant exotic species included; Narrow-leafed Carpet Grass *Axonopus fissifolius,* Small-flowered Summer Grass *Digitaria violascens*, Cobbler's Pegs *Bidens pilosa*, Spear Thistle *Cirsium vulgare*, Panic Veldtgrass *Ehrharta erecta* and Black Medic *Medicago lupulina*.

While SR662 – Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion occurs within the BCAA, this PCT is not present within the area subject to biodiversity certification. This PCT is consistent with Illawarra Subtropical Rainforest Endangered Ecological Community (EEC). Further details regarding the occurrence and condition of SR662 are provided within Appendix 1 of the BAR.

Plate 2 Illawarra Lowlands Grassy Woodland in the BCAA, showing disturbance resulting from regular slashing

Targeted surveys for threatened flora species did not record any threatened species in the area proposed for biodiversity certification within the BCAA. Habitat assessments undertaken to determine the likelihood of threatened fauna species occurring in the BCAA determined it was unlikely that the area proposed for biodiversity certification within the BCAA supports any threatened flora or fauna species ('credit species'), largely due to the high levels of disturbance within the site. Habitat in the area proposed for biodiversity certification within the BCAA is considered to be of poor quality.

A copy of the BAR is provided in Appendix 1.

2.1.2 Red flag areas and other constraints

One red flag was identified in the area proposed for biodiversity certification within the BCAA (Figure 5). Forest Red Gum - Thin-leaved Stringybark grassy woodland (SR545) is considered to be consistent with the *Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion endangered ecological community* (EEC) under the TSC Act and *Illawarra and south coast lowland forest and woodland ecological community* critically endangered ecological community (CEEC) under the EPBC Act. In addition, this vegetation type is estimated to be 85 percent cleared in the Southern Rivers Catchment Management Authority (CMA) area. This red flag is subject to ongoing disturbance through regular slashing.

A total of 10.64 hectares of Illawarra Subtropical Rainforest EEC and 89 individual White-flowered Wax Plant *Cynanchum elegans*, listed as vulnerable under the TSC Act and EPBC Act are located within the BioBank site of the BCAA. No vegetation consistent with the EEC Illawarra Subtropical Rainforest or any White-flowered Wax Plant individuals were identified within the land proposed for biodiversity certification. As such, these red flags will be protection and managed in perpetuity and a red flag variation is not required.

The bushfire constraints assessment undertaken by Australian Bushfire Protection Planners Pty Limited (ABPP 2014) and prepared to accompany the Planning Proposal, identified bushfire hazards affecting the BCAA, and assessed and designed amelioration measures to reduce this hazard. This has included the design of a perimeter road and recommendation of asset protection zones (APZs) for the proposed residential development of the BCAA (Figure 3). Correspondence has been received from the NSW Rural Fire Service (RFS) commenting on the Planning Proposal including the report by ABPP (2014). The RFS recommended consideration of an additional access point to the proposed development, or alternatively a plan of management be established with regard to the vegetation adjacent the proposed thoroughfare. An onsite meeting with RFS confirmed that a dual lane access road, with a managed corridor provided to each side of the road, would be a suitable outcome. The RFS will need to approve any vegetation management actions submitted as part of a subdivision development application.

2.2 Land proposed for biodiversity certification

2.2.1 Biodiversity Certification Assessment Area

As outlined in Section 1.1.2, the BCAA includes all land subject to future development, as well as retained land (including several easements and a BioBank site) and includes part of Lots 815 DP1193843 and 1801 DP1223063 (Figure 3).

The land proposed for biodiversity certification within the BCAA has been identified through an iterative process, with a focus on constraining development to land that has been subject to historic and ongoing disturbance. The land owner engaged Biosis to undertake a constraints assessment (Biosis 2011) to inform concept plans for the proposed rezoning and residential development. This assessment identified that biodiversity values along the centralised ridge plateau were limited to a regrowth canopy over a groundcover disturbed by regular slashing, whilst the northern and southern slopes support significant biodiversity values, including two TECs and one threatened flora species. The long-term land use strategy for the BCAA has been

directed by the site's existing environmental (and topographic) qualities, with proposed development restricted to disturbed land, minimising impacts to native vegetation and avoiding impacts to threatened biodiversity and its potential habitat.

As outlined in Section 1.1.2, no land in or outside the BCAA is proposed for conservation measures as a part of the application for biodiversity certification. A BioBank site has been established within the BCAA (identified as 'Retained land – BioBank site' in Figure 3). The appropriate conservation measure for the biocertification application will be the acquisition and retirement of credits from the BioBank site within the BCAA.

Through consultation between OEH, WCC and the land owner, this option has been selected as it will ensure that funding for ongoing management of the BioBank site is available to achieve the conservation management objectives.

2.2.2 Community engagement

The following summarises the community notification and engagement to date for the proposed biodiversity certification:

- The publically available WCC Business Paper for the Ordinary Meeting of Council on 15 December 2014 (WCC 2014b) noted feedback from the OEH review of the draft Planning Proposal and that biodiversity certification could be an option, as opposed to a conventional biobanking agreement.
- The draft Planning Proposal and suite of documentation was exhibited between 16 March and 17 April 2015, with surrounding residents and key stakeholders notified by mail and advertisements placed in the local newspapers. The suite of materials was made available on WCC's website, at libraries and in WCC's Customer Service Centre.
- The publically available WCC Business Paper for the Ordinary Meeting of Council 14 December 2015 (WCC 2015d) recommended that WCC support in-principle the establishment of a Biodiversity Certification Strategy for the Western Precinct Redgum Ridge Estate Planning Proposal.
- Agenda item for the March 2015 meeting of the Escarpment Planning Reference Group.

In accordance with Section 126N of the TSC Act, WCC as the planning authority is required to publish notice of the application in a newspaper circulating generally throughout the State and on the planning authority's website. Copies of the application and supporting documents must be publicly available for a minimum of 30 days. At the close of the exhibition, Council must provide a submissions report to the Minister administering the TSC Act. OEH then make recommendations to the Minster, who either confers biodiversity certification on the specified land or refuses it. The biodiversity certification application will be publically exhibited and submissions from the public will be sought, responded to where necessary and reported.

2.2.3 Red flag areas and variation request

The land proposed for biodiversity certification within the BCAA contains one red flag area, with 1.44 hectares of Forest Red Gum - Thin-leaved Stringybark grassy woodland (SR545) being a red flag as a result of this vegetation type being consistent with the Illawarra Lowlands Grassy Woodland EEC and being more than 70 percent cleared in the Southern Rivers CMA (estimated to be 85 percent cleared).

As a result, this BCS seeks a red flag variation to allow impacts to this red flag area to be offset.

Table 2 addresses the red flag variation criteria set out in Section 2.4 of the *Biodiversity Certification Assessment Methodology* (DECCW 2011). Only those criteria relevant to vegetation types (as opposed to threatened species) are considered.

Table 2 Red flag variation request, including variation criteria and response

Red flag variation criteria and response
Feasibility of options to avoid impacts on red flag area(s) where biodiversity certification is conferred:
a) All reasonable measures have been taken to avoid adverse impacts on the red flag areas and to reduce impacts of development on vegetation remaining within the biodiversity certification area.
Measures to avoid and minimise impacts are outlined in Section 2.2.1. The biodiversity certification, as proposed, will result in the permanent removal of 1.44 hectares and the permanent protection of 9.31 hectares of Illawarra Lowlands Grassy Woodland. The area of Illawarra Lowlands Grassy Woodland to be removed is in low condition. The following process has been undertaken to avoid and minimise impacts to red flags areas occurring in the BCAA: • The land owner engaged Biosis to undertake a constraints assessment (Biosis 2011) to inform concept plans for the proposed rezoning and residential development. • This assessment was used to inform the location of residential development in areas of lower quality vegetation previously subject to historic and ongoing disturbance resulting from regular slashing of understorey and groundcover vegetation. • Following consultation with Biosis, WCC and OEH, the land owner the reduced the lot yield and re-sited perimeter roads to further reduced impacts to the red flag. • The Planning Proposal to rezone RU2 Rural Landscape to E4 Environmental Living under the Wollongong LEP will also ensure that the long-term land use for the residential subdivision is guided by the site's existing topography and environmental qualities. Finally, through the establishment of a BioBank site, areas supporting high biodiversity value on mid to lower slopes to the north and south of the BCAA will be conserved and managed for conservation in-perpetuity.
b) Appropriate conservation management arrangements cannot be established over the red flag area given its current ownership, status under a regional plan and zoning and the likely costs of future management.
The BCAA is located immediately to the west of the existing Redgum Ridge Estate and is owned by the developer Edenvell Pty Ltd. The land was purchased for residential development, in line with the recommendations of the 1998 Commission of Inquiry which concluded that the cleared area in the centre of the north-western side of the site was suitable for residential development. The majority of the red flag area, along with sections of the BioBank site, are currently zoned RU2 Rural Landscape. This zoning does not reflect the highest and best long-term use of land within the BCAA, as agricultural activities are not in demand or economically viable given the size of the site and surrounding land use, particularly residential development. This zoning may also jeopardise the long-term conservation and management of high biodiversity values identified within the BioBank site. Thus the Planning Proposal seeks to realign zoning boundaries to allow low density residential development in areas subject to disturbance whilst protecting areas of high biodiversity value. These objectives are aligned with the outcomes outlined in the *Illawarra Regional Strategy* (Department of Planning 2007) which seeks to encourage residential development whilst protecting high value environments and habitat corridors. The establishment of conservation measures over the red flag area is not considered suitable as they:

- Are not consistent with the adjacent land use within the Redgum Ridge Estate or the purpose for which the land was purchased.
- Are not consistent with the land use recommended by the 1998 Commission of Inquiry.
- Are not consistent with the objectives of the current zoning.
- Do not encourage the long term conservation and management of high biodiversity values on land to the north within the BioBank site.
- Given the current condition of vegetation and past and ongoing land uses and associated disturbance, it is unlikely that management of this vegetation would result in an improvement in the viability without significant management of the site and associated high costs.

Additional assessment criteria for vegetation types (Section 2.4.2 of BCAM):

The viability of the red flag area must be low or not viable

(a) The current or future uses of land surrounding the red flag area where biodiversity certification is to be conferred reduce its viability or make it unviable. Relatively small areas of native vegetation surrounded or largely surrounded by intense land uses, such as urban development, can be unviable or have low viability because of disturbances from urbanisation, including edge effects.

The red flag area is subject to high levels of disturbance through regular slashing of the understorey and groundcover vegetation. The result is a regrowth canopy consisting of immature trees over a groundcover consisting of a mix of native and exotic grasses maintained at a height of approximately 10 centimetres.

(b) The size and connectedness of the vegetation in the red flag area where biodiversity certification is to be conferred to other native vegetation is insufficient to maintain its viability. Relatively small areas of isolated native vegetation can be unviable or have low viability.

The red flag area is located adjacent to other areas of remnant vegetation, and forms part of a corridor linking vegetation on coastal areas to the east with the Illawarra Escarpment and Woronora plateau to the west. However, native vegetation within land proposed for biodiversity certification is simplified and more highly disturbed compared with remnant vegetation in this corridor. Analysis of site attribute data obtained during surveys (Biosis 2011, 2014, 2017) indicates that the red flag area has much lower native midstory cover, lower native groundcover (shrubs), much higher levels of exotic plant cover and lower levels of fallen logs. Given the current slashing regime and grazing by deer, further degradation of the red flag area is likely to occur further reducing its long term viability.

(c) The condition of native vegetation in the red flag area where biodiversity certification is to be conferred is substantially degraded, resulting in loss of or reduced viability. Native vegetation in degraded condition can be unviable or have low viability. 'Degraded condition' means substantially outside benchmark for many of the vegetation condition variables as listed in Table 1 of the methodology (s.3.6.2), without the vegetation meeting the definition of low condition set out in section 2.3. Vegetation that is substantially outside benchmark due to a recent disturbance such as a fire, flood or prolonged drought is not considered degraded for the purposes of the methodology.

Given the current levels of disturbance, resulting in ongoing degradation of the red flag area, and the condition of the red flag area in comparison to adjacent areas of Illawarra Lowlands Grassy Woodland the viability of the red flag area is considered low. Even, if the Red Flag areas was retained in the BCAA

the future residential development in the proposed Biocertification area would impact its long term viability.

(d) The area of a vegetation type in a red flag area on land where biodiversity certification is conferred is minor relative to the area containing that vegetation type on land subject to proposed conservation measures.

The biodiversity certification, as proposed, will result in the permanent removal of 1.44 hectares and the permanent protection of 9.31 hectares of Illawarra Lowlands Grassy Woodland. The vegetation to be retained represents a total of 87% of the Illawarra Lowlands Grassy Woodland occurring within the BCAA. Therefore, the removal of 1.44 hectares in low condition is considered to be minor in relation to that subject to conservation.

Based on an assessment of the criteria above, the viability of the red flag area is considered to be low in accordance with Section 2.4.2.1 of the BCAM (OEH 2014).

The contribution to regional biodiversity values of the red flag area is low

a) relative abundance: that the vegetation type or critically endangered or endangered ecological community comprising the red flag area is relatively abundant in the region

The proposed residential development will result in the permanent removal of 1.44 hectares of Illawarra Lowlands Grassy Woodland in degraded condition, consisting largely of scattered trees over a mown grassy groundcover. However, the proposed residential development will enable the conservation and management of 9.31 hectares of Illawarra Lowlands Grassy Woodland in higher condition.

Further, NPWS (2002) maps a total of 794 hectares of Coastal Grassy Red Gum Forest (MU23) and 473 hectares of Lowland Woollybutt-Melaleuca Forest in the region, totalling 1268 hectares. These communities are equivalent to Illawarra Lowlands Grassy Woodland.

b) percent remaining is high: that the percent remaining of the vegetation type or critically endangered or endangered ecological community comprising the red flag area is relatively high in the region

Vegetation mapping by NPWS (2002) maps a total of 1268 hectares of Illawarra Lowlands Grassy Woodland in the region. The 1.44 hectares to be removed represents 0.11% of the community in the region.

c) percent native vegetation (by area) remaining is high: that the percent remaining of all native vegetation cover in the region is relatively high.

As outlined above, NPWS (2002) maps a total of 1268 hectares of Illawarra Lowlands Grassy Woodland in the region. The removal of 1.44 hectares will result in 1266 hectares of Illawarra Lowlands Grassy Woodland remains.

NPWS (2002) maps 18,829 hectares of native vegetation in the region. The removal of 1.44 hectares of Illawarra Lowlands Grassy Woodland will result in 18,828 hectares of native vegetation remaining in the region.

Based on an assessment of the criteria above, the contribution of the red flag area to regional biodiversity values is low in accordance with Section 2.4.2.2 of the BCAM (OEH 2014).

2.2.4 Indirect impacts

Potential impacts resulting from the proposed residential development in the BCAA will be largely restricted to land proposed for biodiversity certification. Indirect impacts are largely restricted to:

- Reduced viability of flora and fauna species in the BioBank site due to influence of adjacent land use, including:
  - Encroachment of weeds into the BioBank site.
  - Management of vegetation within APZs impacting on the BioBank site.
  - Increased predation of native fauna by domestic pets.
- Changes in the quality of water entering American Creek and Brandy and Water Creek due to increased levels of pollutants and contaminants and additional weed invasion from stormwater run-off, resulting in impacts to biodiversity values in these waterways.

It is important to note that the proposed residential development is not high intensity development, but rather, low density residential development within an E4 Environmental Living zoning. The objectives of this zoning are:

- *"To provide for low-impact residential development in areas with special ecological, scientific or aesthetic values.*
- *To ensure that residential development does not have an adverse effect on those values."*

These objectives will influence future development of land proposed for residential development, ensuring development is consistent with the biodiversity values present in the BioBank site.

The EPBC Approved Conservation Advice (DEE 2016) for the Illawarra and south coast lowland forest and woodland ecological community recommended a minimum buffer zone of 30 m from the outer edge of the patch is provided to act as a barrier to further direct disturbance. Where the buffer is subject to existing land uses, such as cropping, grazing or fire breaks, these can continue. The BioBank site is buffered from the area proposed for residential development by the perimeter road and a gas easement to the north, and the perimeter road to the south (Figure 3). This will result in a buffer between residential development and the BioBank site of between 40 metres and 20 metres, reducing the impacts of weed invasion from future development areas.

In addition, the BioBank site currently supports moderate levels of weed invasion, particularly from Lantana. As a part of the management actions to be undertaken within the BioBank site weeds will be managed resulting in an overall net positive outcome and lower weed levels.

The current bushfire protection measures proposed for the residential development include a perimeter road around residential areas, and incorporation of the gas easement into the APZ along the northern boundary. These measures have minimised the amount of the APZ that will be located within the BioBank site, reducing the area of native vegetation that will be managed for bushfire protection to a small area along the access road. This small section of the APZ is currently disturbed by regular slashing; the management of this area will result in the same level of disturbance, but will not result in any additional clearing of vegetation. This management does not require additional credits, but will rather reduce the number of credits generated within the relevant management zone in the BioBank site.

Stormwater will be managed in accordance with standard WCC development control requirements and include:

- Rainwater harvesting from the roof of structures and storage within tanks for use in association with landscaping.
- The collection and direction of water associated with the impervious surface area to an underground drainage network (including on-site detention) to be connected to the existing network to the east.

This management will prevent the direction of stormwater to the residue lands and, therefore, maintain the existing water balance associated with these sensitive environments. As required by "best practice" engineering requirements, temporary erosion control and silt arresting measures will be installed and maintained during construction work.

The majority of potential indirect impacts will be managed and mitigated through the measure above and those included in the BioBank site BAR such as fencing to restrict access for rubbish dumping and the like.

2.3 Conservation measures

No land in the BCAA is proposed for conservation measures as a part of the application for biodiversity certification. However, Edenvell Pty Ltd have obtained a BioBanking Agreement (Agreement 221) to establish a BioBank site on land supporting high biodiversity value within the northern and southern sections of the BCAA (Figure 3). This will result in permanently managed and funded conservation measures within the BCAA. Biodiversity credits required to achieve biodiversity certification of land within the BCAA will be sourced from this BioBank site.

2.4 Processes and procedures

WCC, as the planning authority, will be submitting the application for biodiversity certification of the BCAA to OEH on behalf of Edenvell Pty Ltd.

Edenvell Pty Ltd have obtained a BioBanking agreement, to establish a BioBank site on retained land in the north and south of the BCAA in order to retain and manage land supporting high biodiversity value. This BioBank site will be used to fulfil the biodiversity credits required to offset losses arising from the removal of native vegetation due to biodiversity certification. Once biodiversity certification is conferred over the BCAA, Edenvell Pty Ltd will immediately retire the required credits.

Once development of the BCAA is completed (subject to a separate development application and WCC approval) Edenvell Pty Ltd will dedicate the BioBank site to WCC. Subject to sale of the biodiversity credits within the BioBank site, management of the biodiversity values in the BioBank site will be fully funded.

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Brandy And Water Creek

American Creek

Cordeaux Road

William James Drive

Kerrawah Avenue

Jalna Avenue

Lamerton Drive

Foy Avenue

O'briens Road

Foy Avenue

Hennessy Lane

Darragh Drive

Hannah Close

Darragh Drive

Redgum Forest Way

Acknowledgements: Imagery (c) KFW, Nearmap 2015; Basemap © Land and Property Information 2015

Legend

Biodiversity Certification Assessment Area (BCAA)

Land within the BCAA

Land proposed for biodiversity certification

Retained land - BioBank Site

Retained land - Easement

Native vegetation (Biosis 2015)

Forest Red Gum - Thin-leaved Stringybark grassy woodland, Moderate/Good,

Forest Red Gum - Thin-leaved Stringybark grassy woodland, Moderate/Good, Derived grassland

Sydney Blue Gum x Bangalay Lilly Pilly moist forest, Moderate/Good,

Sydney Blue Gum x Bangalay Lilly Pilly moist forest, Moderate/Good, Poor

Sydney Blue Gum x Bangalay Lilly Pilly moist forest, Moderate/Good, Derived grassland

Sydney Blue Gum x Bangalay Lilly Pilly moist forest, Low,

Whalebone Tree - Native Quince dry subtropical rainforest, Moderate/Good,

Whalebone Tree - Native Quince dry subtropical rainforest, Low,

Figure 4: Native vegetation within the BCAA

0 40 80 120 160 200

Metres

Scale: 1:4,059 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

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Date: 23 December 2015,
Checked by: NMG, Drawn by: LH, Last edited by: ngarvey
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6188000 000000

6187600 000000

6187200 000000

Brandy And Water Creek

American Creek

Kerrawah Avenue

Jalna Avenue

Lamerton Drive

Foy Avenue

Obriens Road

Hennessy Lane

Darragh Drive

Hannah Close

Cordeaux Road

William James Drive

Redgum Forest Way

Legend

- Biodiversity Certification Assessment Area (BCAA)

Land within the BCAA

- Land proposed for biodiversity certification
- Retained land - BioBank Site
- Retained land - Easement
- Red flag areas

Acknowledgements: Imagery (c) KFW, Nearmap 2015; Basemap © Land and Property Information 2015

Figure 5: Red flag areas and other constraints

0 40 80 120 160 200

Metres

Scale: 1:4,059 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

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Date: 23 December 2015,
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3. Matching losses and gains in biodiversity credits

3.1 Summary of credits required

Table 3 provides a summary of biodiversity credits required to offset losses arising from the removal of 4.59 hectares of native vegetation due to biodiversity certification.

Table 3 Summary of biodiversity credits required to offset losses due to biodiversity certification

Vegetation zone details	Vegetation zone area (ha)	Number of credits required
Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion – SR652_Moderate/Good	3.15	54
Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion – SR545_Moderate/Good	1.44	31

The biodiversity credit report is provided in Appendix 3.

Section 10 of the Biodiversity Certification Assessment Methodology (DECCW 2011) sets out rules which govern how credits required by the biodiversity certification of the BCAA can be offset. Table 4 provides a summary of credit matching options for biodiversity credits required to offset losses due to biodiversity certification.

Table 4 Credit matching options for biodiversity credits required to offset losses due to biodiversity certification

Vegetation type	Credit matching options
SR545 Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	SR545 Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion
	Coastal Valley Grassy Woodlands
	Grassy woodlands
SR652 Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion	SR652 Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion
	Southern Escarpment Wet Sclerophyll Forests
	Wet sclerophyll forests (shrubby sub-formation)

As per Section 2.3, biodiversity credits required by biodiversity certification of the BCAA will be offset by purchasing and retiring credits from the BioBank site, meaning credits to be retired will be of matching vegetation i.e. like for like credits/vegetation types.

3.2 Summary of credits generated from proposed 'on land' conservation measures

No 'on land' conservation measures are proposed. Edenvell Pty Ltd have obtained a BioBanking Agreement (Agreement 221) to establish a BioBank site on land supporting high biodiversity value within the northern and southern sections of the BCAA (identified as 'Retained land – BioBank site' in Figure 3). This will result in permanently managed and funded conservation measures.

Table 5 provides a summary of the ecosystem credits available within the BioBank site.

Table 5 Summary of biodiversity credits available in the BioBank site

Vegetation type	Vegetation type area (ha)	Number of credits available
Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion – SR652	26.87	281
Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion – SR545	9.30	118
Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion – SR662	10.65	115

In addition, 632 White-flowered Wax Plant *Cynanchum elegans* credits are generated.

In accordance with Section 8.1.1 of DECCW (2011) to offset the impacts of conferral of biodiversity certification, the acquisition and retirement of biodiversity credits from the biodiversity register within the BCAA is proposed.

3.3 Credit status

The biodiversity certification proposal will result in the retirement of all biodiversity credits required to offset losses due to biodiversity certification and achieve the improve or maintain outcome required under BCAM.

Following retirement of these credits, the BioBank site will retain the credits outlined in Table 6.

Table 6 Summary of biodiversity credits retained within the BioBank site following retirement of required credits

Vegetation type	Number of credits retained
Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion – SR652	227
Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion – SR545	87
Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion – SR662	115

The surplus credits in Table 6 will be available for sale by Edenvell Pty Ltd which will provide the funding to satisfy the Biobank site Total Fund Deposit.

No financial contributions are required, as there is no credit deficit.

3.4 Improve or maintain status

The biodiversity certification of the BCAA will improve the biodiversity values in the region by:

- Enabling the establishment of a BioBank site, ensuring the conservation and management of high biodiversity values on land located in the northern and southern parts of the BCAA.
- Assisting in meeting targets set out under the *Illawarra Biodiversity Strategy* (WCC et al., 2011a, 2011b) and *Southern Rivers Catchment Management Authority (CMA) Catchment Action Plan (CAP) 2006 to 2016*, and the current *SRCMA CAP 2013 – 2023* (SRCMA, 2013).
- Providing ongoing, in-perpetuity protection for two TECs (Illawarra Lowlands Grassy Woodland and Illawarra Subtropical Rainforest) and one threatened flora species (White-flowered Wax Plant), including improvement in habitat through ongoing, funded management.
- Maintaining connectivity between significant biodiversity values on the Woronora plateau and in the Illawarra escarpment, to the west, and the Illawarra coastal floodplain to the east identified in biodiversity corridor mapping of regional strategic plans (WCC et al 2011a and DPE 2015).

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WCC 2015d Minutes of Ordinary Meeting of Council Monday 14 December 2015. Wollongong City Council, Wollongong.

Appendices

Appendix 1 Redgum Ridge Western Precinct (part Lot 815 DP1193843): Biodiversity Assessment Report (BAR)

Redgum Ridge Western Precinct (part Lots 815 DP1193843 and 1801 DP1223063) Biodiversity Certification:

Biodiversity Assessment Report

Final Report (Version 3)

Prepared for Edenvell Pty Ltd

24 May 2017

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- MMJ Wollongong: Luke Rollinson
- Wollongong City Council: David Green, Kathryn Adams, John Wood, Brett Morrisey
- NSW Office of Environment and Heritage: Chris Page, Daniel Robson, Jedda Lemmon

Biosis staff involved in this project were:

- Axton Aguiar and Mathew Misdale (assistance in the field)

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Glossary

APZ	Asset Protection Zone
BA	Birds Australia
BAR	Biodiversity Assessment Report
BCAA	Biodiversity Certification Assessment Area
BCS	Biodiversity Conservation Strategy
BVT	Biometric Vegetation Type
CAP	Catchment Action Plan
CMA	Catchment Management Area
Council	Wollongong City Council
DCDB	Digital Cadastral Database
DIWA	Directory of Important Wetlands
DoE	Commonwealth Department of the Environment
DP	Deposited Plan
DTDB	Digital Topographic Database
E4	Environmental Living zoning under the Wollongong LEP
EEC	Endangered Ecological Community
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
GIS	Geographic Information System
GPS	Geographic Position System
ha	Hectares
IBRA	Interim Biogeographical Regionalisation of Australia
LEP	Local Environment Plan

LGA	Local Government Area
LiDAR	Light Detection and Ranging
Locality	10 kilometre buffer of the study area
LPI	NSW Lands and Property Information
NV Act	NSW *Native Vegetation Act 2003*
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
RU2	Rural Landscape zoning under the Wollongong LEP
SALIS	Soil and Land Information System
SEPP	State Environmental Planning Policy
SRCMA	Southern Rivers Catchment Management Area
TEC	Threatened Ecological Community
TSC Act	NSW *Threatened Species Conservation Act 1995*
VIS	NSW Vegetation Information System

Summary

MMJ Wollongong, on behalf of Edenvell Pty Ltd, is co-ordinating the preparation and lodgement of a Planning Proposal request to Wollongong City Council for the rezoning of land in Lot 815 in Deposited Plan (DP) 1193843, Figtree (Figure 1) from RU2 Rural Landscape to E4 Environmental Living and E2 Environmental Conservation under the Wollongong Local Environment Plan 2009 (LEP) in order to facilitate low density residential development and long term conservation of environmental values on site. The Planning Proposal request includes the creation of approximately 27 residential lots, asset protections zones (APZs), roads and other associated infrastructure (Figure 2).

Based on these investigations Edenvell Pty Ltd proposes to rezone the centralised ridge plateau from RU2 Rural Landscape to E4 Environmental Living under the Wollongong Local Environmental Plan 2009 (LEP) to facilitate low density residential development. Areas of high biodiversity value on side slopes will be retained within an expanded E2 Environmental Conservation zone. This E2 zone will be retained and managed for conservation through the development of a BioBanking Agreement and dedication of the land as a BioBank site. Land proposed for future development will be biodiversity certified (to be zoned E4), with the BioBank site identified as retained land (to be zoned E2).

This Biodiversity Assessment Report (BAR) has been prepared in support of an application to seek biodiversity certification under Section 126H of the NSW *Threatened Species Conservation Act 1995* (TSC Act). The Biodiversity Certification Assessment Area (BCAA) includes both the land proposed for biodiversity certification and the BioBank site Figure 2. The area proposed for biodiversity certification includes part of Lot 815 in Deposited Plan (DP) 1193843 and encompasses 8.11 hectares, the Biobank site includes part of Lots 815 DP1193843 and 1801 DP1223063 and encompasses 46.82 hectares.

Biodiversity assessment of the BCAA has been ongoing since 2011. These assessments identified that two parcels of land to the north and south, within Lots 815 of DP 1193843 and 1801 DP1223063, support significant biodiversity values, including two threatened ecological communities (TEC) as well as threatened species listed under the TSC Act and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The protection and management of these areas is supported by both Wollongong City Council (Council) and the NSW Office of Environment and Heritage (OEH) due to the conservation outcomes and assistance in meeting targets set out under the *Illawarra Biodiversity Strategy* (WCC et al., 2011a, 2011b) and Southern Rivers Catchment Management Authority (SRCMA) Catchment Action Plan (CAP) 2006 to 2016, and the current SRCMA CAP 2013 – 2023 (SRCMA, 2013).

Consultation with Council, the OEH and Local Land Services (LLS) determined that the NSW BioBanking scheme was the most appropriate metric to facilitate low density development and allow for the retention and management of high biodiversity values identified. However, due to the proposed zoning of the land as E4 Environmental Living, clearing of native vegetation would require approval under the *Native Vegetation Act 2003* (NV Act), resulting in BioBanking not being available to facilitate the removal of vegetation for residential development from this site. As a result, it was determined that Biodiversity Certification was best suited to facilitate the net positive biodiversity outcomes that will result from a future proposed development.

The land proposed for biodiversity certification within the BCAA supports 4.59 hectares of native vegetation across two vegetation types (Table 1).

Table 1 Vegetation types mapped within the biodiversity certification area

Vegetation type	Area (ha)
SR652 – *Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion*	3.15
SR545 – *Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion*	1.44

Vegetation in the area proposed for certification is considered to be of poor quality for threatened species. No threatened species were recorded within the biodiversity certification area and none are expected to occur due to the high levels of disturbance and past clearing.

This BAR will form an Appendix to the Biodiversity Conservation Strategy (BCS) prepared for the proposed rezoning and Biodiversity Certification.

1. Introduction

MMJ Wollongong, on behalf of Edenvell Pty Ltd, is co-ordinating the preparation and lodgement of a Planning Proposal request to Wollongong City Council for the rezoning of land at Figtree in order to facilitate low density residential development and long term conservation of environmental values on site.

This report has been prepared in support of an application to seek biodiversity certification under Section 126H of the NSW *Threatened Species Conservation Act 1995* (TSC Act).

1.1 Site description

1.1.1 Biodiversity certification area

The Biodiversity Certification Area (BCAA) is located in Figtree, approximately 5 kilometres south-west of the Wollongong Central Business District (CBD). It includes part of Lots 815 in Deposited Plan (DP) 1193843 and 1801 DP1223063, and encompasses 55 hectares of private land (Figure 1).

The centralised ridge plateau is proposed for rezoning from RU2 Rural Landscape to E4 Environmental Living under the Wollongong Local Environment Plan 2009 (LEP). Long term, this land will be subdivided for residential development, with the creation of approximately 27 residential lots, asset protections zones (APZs), roads and other associated infrastructure. Land to the north and south of the proposed development area support significant biodiversity values, including two threatened ecological communities (TECs) and one threatened flora species (White-flowered Wax Plant *Cynanchum elegans*) listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). These lands have been retained in an expanded E2 Environmental Conservation zone, and the biodiversity values managed under a BioBanking Agreement to protect these lands, in perpetuity, as a BioBank site (Figure 2). Together, these areas form the BCAA. Biodiversity certification is being sought for land proposed for future development, with the BioBank site identified as retained land within the BCAA. Therefore, this report focuses on the biodiversity values within the area proposed for biodiversity certification within the BCAA. The biodiversity values of the BioBank site are outlined in the *Redgum Ridge Western Precinct (part Lots 814 and 815 DP1193843) BioBank Site: Biodiversity Assessment Report* (Biosis 2015).

The BCAA incorporates part of the lower section of a ridge that extends from the Illawarra Escarpment, incorporating the subject site, before dropping onto the coastal plain nearby to the east. There is a moderate level of canopy connectivity between the BCAA and the Illawarra Escarpment State Conservation Area less than 2 kilometres to the west. Much of the higher ridge and upper moderate slopes have been cleared of native vegetation and are characterised by scattered individuals or stands of remnant and regrowth native trees. These open grassy woodland areas are being managed by regular slashing and are grazed by feral animals. Remnant and regrowth native vegetation is present over the mid to lower northern and southern slopes. The condition of the native vegetation varies from relatively intact and weed-free to areas of remnant canopy with an understorey dominated by Lantana *Lantana camara*. Woody weeds, including Lantana, are being controlled in places.

The northern slopes drain toward Brandy and Water Creeks, whilst the southern slopes and ephemeral drainages are within the American Creek catchment. Brandy and Water Creeks and American Creek converge nearby to the east of the BCAA.

The BCAA is mapped as occurring on the Gwynneville Soil Landscape (NSW Soil and Land Information System (SALIS) which is present in the footslopes of the Illawarra Escarpment and isolated rises of the Wollongong

Plain between Coledale and Dapto. This soil landscape unit overlies the Illawarra Coal Measures geologic unit. Dominant soils in the upper profile are sandy loams and sandy clay loam with pedal clay in the lower profile (Hazelton and Tille 1990).

The BCAA is within the:

- Sydney Basin Interim Biogeographical Regionalisation of Australia (IBRA) Region.
- Illawarra IBRA Subregion.
- Dapto Wollongong Coastal Slopes Mitchell Landscape.
- Southern Rivers CMA area.
- Wollongong Local Government Area (LGA).

1.2 Planning context

1.2.1 Development history

MMJ Wollongong, on behalf of Edenvell Pty Ltd, is co-ordinating the preparation and lodgement of a Planning Proposal request with Wollongong City Council to rezone land within the western precinct of the Redgum Ridge Estate from RU2 Rural Landscape to E4 Environmental Living and E2 Environmental Conservation under the Wollongong LEP to facilitate low density residential development, with areas of higher biodiversity to be retained in an expanded E2 Environmental Conservation zone.

Whilst the biodiversity values within the land proposed for certification and future development are limited, previous assessments have identified that two parcels of land to the north and south, within Lots 815 DP 1193843 and 1801 DP1223063, support significant biodiversity values. Following these assessments and additional planning with the proponent it was determined that the use of the NSW Biodiversity Banking and Offsets Scheme was appropriate, allowing for losses of biodiversity values arising from development to be offset through the conservation and protection of high biodiversity value land.

Ongoing consultation with Council, the OEH and LLS has garnered significant support for this approach due to the potential for a positive net benefit to biodiversity, including threatened species and communities, in the region. In addition to the net positive benefit of ongoing management of native vegetation within the BioBank site for threatened species and communities, the dedication of moderate to good condition remnant native vegetation under a conservation covenant would assist in meeting targets set out under the *Illawarra Biodiversity Strategy* (WCC et al., 2011a, 2011b) and Southern Rivers Catchment Management Authority (SRCMA) Catchment Action Plan (CAP) 2006 to 2016, and the current SRCMA CAP 2013 – 2023 (SRCMA, 2013).

Pillar 3: Natural resources – strategies and priorities of SRCMA (2013) has a goal to achieve diverse, healthy, connected and productive natural environments. The objective of the goal is that the health and integrity of natural habitats supports people and the environment. The target of the goal is that by 2023 land and water managers are supported to increase the adoption of practices that maintain or improve the:

- Extent and condition of priority habitats where the priorities for action and investment are:
  - Under reserved and threatened vegetation communities.
  - Habitat that supports threatened species.
  - High carbon capture ecosystems.
- Habitats that support connectivity priorities where the priorities for action and investment include State, regional and locally significant corridors.

It is noted that the BCAA is mapped as occurring in the Escarpment Moist Forests Corridor (WCC et al., 2011a, 2011b). The identification of regional corridors in the strategy is to *'highlight those highest priority areas where Councils and other lead agencies should direct scarce resources, and support private land managers to participate in conservation and restoration efforts where resources allow.'* The strategy also states *'Opportunities for acquisition of lands or rezoning should be guided by the values identified within this Strategy. Information that can be used to this end includes the mapping of regional biodiversity corridors, identification of vegetation priorities, and priority threatened species.'* The dedication of the BioBank site for biodiversity conservation would see this strategic land retained for conservation in perpetuity aligning with the following from the *Illawarra – Shoalhaven Regional Plan* (DPE 2015):

- Direction 2.4 Identify and conserve biodiversity values when planning new communities; where biodiversity certification is acknowledged as process providing planning authorities the option to integrate biodiversity conservation with proposed development outcomes at the strategic planning stage.
- Direction 5.1 Protect the region's environmental values by focusing development in locations with the capacity to absorb development; where the Planning Proposal has considered and applied aspects of Action 5.1.1 Avoid, minimise and mitigate the impact of development on significant environmental assets and Action 5.1.3 Protect the region's biodiversity corridors in local planning controls.

Written advice from OEH also acknowledges the potential for net conservation gains of the two TECs; *Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion* and *Illawarra Subtropical Rainforest in the Sydney Basin Bioregion*. In addition to highlighting some of the specific benefits of establishing a BioBank site, OEH note that net gain conservation outcomes would be consistent with the objectives and targets of regional strategies including the *Illawarra Biodiversity Strategy* (WCC *et al*, 2011a and 2011b) and *Illawarra Regional Strategy: 2006–31* (Department of Planning, 2007*),* with a focus on priority vegetation and important habitat corridors.

Given the land identified for development is proposed to be zoned E4 Environmental Living, any clearing of native vegetation would require approval under the NSW *Native Vegetation Act 2003* (NV Act). Under Section 127Zj of the TSC Act, a BioBanking Agreement is not available for any clearing of native vegetation requiring approval under the NV Act. Due to the potential for a positive net benefit to biodiversity from the proposed use of the NSW BioBanking Scheme, an alternate approach was sought. Through ongoing consultation with Council and OEH, Biodiversity Certification of land proposed for future development within the BCAA is now proposed. Under Section 126I of the TSC Act, this has the effect of determining that any future development will not significantly affect any threatened species, population or ecological community under this Act, or its habitat and in determining any future development applications for certified land the planning authority is not required to take into consideration the likely impact of the development on biodiversity values (including under the NV Act).

1.2.2 Development strategy

The development strategy is outlined in the Planning Proposal (MMJ 2015) and is summarised here.

The long-term land use strategy for the BCAA is directed by the site's existing topography and environmental qualities. The densely vegetated ridge side slopes possess high values for ongoing conservation management, whilst the generally cleared centralised ridge plateau provides an opportunity to complement the "Redgum Ridge" Estate development by the addition of large lot low density residential development. Thus, the Planning Proposal seeks to rezone the proposed area for development to E4 Environmental Living whilst retaining land with high biodiversity values within an expanded E2 Environmental Conservation zone. This development strategy is identified within concept plans prepared by KFW Pty Ltd and is shown in Figure 2.

In summary, the existing densely vegetated ridge side slopes will be retained and enhanced for their environment qualities, whilst the ridge plateau will accommodate approximately 27 large residential lots ranging in size from 1,229m² to 1.1 hectares. Access to these allotments will be gained via a public road to be constructed along the ridge line (adjacent to the 24 metre wide gas pipeline easement), which will be an extension of Redgum Forest Way servicing the Estate to the east. The internal road network will consist of a perimeter road to control bushfire hazard management considerations within areas proposed for future development. Full urban reticulation services will be provided from the existing service network within the "Redgum Ridge" Estate.

As mentioned above, the existing densely vegetated southern and northern ridge side slopes are to be enhanced through their protection and management as a BioBank site. Edenvell Pty Ltd have obtained a BioBanking Agreement for the E2 lands, providing ongoing management and improvement of biodiversity values therein. Long term, the BioBank site will be dedicated to Council, with management actions funded under the BioBanking Agreement.

1.3 Information sources

1.3.1 Publications and databases

In order to provide a context for the assessment, information about flora and fauna from the 'locality' was obtained from relevant public databases. Records from the following databases were collated and reviewed:

- DoE Protected Matters Search Tool for matters protected by the EPBC Act.
- NSW BioNet - the database for the Atlas of NSW Wildlife, Office of Environment and Heritage (OEH).
- BirdLife Australia, the New Atlas of Australian Birds 1998-2013 (BA).

Other sources of biodiversity information:

- Relevant vegetation mapping, including:
  - Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands (SCIVI) (Tozer et al. 2010).
  - Native vegetation of the Illawarra Escarpment and Coastal Plain (NPWS 2002).
- NSW Vegetation Information System (VIS): Classification Version 2.1.

The following reports were also reviewed:

- Planning Proposal (MMJ 2015).
- Redgum Ridge Estate BioBanking Assessment (Biosis 2014).
- Redgum Ridge Rezoning Investigation: Terrestrial Flora and Fauna Constraints Analysis (Biosis 2011).
- Vegetation Management Plan for Red Gum Ridge, Figtree (UBM Consultants 2005).

1.3.2 Spatial data

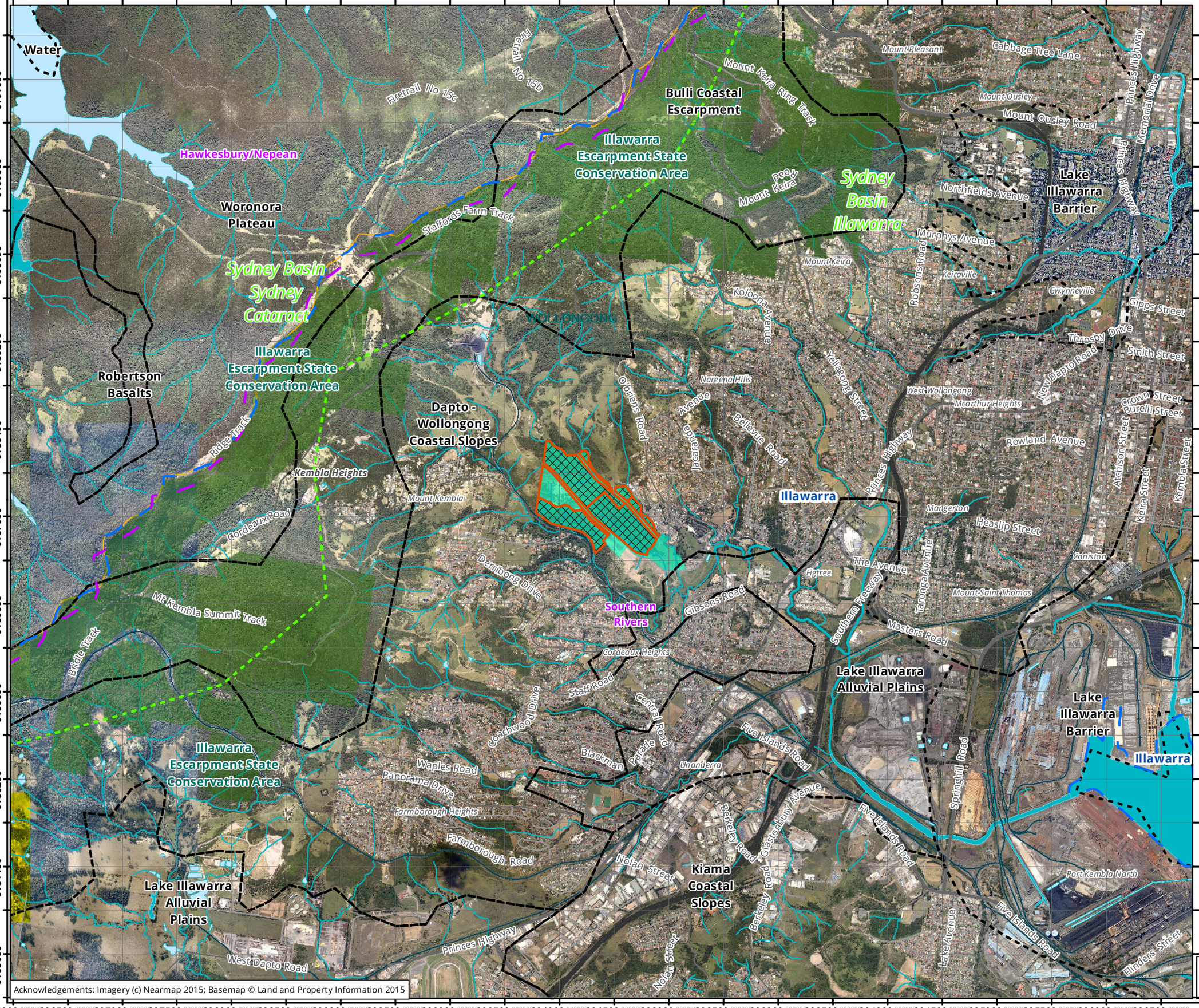
The indicative subdivision layout was supplied by KFW Pty Ltd. Data was converted into shapefile format and imported into ArcGIS.

Basemap data was obtained from NSW Land and Property Information (LPI) 1:25000 digital topographic database (DTDB), with cadastral data obtained from LPI digital cadastral database (DCDB). Mapping of stream order was undertaken manually, using the Hydroline layer within the DTDB.

The following spatial datasets were utilised during the development of this report:

- Catchment data was obtained from the Catchment Boundaries of New South Wales dataset.
- Mitchell Landscapes Version 3.0.
- Interim Biogeographic Regionalisation of Australia (IBRA) Version 7.
- Directory of Important Wetlands (DIWA).
- State Environmental Planning Policy (SEPP) 14 Wetlands.
- Spatial data associated with Tozer et al. (2010) vegetation mapping.
- Spatial data associated with NPWS (2002) vegetation mapping.
- NSW Soil and Land Information System (SALIS).
- Aerial photography was obtained from NearMap (date: November 2014 to January 2015).

Aerial imagery for the BCAA was obtained from KFW, with aerial imagery for the assessment circle obtained from NearMap©.



Legend

- Biodiversity Certification Assessment Area
- BioBank Site
- Lot 814 and 815 DP 1193843
- IBRA Subregions
- CMA Regions
- CMA Subregions
- Mitchell Landscape
- NPWS Estate

Figure 1: Location map – Redgum Ridge Estate Western Precinct, Figtree, NSW

0 320 640 960 1,280 1,600

Metres

Scale: 1:32,105 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 20288
Date: 22 December 2015,
Checked by: NMG, Drawn by: LH, Last edited by: ngarvey
Location:P:\20200s\20288\Mapping\20288_BioBanking_F1_LocationMap

Acknowledgements: Imagery (c) Nearmap 2015; Basemap © Land and Property Information 2015

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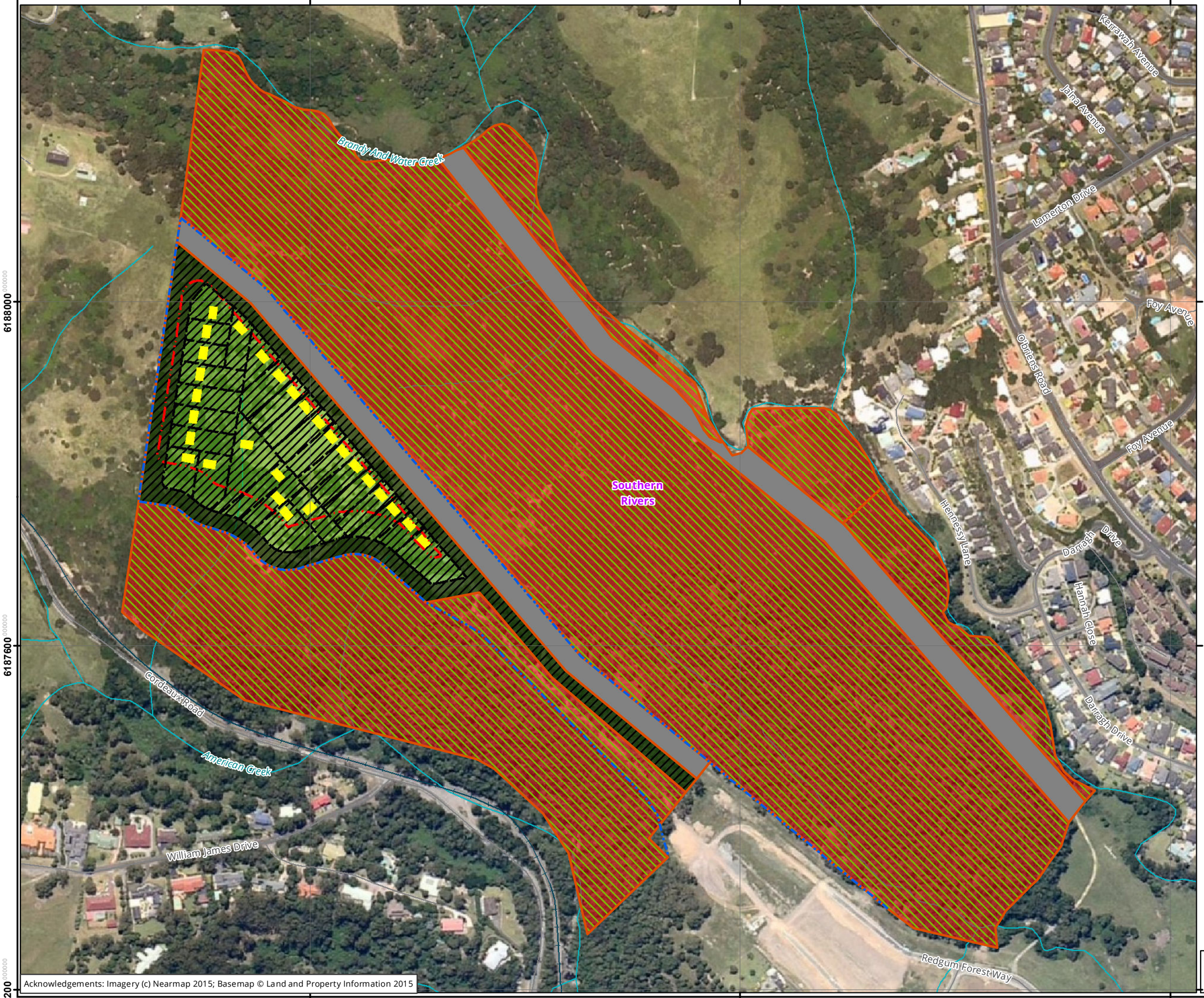

Acknowledgements: Imagery (c) Nearmap 2015; Basemap © Land and Property Information 2015

Legend

- Biodiversity Certification Assessment Area (BCAA)

Proposed zoning in the BCAA

- E2 - Environmental Conservation
- E4 - Environmental Living

Land within the BCAA

- Land proposed for biodiversity certification
- Retained land - BioBank Site
- Retained land - Easement

Proposed subdivision layout

- Proposed Lots
- Outer APZ
- Inner APZ
- Proposed Buildings
- Proposed Road

Figure 2: Assessment Area map – Redgum Ridge Estate Western Precinct, Figtree, NSW

0 40 80 120 160 200

Metres

Scale: 1:4,059 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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Matter: 20288
Date: 23 December 2015,
Checked by: NMG, Drawn by: LH, Last edited by: ngarvey
Location:P:\20200s\20288\Mapping\20288_BioBanking_F2_AssessmentArea_20151223

2. Landscape features

2.1 Bioregions and landscapes regions

The BCAA occurs within the:

- Sydney Basin IBRA region and the Illawarra IBRA subregion.
- Dapto Wollongong Slopes Mitchell Landscape.

No additional IBRA regions or subregions occur within the assessment circle. The Bulli Coastal Escarpment Mitchell Landscape occurs within the western and north-western sections of the assessment circle, while the Lake Illawarra Alluvial Plains Mitchell Landscape occurs in the eastern section of the assessment circle.

2.2 Waterways and wetlands

The BCAA is located between Brandy and Water Creeks (to the north) and American Creek (to the south), with the two creeks converging to the east of the BCAA before discharging to Tom Thumb Lagoon via Allans Creek (Figure 3).

The BCAA supports the upper reaches of two tributaries of American Creek. Within the BCAA these tributaries are present as ephemeral drainage lines, with the upper reaches barely discernible and the lower reaches present as an incised minor drainage line.

No SEPP No. 14 wetlands or DIWA wetlands were located within the BCAA or assessment circle.

2.3 Native vegetation extent

Mapping of vegetation within the outer assessment circle was undertaken using the NPWS (2002) vegetation mapping dataset, along with review of these datasets using aerial photo interpretation. Vegetation in the assessment circle is shown in Figure 3. Native vegetation covers 360 hectares (36 per cent) of the 1000 hectare assessment circle, with the vegetation providing connectivity from the BCAA to the Illawarra Escarpment and large tracts of native vegetation on the adjacent Woronora plateau to the west.

Vegetation mapping of the BCAA was undertaken by Biosis between 2012 and 2015 (see Section 3.2). Native vegetation within the BCAA covers 51.41 hectares (85 per cent) of the 60.23 hectare BCAA. Native vegetation covers 4.59 hectares (57 per cent) of the 8.11 hectares of land proposed to be biodiversity certified (to be zoned E4).

2.4 Assessment of landscape value

Landscape value has been calculated using the method outlined in Part 1.2 of the Biodiversity Certification Operational Manual (OEH 2015).

2.4.1 Assessment of the current extent of native vegetation cover

A 1000 hectare assessment circle was used, as this was the minimum assessment circle which contained the entire BCAA. The assessment circle was centered on the eastern section of the BCAA, where the majority of native vegetation removal will occur.

As conservation measures will be provided by the purchase and retirement of biodiversity credits under the NSW BioBanking scheme, i.e. through a third party, landscape value for the offset area has not been calculated.

Native vegetation cover within the assessment circle was determined using regional vegetation mapping undertaken by NPWS (2002), with some revision made by aerial photo interpretation (API) using recent NearMap© imagery. To determine the extent of native vegetation cover after certification, the extent of vegetation removal (4.59 hectares) was subtracted from the extent of native vegetation cover before certification. Table 2 provides a summary of the extent of native vegetation cover within the assessment circle, before and after certification.

Table 2 Extent of native vegetation cover before and after Biodiversity certification

Assessment Circle	Before Certification		After Certification	
	Area (ha)	Per cent	Area (ha)	Per cent
1000 hectare assessment circle	360	36	356	36

2.4.2 Assessment of connectivity value

The area of land proposed for certification within the BCAA does not support any of the following:

- An area identified as being part of a state biodiversity corridor.
- A riparian buffer 40 metres either side of a major river.
- An area identified as being part of a regional biodiversity corridor.
- A riparian buffer 30 metres either side of a minor river or major creek.
- A riparian buffer 20 m either side of a minor creek on the coast.

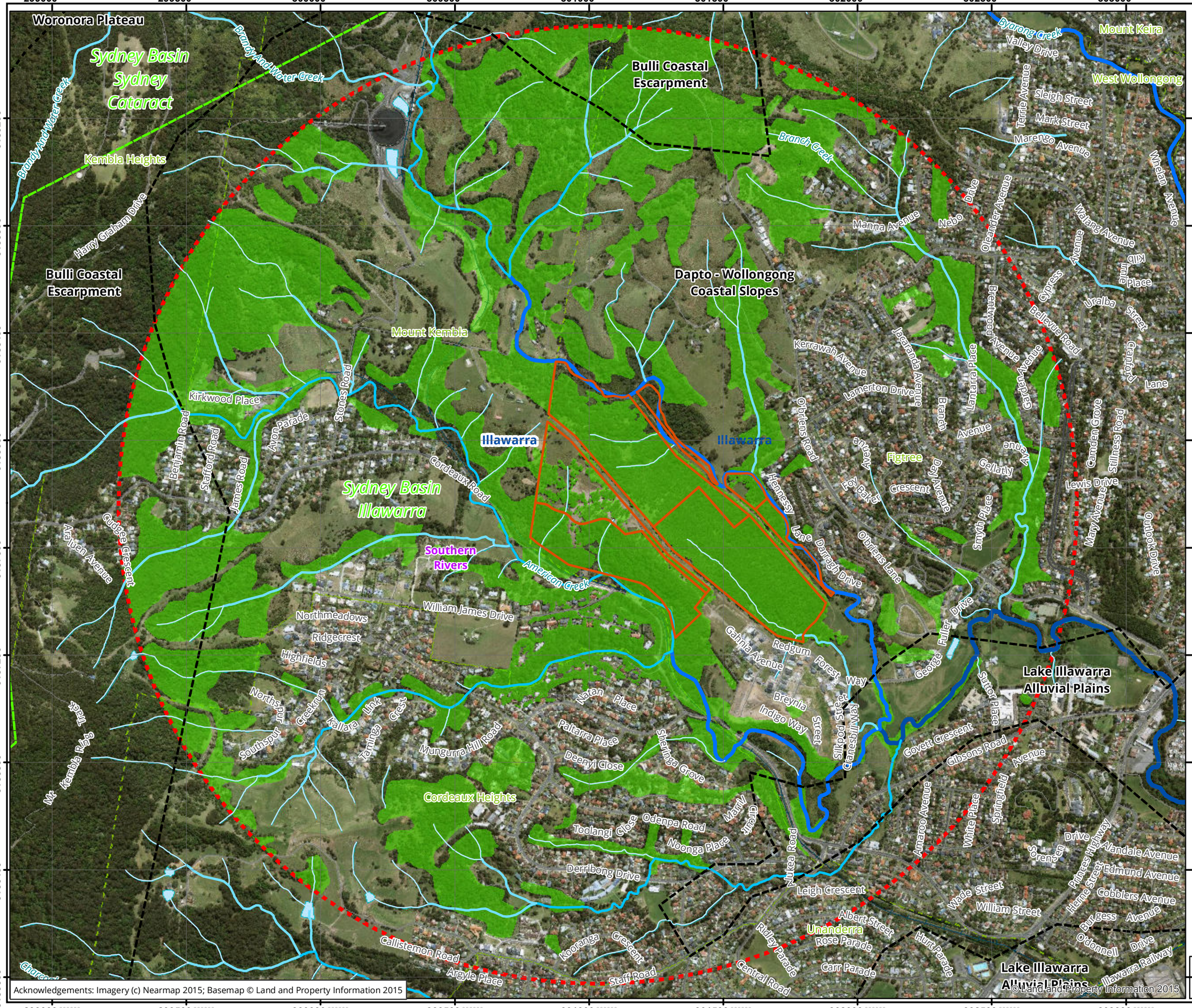
Therefore, the proposed development will not impact on any state biodiversity corridor or regional biodiversity corridors.

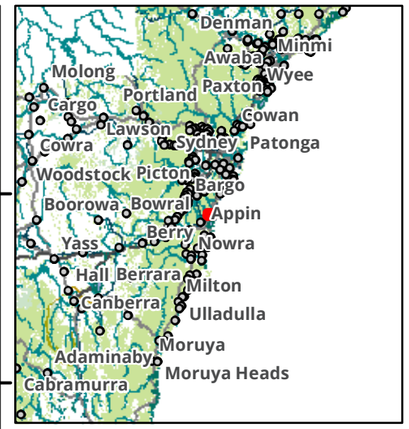
Native vegetation within the BCAA forms part of a large tract of vegetation, extending into the Illawarra escarpment and adjacent areas of the Woronora plateau to the west. This native vegetation conforms to the definition of a local biodiversity link. Therefore, the land proposed to be certified will impact on a local biodiversity link.

2.4.3 Assessment of adjacent remnant area

Adjacent remnant area was assessed using a Geographic Information System (GIS). All patches of native vegetation in moderate to good condition and separated by a distance of less than 30 metres were mapped sequentially using a selection process in ArcGIS. Using this method, vegetation within the BCAA forms part of a large remnant of native vegetation extending into the Illawarra Escarpment and Woronora plateau to the west. The BCAA was assessed as having an adjacent remnant area of > 501 hectares.

The Dapto – Wollongong Coastal Slopes Mitchell Land scape is estimated to be 71 per cent cleared. A patch size of greater than 50 hectares is deemed to be 'Very Large' for Mitchell Landscapes with a percent native vegetation cleared of 70 – 90 per cent. Therefore the BCAA fits into the 'Very Large' patch size class.





Legend

- Biodiversity Certification Assessment Area
- Assessment circle
- IBRA Subregions
- CMA Regions
- CMA Subregions
- Mitchell Landscape
- Native vegetation extent

Watercourses

Strahler Order

- 1
- 2
- 3
- 4
- 5

Figure 3: Vegetation within the assessment circle

0 130 260 390 520 650

Metres

Scale: 1:13,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

biosis

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 20288
Date: 24 May 2017,
Checked by: NMG, Drawn by: LH, Last edited by: lharley
Location:\\bio-data-01\matters$\20200s\20288\Mapping\20288_BioBanking_F3_Vegetation

3. Native vegetation

The extent of native vegetation within land proposed for biodiversity certification in the BCAA was determined in accordance with Part 2 of the Biodiversity Certification Operational Manual (OEH 2015).

3.1 Background review

A review of regional vegetation mapping by NPWS (2002) was undertaken to inform the site investigation. NPWS (2002) shows two native vegetation communities within land proposed for biodiversity certification in (Figure 4), with patches of Moist Box-Red Gum Foothills Forest (MU13) mapped along the entrance road in the eastern section of the proposed certified land, with a small patch along the western boundary, and a small patch of Coastal Grassy Redgum Forest (MU23) mapped along the northern boundary.

Detailed mapping of vegetation within the BCAA was undertaken for this assessment and the BioBanking Assessment (Biosis 2015). The methodology for all field assessments is outlined in Section 3.2 and results presented in Section 3.3.

3.2 Methods

3.2.1 Site investigation

Investigations of the BCAA have been carried out between September 2011 and September 2015, including:

- 2011 – A constraints assessment undertaken to document the flora and fauna habitats within the BCAA and to inform concept plans for a proposed rezoning and residential development. Field work undertaken included initial mapping of the vegetation communities, random meanders for threatened flora species and assessment of fauna habitat features.
- 2013-2014 – A preliminary BioBanking assessment, including consultation with OEH and Local Land Services, to determine the feasibility of BioBanking or Biocertification of the site. Field work undertaken included confirmation of the vegetation types present and alignment with the NSW Biometric Vegetation Types (BVTs), as well as more detailed assessment of fauna habitat features within the BCAA.
- 2015 – Additional detailed surveys, including refinement of vegetation mapping using Light Detection and Ranging (LiDAR) data to map the tree canopy, ground-truthing to provide detailed mapping of vegetation within the BCAA, and targeted surveys for threatened flora species within the BCAA.

Constraints assessment (Biosis Research 2011)

Flora and fauna field assessments were undertaken on 14 September 2011. The flora and fauna surveys were preliminary in nature and designed to inform key elements of concept planning for a rezoning and indicative lot layout of the subject site.

Flora surveys focused on ground-truthing the existing NPWS (2002) vegetation mapping and defining vegetation formations for consideration in bushfire hazard assessment and planning. Redefining the boundaries of plant communities and alignment into vegetation types was based on sampling and observations of vegetation, structure, floristic composition and physiographic features such as soils and aspect. Flora surveys were undertaken using a combination of 20 x 20 metre quadrats, spot locations and

random meanders to sample each stratification unit. Flora surveys were carried out in the following landscape stratification units:

- Closed forest
- Woodland
- Open woodland
- Closed scrub
- Cleared and disturbed areas.

Flora habitat assessments focused on the potential for threatened flora species and populations to occur within the BCAA, and the presence or absence of TECs. The general condition of the vegetation was assessed based on disturbance history, the degree of infestation by exotic species, structure and overall resilience. Threatened flora species previously recorded in the locality and with potential to occur on the site were targeted in the quadrats and random meanders. An inventory of the native and exotic flora species recorded for each plant community was compiled.

Brief diurnal fauna surveys were conducted over the BCAA to determine the values of the site for fauna. These were determined, primarily, on the basis of the types and qualities of habitat(s) present on the site. The presence of the following habitat features was noted:

- Structure and floristics of vegetation communities.
- Ground cover vegetation, leaf litter and presence of coarse woody debris.
- Size, range and abundance of hollow-bearing trees.
- Rocky outcrops, overhangs or crevices.
- Presence of specific feed trees or host plants.
- Presence of foraging, roosting or nesting resources.
- Size, number and vegetation cover of waterbodies present.
- Connectivity to off-site habitat.
- Disturbance, including weed invasion, clearing, rubbish, fire and urban development.

All species of fauna observed during the assessment were recorded and active searching for fauna was undertaken. This included direct observation, searching under rocks and logs, examination of tracks and scats and identifying calls. Particular attention was given to searching for significant species and their habitats. Fauna species were recorded with a view to characterising the values of the site and were not intended to provide a comprehensive survey of all fauna that has potential to utilise the site over time.

Preliminary BioBanking assessment (Biosis 2014)

Diurnal flora and fauna surveys were carried out over the BCAA site on 1 August 2013 to confirm vegetation types and map condition for BBAM surveys. This was followed by a general flora and fauna assessment incorporated as part of the more formal BBAM surveys on 16 October 2013. Flora surveys included:

- Random meanders over the BCAA in the main landscape stratification units targeting threatened flora species and populations previously recorded in the locality and with potential to occur on the subject site. Species targeted included:
  - Eastern Flame Pea *Chorizema parviflorum* (threatened population)

- White-flowered Wax Plant *Cynanchum elegans*
- Illawarra Socketwood *Daphnandra johnsonii*
- Rainforest Cassia *Senna acclinis*
- *Solanum celatum*.

- Searches to locate and confirm the continued presence of threatened flora species recorded in previous surveys by UBM Consultants (2005).
- Assessment to confirm the extent of the of the TSC Act listed threatened ecological communities (TECs) *Illawarra lowlands grassy woodland in the Sydney Basin Bioregion* and *Illawarra subtropical rainforest in the Sydney Basin Bioregion* as previously mapped by NPWS (2002) or amended and mapped by Biosis Research (2011).

General fauna surveys focused on the types and qualities of habitat(s) present. All species of fauna observed during the assessment were noted and active searching for fauna was undertaken. This included direct observation, searching under rocks and logs, examination of tracks and scats and identifying calls. All trees on the site were inspected and the presence of hollow-bearing trees noted. Particular attention was given to searching for significant species identified as potentially occurring within the subject site during database review and their habitats. Fauna species were recorded with a view to characterising the values of the site and the investigation was not intended to provide a comprehensive survey of all fauna with the potential to utilise the site over time.

Additional survey and assessment (Biosis 2015)

Additional surveys and assessment of the BCAA have been undertaken during the development of this Biodiversity Assessment Report and development of the BioBanking Agreement (Biosis 2015). This additional survey and assessment has focused on refining the mapping of vegetation types within the BCAA and targeted surveys for threatened species.

Mapping of the tree canopy was obtained using LiDAR data, sourced from the NSW Lands and Property Information (LPI). Small gaps in the LiDAR data were manually filled to obtain a defined boundary for the tree canopy layer across the BCAA. Data obtained using this method provides an accurate representation of the tree canopy, but does not define if this is native vegetation, and does not provide information on areas with a native understorey but no overstory. This tree canopy layer was used to inform further surveys.

Flora surveys undertaken for this assessment included the refinement of previous vegetation mapping (Biosis Research 2011, Biosis 2014). Vegetation mapping was conducted using hand-held (uncorrected) tablet units using the ArcGIS Collector application, the tree canopy layer and aerial photo interpretation, with the boundaries of vegetation types determined by ground-truthing. The accuracy of this mapping is therefore subject to the accuracy of the GPS units (generally ± 5 metres) and dependent on the limitations of aerial photo rectification and registration. Mapping has been produced using a GIS. Electronic GIS files containing the relevant flora and fauna spatial data are available to incorporate into design concept plans; however this mapping may not be sufficiently precise for detailed design purposes.

Delineation of vegetation community boundaries was undertaken using the vegetation community definitions of NPWS (2002), definitions for the relevant vegetation types obtained from the NSW Vegetation Information System (VIS): Classification Version 2.1, along with the final determination (NSW Scientific Committee 2011) for the Illawarra Lowlands Grassy Woodland endangered ecological community (EEC).

General classification of native vegetation in NSW used in this report is based on the classification system in Keith (2004) which uses three groupings of vegetation: vegetation formation, vegetation class and vegetation type, with vegetation type the finest grouping. The grouping referred to in this report is vegetation type.

Vegetation types were identified using the NSW Vegetation Information System (VIS): Classification Version 2.1.

A 0.1 hectare area of Whalebone Tree – Native Quince dry subtropical rainforest (SR662) was identified within land proposed for biodiversity certification in the BCAA. This area did not meet the minimum size thresholds defined in the Biodiversity Certification Operational Manual (OEH 2015) and a plot / transect could not be placed within this area. For these reasons this small area was included in an area of adjacent Sydney Blue Gum x Bangalay Lilly Pilly moist forest (SR652).

Vegetation types were stratified into vegetation zones based on condition (low or moderate/good) and ancillary code (where relevant). Vegetation types within land proposed for biodiversity certification in the BCAA were relatively homogenous, consisting of a tree canopy layer over a low understorey being maintained through ongoing slashing.

Following stratification of vegetation zones, site value were assessed using plot and transect survey data, as per the methodology outlined in Step 2.2 and Appendix D of OEH (2015). Plot and transect surveys included:

- A 20 metre x 50 metre quadrat and 50 metre transect for assessment of site attributes.
- A 20 metre x 20 metre quadrat, nested within the quadrat outlined above, for full floristic survey to determine native plant species richness.

The minimum number of plots/transects per Vegetation Zone was determined using Table 1 of OEH (2015). A total of five plots/transects were completed within land proposed for biodiversity certification in the BCAA (Figure 5). A list of flora species was compiled for each vegetation type. Records of all flora species will be submitted to OEH for incorporation into the BioNet Atlas of NSW Wildlife.

3.3 Results

3.3.1 Vegetation description

The BCAA supports 51.41 hectares of native vegetation and three vegetation types, with land proposed for biodiversity certification containing 4.59 hectares of native vegetation and two vegetation types (Figure 5). Vegetation in land proposed for biodiversity certification in the BCAA is disturbed through regular slashing of the ground and midstory vegetation layers under a regrowth canopy.

Areas where the tree canopy does not exist are dominated by exotic grasses such as Small-flowered Summer Grass *Digitaria violascens* and Kikuyu *Pennisetum clandestinum*. These areas are not considered native vegetation and are not discussed further within this report.

For further details on vegetation in the BioBank site see Biosis (2015).

3.3.2 Vegetation types

Site investigations, including determination of vegetation types using the methodology outlined in Section 3.2.1, confirmed the presence of three vegetation types within the BCAA, with two of these mapped within land proposed for biodiversity certification.

All areas of vegetation land proposed for biodiversity certification were assessed as being in moderate/good condition using the definitions outlined in Part 2.1.2 of OEH (2015), resulting in two vegetation zones being mapped. Vegetation zones identified within land proposed for biodiversity certification in the BCAA, including the vegetation type, the vegetation formation and vegetation class (Keith 2004) and the area of each vegetation zone are described in Table 3.

Table 3 Vegetation zones mapped within the land proposed for biodiversity certification of the BCAA

Vegetation zone	Vegetation type	Vegetation class	Vegetation formation	Vegetation community (Tozer et al. 2010)	Area (ha)
01	SR652 – Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion	Southern Escarpment Wet Sclerophyll Forests	Wet sclerophyll forests (shrubby sub-formation)	Moist Box-Red Gum Foothills Forest (MU13)	3.15
02	SR545 – Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	Coastal Valley Grassy Woodlands	Grassy woodlands	Coastal Grassy Redgum Forest (MU23)	1.44

A detailed description of each Vegetation Zone within the land proposed for biodiversity certification is provided in Table 4 (Vegetation Zone 1) and Table 5 (Vegetation Zone 2).

Table 4 Vegetation zone 1 - Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion

Vegetation zone 1 – Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion	
PCT ID	1245
Biometric vegetation type ID	SR652
Common name	*Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion*
Condition	Moderate/good
Extent within within the land proposed for biodiversity certification	3.15 ha of Sydney Blue Gum x Bangalay - Lilly Pilly moist forest was mapped across the western section of land proposed for biodiversity certification in the BCAA (Figure 5).
Description	Sydney Blue Gum X Bangalay - Lilly Pilly Moist Forest occurs in the western two thirds of land proposed for biodiversity certification in the BCAA (Figure 5). Along the western ridge *Eucalyptus saligna* X *botryoides,* Blackwood *Acacia melanoxylon* and Cheese Tree *Glochidion ferdinandii* are dominant. Coast White Box *Eucalyptus quandrangulata* and Lilly Pilly *Acmena smithii* become progressively more prominent moving down the southern slope, with Forest Red Gum *Eucalyptus tereticornis* occurring occasionally and increasing to the east in the intergrade to Forest Red Gum - Thin-leaved Stringybark grassy woodland. The midstory and understory are highly modified through regular slashing, with both strata being absent in the higher ridge areas. The groundcover in the slashed areas is a mix of

Vegetation zone 1 – Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion	
	native grasses and vines, and exotic grasses and herbs. Native species include; Milk Vine *Marsdenia rostrata,* Sweet Morinda *Morinda jasminoides,* Blady Grass *Imperata cylindrica, Carex longebrachiata*, Kidney Weed *Dichondra repens*, Weeping Grass *Microlaena stipoides* var. *stipoides* and *Oplismenus aemulus*, whilst dominant exotic species included Narrow-leafed Carpet Grass *Axonopus fissifolius,* Small-flowered Summer Grass *Digitaria violascens*, Cobbler's Pegs *Bidens pilosa*, Spear Thistle *Cirsium vulgare*, Panic Veldtgrass *Ehrharta erecta* and Black Medic *Medicago lupulina*.
Survey effort	Three plots/transects were completed in this vegetation zone (Figure 5).
Disturbance	This vegetation zone shows high levels of disturbance due to consistent slashing of the midstory, understory and ground cover vegetation.
Species relied upon for identification of vegetation type and relative abundance	The midstory and understory are largely absent, and ground cover vegetation is maintained as a low cover through regular slashing, making identification difficult. However, adjacent patches within the proposed BioBank site maintain a diverse midstory and understory, assisting with identification. The presence of White-topped Box and *Eucalyptus saligna* X *botryoides* in the overstory, along with the mapping of this community within the proposed BioBank site and alignment of boundaries, were used to identify the extent of this vegetation type within the area proposed for certification
TEC Status	Commonwealth EPBC Act: Not listed NSW TSC Act: Not Listed
Estimate of percent cleared value of vegetation type	45%

Vegetation zone 1 – Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion	
Plate 1 Sydney Blue Gum x Bangalay - Lilly Pilly moist forest	

Table 5 Vegetation zone 2 - Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion

Vegetation zone 2 – Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	
Plant community type ID	838
Biometric vegetation type ID	SR 545
Common name	*Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion*
Condition	Moderate/good
Extent within within the land proposed for biodiversity certification	1.44 ha Forest Red Gum - Thin-leaved Stringybark grassy woodland was mapped across the access road and eastern section of land proposed for biodiversity certification in the BCAA (Figure 5).
Description	This vegetation type occurs on the eastern section of the ridge within land proposed for biodiversity certification in the BCAA (Figure 5). The canopy is dominated by remnant and regrowth Forest Red Gum from 15 to 25 m with occasional Coast White Box. This area was also lacking midstory species, but contained an understorey with a moderate diversity of native grasses and native herbs. Native species including; Bushy Hedgehog-grass *Echinopogon caespitosus,* Forest Hedgehog Grass *Echinopogon ovatus, Carex longebrachiata*, Kidney Weed,

Vegetation zone 2 – Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	
	Climbing Guinea Flower *Hibbertia scandens,* Trailing Speedwell *Veronica plebeia,* Pennywort *Hydrocotyle peduncularis*, Weeping Grass, Whiteroot *Pratia purpurascens,* Slender Tick-trefoil *Desmodium varians* and Bearded Tylophora *Tylophora barbata*. The dominant exotic species included Small-flowered Summer Grass *Digitaria violascens*, Kikuyu *Pennisetum clandestinum,* Cobbler's Pegs *Bidens pilosa*, Spear Thistle *Cirsium vulgare*, Panic Veldtgrass *Ehrharta erecta* and Red-flowered Mallow *Modiola carolinianum.*
Survey effort	Two plots/transects were completed in this vegetation zone (Figure 5).
Disturbance	This vegetation zone shows high levels of disturbance due to consistent slashing of the midstory, understory and ground cover vegetation.
Species relied upon for identification of vegetation type and relative abundance	The midstory and understory are largely absent, and ground cover vegetation is maintained as a low cover through regular slashing, making identification difficult. However, adjacent patches within the proposed BioBank site maintain a diverse midstory and understory, assisting with identification. The presence of dominance of Forest Redgum in the overstory, with only scattered occurrence of other species, and the predominantly grassy understory, along with the mapping of this community within the proposed BioBank site and alignment of boundaries, were used to identify the extent of this vegetation type within the area proposed for certification.
EEC Status	Commonwealth EPBC Act: *Illawarra and south coast lowland forest and woodland ecological community* critically endangered ecological community NSW TSC Act: *Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion* endangered ecological community
Estimate of percent cleared value of vegetation type	85%

Vegetation zone 2 – Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	
Plate 2 Forest Red Gum - Thin-leaved Stringybark grassy woodland	

3.3.3 Site value scores

Plots and transect survey data was inputted into the Biocertification Credit Calculator (version 1.09.01) to determine site value scores. Plot and transect survey data is presented in Appendix 1. Current site value for each vegetation zone is outlined in Table 6.

Table 6 Site value scores for all Vegetation Zones

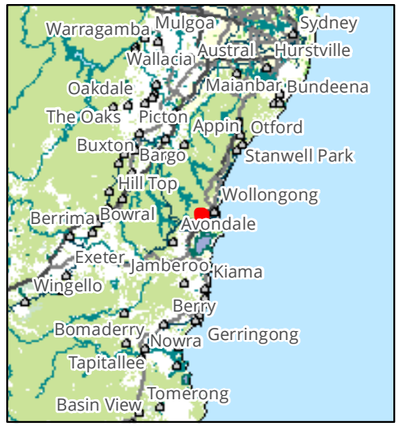
Vegetation zone	Vegetation type	Site value score	Area (ha)
01	SR652 – *Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion*	29.17	3.15
02	SR545 – *Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion*	39.93	1.44

301000 000000 301500 000000 302000 000000

6188000 000000

6187600 000000

6187200 000000



Kerrawah Avenue
Jalna Avenue
Lamerton Drive
Foy Avenue
O'briens Road
Foy Avenue
Hennessy Lane
Darragh Drive
Hannah Close
Darragh Drive
Brandy And Water Creek
Cordeaux Road
American Creek
William James Drive
Gahnia Avenue
Redgum Forest Way

Legend

- Biodiversity Certification Assessment Area

Land within the BCAA

- Land proposed for biodiversity certification
- Retained land - BioBank Site
- Retained land - Easement

Native vegetation (NPWS 2002)

- Lowland Dry-Subtropical Rainforest (MU4)
- Escarpment Moist Blue Gum Forest (MU8)
- Moist Box-Red Gum Foothills Forest (MU13)
- Coastal Grassy Red Gum Forest (MU23)

Figure 4: Native vegetation mapping of the BCAA by NPWS (2002)

0 40 80 120 160 200

Metres
Scale: 1:4,059 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

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Matter: 20288
Date: 12 September 2016,
Checked by: NMG, Drawn by: LH, Last edited by: jshepherd
Location:P:\20200s\20288\Mapping
20288_BioBanking_F4_BCAANativeVegNPWS

301000 000000 301500 000000 302000 000000

6188000 000000

6187600 000000

6187200 000000

Brandy And Water Creek

American Creek

Kerrawah Avenue

Jalna Avenue

Lamerton Drive

Foy Avenue

O'briens Road

Foy Avenue

Henressy Lane

Darragh Drive

Hannah Close

Darragh Drive

Cordeaux Road

William James Drive

Redgum Forest Way

Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11 Q12 Q13 Q14 Q15 Q16 Q17 Q18 Q19 Q20 Q21 Q22 Q23 Q24

Acknowledgements: Imagery (c) KFW, Nearmap 2015; Basemap © Land and Property Information 2015

Legend

- Biodiversity Certification Assessment Area (BCAA)

Land within the BCAA

- Land proposed for biodiversity certification
- Retained land - BioBank Site
- Retained land - Easement

Native vegetation (Biosis 2015)

- Forest Red Gum - Thin-leaved Stringybark grassy woodland, Moderate/Good,
- Forest Red Gum - Thin-leaved Stringybark grassy woodland, Moderate/Good, Derived grassland
- Sydney Blue Gum x Bangalay Lilly Pilly moist forest, Moderate/Good,
- Sydney Blue Gum x Bangalay Lilly Pilly moist forest, Moderate/Good, Poor
- Sydney Blue Gum x Bangalay Lilly Pilly moist forest, Moderate/Good, Derived grassland
- Sydney Blue Gum x Bangalay Lilly Pilly moist forest, Low,
- Whalebone Tree - Native Quince dry subtropical rainforest, Moderate/Good,
- Whalebone Tree - Native Quince dry subtropical rainforest, Low,
- Flora survey effort (Biosis 2015)

Figure 5: Native vegetation within the BCAA, including flora survey effort

0 40 80 120 160 200

Metres

Scale: 1:4,059 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

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Ballarat, Brisbane, Canberra, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 20288
Date: 23 December 2015,
Checked by: NMG, Drawn by: LH, Last edited by: ngarvey
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20288_BioBanking_F5_BCAANativeVegBiosis_20151223

4. Threatened species

4.1 Methods

Flora and fauna assessments of the BCAA are outlined in Section 3.2.

Targeted flora surveys have been undertaken, using a variety of survey techniques, including 20 x 20 metre quadrats, Biobanking plots/transect surveys and random meanders. The majority of targeted flora surveys within land proposed for biodiversity certification in the BCAA have focused on searching at the base of trees, as these areas show lower levels of disturbance from slashing. Threatened flora survey tracks are shown in Figure 6.

Fauna surveys have focused on identifying habitat features suitable for supporting threatened species. These assessments determined that the fauna habitat features within land proposed for biodiversity certification in the BCAA are substantially degraded by ongoing maintenance of the understorey through slashing. These areas lack any midstory or understorey cover, there is little to leaf litter or coarse woody debris and trees within land proposed for biodiversity certification in the BCAA lack hollows, with only a limited number of mature trees providing hollows up to 25 centimetres in diameter. Fauna habitats within land proposed for biodiversity certification in the BCAA are considered to be of poor quality for most threatened fauna species.

For details of threatened species surveys within the BioBank site see Biosis (2015).

4.2 Ecosystem credit species

4.2.1 Species predicted to occur

A list of ecosystem credit species predicted to occur within land proposed for biodiversity certification in the BCAA, based on the CMA subregion, Mitchell landscape and vegetation types present is provided in Table 7.

Table 7 Assessment of ecosystem credit species within the BCAA

	Common Name	Tg Value
SR545 *Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion*		
Ninox connivens	Barking Owl	0.33
Burhinus grallarius	Bush Stone-curlew	0.38
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	0.75
Falsistrellus tasmaniensis	Eastern False Pipistrelle	0.45
Mormopterus norfolkensis	Eastern Freetail-bat	0.45
Petroica phoenicea	Flame Robin	0.75
Callocephalon fimbriatum	Gang-gang Cockatoo	0.5
Calyptorhynchus lathami	Glossy Black-Cockatoo	0.55
Scoteanax rueppellii	Greater Broad-nosed Bat	0.45
Pteropus poliocephalus	Grey-headed Flying-fox	0.93

	Common Name	Tg Value
Hieraaetus morphnoides	Little Eagle	0.73
Glossopsitta pusilla	Little Lorikeet	0.58
Tyto novaehollandiae	Masked Owl	0.33
Petroica boodang	Scarlet Robin	0.75
Myotis macropus	Southern Myotis	0.45
Circus assimilis	Spotted Harrier	0.73
Dasyurus maculatus	Spotted-tailed Quoll	0.38
Lophoictinia isura	Square-tailed Kite	0.73
Lathamus discolor	Swift Parrot	0.75
Neophema pulchella	Turquoise Parrot	0.55
Daphoenositta chrysoptera	Varied Sittella	0.75
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	0.45
SR652 *Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion*		
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	0.75
Falsistrellus tasmaniensis	Eastern False Pipistrelle	0.45
Mormopterus norfolkensis	Eastern Freetail-bat	0.45
Callocephalon fimbriatum	Gang-gang Cockatoo	0.5
Calyptorhynchus lathami	Glossy Black-Cockatoo	0.55
Scoteanax rueppellii	Greater Broad-nosed Bat	0.45
Pteropus poliocephalus	Grey-headed Flying-fox	0.93
Miniopterus australis	Little Bentwing-bat	0.75
Tyto novaehollandiae	Masked Owl	0.33
Ninox strenua	Powerful Owl	0.33
Myotis macropus	Southern Myotis	0.45
Dasyurus maculatus	Spotted-tailed Quoll	0.38
Lophoictinia isura	Square-tailed Kite	0.73
Daphoenositta chrysoptera	Varied Sittella	0.75
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	0.45

Tg values represent how well as species will respond to management at a BioBank site, and, therefore, how the removal of habitat features will impact on the species in a local area. If a species is reliant on habitat

features that take a long time to develop (e.g. hollows), or management actions are ineffective at addressing a species decline, or the species has poor fecundity or dispersal capability this will generate a higher Tg value.

The Barking Owl, Masked Owl and Powerful Owl return the lowest Tg value (0.33) for Vegetation Zone 1 (SR545), and the average Tg value is 0.58. The Masked Owl and Powerful Owl return the same lowest Tg value for Vegetation Zone 2 (SR652) and the average Tg value is 0.55.

4.3 Species credit species

4.3.1 Assessment of geographic / habitat features

An assessment of the occurrence of geographic / habitat features in land proposed for biodiversity certification within the BCAA was undertaken in accordance with Step 3.3.1 of OEH (2015). Geographic and habitat features associated with the vegetation types within land proposed for biodiversity certification in the BCAA and identified by the credit calculator, along with an assessment of their occurrence, is provided in Table 8.

Table 8 Assessment of geographic and habitat features within the BCAA

Feature	Occurs within land proposed for biodiversity certification	Justification
Hollow-bearing trees, bridges, caves or artificial structures within 200 m of riparian zone	No	The land proposed for biodiversity certification in BCAA is located over 200m from any riparian zone.
Land containing caves or similar structures	No	The land proposed for biodiversity certification in BCAA does not contain and caves or similar structures.
Land containing escarpments, cliffs, caves, deep crevices, old mine shafts or tunnels	No	The land proposed for biodiversity certification in BCAA does not contain any of the habitat features identified.
Land within 40 m of gullies in eucalypt forests	No	The land proposed for biodiversity certification in BCAA is not located within 40m of any gullies.
Land within 40 m of heath, woodland or forest	Yes	The land proposed for biodiversity certification in BCAA contains, and is within 40m of the vegetation communities identified.
Land within 40 m of rainforest, coastal scrub, riparian or estuarine communities	Yes	The land proposed for biodiversity certification in BCAA is within 40m of rainforest vegetation.
Rainforest or tall open wet forest with understorey and/or leaf litter and within 100 m of streams	No	The land proposed for biodiversity certification in BCAA is not within 100m of any streams and

Feature	Occurs within land proposed for biodiversity certification	Justification
		vegetation does not contain understorey or leaf litter due to regular maintenance.
Forests along edge of escarpment	No	The land proposed for biodiversity certification in BCAA is located approximately 2.5km east of the Illawarra escarpment, and was not considered to be located 'along the edge'.
North of Batemans Bay	Yes	The land proposed for biodiversity certification in BCAA is located north of Batemans Bay.
Shoalhaven River Valley, and/or north of Oallen	No	The land proposed for biodiversity certification in BCAA is not located within the Shoalhaven River valley, however it is located northeast of Oallen. The biodiversity certification area is located in a different IBRA subregion and different geological formations of Oallen.
Within 5 km of coast	No	The land proposed for biodiversity certification in BCAA is located 5,230m from the coast.
Within 5 km of escarpment, and/or west of Princes Highway	Yes	The land proposed for biodiversity certification in BCAA is located within 5km of the Illawarra escarpment and west of the Princes Highway.

This assessment generated a list of species credit species predicted to occur within land proposed for biodiversity certification in the BCAA. The following sections provide an assessment of whether the land proposed for biodiversity certification in BCAA provides suitable habitat and whether the species will be impacted by the biodiversity certification.

4.3.2 Assessment of candidate species for further assessment

A list of species credit species predicted to occur within land proposed for biodiversity certification in the BCAA, based on the CMA subregion and vegetation types present, along with an assessment of whether this area provides suitable habitat, and therefore the species require further assessment, is provided in Table 9 (flora) and Table 10 (fauna). The potential for a species to occur within land proposed for biodiversity certification in the BCAA was assessed in accordance with Step 3.3.2 of OEH (2015).

It is considered unlikely that the area proposed for certification in the BCAA supports any threatened species credit species, largely due to the high levels of disturbance within this portion of the site.

Table 9 Species credit species (flora) and an assessment of the potential to occur within the area proposed for certification within the BCAA

Scientific Name	Common Name	Likely to occur in the area proposed for certification within the BCAA	Justification
Cynanchum elegans	White-flowered Wax Plant	No	Targeted surveys were undertaken for all flora species listed within the area proposed for certification. These surveys were undertaken in accordance with the methodology outlined in Section 4.1. These surveys focused on searching at the base of trees, as these areas show lower levels of disturbance from slashing. No threatened species were recorded within land proposed for biodiversity certification. The presence of these species is considered unlikely due to the level of disturbance from slashing.
***Daphnandra* sp. C Illawarra**	Illawarra Socketwood	No	
Irenepharsus trypherus	Illawarra Irene	No	
Pimelea curviflora* var. *curviflora	N/A	No	
Pterostylis gibbosa	Illawarra Greenhood	No	
Senna acclinis	Rainforest Cassia	No	
Zieria granulata	Illawarra Zieria	No	

Table 10 Species credit species (fauna) and an assessment of the potential to occur within the area proposed for certification within the BCAA

Scientific name	Common name	Likely to occur in the area proposed for certification within the BCAA	Justification
Anthochaera phrygia	Regent Honeyeater	No	The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. There are only three known key breeding regions remaining, including the Capertee Valley and the Bundarra-Barraba region in NSW. The Regent Honeyeater is a generalist forager, which mainly feeds on the nectar from a wide range of eucalypts and

Scientific name	Common name	Likely to occur in the area proposed for certification within the BCAA	Justification
			mistletoes. Key eucalypt species include Mugga Ironbark, Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany. Also utilizes a variety of other Eucalypt species. There are five records of this species within the Illawarra CMA subregion. The land proposed for biodiversity certification in BCAA is not part of a breeding region, and does not support key eucalypt feed species. Although the species may forage within land proposed for biodiversity certification in BCAA on occasion, it is considered a vagrant species, in accordance with Part 3.3.2 of OEH (2015).
Cercartetus nanus	Eastern Pygmy-possum	No	The species occurs in a broad range of habitat types, with heaths and woodlands preferred. There are 11 records of this species within the Illawarra CMA subregion; however, these records are located in areas more associated with sandstone heaths. Habitat within the BCAA is substantially degraded and of poor quality due to disturbance from slashing. The land proposed for biodiversity certification in BCAA lacks a number of habitat features, including dense complex habitat, nectar producing species and hollows that the Eastern Pygmy Possum is reliant upon.
Miniopterus australis **(Breeding Habitat)**	Little Bentwing-bat (breeding habitat)	No	Whilst the Little Bentwing-bat has been recorded roosting within tree hollows, it prefers caves, abandoned mines, tunnels, stormwater drains or buildings (Churchill 2008). However, this species breed exclusively within caves, often in conjunction with the Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*. The BCAA does not contain any caves or structures that would provide breeding habitat suitable for this species.

Scientific name	Common name	Likely to occur in the area proposed for certification within the BCAA	Justification
Petaurus norfolcensis	Squirrel Glider	No	In coastal areas the Squirrel Glider inhabits Blackbutt-Bloodwood forest with heath understory, often with mixed stands of Acacia species. Require abundant tree hollows for refuge and nest sites. There are two records within the Illawarra CMA subregion; however, these records are located at Jervis Bay and Kangaroo Valley where more suitable habitat occurs. No records exist in relation to the BCAA, and the habitat is considered poor quality due to the absence of suitable forest types and a lack of abundant hollows.
Phascolarctos cinereus	Koala	No	The Koala inhabits a number of forest and woodland vegetation types, with the presence of Koala feed trees an important indicator. In the Southern Rivers CMA Forest Redgum is considered a primary feed tree. There are 18 records of the Koala within the Illawarra CMA subregion; however the majority of these are aged, with only five records within the past 10 years with the majority coming from community surveys. The Koala is rare in the Illawarra, and the BCAA would provide poor quality habitat due to the presence of immature feed tree species and open habitats elevating the risk of predation.
Pteropus poliocephalus **(Breeding Habitat)**	Grey-headed Flying-fox (Breeding habitat)	No	The BCAA does not support a camp of the Grey-headed Flying-fox.
Sminthopsis leucopus	White-footed Dunnart	No	The White-footed Dunnart occurs in a wide range of vegetation types, including forest and woodland communities, generally with an open understory structure. There is one record of this species within the Illawarra CMA subregion, at the furthest southern reach of the subregion. There are no records in close proximity to the BCAA. Habitat within land proposed for

Scientific name	Common name	Likely to occur in the area proposed for certification within the BCAA	Justification
			biodiversity certification in the BCAA is substantially degraded and would be considered poor quality as it has been maintained continuously for long period of time by slashing. It lacks the habitat complexity required by this species.

301000 000000 301500 000000 302000 000000

6188000 000000

6187600 000000

6187200 000000

Brandy And Water Creek

American Creek

Kerrawah Avenue

Jalna Avenue

Lamerton Drive

Foy Avenue

O'briens Road

Foy Avenue

Hennessy Lane

Darragh Drive

Hannah Close

Darragh Drive

Cordeaux Road

William James Drive

Redgum Forest Way

Acknowledgements: Imagery (c) KFW, Nearmap 2015; Basemap © Land and Property Information 2015

Legend

- Biodiversity Certification Assessment Area (BCAA)

Land within the BCAA

- Land proposed for biodiversity certification
- Retained land - BioBank Site
- Retained land - Easement

Native vegetation (Biosis 2015)

- Forest Red Gum - Thin-leaved Stringybark grassy woodland, Moderate/Good,
- Forest Red Gum - Thin-leaved Stringybark grassy woodland, Moderate/Good, Derived grassland
- Sydney Blue Gum x Bangalay Lilly Pilly moist forest, Moderate/Good,
- Sydney Blue Gum x Bangalay Lilly Pilly moist forest, Moderate/Good, Poor
- Sydney Blue Gum x Bangalay Lilly Pilly moist forest, Moderate/Good, Derived grassland
- Sydney Blue Gum x Bangalay Lilly Pilly moist forest, Low,
- Whalebone Tree - Native Quince dry subtropical rainforest, Moderate/Good,
- Whalebone Tree - Native Quince dry subtropical rainforest, Low,
- Threatened flora survey (Biosis 2015)

Figure 6: Threatened flora survey tracks

0 40 80 120 160 200

Metres

Scale: 1:4,059 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 20288
Date: 23 December 2015,
Checked by: NMG, Drawn by: LH, Last edited by: ngarvey
Location:P:\20200s\20288\Mapping
20288_BioBanking_F6_ThreatenedFloraSurvey_20151223

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WCC et al. 2011b. Illawarra Biodiversity Strategy. Volume 2 Background Information. Wollongong City Council, Shellharbour City Council and Kiama Municipal Council, Wollongong, NSW.

Appendices

Appendix 1 Plot and transect data

Table 11 Plot and transect data

PlotName	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
SR545 – *Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion*													
Q1	28	42.5	7	58	2	16	16	0	1	0	301354	6187502	56
Q16	28	38	0	50	0	38	38	0	0	4	301097	6187741	56
SR652 – *Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion*													
Q5	22	21	0	66	0	12	18	0	0	0	300830	6187818	56
Q6	20	44	0	32	4	56	44	0	1	0	300905	6187798	56
Q7	15	22.5	0.2	74	0	24	18	0	1	2	301029	6187728	56

Appendix 2 Curriculum Vitae for Nathan Garvey

Curriculum vitae

Nathan Garvey

Position

Senior Consultant Ecologist and Resource Group Manager

Qualifications

BSc, GDip BioSc

Certified Environmental Practitioner

Accredited Biobanking Assessor (No. 0103)

Professional experience

Nathan has more than 15 years' experience in ecology and impact assessment. Nathan's technical expertise is well regarded throughout NSW with several of his reports receiving high acclaim from state regulators. His ecological knowledge has been endorsed by the industry as a Certified Environmental Practitioner and Accredited BioBanking Assessor.

Leading specialist teams on a wide variety of projects in NSW, Victoria and the ACT, Nathan has a thorough understanding of how to deliver complex projects. He is well versed in project methodology and design as well as having in depth knowledge of NSW and Commonwealth legislation. He is an accredited BioBanking assessor with a reputation as the 'go-to' consultant for offset solutions.

His capacity to design innovative assessment methodologies and new approaches, frequently result in achieving the client's outcomes together with time and cost efficiencies. This capacity can be highlighted by Nathan's development of a LiDAR assessment methodology to improve spatial modelling of upland swamp distribution on the Woronora plateau. This method has improved the accuracy of swamp distribution modelling, reducing field effort, and enabling desktop-based 'what if' impact scenarios to be applied with increased confidence.

Nathan combines an innovative approach with sound processes which includes working closely with clients to identify and resolve issues in a timely and cost-effective manner.

Key project experience

Project Director

Nathan is currently acting as the Project Director for the Coffs Harbour Bypass Biodiversity and Heritage Impact Assessment being undertaken for Arup on behalf of NSW Roads and Maritime Service. This project, involving the final stage of the Pacific Highway upgrade between Sydney and Brisbane, will a legacy project. Biosis is currently undertaking preliminary biodiversity and heritage assessments to identify key constraints to inform the detailed design for the project. Future work will include targeted surveys for threatened species, development of management plans and preparation of the Biodiversity Assessment Report and Biodiversity Offset Strategy.

BioBanking Assessor	Nathan is currently engaged by the NSW Office of Environment and Heritage to provide BioBanking assessor services. This involves Nathan undertaking assessments of BioBanking statement and BioBanking agreement applications on behalf of OEH. Nathan undertakes a review of the technical aspects of these applications.
Project Manager/Ecologist	Nathan has recently completed the biodiversity impact assessment for the proposed Goonumbla Solar Farm at Parkes for Geolyse on behalf of Renewable Energy Developments. The project was deemed State Significant Development and the project has been assessed in accordance with the NSW Offset Policy for Major Projects and associated Framework for Biodiversity Assessment. Nathan has provided well considered technical advice in an understanding of the cost and timing implications for the project. This has resulted in the proponent making an informed decision to avoid impacts to biodiversity, resulting in a zero credit requirement and fast submission process.
Project Manager/Ecologist	Nathan assisted Hansen Bailey and Wollongong Coal in the preparation of the Biodiversity and Heritage assessments for the proposed Underground Expansion Project. This State Significant large scale mining project has involved a multi-faceted assessment, including application of the NSW Offset Policy for Major Projects, new guidelines for offsets for upland swamps and referral of the project to the Commonwealth Department of the Environment. This project gave Nathan the opportunity to develop new methods for the mapping and assessment of impacts to upland swamps and Nathan's work has received significant praise from regulators, with the Department of Planning and Environment calling Biosis' assessment *"the most comprehensive swamp impact assessment yet undertaken in the Southern Coalfield"*.
Project Manager/Ecologist	Nathan has recently undertaken detailed flora and fauna assessments for the proposed Nyngan Inground Storage on behalf of NSW Public Works. Previous habitat based assessments identified the potential for a significant impact to several threatened fauna species. Nathan was engaged to help the proponent navigate this complex projects. Through his expert advice, thorough understanding of the legislative framework and detailed assessment approach Nathan has been able to work with the proponent to design a project that will avoid a significant impact and therefore avoid the need for further assessment and offsetting.
Project Manager/Ecologist	Nathan has recently gained approval for a BioBanking statement for the residential subdivision of land at 33 – 35 Warradale Road, Silverdale BioBanking Statement for SitePlus on behalf of TRN Group. Through the application of the NSW BioBanking Assessment Methodology Nathan assisted TRN Group gain approval for this project, including referral and approval of the project under the EPBC Act.

Other project experience

Project Manager/Ecologist	Gunnedah Solar Farm Biodiversity Assessment. For Overland Sun Farming.
Ecologist	Hillston Solar Farm Biodiversity Assessment. For Overland Sun Farming.
Ecologist	Limondale Solar Farm Biodiversity Assessment. For Overland Sun Farming.
Project Manager/Ecologist	89 Port Stephens Drive Taylors Beach, Biodiversity Assessment Report for proposed BioBanking Agreement. For Port Stephens Council.
Project Manager/Ecologist	89 Port Stephens Drive Taylors Beach, Biodiversity Assessment Report for proposed BioBanking Statement. For Port Stephens Council.
Project Manager/Ecologist	Walgett Solar Farm Biodiversity Impact Assessment. For Geolyse on behalf of Epuron.
Project Manager/Ecologist	Balickera Tunnel Targeted Microbat Surveys. For GHD Pty Ltd on behalf of Hunter Water.
Project Manager/Ecologist	Amended Rocky Hill Coal Project Response to Submissions. For RW Corkery & Co on behalf of Gloucester Resources Limited.
Project Manager/Ecologist	Amended Rocky Hill Coal Project Targeted Fauna Surveys. For RW Corkery & Co on behalf of Gloucester Resources Limited.
Project Manager/Ecologist	Yarraman Abattoir and Feedlot Biodiversity Impact Assessment. For KMH Environmental.
Project Manager/Ecologist	Goonumbla Solar Farm Biodiversity Impact Assessment. For Geolyse on behalf of Renewable Energy Developments.
Project Manager/Ecologist	Brandy Hill Quarry Expansion Biodiversity Impact Assessment. For Hanson Construction Materials.
BioBanking Assessor	Provision of BioBanking Assessor Services. For NSW Office of Environment and Heritage.
Project Manager/Ecologist	Nyngan Inground Storage Biodiversity Impact Assessment. For NSW Public Works.
Project Manager/Ecologist	Additional Crossing of the Clarence River at Grafton, Flora and Fauna Management Plan. For Fulton Hogan.
Project Manager/Ecologist	Redgum Ridge Western Precinct Biodiversity Certification. For Clifford Developments.
Project Manager/Ecologist	Redgum Ridge Western Precinct BioBanking Agreement. For Clifford Developments.

Project Manager/Ecologist	33 – 35 Warradale Road, Silverdale BioBanking Statement. For SitePlus on behalf of TRN Group.
Project Manager/Ecologist	33 – 35 Warradale Road, Silverdale BioBanking Agreement. For SitePlus on behalf of TRN Group.
Project Manager/Ecologist	Crest Road, Albion Park Flora and Fauna Assessment. For Spinitu Pty Ltd.
Project Manager/Ecologist	Underground Expansion Project: Environmental Impact Statement under the EPBC Act. For Wollongong Coal Ltd.
Project Manager/Ecologist	Underground Expansion Project: Biodiversity Offset Strategy. For Wollongong Coal Ltd.
Project Manager/Ecologist	Literature Review on the Effects of Climate Change on Upland Swamps. For Illawarra Coal.
Project Manager/Ecologist	Longwall 6 and 7: Biodiversity and Upland Swamp Management Plans. For Wollongong Coal Ltd.
Project Manager/Ecologist	Russell Vale Colliery Exploration Boreholes Review of Environmental Factors. For Wollongong Coal Ltd.
Project Manager/Ecologist	Russell Vale Colliery Environmental Monitoring Review of Environmental Factors. For Wollongong Coal Ltd.
Project Manager/Ecologist	Underground Expansion Project: Preferred Project Report. For Gujarat NRE Coking Coal Ltd.
Project Manager/Ecologist	Underground Expansion Project: Environmental Impact Assessment. For Gujarat NRE Coking Coal Ltd.
Project Manager/Ecologist	Gujarat NRE Major Expansion – Detailed Upland Swamp Impact Assessment. For Gujarat NRE Coking Coal Ltd.
Project Manager/Ecologist	Longwall 4 and 5 Exploration Works Ready Reckoner. For Gujarat NRE Coking Coal Ltd.
Project Manager/Zoologist	Dendrobium Area 3A, WC 17 – Monitoring of Littlejohn's Tree Frog Populations. For BHP Billiton Illawarra Coal.
Project Manager/Ecologist	Dendrobium Area 2, Swamp1, Impact Assessment. For BHP Billiton Illawarra Coal
Project Manager/Ecologist	NRE No.1 Preliminary Works Biodiversity Management Plan. For Gujarat NRE Coking Coal Ltd.
Project Manager/Ecologist	NRE No.1 Longwalls 4 Biodiversity Management Plan. For Gujarat NRE Coking Coal Ltd.
Project Manager	Dendrobium Area 2 and Area 3A Ecological Monitoring Program 2011/12. For BHP Billiton Illawarra Coal.

Project Manager	Dendrobium Area 2 and Area 3A Ecological Monitoring Program 2010/11. For BHP Billiton Illawarra Coal.
Project Manager/Zoologist	Appin Area 9 Revised Biodiversity Impact Assessment. For BHP Billiton Illawarra Coal.
Project Manager/Zoologist	Appin Area 9 Biodiversity Management Plan. For BHP Billiton Illawarra Coal.
Project Manager/Zoologist	Wongawilli Colliery 33kV Powerline Maintenance Ready Reckoner. For Wollongong Coal Ltd.
Project Manager/Ecologist	Russelll Vale Colliery Environmental Monitoring Review of Environmental Factors. For Wollongong Coal Ltd.
Project Manager/Zoologist	NRE No. 1 Colliery - Targeted Green and Golden Bell Frog Surveys. for Gujarat NRE Coking Coal Ltd.
Project Manager/Ecologist	Wonga South Exploration Boreholes Review of Environmental Factors. For Wollongong Coal Ltd.
Project Manager/Ecologist	Motorcycling NSW Peak Motorcycle Facility, Yerriyong: Flora and Fauna Assessment. For Cowman Stoddart and Motorcycling NSW.
Project Manager/Ecologist	TRN Warradale Road, Peer Review. For SitePlus Pty Ltd.
Ecologist/BioBanking Assessor	NorthConnex Biodiversity Offset Strategy. For Lend Lease Bouyeres Joint Venture.
Ecologist/BioBanking Assessor	Redgum Ridge BioBanking Assessment and Planning Proposal. For Clifford Developments.
Project Manager/Ecologist	Oatley Accessibility Upgrade: Flora and Fauna Assessment. For Transport for NSW.
Ecologist/BioBanking Assessor	Wilton Park Offset Assessment. For Clinton Weaving, Chris Vella and David Manning.
Project Manager/Zoologist	Shell Port Kembla, Green and Golden Bell Frog Management Plan. For URS Australia Pty Ltd.
Project Manager/Ecologist	Darrawank (2NAB) fibre spur route: Desktop ecology and Aboriginal heritage assessment. For NBN Co.
Project Manager/Ecologist	Bamarang Power Station BioBanking Advice and Assessment. For Beca.
Project Manager/Ecologist	AGL Camden North Gas Project – Flora and Fauna Assessment. For AGL Upstream Investments Pty Ltd.
Project Manager/Zoologist	193 Lawrence Hargrave Drive, Coalcliff – Flora and Fauna Assessment. For Cardno.

Project Manager/Zoologist	East Lynne Fibre Optic Cable Flora And Fauna Assessment. For Optus Communications.
Project Manager/Zoologist	Proposed Rezoning Application, Yerriyong – Flora And Fauna Habitat Assessment. For Locale Consulting
Project Manager/Zoologist	National Broadband Network, Minnamurra Wetlands – Flora and Fauna Assessment. For Cardno.
Project Manager/Zoologist	Dundas Tablelands Wind Farm – Detailed Flora and Fauna Assessment. For Origin Energy.
Project Manager/Zoologist	Tarrone Gas-fired Power Station – Flora and Fauna Assessment. For URS Corporation.
Expert Witness	Tarrone Gas-fired Power Station – Expert Witness Statement. For URS Corporation.
Zoologist	Penshurst Wind Farm – Targeted Surveys for the Brolga and Southern Bent-wing Bat. For RES Australia Pty Ltd..
Project Manager/Zoologist	Halladale Speculant 3D Transitional Seismic Survey - Detailed Flora and Fauna Assessment. For Origin Energy Pty Ltd.
Project Manager/Zoologist	Holcim Colac Quarry – Coorangamite Water Skink Translocation Plan. For Holcim Australia Pty Ltd.
Project Manager/Zoologist	Upgrade of the Western Highway between Dimboola and Kiata – Flora and Fauna Assessment. For VicRoads.
Project Manager/Zoologist	Halladale Blackwatch Project – Flora and Fauna Assessment. For Origin Energy Pty Ltd.
Expert Witness	Ballarat Koala Habitat Assessment – Appearance at the Victorian Civil and Administrative Tribunal (VCAT).
Project Manager/Zoologist	Aurora Residential Development - Annual monitoring of the Growling Grass Frog, Striped Legless Lizard and Golden Sun Moth. For VicUrban.
Project Manager/Zoologist	Victorian Desalination Plant - Targeted Surveys for the Growling Grass Frog. For GHD Pty Ltd.
Zoologist	Victorian Desalination Plant - Flora and Fauna Assessment. For GHD Pty Ltd.
Project Manager/Ecologist	Management of the kangaroo population at the former Australian Defence Industries site. Including implementation of a large scale, non-lethal, program to manage the kangaroo population.

Other qualifications and training

Introduction to Groundwater Course

NSCA Occupational Health and Safety Workplace Committee Course

Senior First Aid – St Johns Ambulance

SafeTrek Four Wheel Drive, Driver Training Program

EIANZ Expert Witness Masterclass

Victorian RBA & AUSRIVAS Training Course

Conservation, Welfare and Handling of Australian Marsupials (Macquarie University)

Publications

Garvey, N., Ben-Ami, D., Ramp, D. & Croft, D. Survival behaviour of swamp wallabies during prescribed burning and wildfire. Wildlife Research, 37 (1), 1-12.

Presentations

Garvey, N. The Assessment and Offsetting Of Indirect Impacts. Presentation to the Biodiversity Offsetting for Mining, Infrastructure and Urban development Conference 2015.

Garvey, N. Coastal Upland Swamps and Longwall Mining. Presentation to the Australian Institute of Mining and Metallurgy.

Garvey, N. Ecology and Heritage Assessment for the Underground Expansion Project. Presentation to the Russell Vale Community Consultative Committee.

Professional affiliations and memberships

Certified Environmental Practitioner (CEnvP)

Environment Institute of Australia and New Zealand (EIANZ)

Ecological Consultants Association of New South Wales (ECANSW) – Councillor

Australasian Bat Society (ABS)

Appendix 3 Ecosystem credit report

Table 7 Ecosystem credit report

Vegetation zone details	Vegetation zone area	Percent cleared value	EEC	Red Flag	Loss of SV score	LV score (certification area)	Landscape Tg value	Area of veg zone certified	Number of credits required
Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion - SR652_Moderate/Good	3.15	45	Not an EEC	No	29.17	16	0.55	3.15	54
Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion - SR545_Moderate/Good	1.44	85	Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion	Yes	39.93	16	0.58	1.44	31