Mt Gilead Biodiversity Certification Assessment Report & Biocertification Strategy

Final Report to Minister

Prepared for
Mt Gilead Pty Ltd and Mr & Mrs Dzwonnik

29 May 2018

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Abbreviations

Abbreviation	Description
ARA	Adjacent Remnant Area
APZ	Asset Protection Zone
AW	Alluvial Woodland
BAR	Biodiversity Assessment Report
BCAA	Biodiversity Certification Assessment Area
BBAM 2014	Biobanking Assessment Methodology 2014
BCAM	Biodiversity Certification Assessment Methodology
BCS	Biodiversity Certification Strategy
BVT	Biometric vegetation type
CCC	Campbelltown City Council
CCPD	Canopy cover projection density
CEEC	Critically Endangered Ecological Community
CMA	Catchment Management Authority
CPSWSGTF	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest
CPW	Cumberland Plain Woodland
DEC	NSW Department of Environment and Conservation (now OEH)
DECC	NSW Department of Environment and Climate Change (now OEH)
DECCW	NSW Department of Environment, Climate Change and Water (now OEH)
DoTEE	Commonwealth Department of the Environment and Energy
DPE	NSW Department of Planning and Environment (formerly NSW Department of Planning)
EEC	Endangered Ecological Community
ELA	Eco Logical Australia Pty Ltd
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
IoM	Improve or Maintain
JBA	JBA Urban Planning Consultants
LEP	Local Environment Plan
LGA	Local Government Area
LG Act	NSW *Local Government Act 1993*

Abbreviation	Description
Lendlease Communities	Lendlease Communities (Mt Gilead) Pty Ltd
MALD	More appropriate local data
MDP	Metropolitan Development Program
MNES	Matters of National Environmental Significance (EPBC Act)
Mt Gilead	Mt Gilead Pty Ltd
NPW Act	NSW *National Parks and Wildlife Act 1974*
NPWS	NSW National Parks and Wildlife Service (now part of OEH)
NSW	New South Wales
OEH	NSW Office of Environment and Heritage (formerly DECCW, DECC, DEC)
Old Mill Properties	Old Mill Properties Pty Ltd
PCL	Priority Conservation Lands
RF	Riparian Forest
RFEF	River Flat Eucalypt Forest
SCKHCS	South Campbelltown Koala Habitat Connectivity Study
SEPP 44	State Environmental Planning Policy No 44 – Koala Habitat Protection
SSTF	Shale Sandstone Transition Forest
TSC Act	NSW *Threatened Species Conservation Act 1995*

Definitions

The following table provides definitions for the terminology used in biocertification assessments. Where these terms have been used in the report they have been included in 'quotation marks'.

For this assessment, an additional term, 'retained land – existing conservation measures' has been included. This is to distinguish areas of retained land where two Biobank sites will be registered prior to this application for biodiversity certification being determined.

Definition	Description
Area of High Biodiversity Conservation Value	As described under Section 2.3 of the BCAM. Areas include critically endangered and endangered ecological communities (CEEC and EEC) not in low condition, threatened species that cannot withstand further loss, areas of vegetation that have regional or state conservation significance, and state and regional biodiversity corridors. Also termed Red Flags.
Biodiversity Certification Assessment Area	As described in the BCAM, it includes land where certification is proposed to be conferred and any surrounding or adjacent land. Surrounding and adjacent land may be proposed for biodiversity conservation, or neither certification or development (Retained Land).
Conservation Area	Land that is proposed for conservation measures.
Conservation Measures	The range of measures identified in Section 126L of the TSC Act
Credit Discounting	Applies where there are existing legal obligations to undertake conservation management actions on land.
Development Area	Land within the Biodiversity Certification area that is proposed for development
Ecosystems Credit	As described under the BCAM, the class of credit for biodiversity certification that are generated for conservation measures or required for the land proposed for certification. Ecosystem credits are also generated for some threatened species that are assumed to be present based on the location of the site and the vegetation types present.
Low Condition	As described in Section 2.3 of the BCAM. To meet the 'low condition' threshold a number of criteria described in the method must be met, including <50% of the lower benchmark value of over-story percent cover for the relevant vegetation type or native vegetation with a site value score of less than 34 (Site value score is described in Section 3.6.2 of the BCAM).
Managed and Funded Conservation Measure	As described under Section 8.1.1 of the BCAM. Examples include entering into a Biodiversity Banking Agreement with respect to the land under Part 7A of the TSC Act and the reservation of land under the *National Parks and Wildlife Act 1974* (NPW Act).
Managed Conservation Measure	As described under Section 8.1.2 of the BCAM. Examples include entering into a conservation agreement under Division 12, Part 4 of the NPW Act and entering into a planning agreement under the EP&A Act that makes provision for development contributions to be used for or applied towards the conservation or enhancement of the natural environment.
Moderate-Good Condition	As described in Section 2.3 of the BCAM. Any vegetation that is not in 'low condition' is in 'moderate to good' condition

Definition	Description
More appropriate local data	As described in 3.4 of the BCAM, the Director General may certify that more appropriate local data can be used instead of the data in the Vegetation Benchmark Database, where local data more accurately reflects local environmental conditions.
Planning Instrument Conservation Measure	As described under 8.1.3 of the BCAM. Application of this measure requires a number of conditions to be met that are described under the relevant Section of the method.
Biometric vegetation type	A plant community classification system used in BioMetric Tools, including the BioBanking Tool, Biodiversity Certification Tool and Property Vegetation Planning Tool
Red Flags	As described in Section 2.3 of the BCAM. See 'Areas of High Biodiversity Conservation Value above.
Retained Land	Land within the Biodiversity Certification Assessment Area that is not land proposed for biodiversity certification or subject to proposed conservation measures.
Retained Land – existing conservation measures	Land within the Biodiversity Certification Assessment Area that is not land proposed for biodiversity certification or subject to proposed conservation measures, but which overlaps with the two Biobank sites that will be registered prior to this application for biodiversity certification being determined.
Species credit	As described in the BCAM, the class of credits for biodiversity certification that are generated for a conservation measure or are required for the land proposed for certification

Executive Summary

Eco Logical Australia Pty Ltd (ELA) was commissioned by Old Mill Properties Pty Ltd (Old Mill Properties), on behalf of Mt Gilead Pty Ltd (Mt Gilead) and Lendlease Communities (Mt Gilead) Pty Ltd (Lendlease Communities) on behalf of S. and A. Dzwonnik to undertake a Biodiversity Certification Assessment and prepare a Biodiversity Certification Strategy (BCS) for a proposed residential development at Appin Road, Gilead. The purpose of the assessment is to obtain '*biodiversity certification*' of land proposed for residential development and associated infrastructure from the Minister for the Environment. Biocertification is conferred by the Minister if the '*conservation measures'* proposed in the biocertification application result in an overall '*improvement or maintenance'* in biodiversity values.

The '*Biodiversity Certification Assessment Area'* (BCAA) defined for the study encompasses a total area of 208.89 ha and includes 29.64 ha of native vegetation communities comprising three Biometric vegetation types (BVTs). These BVTs form components of the vegetation communities, Cumberland Plain Woodland (CPW) and Shale Sandstone Transition Forest (SSTF), which are listed as critically endangered ecological communities (CEECs) under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and *Commonwealth Environment Protection and Biodiversity Conservation Act* (EPBC Act) 1999, and River-Flat Eucalypt Forest (RFEF) which is listed as an endangered ecological community (EEC) under the TSC Act. The remaining 179.25 ha of the assessment area is exotic vegetation and cleared land.

Whilst a number of threatened flora and fauna species have been recorded near or within the assessment area, only one vulnerable species, *Phascolarctos cinereus* (Koala), requires specific assessment under the BCAM for impacts to habitat. Koala is classified as a '*species credit'* species and impacts to these species cannot be assessed by the vegetation types. Koala has been 'assumed' to be present for impact assessment purposes based on the presence of suitable browse species and records within and adjacent to the assessment area. Similarly, '*expert reports'* have been prepared stating that Koala is also is likely to occur in the two proposed Biobank sites that have been submitted to the Office of Environment and Heritage (OEH) for registration as 'existing conservation measures'. For the purposes of this assessment, these biobank sites are located within '*retained land – existing conservation measures*' in the BCAA.

The BCAA and proposed impacts are described in **Section 1**. The biodiversity values of the BCAA are described in the Biodiversity Assessment Report (BAR) in **Section 2**. Explanation for data used in the assessment is provided in **Section 3**. The credit calculations and strategy for achieving an 'improve or maintain' outcome are provided in **Sections 4** and **6** respectively.

The application for Biodiversity Certification was publicly exhibited by Campbelltown City Council (CCC or Council) between 12 December 2017 and 31 January 2018 in accordance with s126N of the TSC Act. Nineteen (19) submissions were received. This assessment report and credit calculations have been updated in light of these submissions and minor amendments to the proposed development layout.

The application proposes to directly impact 165.55 ha of the assessment area of which 10.79 ha is mapped as native vegetation and threatened species habitat, and includes 1.37 ha of a CEEC (SSTF) in moderate to good condition and 0.12 ha of CPW within a riparian buffer which are categorised as a '*red flag area'* or '*area of high biodiversity conservation value*' by the BCAM.

Impacts to red flag areas that cannot be avoided require a '*variation*' approval from the Minister that addresses specific red flag viability criteria before Biocertification can be conferred. A request for a red

flag variation is included in **Section 5**. The remaining areas to be impacted are not '*areas of high biodiversity conservation value*', or are cleared of native vegetation.

The application proposes to permanently protect and manage for conservation, 3.61 ha of lands in the BCAA (2.67 ha of which will generate credits, the remaining area being a red flag vegetation conservation area buffer) which are proposed to be conserved as a Council Bushland Reserve registered as a biobank site. These lands will be transferred to Campbelltown City Council (CCC) by 2025. This land will be categorised as 'Community Land - Natural Areas' under the *Local Government Act* 1993 and will be subject to a Plan of Management and the management requirements of a registered Biobank site. In addition to this proposed conservation measure, 18.88 ha of land within the BCAA will be protected and managed for conservation in two Biobank sites (the Noorumba-Mt Gilead and Macarthur-Onslow Mt Gilead Biobank Sites). Mt Gilead will initially manage both biobank sites, with the Noorumba-Mt Gilead Biobank site proposed to be transferred to CCC by 2025 as an addition to the recently registered Noorumba Reserve Biobank site. These Biobank sites are located in '*retained land – existing conservation measures*'. The Biobank sites together include 4.65 ha of CPW (and restoration of a further 1.64 ha), 8.16 ha of SSTF (and restoration of a further 3.8 ha), and 0.44 ha of RFEF, as well as 18.69 ha of existing (13.25 ha) and restored (5.44 ha) habitat for Koala. Conservation management (removal of grazing and initial weed control), commenced in these areas in June 2016).

Similarly, S&S Dzwonnik will manage the proposed 3.61 ha Council Reserve Biobank site for conservation until the land is transferred to Council, expected to be by 2025. Once the land has been transferred, Council will register this land as an addition to the combined Noorumba and Noorumba-Mt Gilead Biobank sites.

Separate assessments for these areas as Biobank Sites have already been completed and submitted to OEH who have now completed the audit and assessment process. Draft Biobank Agreements have been prepared by OEH and they are now ready to be registered. Biobanking Agreements are recognised as '*100% permanently managed and funded'* conservation measures under s.126L (i) of the TSC Act and Section 8.1.1 of the BCAM, and will provide in-perpetuity conservation protection and management on the land title.

The Biodiversity Certification Assessment has found that **132** biocertification *'ecosystem credits'* are required for direct impacts to two BVTs (28 credits for CPW and 104 for SSTF) and **284** '*species credits'* are required for impacts to Koala. The proposed Biobank site in 'land subject to *conservation measures*' is a 100% conservation measure and will generate **20** of the credits required for SSTF (resulting in a deficit of **84** ecosystem credits for SSTF, **28** ecosystem credits for CPW and **284** Koala species credits). In addition to the proposed on-site conservation measure, a further **198** ecosystem credits and **133** Koala species credits will be generated by the two already submitted Biobank sites, Noorumba-Mt Gilead and Macarthur-Onslow Mt Gilead Biobank Sites, within the BCAA. Some of these credits will be retired resulting in all ecosystem credits requirements being met and a **151** credit deficit for Koala. Not all ecosystem credits that will be generated by the two Biobank sites will be retired; there will be a surplus of 46 CPW and 36 SSTF ecosystem credits respectively that can be used to offset impacts from other developments.

If an '*improve or maintain*' outcome is to be achieved, the 151 deficit credits for Koala must be generated by other conservation measures 'outside' the BCAA. It is proposed that these remaining Koala credits will be purchased from registered Biobank sites that generate Koala credits representative of the broader Campbelltown Koala population. A review of the credit registers indicates that there are currently two registered Biobank sites in the Campbelltown area that can provide these credits.

Indirect impacts have been considered in accordance with the BCAM and have been determined to be negligible on the basis that all direct impacts have been assessed on the assumption of complete loss of all biodiversity values, even where impacts are only partial loss as a result of establishing Bushfire Asset Protection Zones and all proposed conservation areas are buffered by perimeter roads and red flagged vegetation buffers.

Subject to the Minister's approval of the request for a red flag variation and the purchase of the additional **151** Koala credits, the proposal can meet an '*improve or maintain*' outcome and is eligible for biodiversity certification. If the Minister confers biocertification on the requested land, CCC as the consent authority for future development applications is no longer required to assess impacts to biodiversity values as these have already been addressed by the Minister and '*conservation areas*' will be required to be managed in perpetuity for conservation.

1 Preamble

1.1 Project background

Eco Logical Australia Pty Ltd (ELA) was commissioned by Old Mill Properties Pty Ltd (Old Mill Properties), on behalf of Mt Gilead Pty Ltd (Mt Gilead) and Lendlease Communities (Mt Gilead) Pty Ltd (Lendlease Communities) on behalf of Mr and Mrs Dzwonnik to undertake a Biodiversity Certification Assessment and to prepare a Biocertification Certification Strategy (BCS) in accordance with the Biocertification Assessment Methodology (BCAM) (Department of Environment, Climate Change and Water [DECCW] 2011) for proposed residential development at Appin Road, Gilead.

The land is located on three lots (Lot 61 DP 752042, Part Lot 2 DP1218887 and Lot 3 DP 1218887 (formerly part of Lot 1 and Lot 2 DP 807555 and Lots 59 DP 752042)) on Appin Road within the Campbelltown Local Government Area (LGA), approximately 5 km south of Campbelltown city centre (**Figure 1**). The lands are proposed to be developed following the rezoning of these lands from a 'deferred matter' to residential in 2017.

An application for biocertification must follow the Biodiversity Certification Assessment Methodology (BCAM) (Department of Environment, Climate Change and Water [DECCW] 2011) and meet the requirements of Section 126K of the *Threatened Species Conservation Act* 1995 (TSC Act), i.e. be accompanied by a BCS.

The BCAM was developed by the New South Wales (NSW) Office of Environment and Heritage (OEH) and was gazetted by the NSW government in February 2011. The methodology may be applied to land for which '*biocertification is sought'*, and is conferred by the Minister for the Environment if the '*conservation measures'* proposed in the biocertification application result in an overall '*improvement or maintenance'* in biodiversity values. This is referred to under the methodology as satisfying the '*improve or maintain test*' (IoM test).

The methodology provides an equitable, transparent and scientifically robust framework with which to address the often competing demands of urban development and biodiversity conservation. If the Minister for the Environment is satisfied that an IoM outcome has been achieved, he/she may confer biocertification on 'land'. If the Minister confers biocertification on land, a consent/approval authority does not have to take biodiversity issues into consideration when assessing development applications, i.e. for the purpose of s.5A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act), the development or activity is not subject to an Assessment of Significance for threatened species, populations or ecological communities.

Only a '*Planning Authority'* as defined by section 126G of the TSC Act may apply to the Minister for biocertification. Campbelltown City Council (CCC) is a Planning Authority as defined by section 126G. CCC is seeking biocertification of the land identified in this assessment report.

This Biocertification Strategy and the associated credit calculations were undertaken by accredited assessors Bruce Mullins (Accreditation Number 0156) and Enhua Lee (Accreditation Number 0176), who was supported by other ELA staff (Joanne Daly and Robert Humphries), and field ecologists who undertook ecological investigations of the Biodiversity Certification Assessment Area (BCAA) as part of previous investigations for rezoning of lands in the BCAA from 'deferred matter' to new zoning (ELA 2014) (Belinda Failes, Rodney Armistead and Mitchell Palmer). Brief cvs for the project team members are provided in **Appendix A**.

1.2 Description of project timelines, management and governance

The BCAA was rezoned in accordance with the Standard Instrument – Principal Local Environmental Plan and consistent with the Campbelltown LEP 2014 to a predominantly R2 residential zone including roads with a neighbourhood centre (151.3 ha), along with areas for public open space (21.2 ha) and conservation (18.88 ha). A total of 17.5 ha is proposed to be retained as rural land.

Rezoning will facilitate development of up to 1,700 new dwellings in a low density environment. The dwellings are proposed in a range of lot sizes, with 600 m2 the average lot size, and will expand the type and choice of dwellings available in the Campbelltown LGA. This outcome is consistent with local and regional strategies and objectives to promote housing diversity.

The planning proposal was placed on exhibition by CCC between 28 April and 30 June 2015 (**Appendix B**) and was rezoned in September 2017. Preliminary subdivision plans are expected to be submitted in 2018. Subject to all approval being in place, construction is proposed to commence in two stages starting with Stage 1 in 2018/19 and subject to demand for lots, be completed by 2022/23.

1.3 Community Consultation and Stakeholder Engagement

The planning proposal to rezone the subject land at Gilead has undergone extensive community and stakeholder consultation, including with the DPE and the OEH, since 2010 (refer to **Figure 2** and **Appendix B**). The planning proposal was placed on public exhibition between 28 April and 30 June 2015 by CCC.

This application for Biodiversity Certification was publicly exhibited by Campbelltown City Council (CCC or Council) between 12 December 2017 and 31 January 2018 in accordance with s126N of the TSC Act. Nineteen (19) submissions were received. A response to submission report has been prepared (**Appendix C)**. This assessment report and credit calculations have been updated in light of these submissions and minor amendments to the proposed development layout.

Further, as there are Matters of National Environmental Significance (MNES)(listed communities and species on the schedules of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)) to be impacted in the study area, the proposal was also referred to the Commonwealth Department of the Environment and Energy (DoTEE) and was subsequently declared a 'controlled action' under the EPBC Act). A Preliminary Documentation Environmental Assessment Report was prepared and also placed on public exhibition between 20 December 2017 to 2 February 2018.

1.4 Biodiversity certification assessment area and proposal

The Biodiversity Certification Assessment Area (BCAA) encompasses a total area of 208.89 ha. The site is accessed off Appin Road and includes land proposed for biodiversity certification (and therefore proposed for development; '*land to be certified*'), '*conservation areas*' i.e. land subject to conservation measures, and '*retained land*' i.e. land that is not proposed for development or subject to conservation measures. However, portions of the 'retained land' within the BCAA overlap with the two Biobank sites that have been submitted for registration prior to this application for biodiversity certification being determined and are therefore referred to as '*retained land – existing conservation measures*'.

The BCAA includes approximately 29.64 ha of native vegetation. Vegetation within the BCAA includes three Biometric vegetation types (BVT), two of which are listed as Critically Endangered Ecological Communities (CEECs) under the TSC Act and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and one of which is listed as an Endangered Ecological Community (EEC) under the TSC Act (**Table 1**). The remaining areas comprise exotic pasture which fits the definition

of 'cleared land' as defined by the BCAM (DECCW 2011a) i.e. areas where there is no canopy or shrub layer and the ground cover is greater than 50% exotic cover.

The regional location of the BCAA is shown in **Figure 1**. The areas proposed to be impacted through urban development (land to be certified or '*development areas*'), land subject to conservation measures or '*conservation areas*', and '*retained land*' in the BCAA are shown in **Figure 2** and **Figure 3**. Details of the proposed land uses within the BCAA are shown in **Figure 4** and **Table 2** and comprise urban development and associated infrastructure (roads, water, sewage, utilities), asset protection zones (APZs), recreational facilities within passive and active open space areas (playing fields etc) and land proposed for conservation of biodiversity values. It is noted that the land proposed for biocertification is consistent with the planning outcome for the area (**Figure 2**) and includes bushfire asset protection zones (APZ) which are generally fully accommodated within the permitter roads and building setbacks and do not impact on the land proposed for conservation measures or the submitted biobank sites (**Figure 4**).

Also shown in **Figures 3** and **4** are the locations of two existing Biobank site (Beulah Biobank Site and Council's Noorumba Reserve Biobank Site), the two Biobank sites that will be registered prior to this application for biodiversity certification being determined (overlapping '*retained land – existing conservation measures*'), and potential future Biobank sites adjacent to the BCAA. Noorumba Reserve has been included as a Western Sydney Priority Area lying on 'Priority Conservation Lands' (PCLs) (also referred to as Priority Areas) for the protection of the CEEC, Cumberland Plain Woodland (CPW), in the CPW Recovery Plan (DECCW 2011b) and updates to the layer. As such, it has been identified by the OEH as a priority site for registration of a Biobank site (OEH 2014b).

Lendlease is proposing a residential development with an indicative yield of up to 1,700 lots in two stages as shown in **Figure 4**. It is intended that development of the site will deliver a broad range of lot sizes consistent with the natural features of the site, environmental conservation areas, and a suitable street and community layout.

The key concepts of the development will be to:

- incorporate and maximise the existing landscape and topographical characteristics of the site
- retain existing native vegetation which is in good condition, and protect and enhance biodiversity and sensitive habitats
- enhance the existing riparian corridors
- protect visually prominent features such as ridgelines
- enhance visual links to distant views, heritage features and open space
- encourage passive surveillance and increase safety
- facilitate sustainable transport access
- maximise solar access for future lots and sustainable design outcomes
- provide a walkable neighbourhood
- increase the supply of housing within the Campbelltown LGA with the addition of 1,700 new dwellings

The development will be predominantly urban and consist of residential constructions and associated infrastructure. More specifically, the proposal will involve:

- the delivery of new housing in proximity to existing residential urban land with access to public transport
- water and sewer infrastructure
- a community centre and small kiosk/store

Details of the development include:

- General residential: The Campbelltown LGA has a forecast population projection of 64,000 between 2011 and 2031. An additional 24,846 homes will be required in the Campbelltown area by 2031 to meet this population growth (Department of Planning and Environment 2014). The Mt Gilead development will deliver approximately 1,700 lots with a range of lot sizes consistent with the natural features of the site. This will enhance and expand housing supply close to the Campbelltown-Macarthur Major Centre.
- Recreation and active open space areas: will be provided including an oval and recreation areas with some landscaping consistent with the local native vegetation. These areas will be classified as Community Land under the Local Government Act and will have a Plan of Management prepared and adopted under the Act.
- Open space – passive: natural areas maintained in their existing rural character as open space, retaining ecological value but not for use as a formal conservation areas/offsets. Where possible, trees will be retained in these areas, and enhanced by landscape plantings of species consistent with the existing environment, resulting in structured restoration and regeneration of these areas. These areas will include management under the Local Government Act, and will include fencing, assisted regeneration, and surrounding paths/cycleways to discourage access into the vegetated areas by controlling and formalising movement patterns. Under this management, these areas will have a positive contribution to the environmental outcome of the project through management as native vegetated areas.
- Services: The development will be serviced by the required infrastructure, including water, sewer and electricity for the proposed development. Infrastructure relating to traffic, stormwater, sewerage, telecommunications and electricity will, where possible, be located onsite. Subsequent rehabilitation works will be carried out in accordance with a site specific management plan
- Detention basins: the development has been designed with detention basins/swales that will capture and treat run-off water. The water will be initially captured by a network of curb and guttering along all roads. The detention basins and swales will treat and control run-off water to ensure post development impacts of water quality and flows when released into natural creeks are no greater than those pre-development. The detention basins will include appropriate plantings around the banks that will retain and enhance habitat for birds and frogs, foraging/nesting resources for bats, birds and arboreal mammals, whilst also acting as a buffer between the urban development and protected areas of vegetation.
- Roads, access ways, and parking: The street network within the site is to be consistent with Campbelltown City Councils Engineering Design Specification and street network principles including the establishment of a permeable network that is based on a modified grid system, and encourages walking and cycling and reduced travel distances.
- Asset Protection Zones (APZs): The development will be carried out in a way to ensure prevention of loss of life and property due to bushfires. The lot layout shows that perimeter roads are located along most bushland and landscaped interfaces. APZ's have been calculated in accordance with Planning for Bushfire Protection (RFS 2006) and are fully met by perimeter roads and building setbacks. Further, none of the required APZs extend into proposed conservation/offset areas.
- On-site Offset sites: Parts of five areas are proposed as on-site offset sites to offset the impacts of the proposed action on EPBC Act listed MNES. All offset sites will be registered as Biobank sites and include signage and perimeter fencing to allow the movement of fauna (including koala) but prevent the entry or people, unauthorised vehicles or cattle from adjacent rural land. The sites will be actively managed for conservation in perpetuity and subject plans of management in accordance with a Biocertification Agreement between Lendlease, Campbelltown City Council and the Minister for the Environment. The applications to register two of these sites (the Macarthur Onslow-Mt Gilead and Noorumba-Mt Gilead Biobank sites have already been

submitted to the NSW OEH and are expected to be registered in 2018 (ELA 2018a & b and **Appendix K** and **L**), the third will be registered after the initial subdivision plans are approved and following land transfer to CCC. All will be actively managed for conservation prior to the commencement of construction. All conservation outcomes will be further protected under a legally binding Biocertification Agreement (see Section 6.7 Statement of Commitments), registered on title, between the NSW Minister for the Environment, Campbelltown City Council and the land owners.

- Riparian lands: Three riparian corridors have been mapped within the study area. Each will be retained and protected within areas proposed as open space or in offset areas.

Table 1: Biometric vegetation types and their conservation status in the BCAA

Biometric vegetation type	Area (ha)	TSC Act	EPBC Act
Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	0.44	RFEF (EEC)	
Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	8.59	CPW (CEEC)	Part CPSWSGTF (CEEC)*
Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	20.61	SSTF (CEEC)	Part SSTF (CEEC)
Cleared land	179.25	NA	NA
Total	**208.89**		

* CPSWSGTF = Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest

Table 2: Proposed biocertification land uses in the BCAA

Development footprint	Area (ha)	% of BCAA	Area of native vegetation (ha)	% of native vegetation
Land proposed for Biodiversity Certification (Development)	165.55	79.25	10.79	36.40
Land proposed for conservation	2.67	1.28	2.67	9.00
Retained lands (land excluded from this assessment but including submitted biobank sites)	40.67	19.47	16.19	54.60
Total	**208.89**	**100**	**29.64**	**100**

1.5 Biocertification Assessment Process and Implications

Under the BCAM, the impact of development and conservation measures on biodiversity values is quantified using '*biodiversity credits*' which are defined by each of the BVTs (ecosystem credits) and threatened species present (species credits). In this regard, the methodology determines the number of credits that are required to offset the adverse impacts of development on biodiversity values and the number of credits that can be generated by undertaking recognised '*conservation measures*' as outlined in s126L of the TSC Act that will improve biodiversity values within the BCAA. Where the number of

credits that are created is equal to, or exceeds the number required, the '*improve or maintain*' test described under the methodology is considered to be satisfied, provided '*red flags*' have been avoided, or a red flag variation has been approved by the Director General of the OEH.

'*Red flags*' are regarded as '*areas of high biodiversity conservation value*' in section 2.3 of the BCAM, and include vegetation types that are >70% cleared in the Catchment Management Authority Area (CMA), CEECs and EECs listed under the TSC Act and/or EPBC Act, vegetation recognised as having regional or state biodiversity conservation significance, and certain threatened species that are regarded as not being able to withstand further loss in the CMA.

The BCAA includes two red flag entities that will be impacted by the proposal:

- One CEEC, '*Shale Sandstone Transition Forest in the Sydney Basin Bioregion*' (SSTF) involving impacts to 1.37 ha.
- Impacts to vegetation within a riparian buffer 20m either side of a minor creek (0.12 ha)

The measures taken to avoid, minimise and mitigate impacts to this '*red flag*' are provided in **Section 5**. As all impacts have not been avoided, this assessment report includes a red flag variation request (**Section 5**).

1.6 Assessment Methodology/Consultation with the OEH

In accordance with the OEH's Biodiversity Certification Guide for applicants (OEH 2015a), CCC and ELA consulted with the OEH prior to and throughout the assessment to ensure that all decisions and assumptions meet the intent of the BCAM. The OEH was also consulted on the proposed impacts to '*red flags'* and the likelihood that these would be supported.

A summary of discussions and outcomes are provided below:

- The proposed biocertification approach:
  - areas of high conservation value (CEECs, riparian areas and biodiversity links), and species credits species to be considered (*Phascolarctos cinereus* (Koala)). The OEH agreed that there were two CEECs, and one species credit species, to be considered, and there were no state or regional biodiversity links on site;
  - the boundaries of the BCAA, focussing on the inclusion/exclusion of the two Biobank sites. The OEH agreed that the two Biobank sites that will be registered prior to this application for biodiversity certification being determined could be included within '*retained land – existing conservation measures*' in the BCAA, and surplus credits could be retired at a later date as per other Biobank sites, rather than retired in their entirety as per surplus credits in conservation lands in biocertification assessments;
- The version of the Biocertification calculator tool to be used for calculations. Version 1.9 was initially used but calculations were updated in May, August and October 2017 and in response to the submissions following public exhibition in March 2018, using version 1.09_HN556_201216 together with amendments to the benchmarks for the number of hollow bearing trees and length of fallen logs for CPW and SSTF being 1 and 50 respectively for both vegetation communities. It is noted that the SSTF is now classified as a Grassy Woodland Vegetation Formation rather than a Dry Sclerophyll Forest Formation;
- In-principle support from the OEH regarding red flag impacts. The OEH indicated it would support a red flag variation given the current condition of the red flag vegetation to be removed and the areas of CEEC proposed to be conserved in the '*conservation areas*' and in one of the Biobank sites (Macarthur-Onslow Mt Gilead Biobank Site); and

- The OEH assessment requirements, preparation and exhibition of the BCS, and the application by CCC for conferral of biocertification to the Minister for Environment. The OEH indicated that the BCAM should be followed, as well as Guidelines for the preparation of Biodiversity Assessments and Strategies.
- Following advice from OEH in early 2016 regarding the assessment of potential breeding habitat for the Southern Myotis (i.e. any hollow bearing trees within 200m of permanent water should, be considered potential breeding habitat) and a recent record (December 2013) of the endangered Green and Golden Bell Frog at Biriwiri Creek, approximately 7km north of the BCAA, targeted survey for the GGBF and an assessment of potential breeding habitat for Southern Myotis was undertaken on 30 November and 7th and 12th of December 2016.

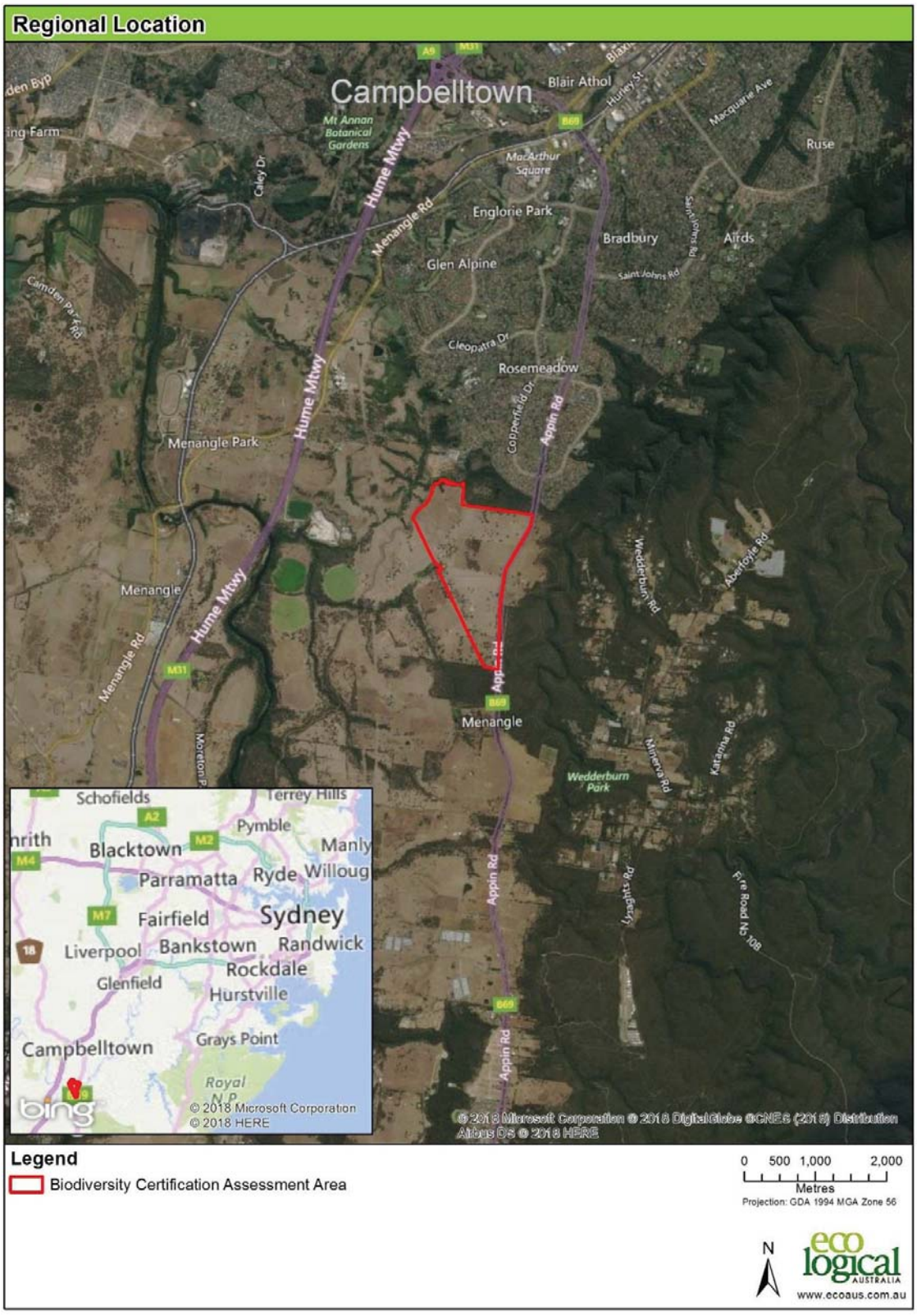

Figure 1: Regional location of the Mt Gilead Biodiversity Certification Assessment Area

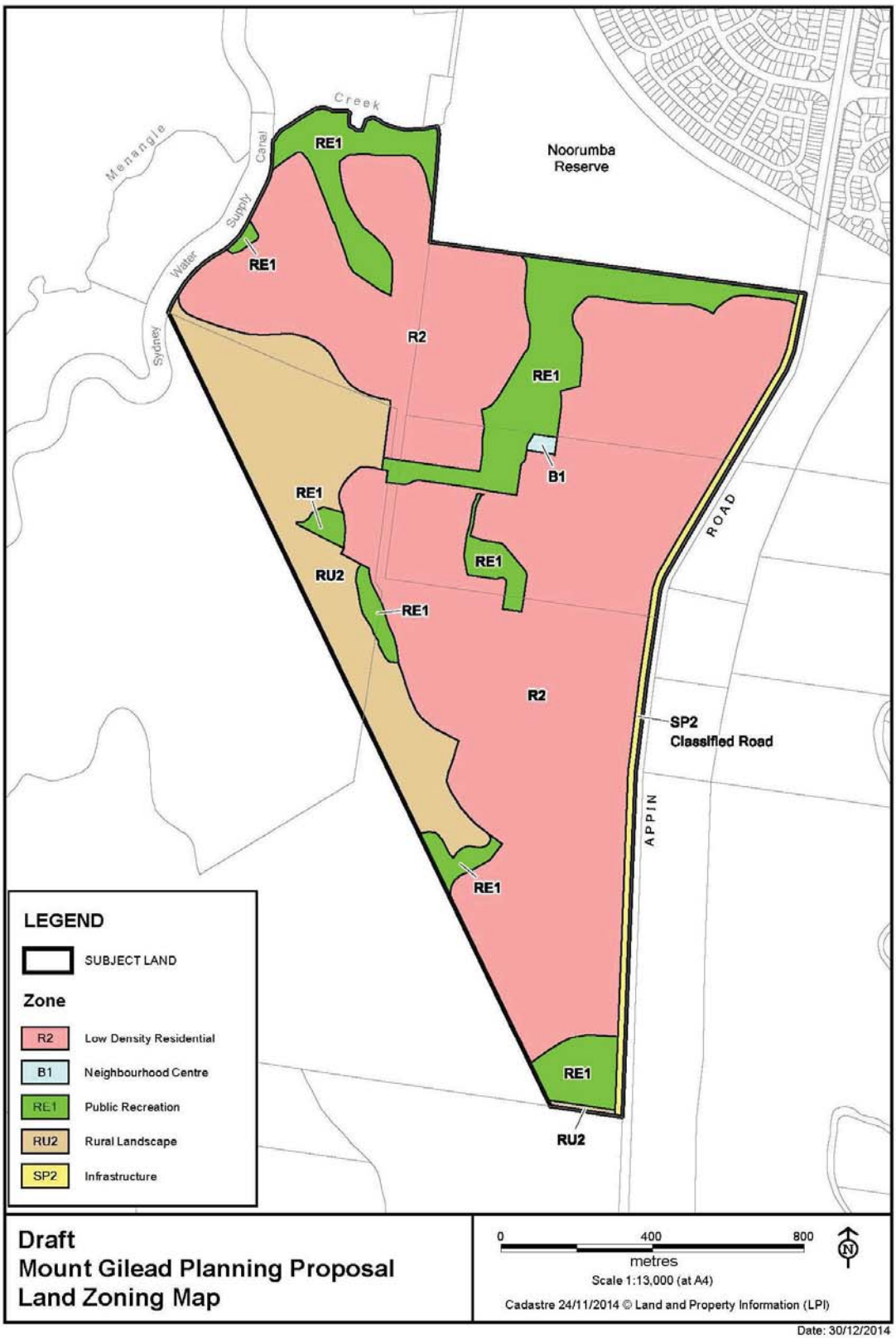

Figure 2: Land Zoning Map (Source CCC 2015)

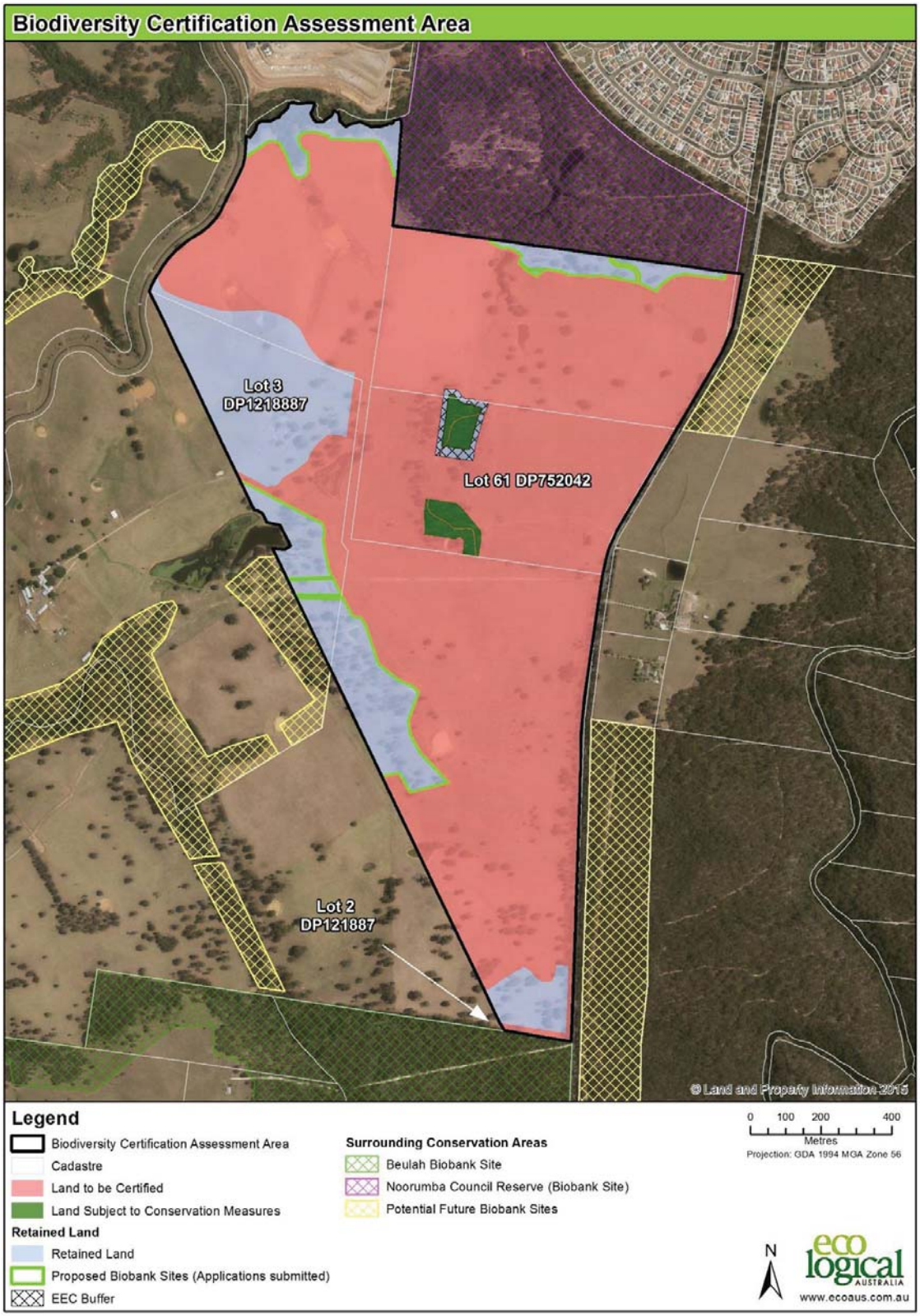

Figure 3: Mt Gilead Biodiversity Certification Assessment Area and location of existing conservation areas (two proposed Biobank sites within the BCAA), and potential Biobank sites outside the BCAA

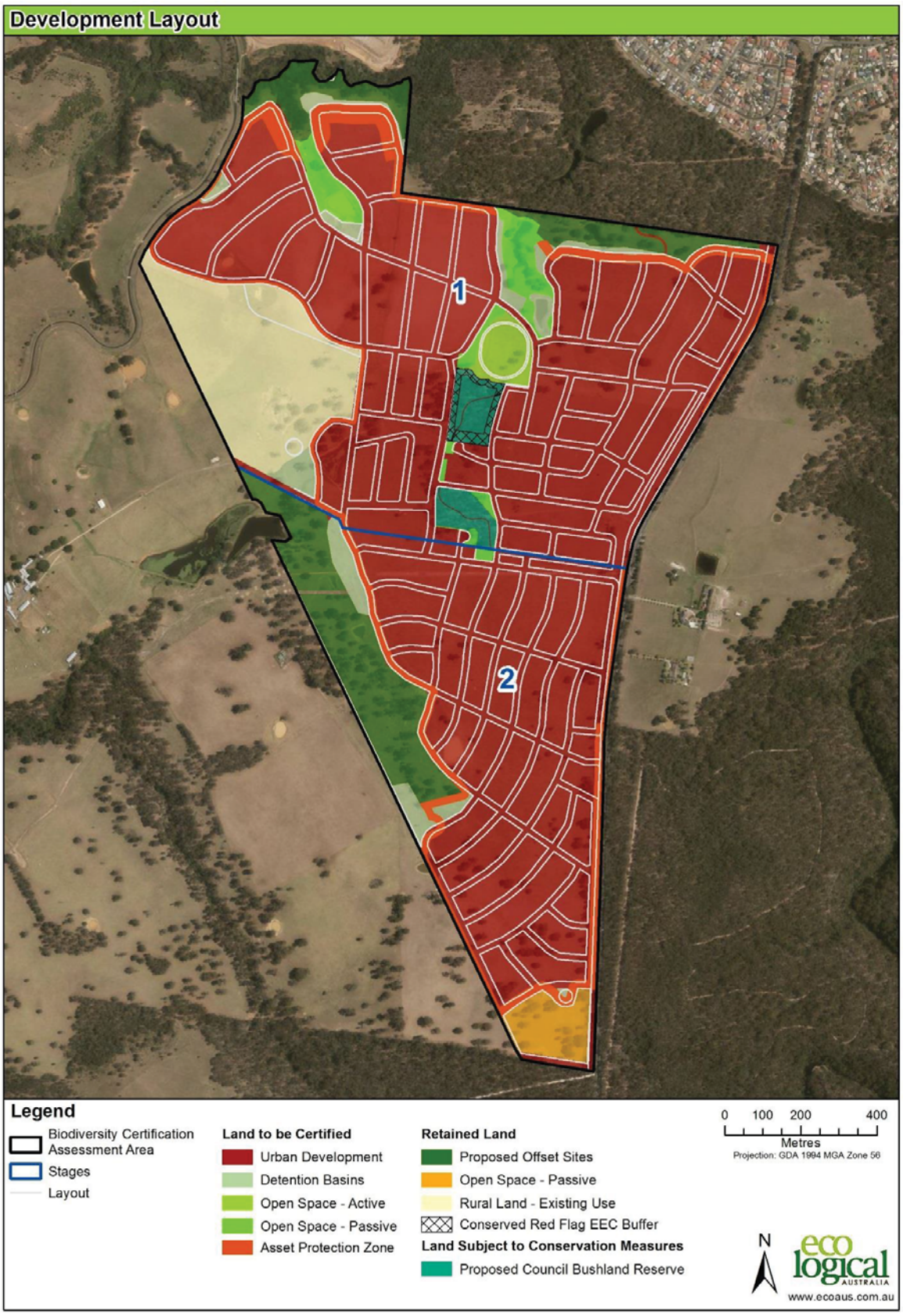

Figure 4: Proposed development / land use within the BCAA

2 Biodiversity Values Assessment Report– methodology and results

An application for biodiversity certification must include an assessment of the biodiversity values of the BCAA undertaken in accordance with the BCAM. The results of the assessment of ecological values are to be included in a report titled '**Biodiversity Assessment Report**'. This section addresses this requirement.

An assessment of the biodiversity values of the BCAA was undertaken by ELA in 2013 as part of an ecological assessment for the rezoning proposal (ELA 2014, CCC 2015). This built on work undertaken by ELA in 2006, which validated vegetation communities present and their condition in the BCAA and adjacent lands and mapped Koala habitat (ELA 2006). The information collected by ELA in 2006 and 2013 (ELA 2006 and 2014) was used to prepare this Biodiversity Assessment Report (BAR). However, as part of preparing this this Biodiversity Assessment Report (BAR) in accordance with the BCAM, additional surveys were undertaken by ELA in 2015 and 2016 including data for two separate Biobank site assessments (ELA 2015a and 2015b), further plots within the BCAA to further validate and refine the vegetation communities and zones, and targeted surveys for the Green and Golden Bell Frog (*Litoria aurea)* and Southern Myotis (My*otis macropus*)(ELA 2016 and **Appendix E**). This was done to ensure data collected in overlapping areas of the BCAA and the two submitted Biobank sites, are consistent for the Biobank sites and the BCAA for these areas.

Note that ELA's 2015 survey for Biobank sites (ELA 2015a and b and outlined in Section 2.1.4) was undertaken following review of previous survey effort (Section 2.1.1), determination of BVTs and number of biometric plots required after changes to the BCAA boundary since the 2013 survey (ELA 2014) (Section 2.1.2), and assessment of species requiring survey for determination of species credits (Section 2.1.3). The 2015 survey data in some instances replaced survey data collected in 2013, with four plots in the 2015 and 2013 surveys located at the same areas in the BCAA.

2.1 Methods

2.1.1 Literature and data review

The two previous reports (ELA 2006 and 2014) were reviewed for vegetation types/condition and biodiversity values in the BCAA. The study area of ELA (2006) were larger than the BCAA and included the BCAA in its entirety. Given only some of the results of ELA (2014) were used in this biocertification assessment, with data from the 2015 and 2016 surveys also used, results of ELA (2006 and 2014) are summarised in subheadings below, as well as in **Table 3**, rather than in Section 2.2 Results, although relevant results from ELA (2006 and 2014) are also reported in Section 2.2 Results. Survey effort is shown in Section 2.1.4 to show total survey effort used for the assessment (previous effort plus ELA's 2015 and 2016 survey effort).

Relevant legislation and standard technical resources including the *Threatened Biodiversity Survey and Assessment Guidelines for Development and Activitie*s (Department of Environment and Conservation [DEC] 2004) and the *Biobanking assessment methodology (BBAM 2014)* (OEH 2014a) underpinned the survey methodologies and provided background information for the ecological assessment. As such, these resources were also reviewed.

In addition to the database searches of the *Atlas of NSW Wildlife* and *EPBC Protected Matters Search Tool* undertaken by ELA (2014), ELA performed more recent searches of these databases, and used the biocertification credit calculator v 1.9 and version 1.09_HN556_201216 to determine ecosystem and species credit threatened species, validating these against the threatened species profile ecological data from the *BioNet Atlas of NSW Wildlife* (see Step 1 in Section 2.1.3).

The results of these databases searches are included in **Appendix D** and shown in **Figure 5** and **Figure 6**.

Mt Gilead Flora and Fauna Assessment – Stage 2 (ELA 2006)

ELA (2006) targeted flora and fauna within the Mt Gilead property (approximately 810 ha), which contained the BCAA as well as land to the west. Field survey was undertaken on 16th and 28th February 2006 and the 1st and 6th March 2006 (total of 56 person hours) and was designed to validate vegetation communities and their condition, identify threatened flora species present, map recovery potential, assess fauna habitat features present, including for Koala (feed trees), and assess riparian health. The overall aim of the survey was to determine and document the ecological significance of the area for input into proposed rezoning documentation. No intensive survey methods such as vegetation plots or fauna trapping were undertaken; flora and fauna species were recorded opportunistically. However, some more detailed survey was undertaken for aquatic habitat/health and Koala (**Table 3**).

Four vegetation communities were confirmed in the study area: Alluvial Woodland (AW), Riparian Forest (RF), Cumberland Plain Woodland (CPW), and Shale Sandstone Transition Forest (SSTF). Shale Sandstone Transition Forest was the dominant vegetation community in the study area. The condition of the vegetation communities ranged from poor to good given the history of disturbance in the study area.

A total of 170 flora species, including a possible record one threatened species, *Eucalyptus benthamii* (Camden White Gum) were recorded. No threatened fauna species were recorded. Suitable habitat for threatened flora and fauna species was considered to be present. Key habitat features for fauna were:

- Diverse vegetation communities (forest, woodland, grassland).
- Diverse vegetation community structures (forest, shrubby woodland, grassy woodland, grassland, riparian, wetland).
- Large numbers of hollow-bearing trees.
- Woody debris and leaf litter in many remnant vegetation communities.
- Outcropping rock, rock crevices and, significantly, rock on rock.
- Ephemeral and permanent rivers, creeks and tributaries.
- Dams and “wetlands” with open water and emergent vegetation.
- Instream woody debris, rocks and vegetation along river, creeks and tributaries

Mt Gilead Rezoning: Ecological Assessment (ELA 2014)

ELA (2014) undertook an ecological assessment of a 210 ha area, which overlapped the BCAA. Field survey was undertaken over five days on 25 and 26 March, 4 April, 27 June, and 20 September 2013. Survey followed the Biobanking and Biocertification methodologies (DECC 2009; DECCW 2011a). It involved undertaking biometric plots and riparian and aquatic habitat assessments, and also targeted flora and fauna species identified by the biodiversity credit calculator and a review of NSW Wildlife Atlas data as requiring field survey. Targeted surveys were undertaken in accordance with survey guidelines. A summary of the field survey is provided in **Table 3**. Survey effort for the initial rezoning proposal is shown in **Figure 8**.

Three vegetation communities were recorded: CPW, SSTF, and River-Flat Eucalypt Forest (RFEF). The vegetation communities were highly modified through a long history of grazing, pasture improvement and

weed invasion, and erosion was present in places, although some patches of SSTF were in good condition.

A total of 154 flora species, comprising 67 native species and 87 introduced species, and 82 fauna species, were recorded. Fauna species recorded were comprised of 58 birds, 13 microbats, five other mammals, three frogs, one reptile, and two fish. No threatened flora species were recorded, but six threatened bat species and one threatened bird species were recorded. These were *Miniopterus schreibersii oceanensis* (Eastern Bentwing Bat), *Mormopterus norfolkensis* (East-coast Freetail Bat), *Falsistrellus tasmaniensis* (Eastern False Pipistrelle), *Saccolaimus flaviventris* (Yellow-bellied Sheathtail Bat), *Myotis macropus* (Southern Myotis), *Scoteanax rueppellii* (Greater Broad-nosed Bat), and *Glossopsitta pusilla* (Little Lorikeet). One migratory fauna species, *Ardea ibis* (Cattle Egret), was also recorded. There was potential for other threatened species, such as Koala, to be present given the presence of food trees in the study area and nearby records. However, for species such as *Meridolum corneovirens* (Cumberland Plain Land Snail), habitat was scant to absent. Targeted surveys did not record this species within the BCAA despite records from Noorumba Reserve (OEH 2014b, ELA 2017) and in remnant Cumberland Plains Woodland on the eastern side of Appin Road (ELA unpublished data).

The majority of the watercourses were considered substantially to slightly modified and erosion was noted in many of the watercourses. Aquatic habitat was limited, and where present was marginal. Fringing vegetation where present provided suitable habitat for amphibians, birds and fish. The overall rating of the riparian and aquatic condition varied from degraded to moderate.

South Campbelltown Koala Habitat Connectivity Study (Biolink 2018)

Biolink Ecological Consultants were commissioned by CCC in 2017 to undertake a Koala connectivity study in the South Campbelltown and Menangle areas to investigate:-

- Koala usage and occupancy,
- the quality and extent of Preferred Koala Habitat; and
- the feasibility of establishing connections across Appin Road

in this strategic linkage area which was identified in the draft Campbelltown Comprehensive Koala Plan of Management (Biolink 2016). The study used Rapid-SAT sampling protocols to determine the presence of diagnostic Koala faecal pellets around the bases of Preferred Koala Food Trees. The study recorded evidence of Koala at 12 of 25 sampling points in the study area (**Figure 10** and **Figure 11**), and concluded that the area was sustaining a resident Koala population and was therefore 'Core Koala Habitat for planning purposes.

Table 3: Previous survey effort and results for validating vegetation communities present and for threatened flora and fauna species

Previous studies	Survey area	Effort	Results
ELA (2006)	Mt Gilead property (810 ha). This contains the BCAA	- Four-day survey on 16th and 28th February 2006 and the 1st and 6th March 2006 (total of 56 person hours). - Vegetation communities and their condition were validated, and their recovery potential was assessed through random meander. - Searches of threatened flora were undertaken through random meander. - Fauna habitat features were recorded opportunistically. - Targeted Koala searches were undertaken at six sites. - Riparian health was assessed, with aquatic survey undertaken at five sites.	- Four vegetation communities were confirmed: Alluvial Woodland, Riparian Forest, Cumberland Plain Woodland, and Shale Sandstone Transition Forest. - One threatened flora species, *Eucalyptus benthamii*, was recorded on the bank of the Nepean River. - No threatened fauna species were recorded, but key habitat features were present which could support a range of common and threatened fauna species. - Potential Koala habitat as defined by the State Environmental Planning Policy No 44 – Koala Habitat Protection (SEPP 44) was recorded
ELA (2014)	Parts of Mt Gilead property (210 ha). This contains the BCAA	- Five-day survey on 25th and 26th March, 4th April, 27th June, and 20th September 2013. - Vegetation communities and their condition were validated through random meander to demarcate vegetation zones. - 18 Biometric plots were undertaken in eight vegetation zones, which included 'cleared' areas. - Searches for flora species were undertaken via random meander in suitable habitat and were all undertaken during appropriate survey times identified by the biodiversity credit calculator. - Birds were surveyed over 20-30 minute intervals at four sites over four mornings, depending on whether one or two observers were present. - Microbat surveys were undertaken using two ultrasonic Anabat detectors at three sites (one Anabat at two sites and one Anabat at one site) targeting areas	- Three vegetation communities were recorded: River-Flat Eucalypt Forest, Cumberland Plain Woodland, and Shale Sandstone Transition Forest. - No threatened flora species were recorded. - Seven threatened species (six bats and one bird) were recorded: Eastern Bentwing Bat, East-coast Freetail Bat, Eastern False Pipistrelle, Yellow-bellied Sheathtail Bat, Southern Myotis, Greater Broad-nosed Bat, and Little Lorikeet. - One migratory species was recorded: Cattle Egret. - There was potential for Koala to be present, but a low likelihood for Cumberland Plain Land Snail to be present.

Previous studies	Survey area	Effort	Results
		where bats are likely to be present over two consecutive nights over a period of 12 hours between 1800 hours and 0600 hours. - Habitat features for fauna across the study area, such as hollow-bearing trees, rocks and rocky outcrops, water bodies, were opportunistically recorded. As some features were assessed to be unsuitable for the frog target species (*Heleioporus australiacus* (Giant Burrowing Frog) and *Litoria aurea* (Green and Golden Bell Frog)), targeted survey for these were not undertaken. - Riparian and aquatic habitat assessments included mapping the top of bank using a differential GPS, classifying the condition and recovery potential of steam reaches, categorising each stream using the Strahler method, and identifying heavily degraded streams or areas of overland flow that do not meet the definition of 'river' and are suitable for removal. Assessments were undertaken over one and a half days.	- The overall rating of the riparian and aquatic condition varied from degraded to moderate.

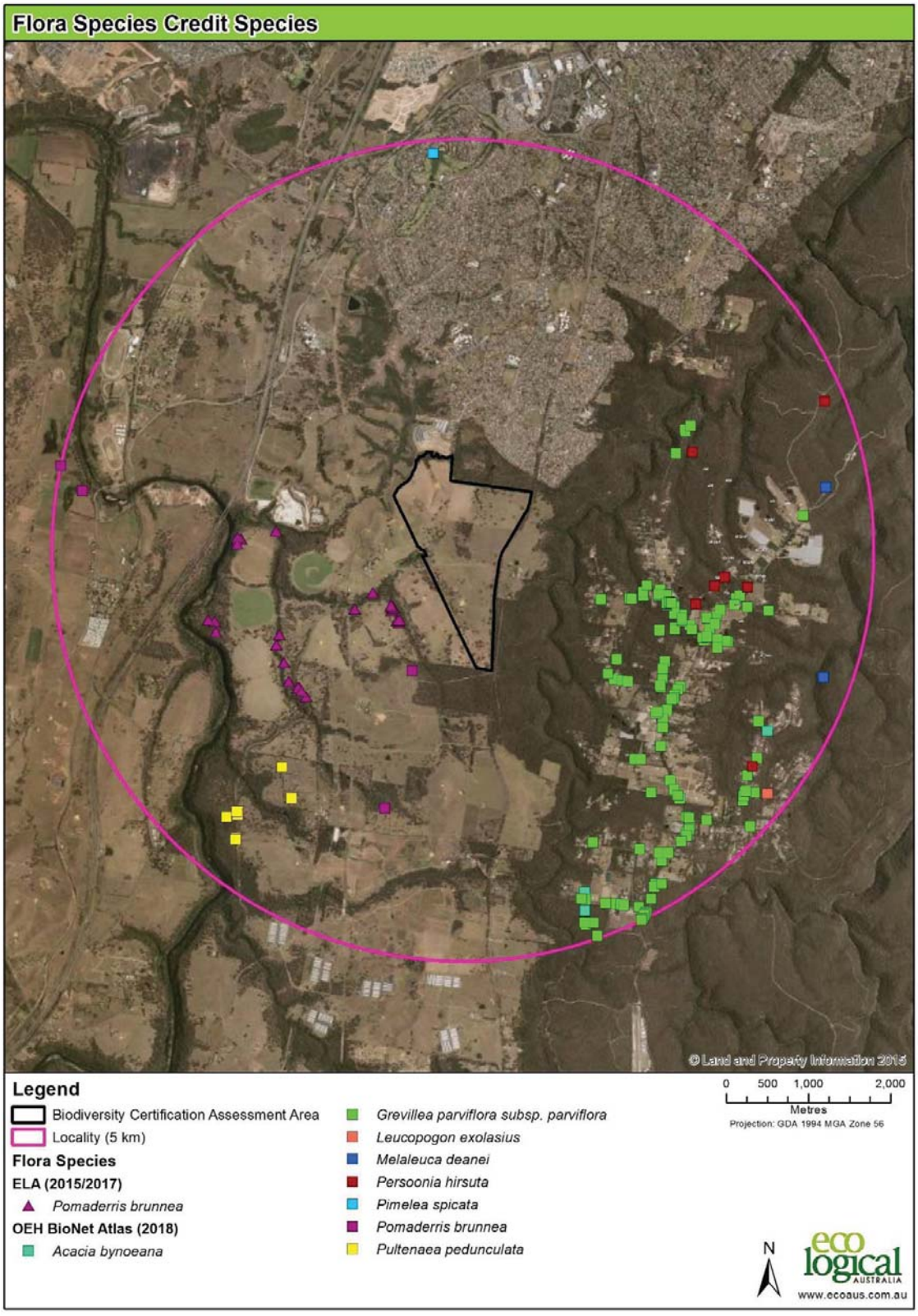

Figure 5: Threatened flora records within 5km of the BCAA (Source Atlas of NSW Wildlife and ELA, unpublished)

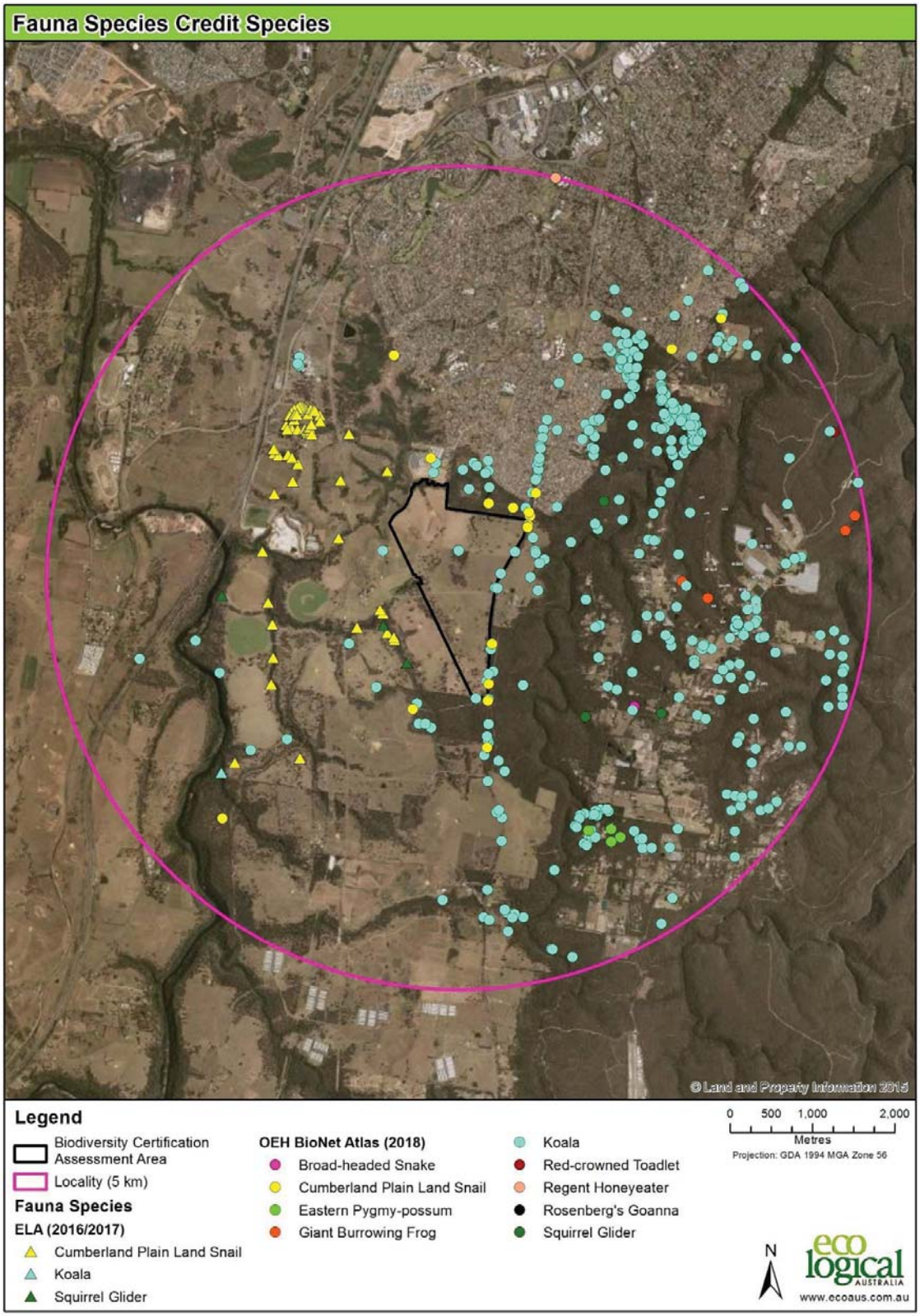

Figure 6: Threatened species credit fauna records within 5km of the BCAA (Source Atlas of NSW Wildlife and ELA, unpublished)

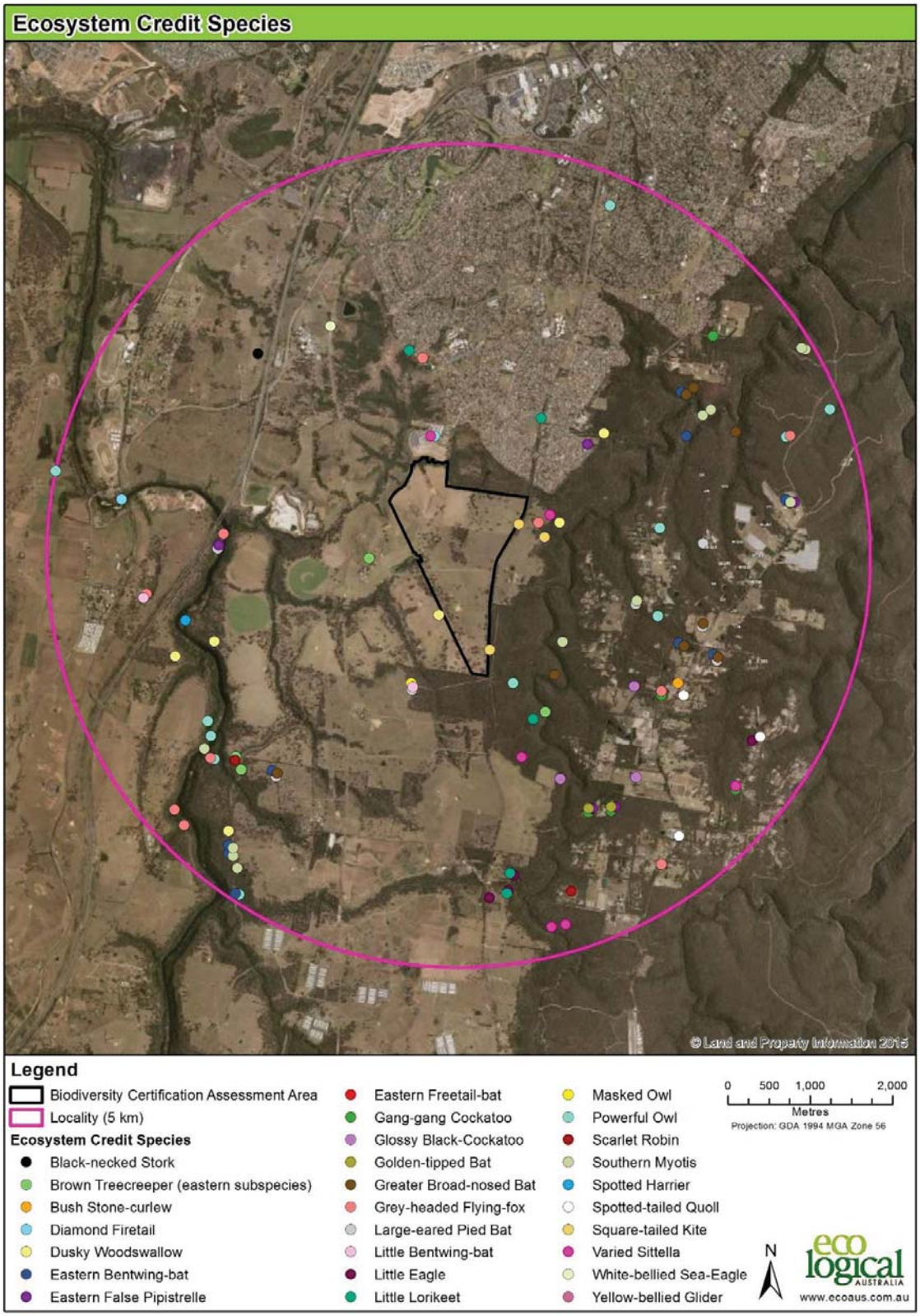

Figure 7: Threatened ecosystem credit fauna records within 5km of the BCAA (Source Atlas of NSW Wildlife and ELA, unpublished)

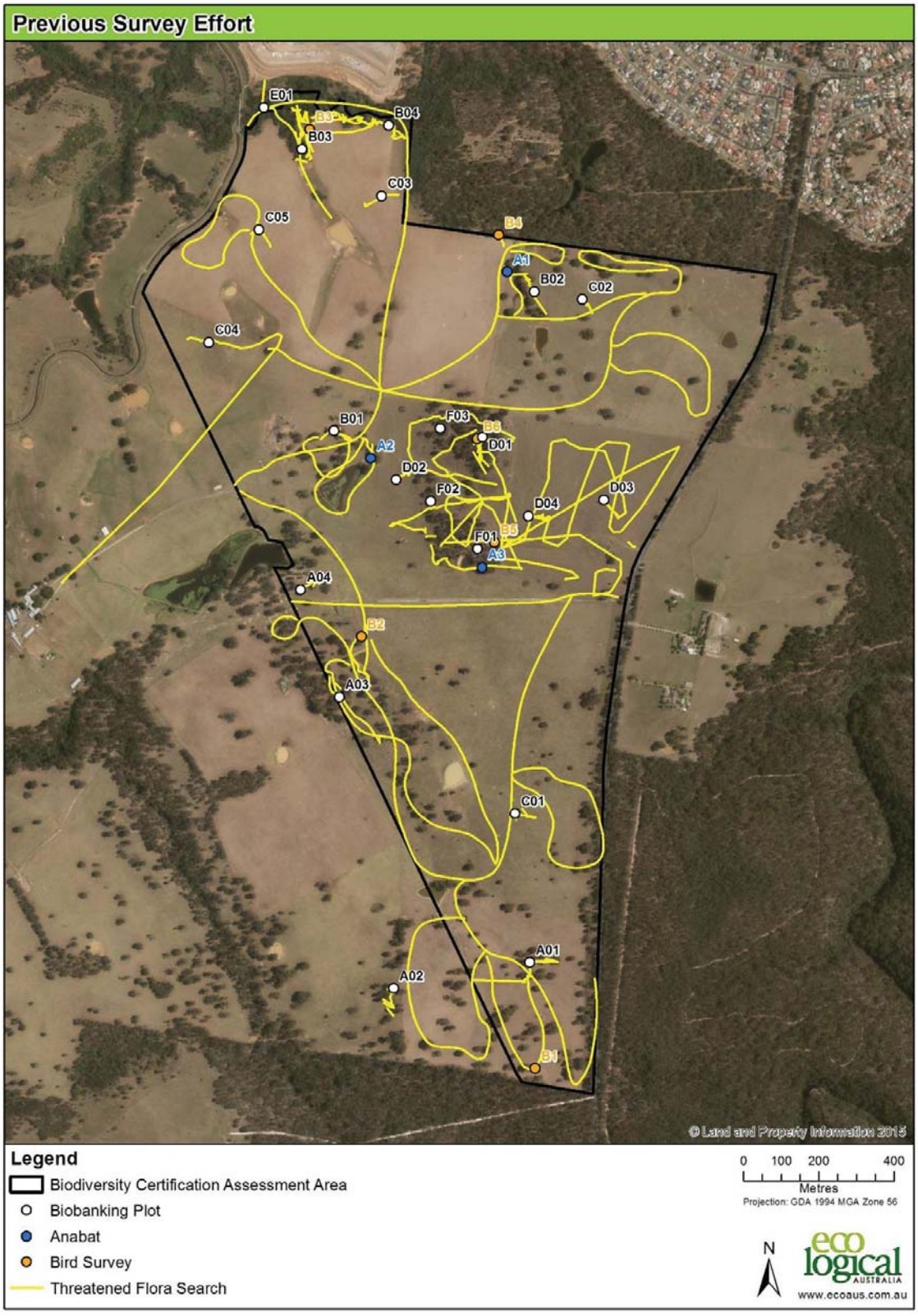

Figure 8: Previous flora and fauna species survey effort in the BCAA as part of rezoning process (ELA 2014)

2.1.2 Biometric vegetation types, condition and threatened status

As indicated in 2.1.1, ELA (2006 and 2014) identified four and three vegetation communities in their respective study areas. Of these, three vegetation communities were mapped within the BCAA.

Through a desktop comparison of vegetation communities with BVTs for vegetation communities recorded by ELA (2006), the best fit BVTs present in the BCAA were determined (**Table 4**). No comparisons were required for vegetation communities recorded by ELA (2014) as ELA (2014) provided equivalent BVTs. The results of the analysis identified three BVTs in the BCAA. These BVTs correspond to three threatened ecological communities listed under the TSC and EPBC Acts (**Table 4**). **Figure 9** shows the indicative BVTs in the BCAA based on this assessment and displays ELA (2014) vegetation mapping.

Table 4: Vegetation communities and equivalent Biometric vegetation types in the BCAA and relationship to threatened ecological communities

Vegetation community (ELA 2006)	Biometric vegetation type equivalent (OEH VIS)	TSC / EPBC Acts*
Alluvial Woodland	HN526 - Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	RFEF (EEC)
Cumberland Plain Woodland	HN528 - Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	CPW (CEEC)
Shale Sandstone Transition Forest	HN556 - Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	SSTF (CEEC)

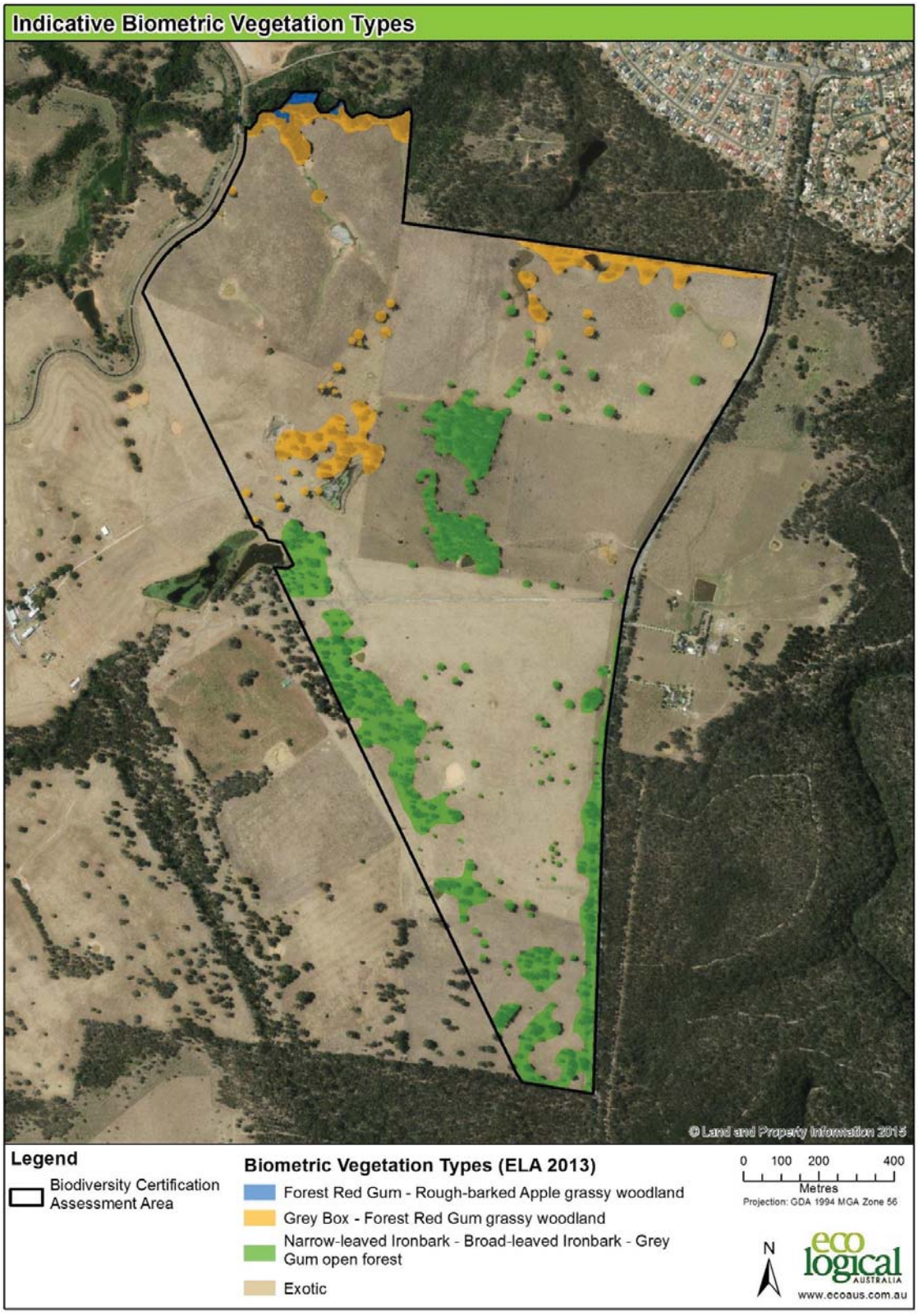

Figure 9: Indicative Biometric vegetation types in the BCAA based on ELA (2014)

2.1.3 Determination of species credit species requiring survey

'*Species credits'* are the class of biodiversity credit created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. All threatened flora and approximately half to two thirds of all threatened fauna species are classified as species credits by the BCAM. Furthermore, some species credit species are also '*red flag species*' which the BCAM defines as "*a species that cannot withstand further loss in the CMA because it is extremely rare/critically endangered, restricted or its ecology is poorly known*".

The BCAM requires targeted survey for threatened flora and fauna that are classified as *'species credit'* species in accordance with the BCAM on the land that will be impacted by development. Alternatively, species credit species can be 'assumed' to be present. Where a survey or expert report confirms that a species credit species is present or likely to use potential habitat on land proposed for biodiversity certification, then a survey must also be undertaken or '*expert report*' prepared for that species on land to be used as an offset confirming its presence or likely presence. The biocertification credit calculator will use the survey results to calculate the number of credits required to offset the loss of the threatened species on land to be certified and the number of credits generated on land subject to conservation measures to determine whether the '*improve or maintain*' test is satisfied provided a '*red flag species*' is not impacted.

Species that require species credits for the land proposed for biodiversity certification or are being used to generate species credits for a proposed conservation measure were identified and assessed in accordance with the seven steps outlined in Section 4.3 of the BCAM. The results of the candidate species identification and assessment process are presented in **Appendix D.**

Step 1. – Identify candidate species for initial assessment

A list of candidate species was filtered into the BCAA using biocertification credit calculator version 1.9 and 1.09_HN556_201216, and validated against the threatened species profile ecological data from the BioNet Atlas of NSW Wildlife. This list is presented in **Appendix D**.

Step 2. – Review list to include additional species

The list of candidate species was reviewed to include additional species for assessment. This was undertaken using the results of previous surveys of the BCAA (ELA 2006 and 2014), and additional database searches undertaken by ELA which included:

- An updated search of the Atlas of NSW Wildlife database to identify records of threatened flora and fauna species located within 5 km radius of the site.
- A search of the EPBC Act protected matters search tool website to generate a report to assist to determine whether matters of national environmental significance (NES) were located within 10 km radius of the site.

Step 3. – Identify candidate species for further assessment

The list of candidate species was reviewed to identify only those species that required further assessment in the BCAA, based on the habitat assessment and surveys undertaken as part of ELA 2014. The species that were removed and a justification supporting the removal of these species from the candidate list are provided in **Appendix D**.

Despite a record of *Pomaderris brunnea* recorded 500m west of the BCAA by ELA in 2016, unpublished data (**Figure 5**), and a possible record of Eucalyptus benthamii recorded along the Nepean River approximately 2km west of the BCAA in 2005 (ELA 2006), no threatened flora species were recorded by ELA (2006, 2014, 2015a or b) in the BCAA and it was considered unlikely that any threatened flora would

occur (given the condition of the vegetation on site. Consequently there were no flora species identified for further assessment. However, potential threatened flora were surveyed for during all additional plots and traverses undertaken for the biocertification assessment in 2015 and 2016.

ELA (2014) did not record any threatened fauna species requiring species credits within the BCAA during the 2014 and 2015 assessments other than Koala.

Whilst there are numerous records of Cumberland Plain Land Snail directly adjacent to the BCAA in Noorumba Reserve (OEH 2014b and ELA 2017), on the eastern side of Appin Road and in remnant vegetation along Woodhouse Creek to the west of the BCAA (ELA unpublished 2016; **Figure 6**), habitat within the BCAA for this species was sparse to absent due to current site conditions (lack of ground litter) and the species was considered unlikely to occur (**Appendix D**).

Similarly, Squirrel Gilder has recently been recorded to the west of the BCAA in remnant vegetation with a dense mid story of Acacias along Woodhouse Creek (ELA unpublished 2016; **Figure 6**). This habitat is not present within the BCAA.

Accordingly only Koala, Southern Myotis, Green and Golden Bell Frog were identified as a candidate threatened fauna species.

Whilst the Koala has not been observed within the BCAA, there are consistent records from the broader locality over the past 20 years, and primary and secondary food tree species (Forest Red Gum, Grey Box and Grey Gum) as listed in the Koala Recovery Plan (DECC 2008b) are present in the BCAA. In consultation with OEH it was agreed to 'assume' the presence of Koala given the presence of these food tree species and numerous records to the east of the BCAA (east of Appin Road), occasional records within the Noorumba and Beulah Biobank sites north and south of the BCAA (**Figure 10)**. Further, as part of finalising the Campbelltown Comprehensive Koala Plan of Management, consultants working for CCC on the South Campbelltown Koala Habitat Connectivity Study (SCKHCS), recently (November 2017) recorded evidence of Koala ultilising a remnant patch of SSTF in the centre of the BCAA and in adjacent areas to the west of the BCAA (Biolink 2018) confirming utilisation of the area by Koala and a resident Koala population (**Figure 11**). Based on these records, it is considered that Koala are likely to use habitat for movement and foraging purposes within the BCAA.

Targeted survey and assessment of potential breeding sites for Southern Myotis and Green and Golden Bell Frog undertaken (**Appendix E**).

Steps 4 and 5. – Identify potential habitat for species requiring further assessment and determine whether species is present

As described above, no candidate species were identified as requiring targeted survey to determine abundance for threatened flora species. Areas of potential breeding habitat were identified for Southern Myotis and Green and Golden Bell Frog (**Appendix E**) and were subject to targeted survey (**Figure 14**).

Step 6 – identify the threatened species that trigger a red flag

There were no species confirmed as likely to have habitat on site that trigger a red flag.

Step 7 finalise the boundary of the species polygon and area of impact

A '*habitat polygon*' including known records and habitat for Koala was identified and the number of species credits required was calculated (**Figure 11**).

The '*habitat polygon*' includes all remnant patches of vegetation as well as individual scattered paddock trees. Consultation with the OEH confirmed that cleared areas did not constitute Koala habitat.

2.1.4 Field assessment

Vegetation communities and plots

Field assessment was designed to meet BCAM requirements for mapping and surveying BVTs and to gather data for use in both this biocertification assessment and the two submitted Biobank sites, while using existing data previously gathered by ELA (2014) where relevant. Field assessment therefore focussed on mapping and surveying BVTs, collecting biometric plots and undertaking additional targeted survey for Southern Myotis and Green and Golden Bell Frog. Based on discussions with OEH, Koala was assumed to be present for this assessment. Previous survey effort by ELA (2014) is outlined in **Table 3**.

ELA senior and graduate ecologists, Bruce Mullins, Dr Enhua Lee, Belinda Failes and Mitch Palmer, respectively, used previous mapping by ELA to target on-ground validation of the BVTs and collect additional biometric plots on 9th and 10th April 2015 and 29 August 2016. This led to a revision of the BVTs boundaries, and number of '*vegetation zones*', which are based on BVTs and their condition and are further stratified using ancillary codes as per the BCAM (DECCW 2011a). An ancillary code is an optional field which splits zones further to reflect a more homogenous condition state. The ancillary code was used in the BCAA to identify zones that had sparse, olive dominated, native or exotic understories, or were thinned, in good condition, or comprised of scattered paddock trees.

Based on the area and number of vegetation zones, the BCAM required a minimum of 12 Biometric plots/transects (DECCW 2011a; **Table 5**), however, 20 were used in the assessment (**Table 5)**. The field survey targeted locations that were considered likely to be representative of the mapped BVTs in their various condition states, which could be used for both the Biobank and biocertification assessment.

Field assessment involved vegetation assessment, with nine biometric plots conducted on 9th and 10th April 2015 and four on 29th August 2016 in accordance with the requirements of the BCAM. The BCAM allows for survey of BVTs to occur at any time of year (other than to determine whether a BVT is in moderate to goo or low condition), and as such, survey timing was appropriate and was in accordance with the methodology.

Of the nine biometric plots undertaken in April 2015, four (A01, B01, B02 and G01) were located at the same locations as plots undertaken by ELA (2014) and data collected replaced data previously collected at these locations. Nine biometric plots (D01, D02, E01, E02, E03, H01, H02, A5 2016 and A6 2016) were located at new locations; there were no corresponding plots at these locations undertaken by ELA (2014). Plots undertaken by ELA (2014) that were used in this assessment were B1_2013, C2_2013, D1_2013, F3_2013, F2_2013, F1_2013, A1_2013, and D2_2013. These were not resurveyed or replaced as they were located in parts of the BCAA that did not overlap with the two Biobank sites. For all biometric plots surveyed, locations that were considered likely to be representative of the mapped BVTs in their various condition states were targeted.

The final mapped BVTs and zones, together with the location of plots are shown in **Figure 12** together with a cumulative survey effort map for threatened flora that includes lands adjacent to the BCAA (**Figure 13**). Note that an additional three biometric plots were undertaken for the Biobank sites that are not used in this biocertification assessment due to their being representative of 'cleared' areas which will be improved under biobanking (see ELA 2015). Additional plots were also collected as part of the rezoning process (2013) but were not used in the biocertification assessment **(Figure 13**).

Threatened Fauna

Following advice from OEH in early 2016 regarding the assessment of potential breeding habitat for the Southern Myotis (i.e. any hollow bearing trees within 200m of permanent water should, be considered potential breeding habitat) and a recent record (December 2013) of the endangered Green and Golden Bell Frog at Biriwiri Creek, approximately 7km north of the BCAA, targeted survey for the GGBF and an assessment of potential breeding habitat for Southern Myotis was undertaken on 30 November and 7th and 12th of December 2016.

Details of the survey method, locations and results) are provided in **Appendix E** and summarised in **Figure 14**. The survey effort included the mapping of all HBTs within 200m of permanent water, diurnal assessment of these trees during the breeding season with the aid of a 'cherry picker" to visual inspect all accessible hollows, spotlight observations and anabat recording of bat activity at each cluster of hollows before and after dusk for sign of bats leaving potential roost sites and a diurnal and nocturnal assessment of potential GGBF habitat using spotlighting and call playback.

Whilst Southern Myotis was recording foraging in the BCAA (as it was in ELA 2014), there was no evidence of any roost or breeding sites within the BCAA.

Similarly the Green and Golden Bell Frog was not recorded in the BCAA.

Table 5: Vegetation zones in the BCAA, plot requirements, and plots completed

Veg zone ID	BioMetric vegetation type	Condition	Ancillary code	Area	Plots required (BCAM)	Plots completed
1	Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain	Low	Sparse	0.44	1	1 (A01)
2	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain	Moderate to good	Olive	2.29	1	2 (B01, B02)
3	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain	Low	Native	2.49	1	2 (D01, D02)
4	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain	Low	Scattered paddock trees	3.81	1	2 (B1_2013, C2_2013)*
5	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain	Moderate to good	Good North	2.04	1	1 (D1_2013)*
6	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain	Moderate to good	Thinned South	0.44	1	1 (F3_2013)*
7	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain	Moderate to good	Thinned North	0.78	1	1 (F2_2013)*

Veg zone ID	BioMetric vegetation type	Condition	Ancillary code	Area	Plots required (BCAM)	Plots completed
8	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain	Low	Good South	1.99	1	1 (F1_2013)*
9	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain	Low	Native	1.95	1	3 (G01, H01, H02)
10	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain	Low	Exotic	8.08	1	3 (E01, E02, E03)
11	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain	Low	Scattered paddock trees	5.33	1	3 (A1_2013*, A5_2016, A6_2016)
Total					**12**	**20**

* Plots undertaken by ELA (2014)

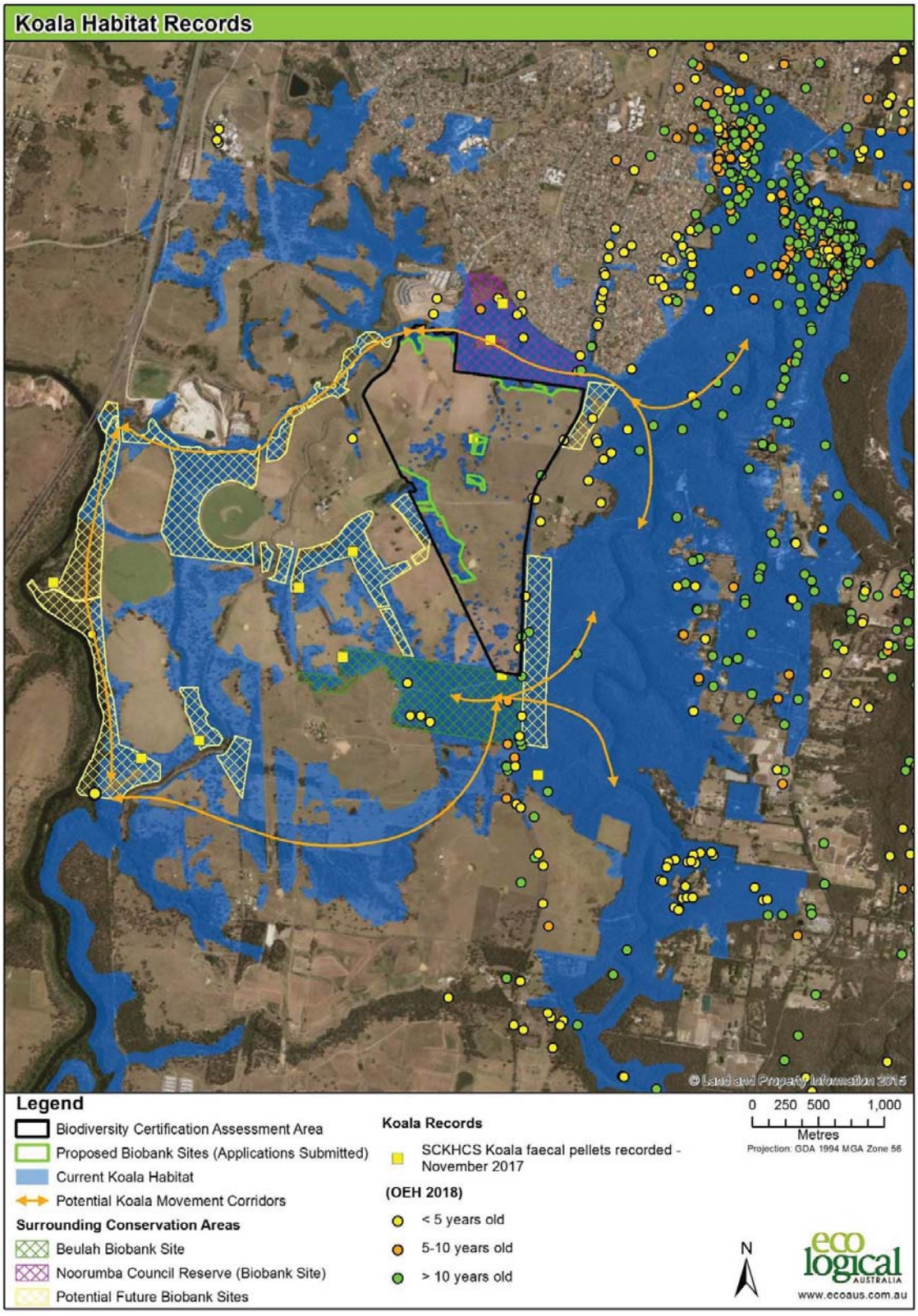

Figure 10: Regional records of Koala and potential movement corridors around the BCAA

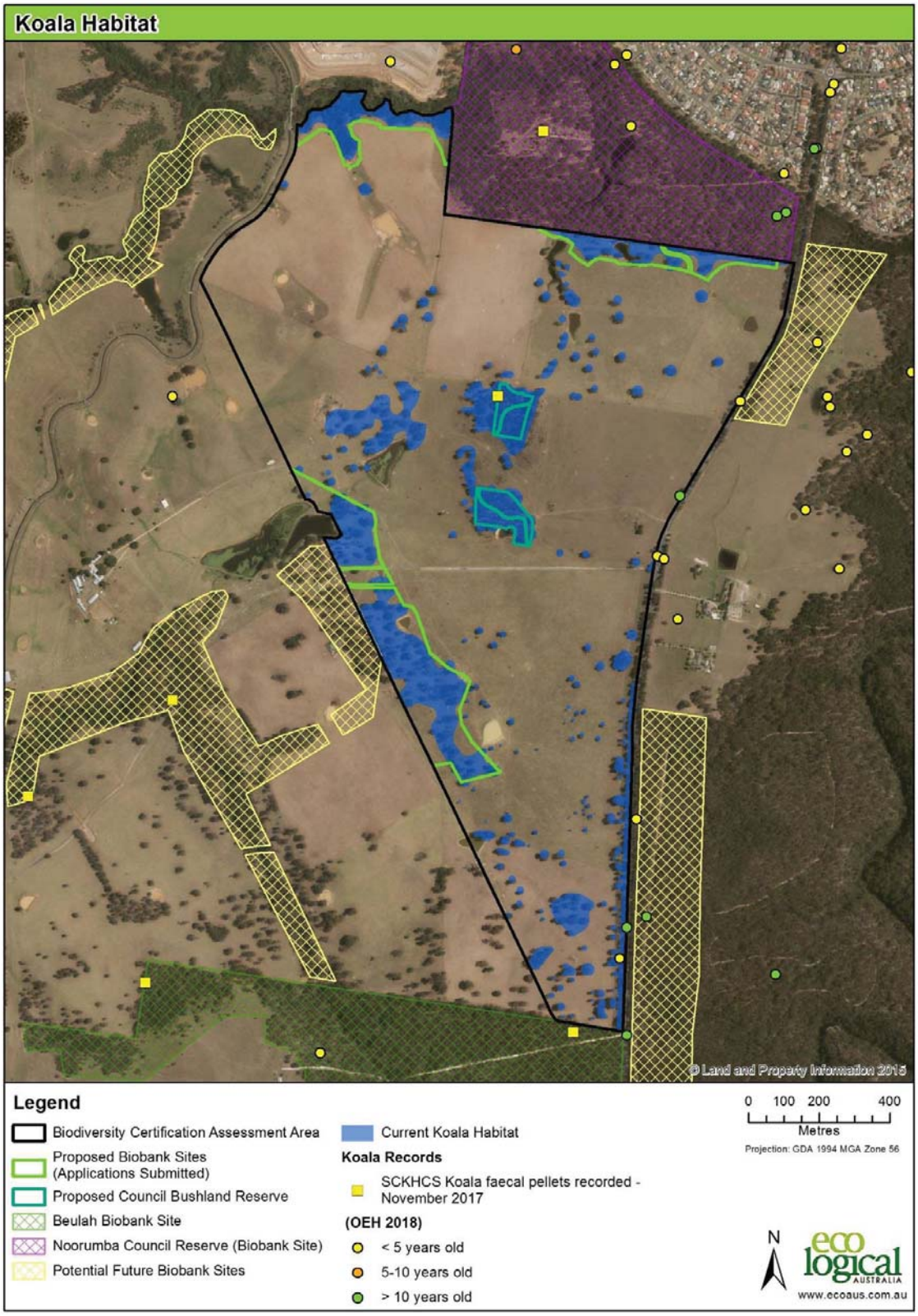

Figure 11: Assumed Koala habitat and records within the BCAA

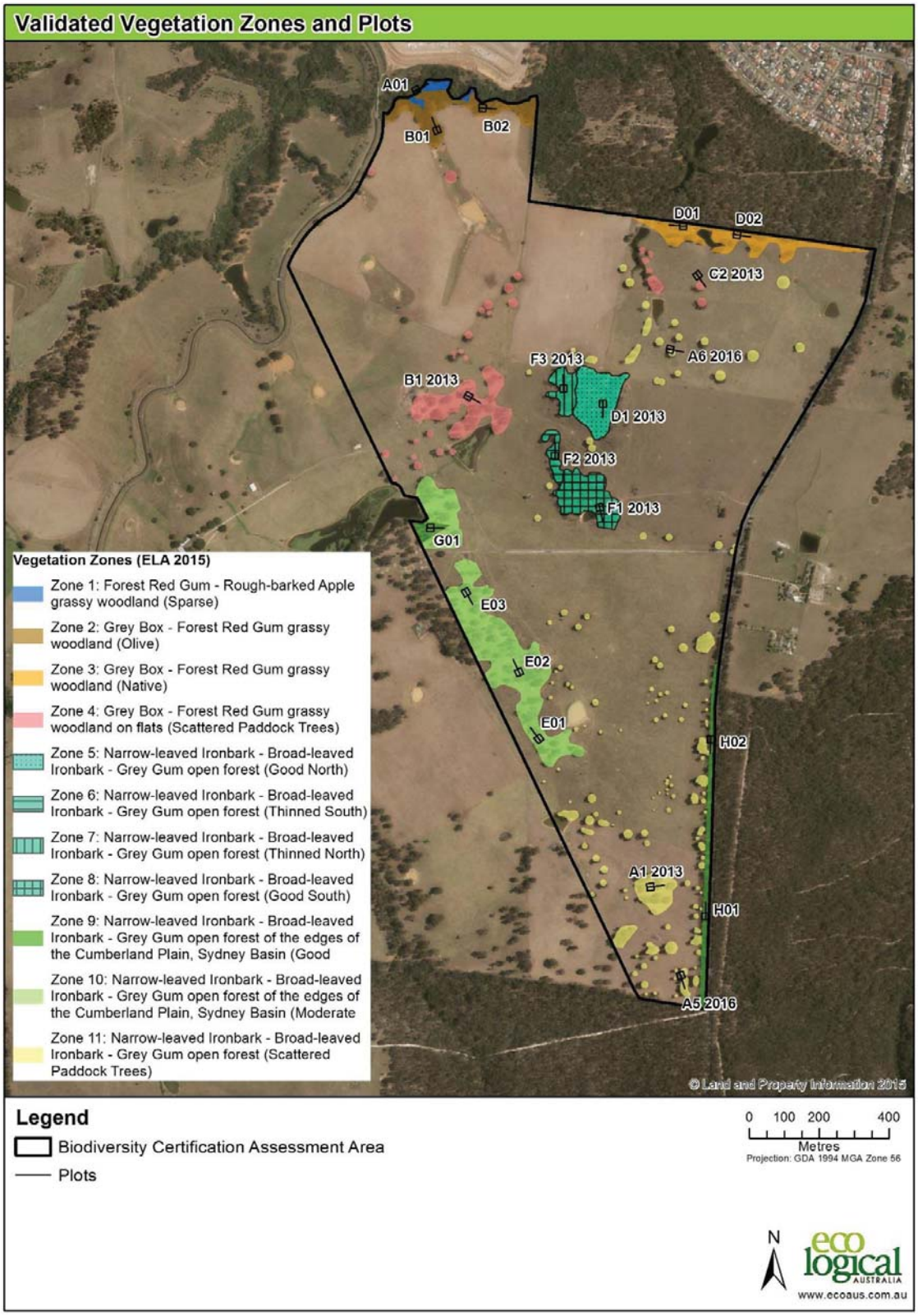

Figure 12: Validated Biometric Vegetation Types in BCAA and location of plots used in credit calculations

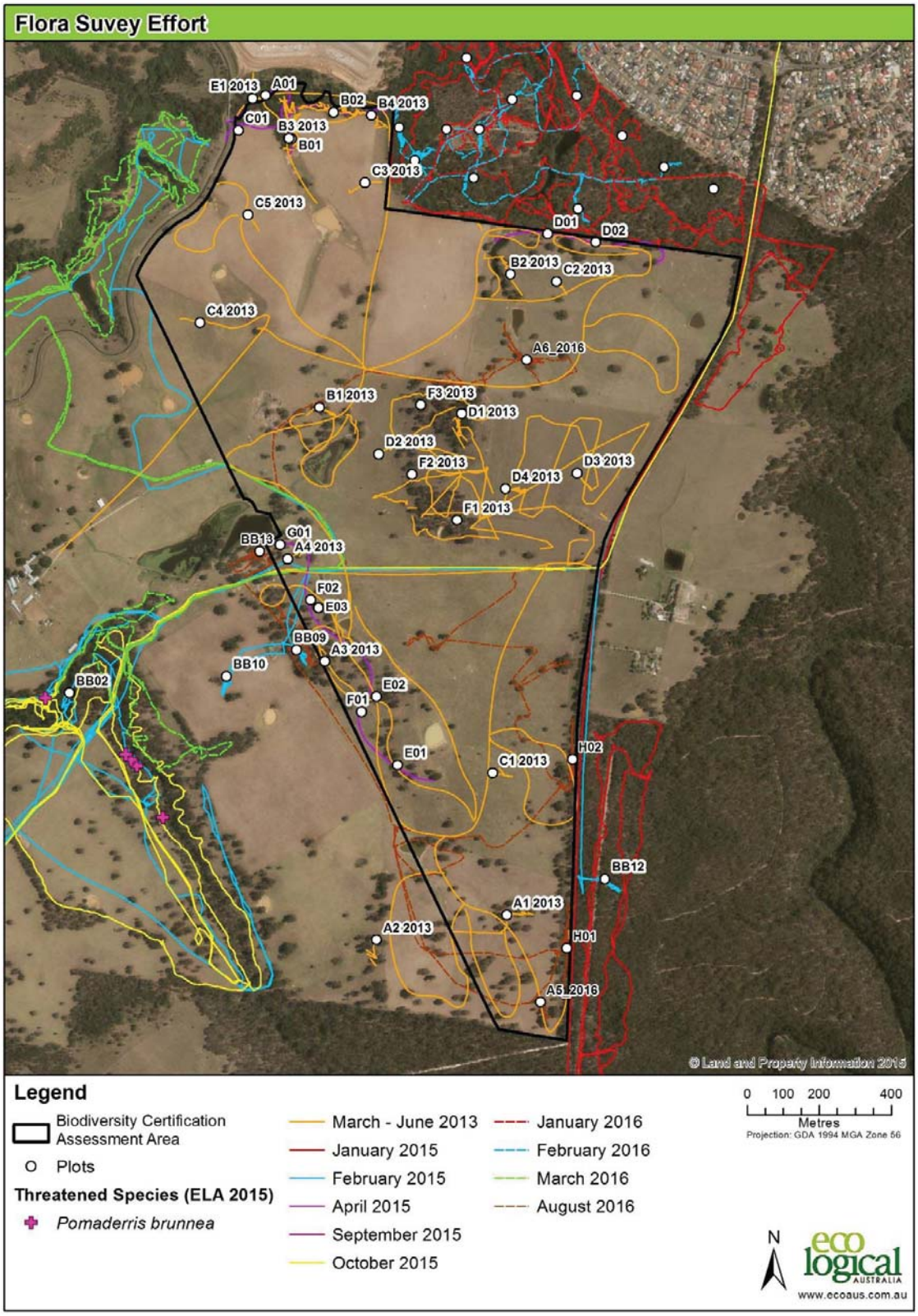

Figure 13: Combined threatened flora survey effort and plots for rezoning, biocertification and EPBC Act assessments

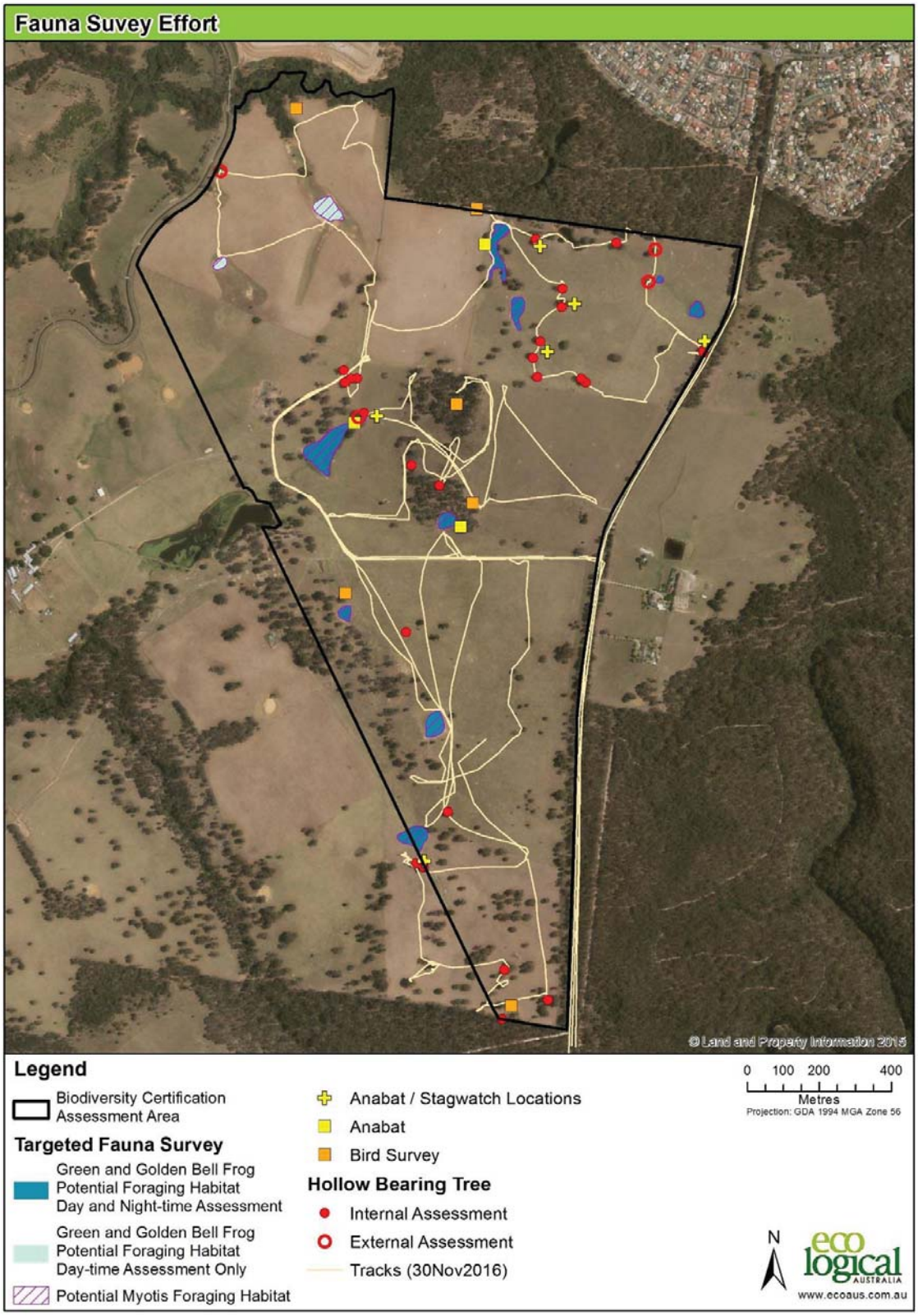

Figure 14: Combined threatened fauna survey effort for rezoning, biocertification and EPBC Act assessments

2.2 Results

2.2.1 Vegetation types and condition

Field survey confirmed three BVTs in the BCAA, and the presence of 11 'vegetation zones'. Field survey generally confirmed the boundaries of vegetation communities mapped by ELA (2006 and 2014), although the boundaries of some were refined and some patches were re-allocated to vegetation zones with corrected ancillary codes (see **Figure 12**).

Full profiles of each BVT within the BCAA, including the different ancillary codes identified, are provided in **Appendix F**.

2.2.2 Flora species

A total of 227 flora species were recorded in the biometric plots used for this assessment and adjacent lands. A full list of species recorded in plots is provided in **Appendix G**.

Threatened flora species

No threatened flora species were recorded in the BCAA by ELA during field survey in either 2006, 2013, 2015 or 2016. However, as outlined in Section 2.1.1, a possible specimen of *Eucalyptus benthamii* was recorded over 2 km away to the west on other parts of the Mt Gilead property (ELA 2006) and ELA has recorded multiple *Pomaderris brunnea* in a Woodhouse Creek, 500 m to the west of the BCAA in 2015 and 2016 as part of studies for a separate proposal.

The BCAA did not contain suitable habitat for any threatened flora species, largely due to the highly degraded nature of most parts of the site.

2.2.3 Fauna species

As outlined in Section 2.1.1, a total of 82 fauna species, comprising 58 birds, 13 microbats, five other mammals, three frogs, one reptile, and two fish, were recorded in the BCAA (ELA 2014). A full list of species recorded by ELA is provided in **Appendix H**. A detailed anabat report is provided in **Appendix I**.

In addition, the 2016 Green and Golden Bell Frog and Southern Myotis survey (**Appendix E**) recorded two additional frog species (Peron's Tree Frog, *Litoria peronii*, and Bleating Frog, *L. dentata*) and two bat species (the vulnerable Large-eared Pied Bat, *Chalinolobus dwyeri*, and Eastern Broad Nosed Bat, *Scotorepens orion).*

Threatened and migratory fauna species

As outlined in Section 2.1.1, seven threatened species and one migratory species were recorded in the BCAA (ELA 2014). These were Eastern Bentwing Bat, East-coast Freetail Bat, Eastern False Pipistrelle, Yellow-bellied Sheathtail Bat, Southern Myotis, Greater Broad-nosed Bat, Little Lorikeet, and Cattle Egret. As these species were recorded opportunistically or use the BCAA broadly, their locations are not displayed on a map.

There was potential for Little Eagle, Swift Parrot, Powerful Owl, Koala, Large-eared Pied Bat, Grey-headed Flying Fox, and some migratory species to occur in the BCAA given the presence of suitable habitat.

Of the above species, only one species, Koala, is classified as a species credit species and has been identified as being impacted by the land to be certified. The other species that have been recorded or have the potential to occur within the BCAA which are species credits species (Eastern Bentwing Bat, Southern Myotis, Grey-headed Flying Fox) have no breeding habitat within the land to be certified so do not require further assessment as species credit species.

Species Credit Habitat Maps

A total of 29.64 ha of habitat for Koala, was mapped on land proposed for biocertification, '*conservation areas*' and '*retained land*' in the BCAA (**Figure 11**).

2.2.4 Red flags

Vegetation types and other areas recognised as having regional or state biodiversity conservation significance.

'*Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*' comprises the EEC, RFEF, and '*Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion'* and '*Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion*' comprise the CEECs, CPW and SSTF, respectively. These are red flag communities if they are in moderate to good condition.

There were only four vegetation zones that were assessed as being in moderate to good condition in the BCAA. These were comprised of '*Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion'* and *'Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion'*. As such, there is a small portion of CPW and SSTF in the BCAA that is red flag vegetation.

In addition, there is vegetation within riparian buffers of minor creeks present in the BCAA, and these are red flag areas in accordance with the BCAM.

The distribution of all red flag vegetation across the BCAA is shown in **Figure 15**.

Threatened species

There were no red flag threatened species that cannot withstand further loss recorded in the BCAA.

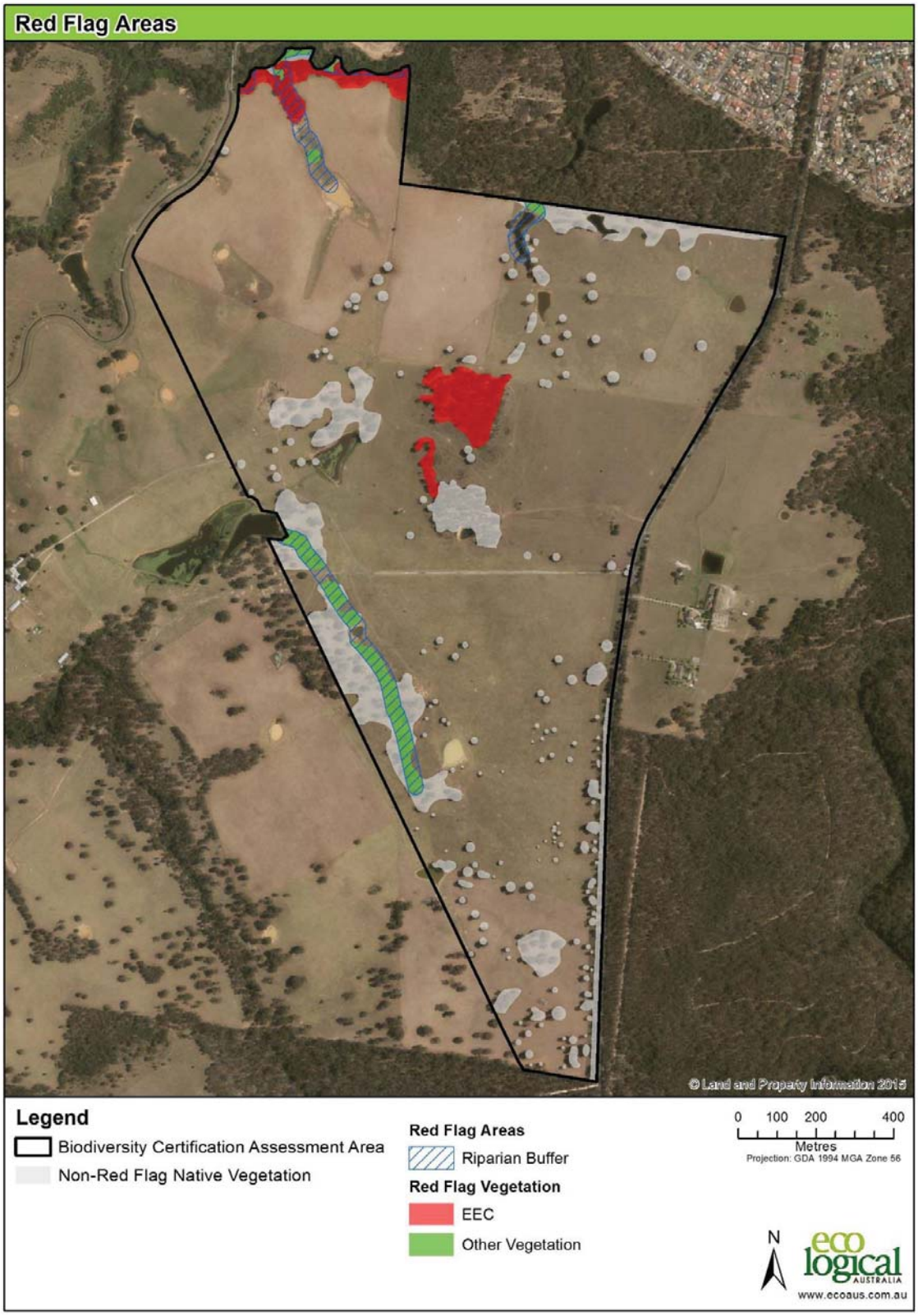

Figure 15: Red flag vegetation within the BCAA

Note other vegetation shown in this figure is in low condition and therefore not red flagged.

3 More Appropriate Local Data used in the Biocertification Assessment

The BCAM outlines the methods by which general biodiversity values are assessed and measured in the BCAA to determine whether the conferral of biodiversity certification on land, as demonstrated in the application for biodiversity certification, improves or maintains biodiversity values (DECCW 2011a). These methods, along with the methods by which measurements of threatened species, assessments of indirect impacts on biodiversity values, and calculations of ecosystem and species credits are made, were followed in the Biocertification Assessment (**Section 4**).

According to the methodology, BVTs are used as surrogates for assessing general biodiversity levels. Information on each BVT, including a description, the vegetation class and formation to which it belongs, and percent cleared value, are contained within the Vegetation Types Database held by the OEH. A range of quantitative measures that represent the benchmark conditions for vegetation types are contained within the Vegetation Benchmark Database, also held by the OEH. The Vegetation Benchmark Database is organised by CMA, and as such, information for the same BVTs that may occur across different CMAs are repeated across CMAs, although the range of measures representing benchmark conditions can differ between CMAs to reflect variations in BVTs across their range.

Generally, default data contained in the Vegetation Benchmark Database are used when undertaking an assessment of, and measuring, general biodiversity values. However, the BCAM specifies that the Director General may certify that '*more appropriate local data'* (MALD) can be used instead of the data in this database, '*where local data more accurately reflects local environmental conditions'* (section 3.4 of the BCAM). Benchmark data that more accurately reflect the local environmental conditions for a BVT may be collected from local reference sites, or obtained from relevant published sources. Data other than benchmark data may also be obtained from relevant published sources. The Director General must provide justifications for certifying the use of local data. The certified local data can then be used in applying the methodology.

ELA considered that some of the benchmark values for '*Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion'* and '*Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion'*, as contained in the Vegetation Benchmark Database, were not accurate reflections of the benchmark condition of these BVTs. This is because the database contained low or benchmark values that were not consistent with the vegetation types i.e. zero values for hollow-bearing trees and length of fallen logs, which would be expected to have some hollows and logs when in benchmark condition.

ELA has previously consulted with the OEH on this matter with regard to '*Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion'*. An outcome of a previous discussion between ELA and Tim Hagar of the OEH was that 'local' benchmark data for the number of trees with hollows and for the length of fallen logs could be added for this BVT, with one and 50 m added for the number of trees with hollows and the length of fallen logs, respectively. This was to be consistent with other woodland/open forest vegetation types on the Cumberland Plain, and is consistent with the assessment undertaken for the Brownlow Hill Stages 1 and 2 Biobank Sites and other assessments undertaken by the OEH on the Cumberland Plain.

ELA also consulted with the OEH on this matter with regard to '*Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion'* (email

correspondence with Tim Hager and John Seidel on 20 April 2015). The OEH advised that 'local' benchmark data for the number of trees with hollows and for the length of fallen logs could be added for this BVT, with one and 30 m added for the number of trees with hollows and the length of fallen logs, respectively. However, more recently, the Vegetation Information System (VIS) has been updated and these benchmarks have now been amended to one and 50 m for the number of trees with hollows and the length of fallen logs, respectively. It is also noted that the VIS now classifies SSTF as a Grassy Woodland Vegetation Formation rather than a Dry Sclerophyll Forest Formation.

As this is an error in the Biobanking Tool datasets, it is not considered that a formal application for the use of local benchmark data is required to be submitted to the OEH for approval. Accordingly, the local (or amended) benchmark values for the number of trees with hollows and the length of fallen logs in the two BVTs were used in this Biocertification Assessment (**Section 4**).

4 Biocertification Credit Assessment

This section details the results of the biodiversity certification assessment conducted to the requirements of the BCAM. Information is technical in nature, and relies on a broad understanding of the BCAM to understand the methods applied. Readers should make themselves familiar with the BCAM before reviewing this section of the document.

4.1 Biodiversity certification assessment area

The BCAA is shown in **Figure 3** and is comprised of:

- Lands proposed for biodiversity certification – impacts to native vegetation and threatened species habitat in these areas 'requires' biodiversity credits;
- Land proposed for conservation – generates biodiversity credits; and
- Lands where the current land use will be retained (retained lands) – neither requires nor generates biodiversity credits.

The footprint proposed for biocertification is 165.55 ha (10.79 ha of which comprises native vegetation as defined by the BCAM) (**Table 6** and **Figure 3**). The land proposed for conservation totals 2.67 ha, all of which has been mapped as native vegetation (with a further 0.94 ha of red flagged vegetation in a 30m buffer areas classified as 'retained' land that will not generate credits but will be managed for conservation (see **Section 4.7**). 40.67 ha of land has been identified as neither impacted or subject to conservation measures, and has therefore been assessed as 'retained land' (i.e. credits are neither required nor generated), however the retained land includes 18.88 ha in two proposed biobank sites that will be registered prior to the determination of the biocertification application and provide the majority of credits required for the assessment.

Table 6: Land use breakdown

Development footprint	Area (ha)	% of BCAA	Area of native vegetation (ha)	% of native vegetation
Land proposed for Biodiversity Certification (Development)	165.55	79.25	10.79	36.40
Land proposed for conservation	2.67	1.28	2.67	9.00
Retained lands (land excluded from this assessment but including submitted biobank sites)	40.67	19.47	16.19	54.60
Total	**208.89**	**100**	**29.64**	**100**

4.2 Vegetation mapping and zones

As outlined in **Section 2.1.2**, three BVTs were identified in the BCAA (**Table 7**). There was 29.64 ha of vegetation mapped in total, with the dominant vegetation type being '*Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin'* (20.61 ha). The BCAA also supported 8.59 ha of '*Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin*', 0.44 ha of '*Forest Red Gum – Rough-barked Apple grassy woodland*

on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion' and 179.25 ha of 'cleared' land, which in the context of the BCAM includes exotic vegetation.

Table 7: Area of vegetation within the BCAA

Biometric vegetation type	Area (ha)
Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	0.44
Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	8.59
Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	20.61
Cleared	179.25
Total	208.89

The three vegetation types were separated into 11 vegetation zones for this assessment (**Table 8**). Four zones were mapped in 'moderate to good' condition and eight vegetation zones were mapped in 'low condition'.

Table 8: Area of vegetation zones assessed within the BCAA

Veg zone ID	Biometric vegetation type	Condition [1]	Ancillary code	Area (ha)			
				Land proposed for biodiversity certification	Land proposed for conservation	Retained land [2]	Total
1	Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Low	Sparse	0	0	0.44	0.44
2	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Moderate to good	Olive	0	0	2.29	2.29
3	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Low	Native	0.15	0	2.34	2.49
4	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Low	Scattered paddock trees	2.28	0	1.53	3.81
5	Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Moderate to good	Good North	0.19	1.12	0.73	2.04
6	Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Moderate to good	Thinned South	0.42	0.02	0	0.44

Veg zone ID	Biometric vegetation type	Condition [1]	Ancillary code	Area (ha)			
				Land proposed for biodiversity certification	Land proposed for conservation	Retained land [2]	Total
7	Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Moderate to good	Thinned North	0.76	0	0.02	0.78
8	Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Low	Good South	0.47	1.52	0	1.99
9	Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Low	Native	1.54	0	0.41	1.95
10	Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Low	Exotic	0.23	0	7.85	8.08
11	Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Low	Scattered paddock trees	4.75	0	0.58	5.33
Total				**10.79**	**2.67**	**16.19**	**29.64**

[1] Condition as defined by the BCAM

[2] Not assessed as area neither requires or generates credits

4.3 Transect/Plot data and site value scores

Appendix 4 of the BCAM defines the minimum number of transects/plots required per vegetation zone area (DECCW 2011a). Data from a total of 20 BioMetric vegetation transects/plots were collected across the BCAA, with a transect/plot requirement of 12 transects/plots (**Table 5**). The collected transect/plot data is provided in **Appendix J**.

Current site value and future site value scores were calculated for each vegetation zone using the transect/plot data collected. The BCAM credit calculator was used to produce the current and future site value scores for development and conservation areas (**Table 9**). Note that some changes were made to default settings for future site scores. Additional gains within conservation areas were calculated above default for three site attributes: the length of fallen logs (vegetation zones 5 and 8), native mid-storey cover, and native groundcover (grass)(vegetation zone 8) as shown in **Figure 20**, in line with the rules set out in Appendix 4 of the BCAM. This was done as it is proposed that logs will be brought into the conservation areas from the adjoining development areas. Also, supplementary planting of mid-storey species is proposed. This will both increase native mid-storey cover and decrease native grass cover (through shading which will thin native grass) over time.

Table 9: Site value scores allocated to each vegetation zone

Veg zone ID	Biometric vegetation type	Ancillary code	Current site value score (if left as Retained Land)	Future site value score (after Development)	Future site value score (if proposed for Conservation)
1	Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Sparse	13.02	N/A	N/A
2	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Olive	38.02	N/A	N/A
3	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Native	26.04	0	N/A
4	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Scattered paddock trees	22.40	0	N/A
5	Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Good North	63.54	0	82.00

Veg zone ID	Biometric vegetation type	Ancillary code	Current site value score (if left as Retained Land)	Future site value score (after Development)	Future site value score (if proposed for Conservation)
6	Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Thinned South	36.46	0	54.00
7	Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Thinned North	36.28	0	59.00
8	Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Good South	25.52	0	49.00
9	Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Native	26.04	0	N/A
10	Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Exotic	25.00	0	N/A
11	Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Scattered paddock trees	19.79	0	N/A

4.4 Landscape Score

The credit calculator calculated a landscape value score of **8.5** for the land to be certified, and a score of **4.7** for the land subject to conservation measures. The landscape value is calculated from the sum of the scores obtained from the following three attributes:

- percent native vegetation cover in the landscape
- connectivity value
- adjacent remnant area determined according to the Mitchell landscape in which most of the land proposed for biocertification occurs.

Scores for each landscape attribute for 'land to be certified' and 'land subject to conservation measures', as well as an explanation of how the scores were determined, are provided in the sub sections below.

4.4.1 Percent Native Vegetation Cover Score

The percent native vegetation cover calculation was completed within a single 1,000 ha circle (**Figure 16**). The area of vegetation cover was digitised from an aerial photograph at a scale of approximately 1:10,000. The results of the assessment are contained in **Table 10**.

A pre-certification score of **15** was determined with 451 ha (451/1,000 = 45.1%) native vegetation mapped within the 41-50% native vegetation cover class. Vegetation clearance would result in 440 ha of vegetation cover (44.0%) remaining in the assessment circle. The post certification score is also **15** because vegetation cover falls within the same 10% increment (41-50%).

Table 10: Native vegetation cover in assessment circle

Circle	Pre-certification			Post-certification		
	Area of vegetation within assessment circle (ha)	Native vegetation cover class (%)	Score	Area of vegetation within assessment circle (ha)	Native vegetation cover class (%)	Score
1 (1,000ha)	451 (45.1%)	41-50%	15	440 (44.0%)	41-50%	15

The land subject to conservation measures (post-biodiversity certification) is 2.67 ha, all of which is currently vegetated land. Therefore (using Table 3 of the BCAM) a gain of **2.2** is recorded for the percent native vegetation score after conferral of biodiversity certification.

4.4.2 Connectivity Value

The current connectivity value of the site was assessed according to Section 3.7.2 of the BCAM. There are three components of connectivity; these are areas approved as a 'state' or 'regional' biodiversity links by the Director General, the hierarchy and riparian zone width of water courses in accordance with Appendix 1 of the BCAM and an assessment of vegetation connectivity. At a meeting with the OEH on January 2015, the OEH officers confirmed that there were currently no state or regional biodiversity links relevant to the BCAA.

'Minor creeks' and 'minor watercourses', defined as a 'local biodiversity link', and patches of vegetation that conform to the criteria of a local biodiversity link (moderate to good condition, has a patch size >1 ha which is separated by <30 m), occur on land to be developed (**Figure 17**: Connectivity). They do not occur on land subject to conservation measures. According to Table 4 of the BCAM the score for a local biodiversity link is **6**. As a local biodiversity link is located on land proposed for biodiversity certification and will be impacted it was allocated a score of zero after development (**Table 11**). The vegetation on land subject to conservation had a width greater than 30 m but did not link with areas of native vegetation in moderate to good condition greater than 30 ha. Given this, there was no local link on land subject to conservation measures, and a score of zero was allocated.

Table 11: Connectivity scores allocated for the assessment

Connectivity score	Pre-certification	Post-certification
Land to be certified	6	0
Land subject to conservation measures	0	0

4.4.3 Adjacent Remnant Area

The BCAA predominantly occurs on the Cumberland Plain Mitchell Landscape which is 89% cleared. The vegetation on site is not well connected given the areas of moderate to good vegetation are separated by areas of low condition vegetation and cleared land, resulting in an adjacent remnant area (ARA) of 2.83 ha (**Figure 17**). This receives a score of **2.5** for Mitchell Landscapes within the 70-90% cleared range.

The land subject to conservation measures also occurs within the same Cumberland Plain Mitchell Landscape with the same ARA of 2.83 ha. Therefore the score allocated for the conservation lands is also **2.5**.

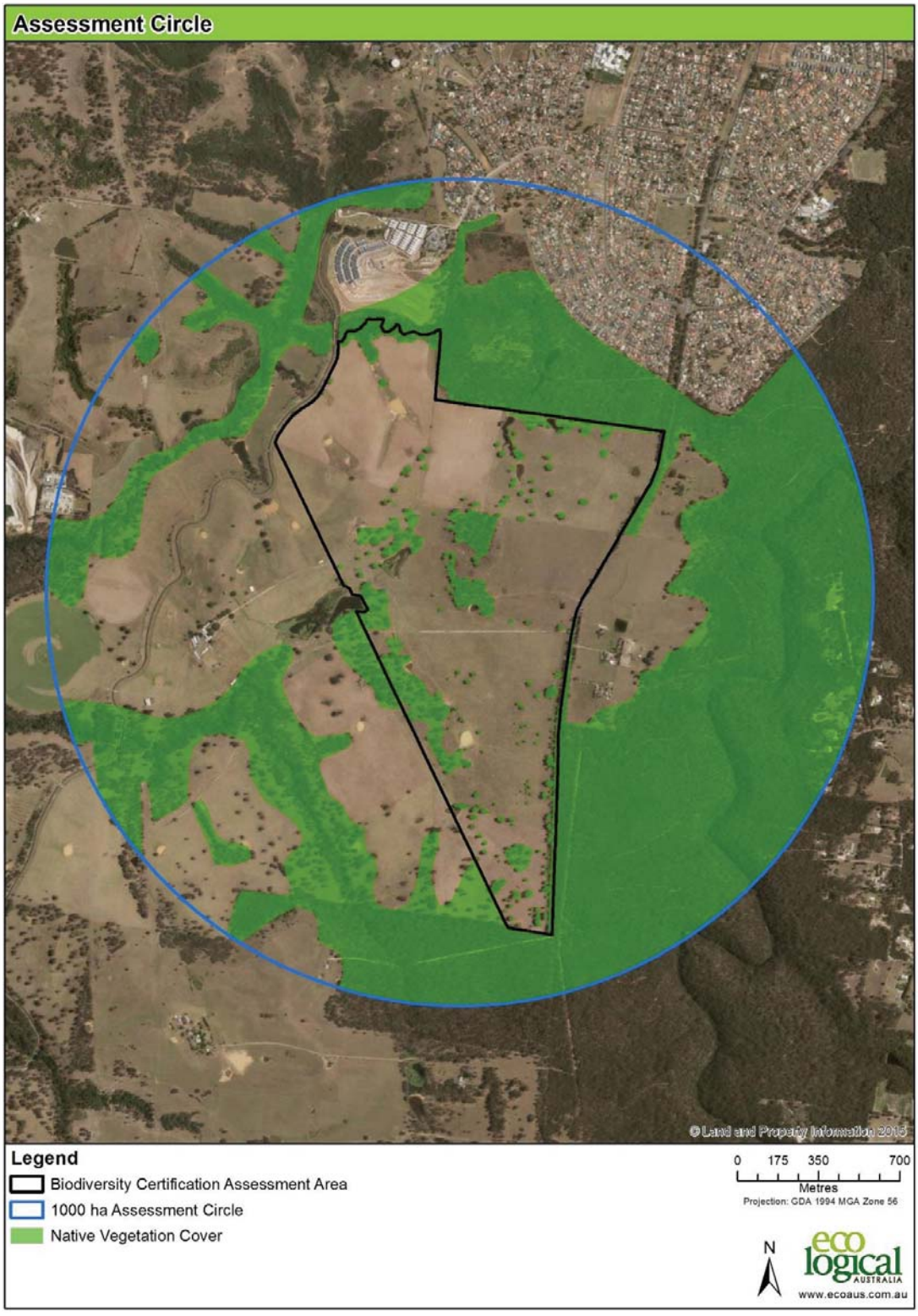

Figure 16: Assessment circle

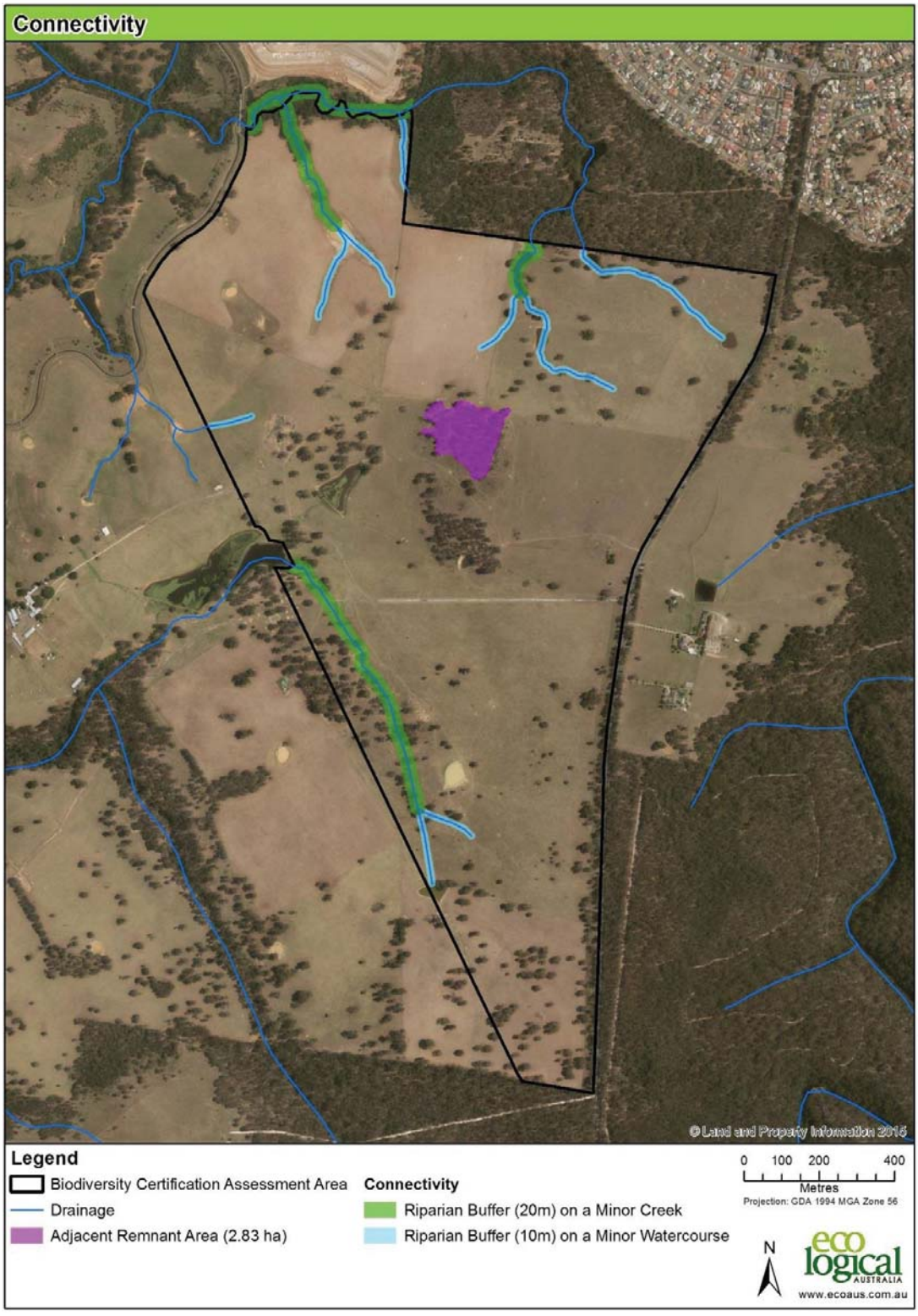

Figure 17: Connectivity

Note: the vegetation surrounding the ARA is in Biometric low condition or > 30m apart and therefore not part of the ARA calculation.

4.5 Red Flags

The BVTs, '*Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*' has been identified as comprising an EEC (RFEF), while '*Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion*' and '*Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion*' have been identified as comprising two CEECs (CPW and SSTF). These are also classified as over-cleared vegetation types (>70% of original extent in the CMA cleared; DECC 2008a). These vegetation types are therefore 'red-flagged' when in moderate to good condition under the BCAM.

Seven zones of the vegetation types identified as CEECs/EECs were in 'low' condition because the site value score for these vegetation zones was less than 34/100. Accordingly, these vegetation zones are not red flagged.

Only four zones (zones 2, 5, 6 and 7) comprising 5.55 ha of vegetation, had a site value score greater than 34/100.

There were also 3.01 of vegetation within a 20 m buffer area of a minor creek within the BCAA which classifies as red flag vegetation.

The area of impacted red flagged vegetation is shown in **Table 12** and **Figure 20.** Red flag areas should be avoided and can only be impacted in accordance with certain rules outlined in Section 2.4 of the BCAM.

A total of 8.56 ha of red flagged vegetation/areas is present within the BCAA of which 1.37 ha of EECs in moderate to good condition (42.02% of red flagged EECs) and 0.12 ha of vegetation within riparian buffers (3.99% of vegetation in riparian buffers) would be impacted by the proposal. A red flag variation request prepared in accordance with the criteria set out in Section 2.4 of the BCAM is provided in **Section 5**. It is noted that a red flag variation request must be assessed and approved by the OEH before biodiversity certification can be conferred.

In accordance with the procedures outlined by the OEH in undertaking a biocertification assessment, the OEH were consulted to determine whether a red flag impact and request for variation of this magnitude would likely be approved by the Director-General of the OEH. At a meeting with the OEH in January 2015, OEH officers indicated that a red flag variation for this area was likely to be approved.

Table 12: Impacts to red flagged vegetation

Red flag vegetation (BVTs)	CEEC name	% Cleared within CMA	Red Flag Area within BCAA (ha)	Red Flag Area impacted (ha)	Proportion impacted (%)
Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Cumberland Plain Woodland in the Sydney Basin Bioregion	95%	2.29	0	0
Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Shale Sandstone Transition Forest in the Sydney Basin Bioregion	80%	3.26	1.37	42.02
Vegetation within riparian buffers	NA	NA	3.01	0.12	3.99%
Total			**8.56**	**1.49**	**17.41**

4.6 Indirect Impacts

The BCAM requires that any application for formal biodiversity certification must demonstrate how the "*proposed ownership, management, zoning and development controls of the land proposed for biodiversity certification is intended to mitigate any indirect impacts on biodiversity values*" (DECCW 2011a).

Indirect impacts have been considered in accordance with the BCAM and have been determined to be negligible on the basis that all direct impacts have been assessed on the assumption of complete loss of all biodiversity values including where these losses are only partial e.g. for Asset Protection Zones (APZs) and the outer perimeter of the proposed residential footprint largely adjoins cleared rural land (and thus negligible in direct impacts) or areas that will be used for recreational purposes and include landscape plantings and active ongoing management. In effect the APZ areas will provide a buffer between the development lands and the adjacent (off-site) conservation areas, thereby mitigating and buffering any indirect impacts such as increased weeds, run-off, changed noise and light conditions.

There is potential for some indirect impacts resulting from the fragmentation of movement corridors or loss of foraging opportunities for some species. For example, removal of vegetation, including scattered paddock trees, and their replacement with residential housing, could impede the movements of the species credit species, Koala, as well as other fauna species, in an east-west and north-south direction. However, movement corridors will remain in the local landscape in the form of retained areas and proposed Biobank sites. In addition, there are a number of proposed Biobank sites and other reserves adjacent to the BCAA (**Figure 2**). The proposed Biobank site south west of the BCAA will continue to link vegetation within the Macarthur-Onslow Mt Gilead Biobank Site that lies in '*retained land – existing conservation measures'* to vegetation in the south of the BCAA, which further links to vegetation east of Appin Road. Also, the proposed Biobank sites to the north west and north east of the BCAA will continue to link vegetation within the Noorumba-Mt Gilead Biobank Site that lies within '*retained land – existing conservation measures'* to vegetation west and east of the BCAA.

Whilst all impacts within the land to be certified have been calculated on the assumption of complete loss, the following mitigation measures have been included to minimise impacts and address indirect impacts to areas proposed for conservation and retained areas:

- Any hollow-bearing trees that potentially contain roosting and breeding habitat for threatened microbats will be identified and retained in non-conservation areas where possible; and
- Any trees and hollows removed under the supervision of a fauna ecologist from trees, including hollow-bearing trees, that cannot be retained will be relocated to within '*conservation areas*' and '*retained land – existing conservation measures*'.

4.7 Buffers on Red flag areas

Where a proposed conservation measure is used to protect land that is a red flag area, the area of the proposed conservation measure must include a buffer to mitigate any negative indirect impacts from development following the conferral of biocertification. The buffer area may be secured via a conservation measure and used to offset the impacts of biodiversity certification, or it may be a retained area in the biocertification assessment area (and not generate any credits) (see Section 6 of the BCAM).

In consultation with OEH it was determined that an appropriate buffer for the red flag vegetation in the proposed conservation area would be 30 m and this could be partly comprised by any perimeter roads separating development from the proposed conservation area and should be classified as a 'retained area' within the BCAA.

A retained area has been identified around the red flag vegetation in the proposed conservation area shown in **Figure 19**, it is noted that this reduces the conservation area by 0.94 ha, however, this retained area will still be managed as part of the conservation area as outlined in **Section 6.3 and 6.7**.

The roads surrounding this conservation buffer area will be fully curbed and guttered with piped stormwater management that will not flow into the conservation area of buffer area.

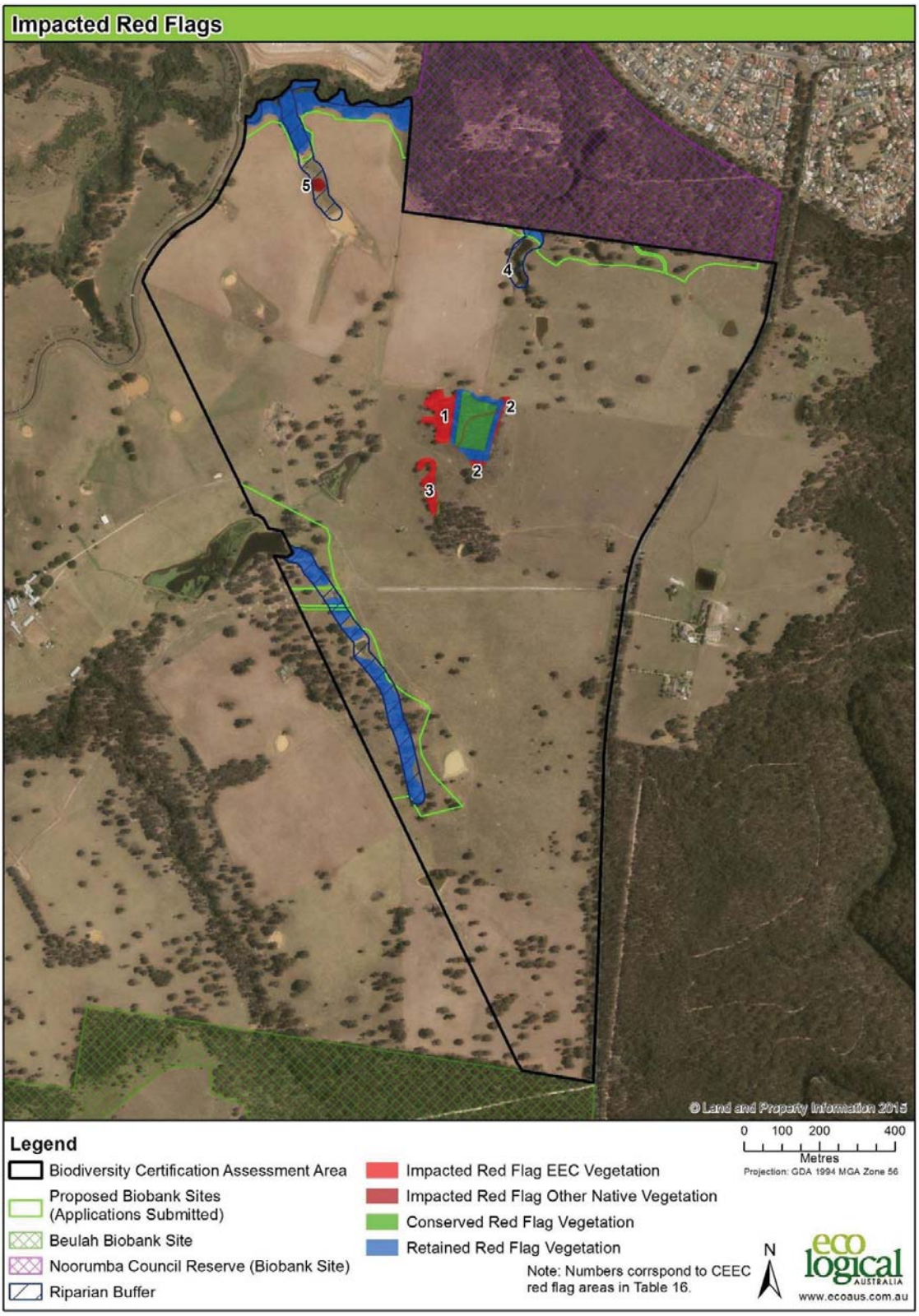

Figure 18: Impacted Red Flag vegetation

Figure 19: Buffers to areas of conserved red flag vegetation

4.8 Credit Calculations

4.8.1 Ecosystem Credits

Ecosystem credits have been calculated for the loss of vegetation resulting from the proposed development. In total, **132** ecosystem credits are required for the development of the area (**Table 13**).

As defined in the BCAM, different levels of protection and management for conservation lands results in the generation of a different number of credits as outlined below:

- Areas that are managed and funded in perpetuity (i.e. Biobank sites or national parks) – 100% credit entitlement – potentially generating **20** credits;
- Areas that are managed in perpetuity (e.g. classification and management of land as community land 'Natural Area' under the Local Government Act 1993 and adoption of a Plan of Management etc) – 90% credit entitlement – potentially generating **18** credits; and
- Areas that are secured through a planning instrument (i.e. environmental zoning) – 25% credit entitlement – potentially generating **5** credits.

It is proposed that the land subject to conservation measures within the BCAA will be secured by transferring the land to Campbelltown City Council as a Natural Area – Bushland Reserve, and registering the area as a Biobank site, as described in **Section 6** of this report – Biodiversity Certification Strategy, thus generating **20** ecosystem credits as a 100% conservation measure. **Table 13** shows the number of credits generated per vegetation zone for the different levels of protection and management for conservation lands.

There will thus be a deficit of **112** credits (**28** CPW credits and **84** SSTF credits) (**Table 13**). The remaining credits required will be generated by the two proposed Biobank sites (Noorumba-Mt Gilead and Macarthur-Onslow Mt Gilead Biobank sites) that will be registered prior to this application for biodiversity certification being determined and retired in accordance with the commitments in **Section 6** of this report.

The two biobank sites will generate **74** CPW and **120** STF credits respectively (see ELA 2018a and b and **Appendices K** and **L**), i.e. meeting the full credit deficit.

4.8.2 Species credits

Species credit requirements have been calculated for Koala, which has been assumed to be present for this assessment in the '*land to be certified*', and a species polygon for likely habitat has been mapped. No other threatened fauna or flora species requiring species credits were detected and therefore have not been calculated for species credit requirements.

A total of **284** species credits are required for Koala for the land proposed to be certified (**Table 14**).

The two Biobank sites that will be registered prior to this application for biodiversity certification being determined, Noorumba-Mt Gilead and Macarthur-Onslow Mt Gilead Biobank Sites (ELA 2018a and b), will generate **48** and **85** credits for Koala respectively (100% conservation measures for Biobank sites). This leaves a deficit of **151** Koala credits which will need to be secured from outside of the BCAA. **Section 6** of this report makes commitments regarding the purchase of these credits from a registered Biobank site that generates credits for the broader Campbelltown Koala population.

It is noted that whilst the proposed **3.61** ha conservation area has been mapped as Koala habitat within the BCAA, with the potential to generate **22** Koala credits (**Figure 11**), a claim for these 22 Koala credits has not been made for credits.

Table 13: Final ecosystem credit results

Veg zone ID	Biometric vegetation type	Condition	Ancillary code	Credits required	Credits generated			Credit status			Credit status summary for vegetation types based on 100% conservation measure
					100%	90%	25%	100%	90%	25%	
1	Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Low	Sparse	-	0	0	0	0	0	0	0
2	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Moderate to good	Olive	-	0	0	0	0	0	0	
3	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Low	Native	2	0	0	0	-2	-2	-2	-28
4	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Low	Scattered paddock trees	26	0	0	0	-26	-26	-26	
5	Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Moderate to good	Good North	5	8	7	2	3	2	-3	
6	Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Moderate to good	Thinned South	7	0	0	0	-7	-7	-7	
7	Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Moderate to good	Thinned North	13	0	0	0	-13	-13	-13	
8	Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Low	Good South	6	12	11	3	6	5	-3	-84
9	Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Low	Native	20	0	0	0	-20	-20	-20	
10	Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Low	Exotic	3	0	0	0	-3	-3	-3	
11	Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Low	Scattered paddock trees	50	0	0	0	-50	-50	-50	
Total				**132**	**20**	**18**	**5**	**-112**	**-114**	**-127**	**-112**

Table 14: Final species credit results

Habitat	Area impacted (ha)	Credits required
Koala	10.79	284

5 Red Flag Variation Request

5.1 Impact on Red Flagged Areas

The Biodiversity Assessment Report for the ecological values within the BCAA (**Section 2**) identified '*red flags*' as defined by the BCAM, some of which would be impacted by the land proposed for biocertification. The BCAM requires each of the criteria set out in Section 2.4 of the BCAM to be addressed in order for the Director-General to be satisfied that impacts to these '*red flags*' are able to be offset. This section addresses this requirement.

A red flag is triggered under the BCAM when there is an impact on any of the following:

- a vegetation type >70% cleared in the CMA for which it is mapped (not in 'low condition')
- a CEEC or EEC listed under the TSC Act or EPBC Act (not in 'low condition')
- a threatened species that cannot withstand further loss
- areas of vegetation recognised as having regional or state biodiversity conservation significance (including vegetation within a riparian buffer 20m either side of a minor creek as defined by Appendix 1 of the BCAM)

The Biodiversity Certification Operational Manual (OEH 2015c) states that each red flag area within the proposed biodiversity certification area should be numbered and listed in a table and shown on a map. Each red flag area impacted will require a separate red flag variation request unless the responses are the same for each entity, i.e. vegetation type is the same, patches are of similar condition, patches have the same connectivity etc.

The BVTs recorded within the BCAA are equivalent to '*River-Flat Eucalypt Forest on the Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregion*' (RFEF), which is an EEC listed on the schedules of the TSC Act, and '*Cumberland Plain Woodland in the Sydney Basin Bioregion'* (CPW) and '*Shale Sandstone Transition Forest in the Sydney Basin Bioregion*' (SSTF), which are CEECs listed on the schedules of the TSC Act. Parts of the BVTs are also equivalent to CPW and SSTF listed under the EPBC Act. Areas of CEECs and EECs are only considered as red flags if they are in moderate to good condition. Four out of 11 vegetation zones are in moderate to good condition, and three of these (zones 5, 6 and 7) will be impacted, totalling 1.37 ha. Vegetation zone 2 will not be impacted. There are no other vegetation types >70% cleared in the Hawkesbury Nepean CMA.

There is 3.01 ha of vegetation within the riparian buffer of a minor creek within the BCAA of which two patches (Patch 4 of 0.02 ha in vegetation zone 3 CPW) and Patch 5 of 0.10 ha in vegetation zone 4 CPW will be impacted.

There are no threatened species requiring species credits that cannot withstand further loss that will be impacted.

In accordance with the procedures outlined by the OEH in undertaking a biocertification assessment, the OEH were consulted in 2014 and 2015 to determine whether a red flag impact and request for variation of this magnitude would likely be approved by the Director-General of the OEH. At meetings with the OEH in 2015 the OEH officers advised that the impacts to the red flag areas were likely to be supported due to the small areas involved and the extent of these vegetation types proposed for conservation measures within the BCAA.

Impacts on red flagged areas according to vegetation zones are shown in **Table 15.** The distribution of red flag vegetation on land proposed for biodiversity certification is discussed below for each of the red flag variation criteria outlined in section 2.4 of the BCAM, and are shown in **Figure 20**, along with red flag vegetation that will be conserved or retained.

Table 15: Impacted red flag vegetation

Veg zone ID	Biometric vegetation type	CEEC	Condition	EEC Area impacted (ha)	Vegetation within Riparian Buffer impacted (ha)
3	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	*Cumberland Plain Woodland in the Sydney Basin Bioregion*	Low		0.02
4	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	*Cumberland Plain Woodland in the Sydney Basin Bioregion*	Low		0.10
5	Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Shale Sandstone Transition Forest in the Sydney Basin Bioregion	Moderate to good (Good North)	0.19	
6	Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Shale Sandstone Transition Forest in the Sydney Basin Bioregion	Moderate to good (Thinned South)	0.42	
7	Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Shale Sandstone Transition Forest in the Sydney Basin Bioregion	Moderate to good (Thinned North)	0.78	
Total				**1.37**	**0.12**

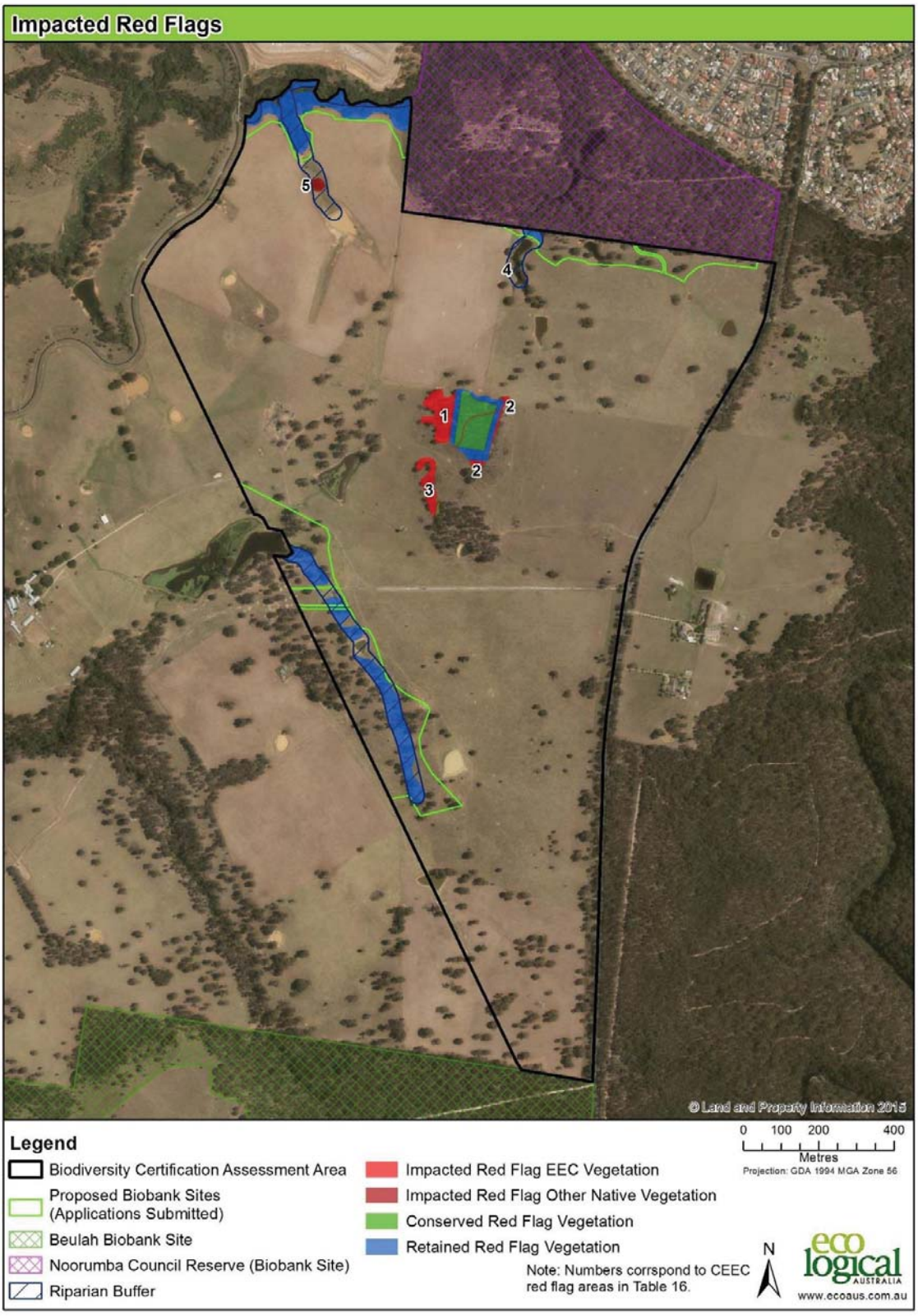

Figure 20: Impacted, conserved and retained red flag vegetation

Note: The scattered trees in the assessment area do not constitute red flags as their site value score < 34.

5.2 Red Flag Variation Criteria

The presence of Red Flags within the proposed development area means that Biocertification of the land cannot be conferred unless a red flag variation is granted by the Director General of the OEH. An application for a red flag variation must satisfactorily address the criteria in Section 2.4 of the BCAM (DECCW 2011a) for a proposal to be regarded as improving or maintaining biodiversity values.

Firstly, as outlined in Section 2.4.1 of the BCAM, the feasibility of options to avoid impacts on red flag area(s) where biodiversity certification is conferred must be addressed.

In addition, the following criteria, as outlined in Section 2.4.2 of the BCAM, must be addressed for a vegetation type which is greater than 70% cleared or is a CEEC or EEC:

1. Viability must be low or not viable (Section 2.4.2.1 of the BCAM)
2. Contribution to regional biodiversity values must be low (Section 2.4.2.2 of the BCAM)

The following criteria, as outlined in Section 2.4.4 of the BCAM must be addressed for areas with regional or state biodiversity conservation significance:

a) The width of a riparian buffer with regional or state biodiversity significance must not be substantially reduced

b) The ecosystem functioning of a state or regional biodiversity link, considering migration, colonisation and interbreeding of plants and animals between two or more larger areas of habitat, must not be substantially impacted,

c) The water quality of a major or minor river, major or minor creek, or a listed SEPP 14 wetland must not be significantly impacted

The remaining red flag variation criteria (Sections 2.4.3 and 2.4.4 – species that cannot withstand further loss) do not need to be addressed in this application as there are no red flag species that will be impacted in the BCAA.

The following sections provide the information required for the OEH to assess a red flag variation for the impacted areas of the CEEC, SSTF (**Section 5.2.1, 5.2.2**).

5.2.1 Avoiding and Minimising Impacts on Red Flags (Criteria 2.4.1 of the BCAM)

The Director General must be satisfied that the feasibility of options to avoid impacts on red flag areas has been considered in the application for biodiversity certification. An application for biodiversity certification can address this requirement by demonstrating that:

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

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.

a) All reasonable measures to avoid adverse impacts

The land within the BCAA has been identified for some time on the former Metropolitan Development Program (MDP) as a future greenfield release area. A preliminary planning proposal was endorsed by

Campbelltown City Council in July 2012 and the Department of Planning and Infrastructure made a Gateway Determination in September 2012 (CCC 2015).

CCC and the proponents have been liaising with the OEH since 2012 regarding the final planning proposal. The main issue discussed during these consultations was the need to reduce impacts to CPW and SSTF within the BCAA. The current proposal is consistent with this advice, and the application has largely excluded from the development footprint areas that contain patches of CPW and SSTF in moderate to good condition. These areas are now within the 'land subject to *conservation measures*' or in proposed Biobank sites mapped in this assessment as '*retained land – existing conservation measures*'.

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 majority of the site is zoned R2 Low Density Residential and RE1 Public Recreation. The land was previously zoned RU2 under the default zoning of Campbelltown LEP 2002 and is currently used primarily for agricultural production – cattle grazing. Under its current use and recent rezoned status, the land is not required to be managed for conservation.

5.2.2 Assessment criteria for red flag areas that contain CEECs (Criteria 2.4.2 of the BCAM)

Viability (Criteria 2.4.2.1 of the BCAM)

The BCAM states that:

> *The application for biodiversity certification must demonstrate to the satisfaction of the Director General that the viability of biodiversity values in the red flag area is low or not viable.*
>
> *For the purpose of the methodology, viability is defined as the ability of biodiversity values at a site to persist for many generations or long time periods. The ecological viability of a site and its biodiversity values depend on its:*
>
> - *condition*
> - *the area of the patch of native vegetation and its isolation*
> - *current or proposed tenure and zoning under any relevant planning instrument*
> - *current and proposed surrounding land use*
> - *whether mechanisms and funds are available to manage low viability sites such that their viability is improved over time*
>
> *In making an assessment that the viability of biodiversity values in the red flag area is low or not viable, the Director General must be satisfied that <u>one</u> of the following factors applies:*
>
> *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; or*
>
> *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; or*

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; or

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.

In summary, 1.37 ha of red flag SSTF, which occurs in three vegetation zones will be impacted.

Note that different criteria/factors (a, b, c or d) are considered in assessing the viability of the separate CEEC red flag areas. Not all CEEC red flag areas are discussed under the different factors given viability is dependent on a number of factors, with some factors at play for some CEEC red flag areas and not others. However, each CEEC red flag area is discussed under at least one of the factors to demonstrate that viability of biodiversity values in red flag areas is low or not viable. **Table 16** summarises the criteria that are satisfied by the CEEC red flag area, with detail provided under each criteria.

Table 16: Criteria satisfied by CEEC red flag areas

CEEC red flag areas	Section 2.3.2.2. criteria satisfied
SSTF1 (corresponds to impacted vegetation in vegetation zone 7 (Patch 1)	A - current and/or future proposed land use surrounding red flag area reduces viability
SSTF2 (corresponds to impacted vegetation in vegetation zone 5 (Patch 2)	A - current and/or future proposed land use surrounding red flag area reduces viability C - red flag area is substantially degraded
SSTF3 (corresponds to impacted vegetation in vegetation zone 6 (Patch 3)	A - current and/or future proposed land use surrounding red flag area reduces viability C - red flag area is substantially degraded

a) Current or Future Land Use surrounding the red flag area

Lands surrounding the red flag areas are currently used for grazing, although unlike other areas within the BCAA, lands immediately surrounding the red flag areas have not been as extensively pasture improved.

The current land use surrounding the red flag areas SSTF1 and SSTF2, and SSTF3 reduce the viability of SSTF in these areas. The red flag areas occur as small patches and are surrounded by open, exotic grassed areas. Current land use is likely to result in on-going long-term impacts on the edges of the patches, particularly SSTF3 as it is long and narrow in shape. These impacts, termed "edge effects" describe the various consequences on vegetation and wildlife, which occur as a result of vegetation

sharing a border with a developed/cleared area. The type of edge effects likely to impact the vegetation patches at these locations include nutrient enrichment and weed invasion. Indeed, red flag areas SSTF1 and SSTF3, are already subject to weed invasion, with these areas recording 18% and 40% exotic plant cover (see 'EPC' [Exotic Plant Cover] column in tables presented in **Appendix J – Plot Data**).

b) Size and connectedness

The size and connectedness of the vegetation in the impacted red flag areas would be sufficient to maintain their viability given they are contiguous with other areas of SSTF (including red flagged vegetation as well as vegetation that is not red flagged) providing that they are actively managed. Together, red flag areas SSTF1, SSTF2 and SSTF3 and other areas of SSTF adjacent to red flag areas total 5.25 ha. They occur within 500 m of native vegetation present to the north in Noorumba Reserve, within 300 m of SSTF present to the south west in '*retained land – existing conservation measures*' that contains the two Biobank sites that will be registered prior to this application for biodiversity certification being determined, and within 550 m of SSTF present to the south east, to the east of Appin Road. However, under the current zoning and land use these areas are not actively managed for conservation and are not required to be actively managed.

As such, this factor cannot be applied in demonstrating that the viability of biodiversity values in SSTF is low or not viable.

c) Vegetation substantially outside of benchmark condition

Red flag areas SSTF 2 and SSTF3 were considered to be 'degraded', despite their being in biometric 'moderate-good' condition.

The site value scores for the vegetation zones that contained red flag areas SSTF1 and SSTF3 (vegetation zones 7 and 6, respectively) were low at 36.28 and 36.46 (i.e. very close to a site value score of 34 which is considered low condition and therefore not red flagged). Plot data for vegetation zones 6 and 7 showed that the majority of vegetation condition variables were outside benchmark. Native over-storey, mid-storey, and groundcover (other) cover values were below benchmark, while native groundcover (grass) cover values were above benchmark. Also, values for the number of hollow-bearing trees, over-storey regeneration, and length of fallen logs were below benchmark for these vegetation zones containing red flag areas SSTF 1 and SSTF3. Details of plot data are presented in **Appendix J**.

d) Relative area of red flag vegetation impacted compared to area within land subject to conservation measures

The areas and proportions of red flagged SSTF impacted and conserved in the BCAA are detailed in **Table 17**. Also included in **Table 17** are details of the relative amount of red flagged SSTF impacted compared to red flagged SSTF in 'land subject to conservation measures'.

The OEH has previously indicated that a 5-10% range of CEECs impacted compared to CEECs in land subject to conservation measures represents a 'relatively minor' impact. The amount of red flagged '*Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion*' that will be impacted (1.37 ha) compared to the amount conserved (1.14 ha) is well above this range of minor impact (83.27%), however this does not include the 0.94 ha of red flagged vegetation in the 30m red flag buffer area, categorised as retained that will effectively be managed for conservation. Given this, this factor cannot be applied in demonstrating that the viability of biodiversity values in SSTF is low or not viable.

Table 17: Red Flagged CEECs on development and conservation land and proportion of red flagged CEECs impacted relative to conserved

Biometric vegetation type	CEEC name	Area of red flagged veg within BCAA (ha) **A**	Area of red flagged veg impacted (ha) **B**	Proportion of red flagged veg in BCAA impacted (%) **B/A**	Area of red flagged veg conserved (ha) **C**	Proportion in BCAA conserved (%) **C/A**	Proportion impacted relative to conserved (%) **(C/A)/(B/A)**
Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Shale Sandstone Transition Forest in the Sydney Basin Bioregion	3.26	1.37	42.02	1.14	34.99	83.27

Contribution to Regional Biodiversity Values (Criteria 2.4.3.2 of the BCAM)

The BCAM states that:

> *The application for biodiversity certification must demonstrate to the satisfaction of the Director General that the red flag area on land proposed for biodiversity certification makes a low contribution to regional biodiversity values.*
>
> *In making an assessment that the contribution of the red flag area to regional biodiversity values is low, the Director General must consider the following factors for each vegetation type or critically endangered or endangered ecological community regarded as a red flag area:*
>
> *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; and*
>
> *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; and*
>
> *c) percent native vegetation (by area) remaining is high: that the percent remaining of all native vegetation cover in the region is relatively high.*
>
> *'Region' for the purposes of section 2.4.2.2 means the CMA subregion in which the red flag area is located and any adjoining CMA subregions.*

The contribution to regional biodiversity values was assessed for the red flagged CEEC, SSTF, in the BCAA, using regional datasets where available. Under the BCAM the 'region' is defined as both the CMA subregion where the red flag area is located (in this case the Cumberland subregion of the Hawkesbury Nepean CMA) and adjoining CMA subregions: the Cumberland (Sydney Metro), Burragorang, Pittwater, Sydney Cataract (Hawkesbury/Nepean), Sydney Cataract (Sydney Metro), Wollemi, and Yengo CMA subregions as shown in **Figure 21**.

The use of regional vegetation datasets in this assessment, while the best data currently available, does have limitations. The data in some cases is several years old and therefore the extant mapping may require revision.

In addition, most regional vegetation mapping products only map patches greater than a minimum size (for example 0.5 ha) and generally only map vegetation in reasonably good condition. It is highly likely that smaller patches of the red flag vegetation type exist in the relevant regions, however have not been included in this assessment as the patches are too small to map, or the condition is disturbed and therefore has not been mapped.

Information on the contribution to regional biodiversity values, including an assessment of the relative abundance of the red flagged vegetation type, the percent remaining of the vegetation type, and percent native vegetation remaining in the region, is provided below.

a) Relative Abundance

The first measure for the contribution to regional biodiversity values criteria is a measure of relative abundance of the red flagged vegetation types in the 'region'.

Analysis was conducted into the relative abundance of the red flagged vegetation types across the entire 'region'. The associated data layers that were assessed included:

- Sub CMA Cumberland and Yengo (Hawkesbury Nepean) (Cumberland Plain western Sydney vegetation mapping; NPWS 2002);
- Sub CMA Cumberland (Sydney Metro) (Cumberland Plain western Sydney vegetation mapping; NPWS 2002);
- Sub CMA Pittwater (Cumberland Plain western Sydney vegetation mapping; NPWS 2002);
- Sub CMA Burragorang and Wollemi (Hawkesbury-Nepean) (Native Vegetation of the Warragamba Special Area; NPWS 2003a); and
- Sub CMA Sydney Cataract (Hawkesbury-Nepean and Sydney Metro) (Native Vegetation of the Woronora, O'Hares and Metropolitan Catchments; NPWS 2003b).

ELA is confident that the data used capture the majority of the BVT '*Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion*' as the extent of this BVT is restricted to the 'region' as defined by the BCAM and is largely incorporated into the mapping used. The results of the analysis can be seen in **Table 18** and the distribution of the BVT is displayed in **Figure 22**.

The results for the '*Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion*' are summarised below:

- 11,555 ha (of which 5,886 ha is in condition class A, B or C) is recorded within the Cumberland (Hawkesbury Nepean) sub CMA, in which the BCAA is located. The clearing of 1.37 ha of red flagged vegetation represents 0.01% of the total extent of the BVT in the Cumberland (Hawkesbury Nepean) sub CMA and 0.023% in condition A, B or C.

- 21,769 ha (of which 9,949 ha is in condition class A, B or C) is recorded within the region in which the BCAA is located, 1.37 ha to be impacted by this proposal represents 0.006% of the extant '*Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the*

Cumberland Plain, Sydney Basin Bioregion' or 0.014% of the extent of condition class A, B or C in the region.

The above information indicates that the impact to the red flagged vegetation/CEECs from the proposal is 'relatively minor' when compared to the amount mapped in the analysed regions.

Table 18: Relative abundance of red flag vegetation/CEECs in surrounding regions

Biometric vegetation type	Area impacted (ha)	Vegetation condition#	Area in Sub CMA (ha)								Total area in sub CMAs (ha)
			Cumberland (HN)	Cumberland (SM)	Burragorang	Pittwater	Sydney Cataract (HN)	Sydney Cataract (SM)	Wollemi	Yengo	
Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin	1.37	ABC	5,886	593	977	14	49	485	119	1,826	9,949
		Cmi & Txs	5,420	711	1,113	7	54	466	176	1,436	9,383
		Unknown	249	0	874	0	1,106	0	208	0	2,437
Total			**11,555**	**1,304**	**2,964**	**21**	**1,209**	**951**	**503**	**3,262**	**21,769**

Vegetation condition follows NPWS (2002) with A, B, C being patches >0.5 ha in area and canopy cover projection density (CCPD) > 10%. Cmi, Txs being patches > 0.5 ha and CCPD < 10%.

Figure 21: 'Region' derived from adjacent CMA subregions

Figure 22: Regional distribution of red flag vegetation/CEECs

b) Percent Remaining is high

There are few data sources available to determine the percent remaining of the vegetation type in the 'region'. While the database for BVTs (DECC 2008a) has estimates for the percent remaining of each vegetation type, estimates are for entire CMAs, not for individual CMA subregions. Information at the subregion level is required to estimate the percent remaining of the vegetation type in the 'region' given the definition of 'region' includes the CMA subregion in which the BCAA occurs and adjoining CMA subregions.

Given the lack of data sources to determine the percent remaining of the vegetation type in the 'region', information on the percent remaining of the vegetation type in the Hawkesbury Nepean CMA and the Sydney Metro CMA from the BioMetric Vegetation Types database (DECC 2008a) is provided. It is acknowledged that the percent remaining of the vegetation type in these CMAs may not be an accurate reflection of the percent remaining in the 'region'. To supplement information, the National Parks and Wildlife Service's (NPWS) Cumberland Plain western Sydney vegetation mapping (NPWS 2002) was also used. The pre-1750 data for each vegetation type was compared to the extent remaining to determine the percent remaining for the red flagged vegetation type.

The results of the analysis are shown in **Table 19**. The BVTs database (DECC 2008a) records '*Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin*' as being 80% cleared within the both the Hawkesbury Nepean and Sydney Metro CMAs, therefore leaving 20% of the vegetation type remaining. Using the vegetation types in Western Sydney mapping for the Cumberland CMA sub-region (NPWS 2002), 22.6% of the '*Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin*' with canopy cover >10%, remains (i.e., condition A, B, C), though with the inclusion of all remaining vegetation (i.e. including condition Tx), 44% remains. Note that the mapping by NPWS (2002) does not included derived native grasslands in these percent remaining figures, which also meets the biometric condition 'moderate-good' definition. Thus, a proportion of the Tx category meets the biometric condition 'moderate-good' definition and thus would be red flagged.

Table 19: Percent remaining of each vegetation type/CEEC

Biometric vegetation type	Area impacted (ha)	% remaining in Hawkesbury Nepean CMA (DECC 2008a)	% remaining in the Sydney Metro CMA (DECC 2008a)	% remaining in the Cumberland Plain (ABC condition) (NPWS 2002)	% remaining in the Cumberland Plain (ABC & Tx condition) (NPWS 2002)
Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin	1.37	20	20	22.6	44.0

c) Percent Native Vegetation (by area) is high

The area of native vegetation was calculated for the region, being the Cumberland (Hawkesbury/Nepean (HN)), Cumberland (Sydney Metro (SM)), Wollemi, Burragorang, Sydney Cataract (HN), Sydney Cataract (SM), Pittwater and Yengo CMA subregions, is shown in **Table 20** and **Figure 23**. The OEH state-wide vegetation extent layer was used for the assessment (Keith and Simpson 2006) and was intersected with the six CMA subregions to determine the proportion of each region with native vegetation cover.

Table 20: Native vegetation cover of CMA subregions

Native vegetation cover	Burragorang (ha)	Cumberland (ha)	Pittwater (ha)	Sydney Cataract (ha)	Wollemi (ha)	Yengo (ha)	Total (ha)
Cleared	41,567 (18%)	231,218 (84%)	44,079 (35%)	17,095 (12%)	21,260 (4%)	29,613 (9%)	384,831 (24%)
Vegetated	192,769 (82%)	44,200 (16%)	80,915 (65%)	131,254 (88%)	485,884 (96%)	293,273 (91%)	1,228,296 (76%)
Total	**234,335 (100%)**	**275,418 (100%)**	**124,994 (100%)**	**148,349 (100%)**	**507,144 (100%)**	**322,886 (100%)**	**1,613,127 (100%)**

In total, 76% (1,228,296 ha) of the assessment region contains native vegetation cover. The proportion of vegetation cover for five of the CMA subregions is high, with Burragorang containing 82%, Pittwater containing 65%, Sydney Cataract containing 88%, Wollemi containing 96% and Yengo containing 91% vegetation cover. As stated earlier, the vegetation types impacted are predominantly located on the Cumberland Plain, and therefore very little of the vegetation types are likely to extend into the surrounding five CMA subregions. This assessment demonstrates that the majority of the CMA subregions assessed are relatively well vegetated, however when considering the two Cumberland CMA subregions, which are between 7-17% vegetated, native vegetation cover is low.

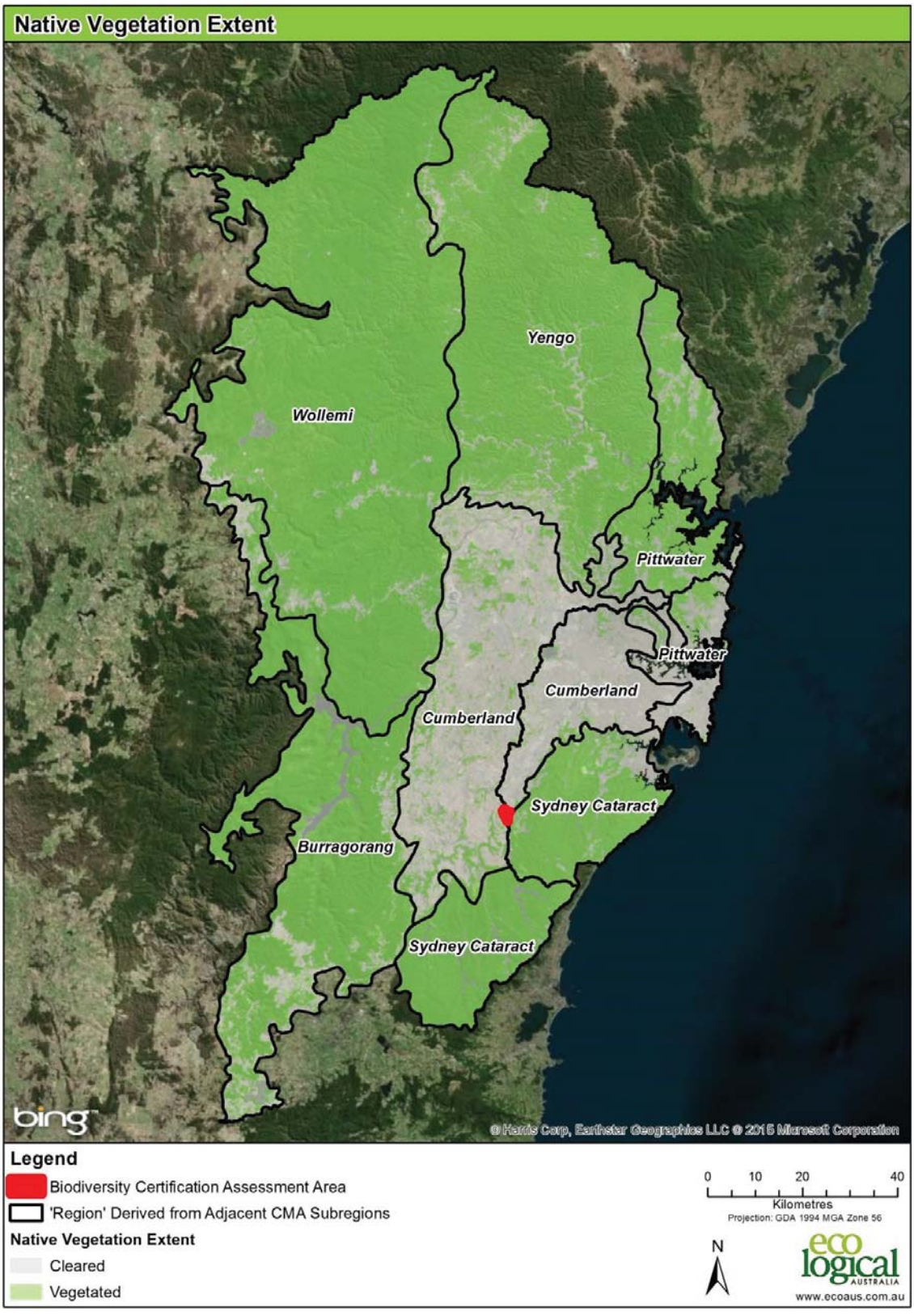

Figure 23: Native vegetation extent

5.2.3 Additional Assessment criteria for areas with regional or state biodiversity conservation significance (Criteria 2.4.4)

Width of riparian buffer with regional or state biodiversity significance (Criteria 2.4.4a)

The width of a riparian buffer with regional or state biodiversity significance (i.e. the riparian buffers on major or minor creeks and rivers) must not be substantially reduced.

The proposal will not reduce the riparian buffer on two 'minor creeks' that meet the definition of "areas of vegetation having state or regional biodiversity conservation significance'.

The riparian buffers comprise land zoned RE1 Public Recreation and will be transferred to Campbelltown City Council as 'community land' and will be subject to landscape plantings and passive community use (walking paths, cycle ways and open space) and are expected to increase the area of vegetation within these buffers.

Ecosystem functioning of a state or regional biodiversity link (Criteria 2.4.4b)

The ecosystem functioning of a state biodiversity link or a regional biodiversity link must not be substantially impacted, considering migration, colonisation and interbreeding of plants and animals between two or more larger areas of habitat.

There are no registered state or regional biodiversity links as defined by section 3.7.2 of the BCAM that will be impacted by the application for biocertification therefore the ecosystem functioning of a state biodiversity link or a regional biodiversity link will not be substantially impacted .

Water quality of major river, minor river, major creek, minor creek or a listed SEPP 14 wetland (Criteria 2.4.4c)

The water quality of a major river, minor river, major creek, minor creek, or a listed SEPP 14 wetland must not be significantly impacted.

The BCAA are does not include a SEPP 14 wetland, therefore the water quality of a listed SEPP 14 wetland will not be impacted.

The BCAA includes 'minor creeks' where remnant native vegetation (0.12 ha of canopy of scattered paddock trees) will potentially be impacted by earth works and construction of stormwater detention basins and thus have been included as 'impacted' or land to be certified.

Surface run-off will be managed through proposed stormwater infrastructure and a stormwater management strategy which will direct surface flows to specifically designed stormwater detention basins to ensure that post development peak discharges are equal to or less than pre-development discharges (Worley Parsons 2014). These detention basins will be constructed within the riparian buffers to retain water intermittingly after prolonged heavy rain. These minor creeks are currently within a rural landscape and subject to ongoing agricultural land use including cropping and cattle grazing and associated run-off. They are in poor condition, with predominantly exotic ground cover and scattered remnant paddock trees comprising degraded CPW vegetation. The riparian buffers comprise land zoned RE1 Public Recreation and will be transferred to Campbelltown City Council as 'community land' and will be subject to landscape plantings and passive community use (walking paths, cycle ways and open space) and are expected to have improved water quality post development.

6 Biocertification Strategy

Section 126K of the TSC Act states that biocertification may only be conferred on land by the Minister if the applicant has a biocertification strategy.

Section 126K (2) states that a biocertification strategy is a policy or strategy for the implementation of conservation measures to ensure that the overall effect of biodiversity certification is to improve or maintain biodiversity values. The Biocertification strategy is to be used as the basis for the assessment of the application for biodiversity certification.

A biodiversity strategy is to include the following:

a) the land proposed for biodiversity certification
b) the land proposed for biodiversity conservation
c) the proposed conservation measures
d) any person or body proposed as a party to the biodiversity certification

This section addresses these requirements.

6.1 Land proposed for biodiversity certification

The land proposed for biodiversity certification is shown in **Figure 3** in **Section 1** of this report.

6.2 Land proposed for biodiversity conservation

The land proposed for biodiversity conservation is shown in **Figure 3** in **Section 1** of this report.

Also shown in **Figure 3** are areas of '*retained land*', some of which i.e. '*retained land – existing conservation measures*', overlaps with the submitted Noorumba-Mt Gilead and Macarthur-Onslow Mt Gilead Biobank Sites which will be registered prior to this application for biodiversity certification being determined.

6.3 Proposed conservation measures

Conservation measures within the 'BCAA'

It is proposed that the 3.61 ha of land subject to conservation measures within the BCAA (2.67 ha plus 0.94 ha of retained red flag buffer area) will be secured by transferring the land to Campbelltown City Council by 2025 and will be managed in accordance with a Plan of Management adopted under the *Local Government Act* 1993 (LG Act) and registered as a Biobank site and be fully funded for active conservation management. The land will be classified as community land under the LG Act, and categorised as a 'natural area' with an adopted plan of management under Division 2 of Part 2 of Chapter 6 of that Act that. Permanently managed and funded conservation measures are a 100% Conservation Measure as outlined in section 8.1.1 of the BCAM and will generate 100% of the calculated credits as shown in **Table 21**.

The Biobank and Local Government management plans for the conservation area will include the standard mandatory suite of biobanking actions to improve biodiversity values by the implementation of the following management actions:

- The erection and maintenance of boundary fencing to prevent in appropriate access

- Council Reserve signage outlining the management objectives of the site
- The active management and reduction of weeds
- The application of fire, where appropriate;
- Replanting or supplementary planting where natural regeneration is insufficient to bring back to benchmark condition within a reasonable timeframe - vegetation zone 8 (**Figure 24**);
- Addition of logs to supplement the current low level of logs in Vegetation Zone 5 and 8 (**Figure 24**).
- Control of rabbits and foxes (as required).
- The retention of regrowth/native vegetation, dead timber, and rocks.

The in perpetuity cost of these management actions has been estimated using the biobanking in perpetuity cost spreadsheet and agreement reached with Council regarding the transfer of these funds once initial management has been undertaken by the current land owners to reach maintenance management.

The current land owners, Mr and Mrs Dzwonnik and Lendlease Communities (Mount Gilead) Pty Ltd, will be responsible for the initial temporary stock fencing of the conservation area, establishment of the walking path/ management trail, initial weed and feral animal control, revegetation/supplementary planting and the bringing in of fallen timber from the adjacent development area. The boundary of the offset area will also be fenced following the subdivision of the adjacent land with post and chain markers prior to land transfer.

Campbelltown Council will be responsible for the on-going maintenance of these activities in perpetuity from the date that the land is transferred to Council and the land is gazetted as a natural area – bushland and registered as a Biobank site. Council will also install the Council Reserve signs.

The land subject to this conservation measure will generate **20** ecosystem credits for HN556 '*Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest on the edges of the Cumberland Plain'*. It will not generate any credits for HN528 '*Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain'*.

A Biocertification Agreement will be entered into between CCC, S&A Dzwonnik (the current land owners), Lendlease Communities (Mount Gilead) Pty Ltd and the Minister stating that the land will be transferred by S&A Dzwonnik to Lendlease Communities (Mount Gilead) Pty Ltd and then to CCC prior to 2025, classified as 'Community Land – Natural Area', registered as a Biobank site by CCC and a plan of Management will be prepared and Adopted by 2025. Lendlease Communities (Mount Gilead) Pty Ltd will provide the funding to assess and register the area as a Biobank site, prepare the plan of management and fund its implementation, in perpetuity.

The number of credits generated is less than the credits required for impacts to HN556 '*Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest on the edges of the Cumberland Plain'* (**104** credits) and HN528 '*Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain'* (**28** credits). Additional credits for both vegetation types (**84** credits for HN556 and **28** credits for HN528) as well as Koala (**284** credits) will be purchased and retired from the two proposed Biobank sites within the BCAA.

Purchase of biodiversity credits from 'existing' Conservation measures 'within' the BCAA

Three areas within '*retained land – existing conservation measures*' are the proposed Noorumba-Mt Gilead and Macarthur-Onslow Mt Gilead Biobank Sites which will be registered prior to this application for biodiversity certification being determined. These will be subject to the terms of Biobanking Agreements under Part 7A of the TSC Act, which will include annual conservation management in

perpetuity, submission of an annual report to the OEH regarding these management obligations, and audit by the OEH. A Biobanking Agreement is a 'Permanently Managed and Funded' or 100% Conservation Measure as outlined in s126L(i) of the TSC Act and section 8.1.1 of the BCAM.

Assessment of the sites found that they will generate the required **84** credit deficit for HN556 '*Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest on the edges of the Cumberland Plain'* (the Macarthur-Onslow Mt Gilead Biobank site will generate 120 SSTF ecosystem credits as shown in **Appendix K**) and the required **28** credit deficit for HN528 '*Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain* (the Noorumba - Mt Gilead Biobank site will generate 74 CPW ecosystem credits as shown in **Appendix J**). The Biobank sites will also generate **133** Koala credits, resulting in a residual **151** credit deficit for this species which will need to be secured from outside of the BCAA.

A Biocertification Agreement will be entered into between Mt Gilead Pty Ltd, S&A Dzwonnik, Lendlease Communities (Mount Gilead) Pty Ltd and the Minister stating that **40** of the **104** HN556, **28** HN528 and **133** Koala credits will be purchased and retired prior to the commencement of Stage 1 with the remaining **64** HN556 credits and **151** Koala credits retired prior to the commencement of Stage 2 as outlined in **Tables 22** and **23**.

Conservation measures 'outside' the BCAA

The remaining **151** Koala species credits will be purchased from a registered BioBank site outside of the BCAA. ELA is aware of a number of registered Biobank sites in the locality that will be able to supply these credits.

A Biocertification Agreement will be entered into between Lendlease Communities (Mount Gilead) Pty Ltd and the Minister stating that these additional **151** Koala credits will be purchased from a registered Biobank site in the broader Campbelltown Council Koala population area and retired by the end of 2020 (or prior to the commencement of Stage 2).

6.4 Existing management obligations

The land proposed as a Council Reserve / Biobank site is zoned RE1 Pubic Recreation under CLEP 2011. There are no covenants or conservation funding arrangements for the land proposed for conservation measures or any existing requirements to actively manage the site for biodiversity conservation. The entire conservation area is to be managed for ecosystem and species credits.

Similarly, the proposed Noorumba-Mt Gilead and Macarthur-Onslow Mt Gilead Biobank Sites which will be registered prior to this application for biodiversity certification being determined are also zoned RE1 Public Recreation, and have no covenants or existing requirements to actively manage the sites for biodiversity conservation. The Biobank sites will be managed for ecosystem and species credits.

6.5 Any person or body proposed as a 'party' to the biodiversity certification

A Biocertification Agreement will be entered into between CCC, S&A Dzwonnik (the current land owners), Lendlease Communities (Mount Gilead) Pty Ltd and the Minister stating that the land will be transferred by S&A Dzwonnik to Lendlease Communities (Mount Gilead) Pty Ltd and then to CCC, prior to 2025, classified as 'Community Land – Natural Area', registered as a Biobank site and a plan of Management will be prepared and adopted by 2025.

Campbelltown City Council will be responsible for registering the land identified as a biobank site after the land transfer, and adopting the Plan of Management in accordance with the Local Government Act. Lendlease Communities (Mount Gilead) Pty Ltd will provide the funding to assess and register the area as a Biobank site, prepare the plan of management and fund its implementation, in perpetuity.

Mt Gilead Pty Ltd has prepared and submitted the applications for registration of the two Biobank Agreements for Noorumba-Mt Gilead and Macarthur-Onslow Mt Gilead Biobank Sites. These Biobank sites will be registered prior to this application for biodiversity certification.

Mt Gilead Pty has committed to making the **120** ecosystem (104 HN556 and 28 HN528) and **133** Koala credits available to meet the credit requirements of this Biocertification application as outlined in **Table 21, 22, 23** and **24**.

The subsequent implementation, monitoring, reporting and review of the terms of the BioBanking Agreements will be the responsibility of Mt Gilead and any future owners of the Biobank sites who would assume all responsibility for the implementation of the requirements of the Biobank Agreement.

A Biocertification Agreement will be entered into between Mt Gilead Pty Ltd, Lendlease Communities (Mount Gilead) Pty Ltd and the Minister stating that **40** of the **104** HN556, **28** HN528 and **133** Koala credits will be purchased and retired prior to the commencement of Stage 1 with the remaining **64** HN556 credits retired prior to the commencement of Stage 2 as outlined in **Tables 22** and **23**.

A Biocertification Agreement will be entered into between Lendlease Communities (Mount Gilead) Pty Ltd and the Minister stating that these additional **64** HN566 credits and **151** Koala credits will be purchased and retired by the end of 2020 (or prior to the commencement of Stage 2).

6.5.1 Timing of credit retirement

It is proposed to "retire" biodiversity and species credits in accordance with the staged development of the certified land as outlined in **Table 23** and **Table 24** and shown in **Figure 25** and includes the **20** credits generated by the 100% conservation measure. The proportion and types of credits to be retired is based on the area of vegetation to be cleared (and corresponding number of credits) in each stage of development and is split proportionally between the respective landowners.

A likely time frame is provided; however, this will be subject to the demand for housing lots and may occur sooner or later than indicated. No clearing of mapped vegetation will occur in each stage until Mt Gilead and/or S. and A. Dzwonnik accordingly have provided proof of the retirement of the required quantum of credits in accordance with **Table 23** and **Table 24.** This proof will be in the form of a 'certificate' of credit retirement issued by the OEH. Development in areas with no mapped native vegetation may occur prior to the purchase and retirement of credits.

The requirements for the retirement of credits from the Macarthur-Onslow Mt Gilead and Noorumba-Mt Gilead BioBank sites are expressed in this strategy as credits calculated using the BBAM which have been treated as being equivalent to the required number of BCAM credits. As part of the sites will be secured as Biobank sites it will be the credits calculated using the Biobanking Assessment Methodology 2014 (BBAM 2014; OEH 2014a) that are actually retired. Whilst there is usually the requirement to convert BCAM credits into an equivalent amount of BBAM 2014 credits, there is no requirement for this in this instance. This is because the number of credits generated by the Biobank sites is already known. Conversions are usually required due to not knowing the amount of BBAM credits generated; calculations under BBAM generally generate less credits than calculations under BCAM.

Management of the two Biobank sites that will be registered prior to this application for biodiversity certification being determined and will occur prior to the commencement of any clearing of vegetation.

Figure 24: Management actions within land proposed for conservation measures

Table 21: Summary of ecosystem credit surplus/deficit

Biometric Vegetation Type	Credits Required	Credits generated (100% Measure)	Credit Status within BCAA	Proposed Biobank Sites	Credit Status Existing Conservation Measures
HN526 Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin	0	0	0	4	4
HN528 Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin	28	0	-28	74	46
HN556 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin	104	20	-84	120	36
	132	**20**	**-112**	**198**	**86**

Table 22: Summary of species credit surplus/deficit

Habitat	Credits	Credits generated (100% Measure)	Credit Status within BCAA	Proposed Biobank Sites	Credit Status Existing Conservation Measures
Koala	284	0	-284	133	-151

Table 23: Staging of development and retirement of ecosystem credits

Property	Stage	Indicative Time Frame	Grey Box - Forest Red Gum grassy woodland on flats (ha of impact)	Credits to be retired	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum (ha of impact)	Credits to be retired
Mt Gilead	1	0-2 years (2018-2020)	2.22	26	1.00	8
Dzwonniks	1	0-2 years (2018-2020)	0.21	2	1.84	32
Mt Gilead	2	3-5 years 2021-2023	0.00	0	5.52	64*
Total			**2.43**	28	**8.36**	104

*Includes the 20 SSTF credits generated by the 100% Council Reserve/Biobank site conservation measure

Table 24: Staging of development and retirement of species credits

Property	Stage	Indicative Time Frame	Koala habitat impacted	No. of Koala credits to be retired
Mt Gilead	1	0-2 years (2018-2020)	**3.22**	79**
Dzwonniks	1	0-2 years (2018-2020)	**2.05**	55**
Mt Gilead	2	3-5 years (2021-2023)	**5.52**	151
Total			**10.79**	284

** Includes the 133 Koala credits generated by the Noorumba-Mt Gilead and Macarthur-Onslow Biobank sites

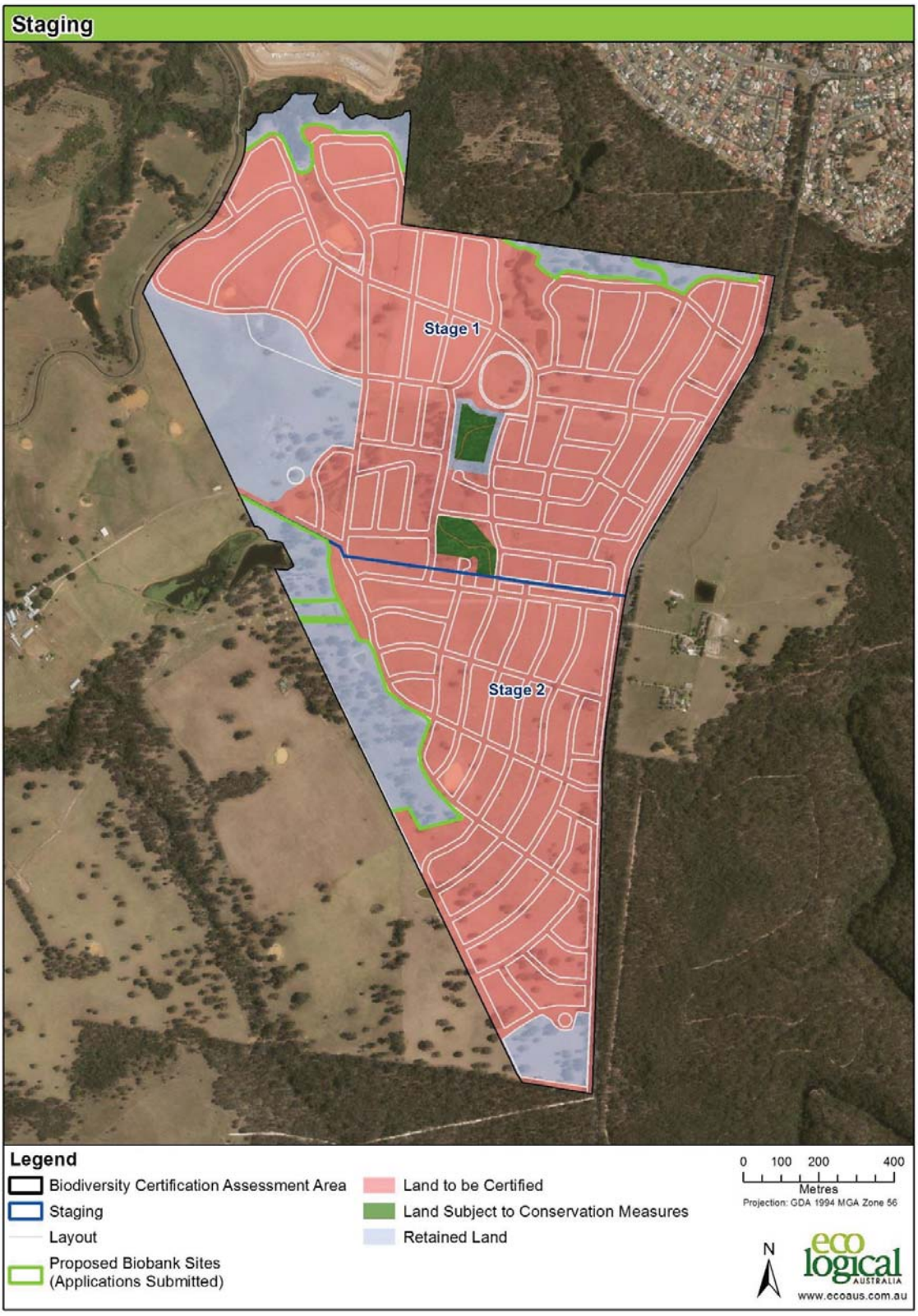

Figure 25: Development stages for certified land

6.6 Is an Improve or Maintain Outcome Achieved?

Subject to the Director-Generals consideration and approval of the red flag variation request (**Section 4**), an '*improve or maintain*' outcome can be achieved by the purchase and retirement of credits from the proposed conservation lands, the existing Biobank sites within the BCAA and the purchase and retirement of 1**51** additional Koala credits from outside the BCAA.

6.7 Statement of commitments

The following is a summary of the commitments made throughout this biocertification assessment and application.

1. A Biocertification Agreement will be entered into between CCC, S&A Dzwonnik (the current land owners), Lendlease Communities (Mount Gilead) Pty Ltd and the Minister stating that the land proposed for conservation measures within the BCAA will be transferred by S&A Dzwonnik to Lendlease Communities (Mount Gilead) Pty Ltd and then to CCC, prior to 2025, classified as 'Community Land – Natural Area', registered as a biobank site, and a plan of Management will be prepared and adopted by 2025.
    a. S&A Dzwonnik and subsequently Lendlease Communities (Mount Gilead) Pty Ltd, will be responsible for managing the land proposed as a Council Reserve Biobank site for the first seven years, or until such time that CCC is satisfied that the ongoing management is at a maintenance level, expected to be by 2025.
    b. The current land owners, Mr and Mrs Dzwonnik and subsequently Lendlease Communities (Mount Gilead) Pty Ltd, will be responsible for the initial temporary stock fencing of the conservation area, establishment of the walking path, initial weed and feral animal control, revegetation/supplementary planting and the bringing in of fallen timber from the adjacent development area. The boundary of the offset area will also be fenced following the subdivision of the adjacent land with post and chain markers prior to land transfer.
    c. Lendlease Communities (Mount Gilead) Pty Ltd will provide the funding to assess and register the area as a Biobank site, prepare the plan of management and fund its implementation, in perpetuity.
    d. Campbelltown City Council will be responsible for registering the land as a biobank site, classifying the land as Community Land - Natural Area – Bushland, under the Local Government Act, and adopting the Plan of Management.
    e. Campbelltown Council will be responsible for the on-going maintenance of these activities in perpetuity from the date that the land is transferred to Council, registered as a biobank site and the land is gazetted as a natural area – bushland. Council will also install the Council Reserve signs.
2. Mt Gilead Pty Ltd has prepared and submitted the applications for registration of the two Biobank Agreements for Noorumba-Mt Gilead and Macarthur-Onslow Mt Gilead Biobank Sites. These Biobank sites will be registered prior to this application for biodiversity certification being determined.
    a. Active management of the proposed Noorumba-Mt Gilead and Macarthur-Onslow Mt Gilead Biobank Sites (i.e. meeting the Total Fund Deposit Amount), will commence prior to the commencement of Stage 1 construction (it is noted that conservation management of both biobank sites commenced in 2016 with the removal of grazing, fencing the boundary and initial weed control works underway).
    b. Mt Gilead Pty has committed to making **84** ecosystem and **133** Koala credits available to meet the credit requirements of this Biocertification application as outlined in **Table 21, 22, 23** and **24**.

c. CCC has committed to making **20** HN566 credits available from the Council Reserve Biobank site to meet the credit requirements of this Biocertification application as outlined in **Table 23**.
d. The subsequent implementation, monitoring, reporting and review of the terms of the Biobanking Agreements will be the responsibility of Mt Gilead and any future owners of the Biobank sites who would assume all responsibility for the implementation of the requirements of the Biobank Agreement.
e. A Biocertification Agreement will be entered into between Mt Gilead Pty Ltd, Lendlease Communities (Mount Gilead) Pty Ltd and the Minister stating that **40** of the **104** HN556, **28** HN528 and **133** Koala credits will be purchased and retired prior to the commencement of Stage 1 with the remaining **64** HN556 credits (20 from the Council Reserve Biobank site and 44 from the Macarthur Onslow Biobank site) and **151** Koala credits retired prior to the commencement of Stage 2 as outlined in **Tables 23** and **24**.

3. A Biocertification Agreement will be entered into between Lendlease Communities (Mount Gilead) Pty Ltd and the Minister stating that the additional **151** Koala credits required will be purchased and retired by the end of 2020 (or prior to the commencement of Stage 2).
4. Lendlease Communities (Mount Gilead) Pty Ltd will prepare and implement a Construction Environment Management Plan for vegetation clearing within the BCAA to guide the development outlined in this biocertification assessment and ensure that all direct and indirect impacts (e.g. APZs, utilities, access, stormwater run-off etc) are contained within the development footprint and appropriate mitigation measures are put in place to minimise indirect impacts to threatened fauna including Koala. Specifically, this will address the management of the land proposed for conservation measures and its buffer such that surrounding roads will be fully curbed and guttered with no stormwater being discharged into the conservation areas.

   In addition, the CEMP will include, but not be limited to:

   - temporary and permanent protective fencing will be erected around all areas identified for conservation prior to clearing activities to minimise any inadvertent damage
   - a fauna pre-clearance protocol
   - retention of HBTs where possible and practical
   - where trees are removed in the development area, these will be salvaged for fauna habitat values in the proposed Council Reserve Biobank site and Noorumba-Mt Gilead and Macarthur Onslow Biobank sites (i.e. meeting the additional management requirement if importing logs into the conservation area)
   - a de-watering plan for any farm dams that are removed

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Eco Logical Australia (ELA) 2018b. *Biobank Agreement Credit Assessment Report – Noorumba-Mt Gilead- Biobank Site*. Report prepared for Mt Gilead Pty Ltd, April 2018.

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Office of Environment and Heritage (OEH) 2014b. *BioBanking Assessment Methodology 2014a*. Office of Environment and Heritage for the NSW Government, September 2014, Sydney. Available online: http://www.environment.nsw.gov.au/resources/biobanking/140661BBAM.pdf

Office of Environment and Heritage (OEH) 2014b. *Sydney Growth Centres Strategic Assessment Commitment 7: Cumberland Plain Woodland HMV and PCLs review Outcomes Report*. Office of Environment and Heritage.

Office of Environment and Heritage (OEH) 2015a. *Atlas of NSW Wildlife database*. Office of Environment and Heritage.

Office of Environment and Heritage (OEH) 2015b. Biodiversity Certification Guide to Applicants. Office of Environment and Heritage, May 2015

Office of Environment and Heritage (OEH) 2015c. Biodiversity Certification Operational Manual. Office of Environment and Heritage, May 2015

Office of Environment and Heritage (OEH) 2015d. *Threatened Species Profiles*. Office of Environment and Heritage. Available online: http://www.environment.nsw.gov.au/threatenedspecies/

Rural Fire Service 2006. Planning for Bushfire protection: a guide for Councils, Planners, Fire Authorities and developers.

Worley parsons 2014 Mount Gilead Rezoning Stormwater Management and Flooding Assessment. Prepared for Mount Gilead Pty Ltd and S&A Dzwonnik, 4th November 2014

Appendix A: Project Staff CVs

The following are brief curriculum vitae's for the key project staff. Please note that since this project commenced in 2013, there have been a number of staff movements, and some of the staff who undertook the field work and credit calculations are no longer with Eco Logical Australia, they have however been consulted in making revisions to this report.

Robert Humphries – Project Manager

CURRICULUM VITAE

Robert Humphries

MANAGER, BIOBANKING AND BIOCERTIFICATION OFFSETS PROGRAMS

QUALIFICATIONS

- Bachelor of Applied Science, Ballarat C.A.E 1983-85.
- Master of Applied Science (Research) University of Ballarat 1986-89.

Robert is an ecologist, environmental planner and project manager with over 25 years experience. Since graduating with Bachelors and Masters Degrees in wildlife management in 1985, Robert has worked mainly in the public sector with the Department of Environment and Conservation (Victoria) 1988-1996 and NSW National Parks and Wildlife Service, now NSW Office of the Environment & Heritage 1996-2006. Robert joined Eco Logical Australia in March 2008.

Robert was the Manager of the Threatened Species Section of the NSW Department of Conservation and Environment for over 10 years and has extensive experience of the NSW Threatened Species and Environmental Planning legislation, Government policy, the biodiversity of the Greater Sydney and Hunter Regions and the new biodiversity certification and biobanking provisions.

Robert was a member of the Biobanking Ministerial Reference Group from 2007-2012 and is the lead trainer in the BioBanking and Biodiversity Certification Accredited Assessor Training program.

RELEVANT PROJECT EXPERIENCE

BioCertification Assessments

Have completed or are currently undertaking formal Biodiversity Certification Assessments for:-

- Port Macquarie Airport Master Plan (Port Macquarie- Hastings Council)
- Tuncurry State Significant Site (Urban Growth NSW)
- Emerald Hills Urban Release Area (Camden City Council). Assessment completed and reviewed by OEH
- Warnervale Town Centre (Wyong Council)(Approved March 2014)
- Broulee and South Moruya Urban Release Areas (Eurobodalla Shire Council)(Approved September 2014)
- Mount Gilead Urban Release Area (Campbelltown City Council)

Have completed informal Biodiversity Certification Assessments for

- Ralston Avenue, Belrose for Metropolitan Local Aboriginal Land Council (August 2013)
- Greater Sancrox Area for Port Macquarie –Hastings Council (August 2013)
- Glenning Valley Urban Release Area (Travers Ecology and Glenning Valley Partnership 2011);
- Kings Hill Urban Release Area, Port Stephens LGA (Mondell Property Group and Hunter Land 2011);
- Ingleside Release Area, Pittwater/Warringah LGAs (Urban Growth NSW 2011)
- Darkinjung Local Aboriginal Land Council (North Wyong Structure Area)
- Yallah-Marshall Mount Urban Release Area (Wollongong City Council)
- Whitebridge Investigation Area (Urban Growth NSW 2011)
- Balmoral Urban Release Area, north west Sydney (Urban Growth NSW 2013)

Biodiversity Offset Strategies

- North West & South West Growth Centres Biodiversity Offset Strategy for Sydney Water Infrastructure developments (May 2013)
- Biodiversity Offset Strategy for the proposed extension of the Pine Dale Mine (Enhance Place Pty Ltd, July 2013)
- Biodiversity Offset Strategy for proposed Stage 1 Modification, Moolarben Coal Mine (Yancoal, May 2013)
- Biodiversity Offset Strategy for Crudine Wind Farm (Wind Prospect CWP Pty Ltd – 2012)
- Biodiversity Offset Strategy for Sapphire Wind Farm (Wind Prospect CWP Pty Ltd – 2011)
- Biodiversity Offset Strategy for Boco Rock Wind Farm (Wind Prospect CWP Pty Ltd – 2011)
- Improve or Maintain Biodiversity Offset Strategy for Kings Hill Urban Release Area, Port Stephens LGA (Mondell Property Group, 2011)
- Biodiversity offset strategy for proposed Narrabri Coal mine (Narrabri Coal Operations Pty Ltd, 2011)
- Biodiversity offset strategy for proposed modification to Rocglen Coal Mine (Whitehaven Coal Pty Ltd, 2010)
- Biodiversity offset strategy for proposed Werris Creek LOM Coal Mine (Werris Creek Coal Pty Ltd, 2010)
- Biodiversity offset strategy for the South West Rail Link (Transport Construction Authority, 2010)
- Biodiversity offset strategy for the Richmond Rail Line duplication (Transport Construction Authority, 2011)
- Biodiversity offset strategy for the Camden Valley Way Upgrade (NSW RTA, 2011)
- Biodiversity Offset Strategy for the Oxley Highway Upgrade, Port Macquarie (NSW RTA, 2010)
- Preparation of Offset Strategy and package for the Kingsgrove to Revesby Quadruplication Project (2008/09 K2RQ/TIDC Alliance)

Biobank Site Assessments and Registrations

- 80 ha site at Salamander for Port Stephens Shire Council (Assessment currently being assessed by OEH)
- Two Biobank sites (100 ha) in Western Sydney Parklands as an amendment to the existing Cecil Hills Biobank Site (Agreement No. 120 registered August 2014)
- 54 ha proposed Biobank at the Oaks on the Cumberland Plain (Private landholder) (Agreement No. 100, registered in September 2013)
- 69 ha proposed Biobank for Shoalhaven City Council at (Agreement No. 101, registered in June 2013)
- 45 ha proposed Biobank for Lake Macquarie City Council at Belmont (Agreement No. 103, registered in June 2013)
- 51 ha site west of Camden on the Cumberland Plain (Private landholder) (Agreement No. 88, registered in January 2013)
- 25 ha site west of Camden on the Cumberland Plain (Private landholder) (Agreement No. 3, registered in January 2011).
- 24 ha site in western Sydney (Western Sydney Parklands Trust). (Agreement No. 70, registered in February 2012).
- 10 ha site at Belrose (WSN Environmental Solutions) (Agreement No. 55, registered in March 2012)
- 1,500 ha site near Gunnedah to offset an approved Coal mine (Whitehaven Coal) (Agreement No. 43, registered in August 2012).

Bruce Mullions – Senior Field Ecologist – Vegetation Mapping and threatened flora (moved to Eco Planning Pty Ltd, December 2016)

CURRICULUM VITAE

Bruce Mullins

ASSOCIATE - MANAGER, ECOLOGY AND ASSESSMENT - PRINCIPAL ECOLOGIST

QUALIFICATIONS

- Master of Science, University of Technology, Sydney. Factors affecting the vegetation of mined and unmined areas in a montane forest.
- Bachelor of Science, University of Technology, Sydney
- Accredited Biobanking Assessor

Bruce is an ecologist with over twenty years post-graduate experience and is Eco Logical Australia's Senior Ecologist and Manager of the Ecology and Assessment team. Following the completion of a Master of Science thesis examining patch dynamics and plant ecophysiology at an abandoned mine site in the central tablelands of NSW, Bruce has been working as a researcher and environmental consultant. For seven years he managed the environmental consulting activities of Charles Sturt University, principally through the Johnstone Centre, after which time he joined Eco Logical Australia.

Bruce has highly developed skills in research and consulting. He is experienced in the design and execution of ecological surveys, environmental impact assessment, the development of management plans, literature reviews and all aspects of project management.

RELEVANT PROJECT EXPERIENCE

- Parramatta Escarpment shared path and boardwalk, Options study, Parramatta City Council
- Jerrabombera wetlands, vegetation mapping project.
- Plains-wanderer, survey and habitat assessment 2015, OEH
- Floristic Value Score advice, Riverina grasslands, OEH
- Mt Gilead Biocertification Assessment
- Bingara Gorge, Ecological surveys
- Western Sydney Dieback project, bird surveys and advice, Goodman.
- Metropolitan Colliery Vegetation Monitoring Program 2008 - present
- Ecological Assessment, Proposed Hume Highway Duplication, RTA
- Flora and Fauna Impact Assessment, Roadside Vegetation Maintenance, Old Princes Highway, Bulli Tops to Waterfall, Wollongong City Council
- Goodnight Island Ecological Assessment, Studio Internationale
- Research and Monitoring Program, DEFCOMMSTA Morundah, Dept of Defence
- Ecological Expert, Land and Environment Court, Booralie Rd, Warringah, Northern Beaches Council.
- Superb Parrot Surveys, selected sites in ACT 2014 and 2015
- Eastern Highlands Vegetation Surveys, (Kosciusko NP and ACT), DECCW and ACT government.
- West Dapto and Adjacent Growth Areas, Part 3A Assessment, Sydney Water Corporation
- Tharbogang Landfill Biodiversity Offset Strategy, Griffith City Council
- Ecological Equivalence Assessment, Carmichael Mine, central QLD.
- Rapid vegetation assessment, mid to lower Murrumbidgee (Griffith to below Balranald), OEH
- PAS expert advice (Plains-wanderer, *Brachyscome muelleroides* and *Leptorhynchos orientalis*), OEH

- Council Appointed Expert, terrestrial ecology, Proposed Subdivision Hampton Cres Blacktown
- Council Appointed Expert, terrestrial and aquatic ecology, Rooty Hill
- Box-Gum Woodland Mapping and Monitoring Plan for Kapooka Military Area, Dept of Defence
- Monitoring the Impacts of Kangaroo Grazing in the Kapooka Military Area, Dept of Defence
- Monitoring the Impacts of Kangaroo Grazing in Latchford Barracks, Dept of Defence
- North Bandiana Landscape Management Plan, Dept of Defence
- South Bandiana Landscape Management Plan, Dept of Defence
- Vegetation Condition Assessment, South West Slopes, DEWHA
- Flora and Fauna Assessment, Proposed Bayswater 2 Powerstation, Part 3A, AECOM
- Rapid weed assessments, Wilderness areas (Kosciusko, Deua, Monga, Mummel Gulf National Parks), OEH
- Hargraves to Windeyer Powerline Ecological Assessment, Barnson Pty Ltd
- Moolarben Coal Mine Preclearing Survey, Moolarben Coal Operations
- Vegetation Mapping, Mulwala Explosives Facility, Mulwala, Dept of Defence
- Native Grassland Condition Assessment, Tubbo Station, Tubbo Farming.
- Wagga Wagga Linepack Extension, Environmental Licencing Professionals
- Ecological Assessment, Cooktown, QLD, Airservices Australia
- Assessment of Irongrass Natural Temperate Grassland, Tailem Bend, SA, Airservices Australia
- Moorlaben Coal, Flora and Fauna Monitoring 2010-2011, Moolarben Coal Operations
- Tralee Station proposed rezoning, environmental assessment and constraints analysis, Queanbeyan, Urbis.
- Ecological Surveys, Nymagee, Triako mines with Charles Sturt University.
- Ecological Surveys, Cobar, Endeavour mine with Charles Sturt University.
- Ecological assessment, piping Llanillo Bore Drain, Lightning Ridge
- Ecological Assessment, proposed upgrade to Lake Brewster, near Hillston, State Water
- Ecological Assessment, Muggabah and Merrimajeel Creeks, Booligal, Dept Commerce
- Flora survey, Coleambally Irrigation Area, Australian Museum.
- Towra Point Artificial Bird Roosts REF, DECCW
- Southern Highlands Transfer, Identification of Flora and Fauna Constraints, Dept Commerce
- Shoalhaven Water Transfers, Terrestrial Ecology and Wetlands, Dept Commerce
- Wetland Vegetation Surveys for LiDAR comprising the Gwydir Wetlands, DECCW
- Wetland Characterisation and Management, Port Stephens Council
- EPBC Box Gum woodland survey and mapping, Molonglo region, ACT
- Tallawarra Local Environment Study, TRUenergy
- Shellharbour Hardrock Extraction Flora and Fauna Assessment, NSW Dept of Planning
- Campbelltown Biodiversity Study, Campbelltown City Council
- Native Vegetation Guide for the Riverina, Greening Australia
- Buckingbong State Forest Environmental Assessment, Dept of Defence
- Wagga Wagga Planning Studies, Willana Associates
- Historical distribution of Native Grasses through Parkes, Forbes and Lachlan Shires, Western Research Institute
- A review of the ecological health of the Murrumbidgee River, Living Murray
- Systematic Vegetation Surveys, Upper Hunter Valley
- Environmental investigations and vegetation mapping, DEFCOMMSTA properties, Dept of Defence
- Vegetation Condition Assessment, Woodlands Historic Park, Melbourne, Parks Victoria
- Flora survey, Riverine Plain (62 sites), DLWC
- Flora survey, Jingellic, Bogandyera and Clarkes Hill Nature Reserves, NPWS
- Flora survey, Wagga Wagga LGA, DEC
- Googong Environmental Investigations for Local Environment Study, Willana Associates
- Gum Swamp Management Plan and Operation and Maintenance Manual, Gum Swamp, DLWC
- Evaluation of 1750 mapping of vegetation by the Riverina Vegetation Committee, NPWS
- Edwin Land Parkway, Queanbeyan, GHD
- Vegetation validation - Narrandera, Ardlethan, Barmedman and Coolamon 1:100,000 Map Sheets, DECCW
- Scoping Report for the Development of a Biodiversity Strategy and Plan for the Rice Industry, Rice Growers Association

Dr Enhua Lee – Senior Field Ecologist – Biometric Plots and threatened flora (now with the Office of Environment and Heritage)

CURRICULUM VITAE

Dr Enhua Lee

SENIOR ECOLOGIST

QUALIFICATIONS

- PhD in Ecology and Wildlife Management. The Ecological Effects of Sealed Roads in Australia's Arid Zone. – 2006
- Bachelor of Advanced Science (First Class Honours). Mitochondrial Adjustments in the Muscles of the Fat-tailed Dunnart, *Sminthopsis crassicaudata*, During Cold Acclimation – 2000
- Accredited BioBanking Assessor (number 176)

Enhua is a Senior Ecologist in the Sutherland office of ELA with a Doctor of Philosophy in wildlife management and over 12 years of experience in environmental research and consulting.

Enhua has extensive practical experience in biodiversity survey and monitoring. As a senior ecologist, Enhua has been involved in planning, establishing and undertaking vegetation and fauna monitoring programs, and baseline flora and fauna surveys. Enhua also has well developed research and analytical skills, and time management and project management skills. She is an effective communicator, as demonstrated through her work in developing biodiversity education programs and her invitations to present her research findings at specialist conferences and to lay audiences. She has trained people in conducting flora and fauna surveys in Australia's rangelands and has published peer-reviewed book chapters and papers in international and national scientific journals.

Since joining Eco Logical Australia in 2007, Enhua has completed work for state and federal government agencies, local councils, as well as private businesses and property owners. She has a sound knowledge of environmental and planning legislation (NSW, VIC and WA State legislation and Commonwealth legislation) and has applied her knowledge to a range of projects. Her work has ranged from completing NSW biocertification, biobanking and ecological impact assessments (NSW and WA) to conducting complex statistical analyses to inform management plans. She has also been involved in numerous monitoring projects, strategic assessments, and has provided high level conservation advice to government agencies.

RELEVANT PROJECT EXPERIENCE

Biobanking/Biocertification Assessments

- Mt Gilead Biocertification Assessment (Mt Gilead and S. and A. Dzwonnik) (in progress)
- Macarthur-Onslow Mt Gilead Biobank Assessment (in progress)
- Noorumba-Mt Gilead Biobank Assessment (in progress)
- Hardwicke Stage 1 Biobank Assessment (submitted)
- Hardwicke Stage 2 Biobank Assessment (in progress)
- Port Macquarie Airport Biocertification Assessment (Port Macquarie Hastings Council) (in progress)
- Biobank Feasibility Assessments (Noorumba, Simmo's Beach, and Smiths Creek Reserve) (Campbelltown City Council)

Ecological Constraints / Impact Assessment / Flora and Fauna Survey

- Rossmore Ecological Constraints Assessment (Stephen Bowers Architects)
- Wilton Flora and Fauna Assessment (Sydney Water)
- Wilton Ecological Constraints Assessment for three sites in Wilton (Sydney Water)
- Gregory Hills Flora and Fauna Assessment of non-certified land (Dart West Developments)
- Denham Court Road Flora and Fauna Assessment (Rawson Communities)
- EPBC Act Strategic Assessment of Procedures and Guidelines (RMS)
- Narrabri Ecological Assessment (Santos)
- Lancelin Defence Training Area Flora and Fauna Survey (Defence) (WA)
- Marandoo East Drilling Flora and Fauna Survey for Native Vegetation Clearing Permit (RTIO) (WA)
- Homestead to Silvergrass Rare Flora Survey (RTIO) (WA)
- Brockman 2 Expansion Flora and Fauna Survey for Native Vegetation Clearing Permit (RTIO) (WA)
- McPhee Creek Environmental Approvals (Atlas Iron) (WA)
- Pilbara Expansion Cumulative Impact Assessment (BHPBIO) (WA)
- Kemerton Industrial Park Gap Analysis and Ecological Surveys (LandCorp) (WA)
- WestBank Ecological Survey and Assessment (LandCorp) (WA)
- Ninga Vertebrate Fauna Survey and Habitat Mapping (BHPBIO) (WA)
- Koodaideri Iron Ore and Infrastructure Project (Public Environmental Review) (Rio Tinto Iron Ore) (WA)
- Carnaby's Cockatoo habitat surveys throughout the south-west of WA (DSEWPaC) (WA)
- Warwick Open Space Flora, Fauna and Fungi Survey (City of Joondalup) (WA)
- Edgewater Quarry Flora and Fauna Survey (City of Joondalup) (WA)
- Callawa Vertebrate Fauna Survey (WA Level 2 Fauna Survey) (BHPBIO) (WA)
- Menai Species Impact Statement (Landcom)
- Annangrove Light Industrial Area Flora and Fauna Constraints Assessment (Hills Shire Council)
- Crudine Ridge Wind Farm Ecological Assessment (Part 3A project) (Wind Prospect)
- Narrabri Gas Field Ecological Assessment (Part 3A project) (Eastern Star Gas)
- Beacon Hill Species Impact Statement (The Trustees of the Sisters of the Good Samaritan)
- Pittwater Road Upgrade Flora and Fauna Assessment (City of Ryde)
- Preliminary ecological assessment of Allenby Park (Stage 1) (AMPCI)
- Ecological Assessment of Allenby Park (Stage 2) (AMPCI)
- Ecological Assessment, Proposed Drainage Augmentation, Warringah Mall (AMPCI)
- Glenmore Park Flora and Fauna Assessment (AMPCI)
- Commonwealth BER Flora and Fauna Assessments (Hansen Yunckin)
- Wedderburn Hazard Reduction Flora and Fauna Assessment (Campbelltown Council)
- Stanwell Tops Conference Centre Ecological Assessment (Borst and Conacher Architects)
- Tubbo Farming Grassland Assessment (Tubbo Farming)
- Ecological Impact Assessments – various (Integral Energy)
- Sensitivity Mapping for NW and SW Growth Centre (Sydney Water)
- Western Parklands Ecological Constraints Assessment (DoP)
- Biobanking Pilot Assessments (DECC)
- El Caballo Blanco and Gledswood Rezoning Ecological and Bushfire Assessment (Landcom)
- South Randwick Feasibility Review: Environmental Issues and Constraints (Landcom)
- Whitebridge Constraints Assessment (Landcom)
- Ballanagamang Biobanking Assessment (Ecotrades)
- Fauna Report for the Gap Park Masterplan (Thompson Berril Landscape Design)
- Flora and Fauna Assessment: Compound Sites for Hume Highway Duplication (Leighton Contractors)

Management Plans

- Cloudbreak Life of Mine Revegetation Plan and Procedures (Fortescue Metals Group) (WA)
- Sunningdale Vegetation and Fauna Management Plan (Pacific Dunes)
- South Bandiana Landscape Management Plan (Defence)
- North Bandiana Landscape Management Plan (Defence)
- Kapooka Box-Gum Mapping and Monitoring Plan (Defence)
- Cooper Park Management Plan (Woollahra Council)

- SWC Carrier Flora and Fauna Assessment and Management Plan (Water Infrastructure Group)
- Sydney South West Property Environmental and Vegetation Management Plans (Sydney Water)
- Hawkesbury Roadside Vegetation Management Plan (Hawkesbury Council)
- Flying Fox Plan of Management – Parramatta Park (Parramatta Park Trust)
- *Acacia terminalis* Plan of Management – North Head Sewerage Treatment Plant (Sydney Water)
- North Head Sewage Treatment Plant Fire Management Plan (Sydney Water)

Vegetation Community Mapping

- Kapooka Box-Gum Mapping and Monitoring Plan (Defence)
- Wetland Vegetation Surveys for LiDAR, Lowbidgee and Gwydir wetlands (DECC)
- Molonglo River Vegetation and Habitat Survey and Mapping (ACT Planning)

Ecological Monitoring

- Drayton Coal Mine Monitoring (Anglo Coal (Drayton Management))
- Bindoon Defence Training Area Annual Monitoring (Defence) (WA)
- Mulgara Trapping, Translocation and Monitoring (Samsung/Roy Hill) (WA)
- Garden Island Weed Monitoring Survey and Assessment (Defence) (WA)
- Lancelin Defence Training Area Rapid Vegetation Monitoring (Defence) (WA)
- Tropicana Gold Mine Vegetation Monitoring (AngloGold Ashanti Australia) (WA)
- Bungaribee *Themeda australis* Relocation Monitoring (Landcom)
- Werris Creek Biodiversity Offset Area Annual Monitoring (Werris Creek Coal)
- Liddell Colliery Flora and Fauna Monitoring (Liddell Coal Operations)
- Kapooka Kangaroo Impact Monitoring (Defence)
- Latchford Barracks Kangaroo Impact Monitoring (Defence)
- Microbat Monitoring, Warringah Mall (AMPCI)
- Metropolitan Colliery Vegetation Monitoring (Metropolitan Colliery)

Ecological Reviews

- Review of Dunheved Rail Corridor Ecological Assessment and Advice (Lend Lease)
- EPBC Conservation Advice (DEWHA)
- Review of Threatened Species Recovery Plans (DECC)
- Review of DA documents (Ku-ring-gai Council)

Statistical Analyses

- Vegetation Community Assessment (PATN analysis), Neerabup Industrial Area (Landcorp) (WA)
- Historical Impacts of Linear Infrastructure on Sheetflow-dependent Vegetation Associations (API) (WA)
- Habitat Modelling for Flora and Fauna species in the Gold Coast region (Gold Coast Council)
- Rufous Scrub-bird Monitoring Assessment (DECC)
- Habitat Modelling Pilot for Flora and Fauna Species: Swan Coastal Plain and Jarrah Forest IBRAs (WA DEC)
- Far South Coast Fire Assessment: Effects of Fire on Vegetation Composition (DECC)

Training/Education

- Biodiversity Awareness Training Course (DECC)
- Part 5 Training Course (Rockdale Council)

Other

- Ecological Character Description for the Paroo River Wetlands Ramsar Site (DEWHA)
- Information sheet for the Menindee Lakes System (Australian Floodplain Association)
- Flora assessment at Pinaroo Lake in north-western New South Wales (DEHWA)

Biodiversity Survey Experience

Enhua has conducted surveys in a range of ecosystems, including semi-arid woodlands, shrublands and grasslands, temperate woodlands, forests, rainforests, and grasslands, and alpine woodlands across NSW, and

in parts of Victoria (North east region) and WA (Pilbara, Kimberley, and Goldfields-Esperance regions). This experience has exposed her to a diversity of fauna distributed across these ecosystems.

She is familiar with both active and passive survey techniques, including:

- Terrestrial and arboreal Elliott trapping
- Pitfall trapping
- Cage trapping
- Harp trapping
- Funnel trapping
- Active searches (herpetofauna)
- Bird point and transect census
- 'Distance' transect surveys (for population density estimation)
- Call playback
- Remote camera survey
- Anabat detection
- **Call detection**

Scientific Publications

Lee, E., Croft, D. B., and Achiron-Frumkin, T. (2015). 'Roads in the Arid Lands: Issues, Challenges and Potential Solutions'. In: Handbook of Road Ecology. van der Ree, R., Smith, D.J. and Grilo, C (eds.). John Wiley & Sons, Oxford. 552 pp. ISBN: 978-1-118-56818-7.

Dawson, T. J., Webster, K. N., Lee, E. and Buttemer, W. A. (2013). 'High muscle mitochondrial volume and aerobic capacity in a small marsupial (Sminthopsis crassicaudata) reveals flexible links between energy-use levels in mammals.' Journal of Experimental Biology, 216: 1330-1337.

Lee, E., Ramp, D. and Croft, D. B. (2010). 'Flight response as a causative factor in kangaroo-vehicle collisions'. In: Macropods (Eds. G. Coulson and M. Eldridge). Surrey Beattie and Sons, Chipping Norton.

Lee, E. and Croft, D. B. (2009). 'The effects of an arid-zone road on vertebrates: Priorities for management?' In: Too Close for Comfort: Contentious issues in human-wildlife encounters (Eds. D. Lunney, A. Munn and W. Meikle). The Royal Zoological Society of New South Wales, Mosman.

Lee, E., Klöcker, U., Croft, D. B. and Ramp, D. (2004). 'Kangaroo-vehicle collisions in Australia's sheep rangelands, during and following drought periods'. Australian Mammalogy, 26: 215-226

Dawson, T. J., Webster, K. N., Mifsud, B., Raad, E., Lee, E. and Needham, A. D. (2003). 'Functional capacities of marsupial hearts: Size and mitochondrial parameters indicate higher aerobic capacities than generally seen in placental mammals'. Journal of Comparative Physiology – B, 173(7): 583-590

Dr Rodney Armistead – Senior Field Ecologist – threatened fauna

CURRICULUM VITAE

Dr Rodney Armistead

ECOLOGIST

QUALIFICATIONS

- PhD in Conservation Biology from Murdoch University, Perth Western Australia. The impact of Phytophthora Dieback on the Mardo or Yellow Footed Antechinus (*Antechinus flavipes leucogaster*).
- Bachelor of Advanced Science (Honours), Deakin University, Geelong. A phylo-genetic assessment of Swamp Antechinus (*Antechinus minimus*).

Rodney is an ecologist with a Doctor of Philosophy in Conservation Biology with 14 years' experience in environmental research and consulting. Rodney has considerable experience conducting flora, Phytophthora Dieback, terrestrial and aquatic fauna assessments across a variety of desert, alpine, coastal, woodland, tall forests, aquatic and urban habitats in Western Australia, Victoria, Tasmania and New South Wales. He has particular experience in establishing and conducting large broad scale mammals, reptile, frog as well as bird population, biodiversity and presence-absence surveys. He has had the pleasure of surveying such threatened and iconic native fauna species as the Green and Golden Bell Frog, Growling Grass Frog, Spotted Tree Frog, Striped Legless Lizard, Grassland Earless Dragon, Guthega Skink, Grey-headed Flying-foxes, Western and Northern Quoll, Pilliga Mouse, Southern Brown Bandicoots, Brush-tailed Phascogale, Brush-tailed Bettong, Platypus and the Mountain Pygmy Possum.

RELEVANT PROJECT EXPERIENCE

Impact assessments and large scale flora and fauna surveys

New South Wales

- Moxham Quarry, Flora and Fauna Assessment at Moxham Quarry, Northmeade, NSW.
- Bong Bong Road, Flora and Fauna Assessment, West Dapto, NSW
- The Crescent, Flora and Fauna Assessment Helensburgh,
- Bringelly Rd, Flora and Fauna Assessment, Bringelly
- Bingara Gorge, Flora and Fauna Assessment
- Shellharbour wetlands, Flora and Fauna Assessment
- Yennora, Ecological Constraints Assessment
- Calvary, Ecological Constraints Assessment, Victoria Road, Ryde

Western Australia and Christmas Island

- Busselton Flora and Fauna Assessment, Western Australia.
- Pinjarra urban growth Flora and Fauna Assessment, Western Australia.
- Flora and Fauna Assessment at Mount Gibson, Western Australia.
- Pilbara Fauna Assessment, Western Australia. (Fortescue Metals)
- Murchison Flora and Fauna Assessment, Western Australia.
- Great Victoria Desert Flora and Fauna Assessment, Western Australia.
- Spring vegetation surveys in rehabilitated bauxite mine pits.
- Seasonal hydrological changes in areas where bauxite mining and habitat rehabilitation has occurred. (Alcoa World Alumina)
- Stream monitoring in areas where bauxite mining and habitat rehabilitation has occurred. (Alcoa World Alumina)

- Habitat use by small mammals, reptiles and frogs in rehabilitated bauxite mine pits. (Alcoa World Alumina)
- Impact of fibrinol baiting for yellow-crazy ants on Christmas Island's native invertebrates and waterways. (Christmas Island National Parks).

Victoria

- Manor Lakes Flora and Fauna Assessment, Victoria. (Urban Growth Authority)
- Stella Property Flora and Fauna Assessment, Victoria. (Urban Growth Authority)
- Rye Flora and Fauna Assessment, Victoria. (Urban Growth Authority)
- Flinders St, Rye Flora and Fauna Assessment, Victoria. (Department of Education)

Preliminary Flora, Fauna and geomorphic Assessment at Grantville, Victoria. (Melbourne Water)
Rockbank Golden Grass Frog and Golden Sun Moth Surveys, Victoria. (Victorian Urban Growth Authority)

- Port Campbell gas pipeline alignment Flora and Fauna Assessment, Victoria.
- Melbourne/Geelong water pipeline Fauna Assessments, Victoria (Abigroup, Melbourne Water and Barwon Water).

Targeted Species Surveys and Ecological Monitoring

New South Wales

- Migratory shorebirds and Waders at Cronulla and Kurnell.
- Green and Golden Bell Frog Surveys at Cronulla, Kurnell, Enfield, Port Kembla and Sydney Olympic Park.
- Long-nosed Bandicoot, Inner Western Sydney threatened Population
- Guthega Skink Surveys. Perisher
- Pilliga Mouse surveys in the Pilliga State Forest
- Spot-tail Tiger Quoll surveys in Pilliga State Forest
- New Holland Mouse Surveys in the Pilliga State Forest
- Spot-tail Quoll, Eastern Pygmy Possum, Southern Brown Bandicoot, Giant Burrowing Frog and Broad Headed Snake surveys at Coalcliff
- Grey-headed Flying-fox camp static and fly-out population assessments at Kareela, Cannes, Parramatta River, Burnt Bridge Creek (Manly) and Wolli Creek Camps
- Grey-headed Flying-fox - preparation of management plans for Kareela, Cannes, Parramatta River, Burnt Bridge Creek (Manly) and Wolli Creek Camps
- Grey-headed Flying-fox – assistance and guidance with the preparation of the dispersal plan for the Kareela GHFF camp
- Grey-headed Flying-fox – Vegetation Management Plan for the Centennial Park Flying-fox Camp
- Microchiropteran bat harp-net live capture at Lake Keepit and a Kellyville culvert
- Microchiropteran bat anabat recording and data interpretation at Sydney, Wollongong, Lake Keepit, Mudgee and Newcastle

Western Australia

- Dibbler surveys on Boulanger and Whitlock Islands (University of Western Australia)
- Woylies or Brush-tail Bettong surveys in the southern Jarrah Forest and Dryandra Woodlands (Murdoch University)
- Southern Brown Bandicoot and Brush-tail Phascogale surveys in urban Busselton
- Northern Quoll, Pebble-Mound Mouse and Mulgara surveys in the central and southern parts of the Pilbara (Fortescue Metals and BHP)
- Mulgara, Sandhill Dunnart, Long-tailed Dunnart and Marsupial Mole surveys in the Great Victoria Desert (ecologia, Western Australia Museum and Department of Environment and Sustainability (DSE))

Victoria

- The distribution of Swamp Antechinus in the eastern Otway Ranges. (Deakin University)
- The distribution of Swamp Antechinus on Greater Glennie Island, Bass Strait (Deakin University)
- The distribution of New Holland Mouse at Anglesea and Wilson's Promontory
- The distribution and status of Mountain Pygmy-possums on Mount Buller, Mount Hotham and Bogong High Plains. (Parks Victoria).
- Spotted Tree Frog surveys in north-eastern Victoria (Parks Victoria).
- Platypus surveys in Melbourne's urban Melbourne's urban waterways (Melbourne Water)
- Modified gill net platypus surveys in the Wimmera region. (Project Platypus and Wimmera Catchment Management Authority)
- Platypus surveys in the Mackenzie River, Grampians National Park. (Wimmera Catchment Management Authority)
- Growling Grass Frog surveys in the urban growth areas of Werribee, Cranbourne and outer Melbourne.
- Plains Wanderer surveys in the urban growth areas of Werribee.
- Golden Sun Moth surveys in the urban growth areas of Werribee, Cranbourne and outer Melbourne.
- Micro-bat anabat recording surveys in the urban growth areas of Werribee, Cranbourne and outer Melbourne

- Striped Legless Lizard surveys in the urban growth areas of Melbourne.
- Grassland Earless Dragon surveys in the urban growth areas of Werribee
- Dwarf Galaxias surveys in urban waterways of the Mornington Peninsula, Melbourne.
- Dwarf Galaxias relocation surveys in urban waterways of the Mornington Peninsula, Melbourne.
- Broad Toothed Rat surveys in areas impacted by the Black Saturday Fires
- The distribution of Shearwater and Little Penguin nests and reproductive success on Phillip Island (Phillip Island National Park)

Publications

Western Australia

- Dunstan, W. A., Rudman, T. Shearer, B. L., Moore, N. A., Paap, T., Calver, M. C., Armistead, R. Dobrowolski, M. P., Morrison, B., Howard, K., O'Gara, E., Crane, C., Dell, B., O'Brien, P., McComb, J. A., and Hardy, G. E. St J. (2008) Research into natural and induced resistance in Australian native vegetation of Phytophthora cinnamomi and innovative methods to contain and/or eradicate within localised incursions in areas of high biodiversity in Australia. Eradication of *Phytophthora cinnamomi* from spot infections in native plant communities in Western Australia and Tasmania. Prepared by the Centre for Phytophthora Science and Management for the Australia Government Department of the Environement, Water, Heritage and the Arts.

Victoria

- Cahill, D. M., Wilson, B. A., and Armistead, R. J. (2001). Dieback assessment at Fairhaven Ridge, Ganghook – Lorne State Park, Victoria. A report to Parks Victoria.
- Cahill, D. M, Wilson, B. A., and Armistead, R. J. (2001). Assessment of *Phytophthora cinnamomi* (cinnamon fungus) at Coalmine Road, Anglesea Alcoa lease, Victoria. As report for Alcoa World Alumina, Anglesea.
- Cahill, D. M., Wilson, B. A., and Armistead, R. J. (2001). Assessment of Phytophthora dieback, *Phytophthora cinnamomi* in the Otway National Park, Victoria. A report for Parks Victoria for the Great Ocean Walk.
- The distribution of platypus in waterways in greater Melbourne: spring 2008 and autumn 2009 survey results. A report prepared by Dr. R. Armistead and Dr. A Weeks for Melbourne Water (2009).
- The distribution of platypus in waterways in greater Melbourne: spring 2009 and autumn 2010 survey results. A report prepared by Dr. R. Armistead and Dr. A Weeks for Melbourne Water (2009).
- The distribution of platypus in waterways in the McKenzie River, Grampians National Park 2008 and 2009 survey results. A report prepared by Dr. R. Armistead and Dr. A Weeks for Wimmera Catchment Management Authority (2009).
- The Mount Hotham Mountain Pygmy Possum Recovery Plan (Biosis Research, Mount Buller and Mount Stirling Alpine Resort Management Board and Parks Victoria)

New South Wales

- Eco Logical Australia (2012). Cannes Reserve, Avalon – Grey-headed Flying-fox camp Management and Species Impact Statement. A report to Pittwater Council
- Eco Logical Australia (2013). Kareela Grey-headed Flying-fox camp management plan. A report to Sutherland Shire City Council
- Eco Logical Australia (2013). Parramatta River Grey-headed Flying-fox camp management plan. A report to NPC Consultants
- Eco Logical Australia (2015). Wolli Creek - Grey-headed Flying-fox camp management plan. A report to Rockdale City Council
- Eco Logical Australia (2015). Burnt Bridge Creek - Grey-headed Flying-fox camp management plan. A report to Manly City Council

Memberships

- Australasian Bat Society.
- Foundation for Australia's Most Endangered Species Ltd

Belinda Failes – Field Ecologist – Vegetation mapping and biometric plots

CURRICULUM VITAE

Belinda Failes

ECOLOGIST

QUALIFICATIONS

- Master of Wildlife Management (Macquarie University)
- Bachelor of Environmental Science, (University of Newcastle)
- Senior First Aid Certificate
- OHS Construction Induction Certificate – White Card
- Rail Industry Safety Induction (RISI) Card
- Working at heights
- Tree Rescue training
- Basic Tree Climbing training

Belinda has been working as an ecologist with Eco Logical Australia since 2011, and has been involved in the monitoring of, and preparation of reports for, threatened flora and endangered ecological communities, as well as the preparation of Vegetation Management Plans (VMP), Part 3A and Section 5A Assessments under the EP&A Act, Local Environment Studies, and Species Impact Statements (SIS).

Belinda has built on the skills she learned while studying a Master of Wildlife Management at Macquarie University through on-going professional development, and is skilled in both flora and fauna identification.

RELEVANT PROJECT EXPERIENCE

Biobanking and BioCertification

- Mount Gilead rezoning Biocertification
- Teralba Quarry Biobanking
- Ingleside rezoning Biocertification

Flora and Fauna Impact Assessments

- Bunya, Doonside, flora and fauna field work
- National Broadband Network ISEPP and DA approvals
- ITS for Sydney Water REF
- Water Infrastructure Group REF
- Jet Strike Fighters EIS - ecological impacts literature review
- Bunya, Doonside Themeda - relocation monitoring project (field work)
- South West Growth Centres - translocation of Cumberland Plain Land Snail
- North West Rail Link - ecological assessment (field work)
- Moxham Quarry, Northmead, impact assessment
- Schofield Road, Alex Avenue Precinct - impact assessment
- North Narrabeen Dunes, NSW - impact assessment
- Curl Curl Off-leash Dog Park Proposal - impact assessment
- Kilcare Rd, Blacktown - impact assessment
- Harbord Diggers - ecological constraints and impact assessment
- Metropolitan Colliery Vegetation Monitoring (field work)
- Hamlyn Terrace – ecological constraints and impact assessment

- Greta Freight Train Upgrade, Greta - pre-clearance surveys
- Withers Rd, Kellyville, impact assessment
- Schofields Defence Housing Association
- Wolgan Valley Road – Cranbrook School
- St Leonards Plaza
- Jemena gas pipeline
- Woolahra Biodiversity Management Plan – field work

Vegetation Management Plans
- Bunya, Doonside Landscaping DA
- Richmond Road Upgrade, Marsden Park, RMS
- The Hills Shire Council Weed Management Plan
- Hills M2 Corridor Weed Management Plan
- Edmondson Park Development
- Schofields Defence Housing Association
- Glenfield Stage 3
- Campbelltown Comprehensive Koala Plan of Management – field work

Monitoring Field Work
- Moolarben Mine Monitoring – flora and fauna monitoring
- Wivenhoe Bird Monitoring

Relocation
- Bunya Cumberland Plain Land Snail
- South West Growth Centres - translocation of Cumberland Plain Land Snail

Pre-clearance Surveys
- Hamlyn Terrace
- Greta Freight Train Upgrade, Greta
- Tomago industrial development
- M5 surreys

Constraints Assessment
- Menangle Park Wastewater
- Harbord Diggers
- Wolgan Valley Road – Cranbrook School

Joanne Daly - Mapping and area calculations (on secondment to Illawarra Local Land Services

CURRICULUM VITAE

Joanne Daly

GIS OFFICER AND ENVIRONMENTAL SCIENTIST

QUALIFICATIONS

- Bachelor of Environmental Science (Honours)
- Attended the BioBanking Assessor Accreditation training Course, TAFE NSW and DECCW

Joanne joined the Eco Logical Australia team full-time in September 2008 after completing a Bachelor of Environmental Science (Honours) at the University of Wollongong. Jo has worked on mapping wetlands in the Namoi catchment, refining the Mitchell Landscapes data layer and other projects that have required GIS for analysis and mapping.

Jo has a multidisciplinary background with focuses in GIS and geomorphology. She has a range of GIS skills including: map production; vectorisation; and digitizing. She is also able to utilize GIS to determine the inputs for the BioBanking Credit Calculator for a BioBanking Assessment.

RELEVANT PROJECT EXPERIENCE

GIS Editing and Analysis:

- Natural Asset Management for Urban Waterways Baulkham Hills Shire Council
- Namoi CMA Wetland mapping Namoi Catchment Management Authority
- Liverpool Plains Biodiversity Strategy
- Mainland Islands Conservation Status Prioritisation
- Hunter Councils API Vectorisation
- Regionally Significant Riparian Corridors Assessment
- Species Habitat Modelling for Gold Coast City Council
- Strathfield Local Environmental Plan and Zoning Update
- Sydney Metro CMA Land Use Mapping
- Whitehaven Regional Biodiversity Offset

BioBanking Assessments and Biodiversity Offset Calculations:

- Strategic Biodiversity Offsets Overview for Cockatoo Coal Ltd
- Brownlow Hill Biobank Site
- Darkinjung Land Council Biobank Agreement Assessment
- Liddell Colliery Expansion

Plans of Management and Masterplans:

- Queanbeyan River Corridor Plan of Management
- Wongawallan Management Plan
- Bonogin Conservation Reserves Management Plan
- Bidjigal Reserve Plan of Management
- Middle Creek Management Plan
- Dunbar Park Plan of Management

Dr Deanne Hickey - Mapping and area calculations

CURRICULUM VITAE

Deanne Hickey

GIS ANALYST

QUALIFICATIONS

- Bachelor Science (Marine Science Honours 1) University of Sydney
- Master of Science (Research) Inundation modelling of coastal wetland communities to identify coastal wetland communities vulnerable to predicted sea level rise
- PhD Candidate (current) Benefits of a Bayesian approach to land use modelling

Deanne is a GIS Analyst with experience in landscape mapping, spatial modelling, multi-criteria analysis, high quality map production, spatial data collection and quantitative analysis. Deanne is experienced using big data for spatial analysis and is competent across various platforms.

Deanne is based in the Sutherland Office and works on a variety of projects from Biobanking, restoration ecology, bushfire, planning and ecology disciplines. Previously she has worked in an academic environment, most recently at the University of Sydney on a Rural Industry Research and Development Corporation (RIRDC) funded project. This research project investigated spatial trends emerging from the aggregation and subdivision of rural land holdings across Australia.

RELEVANT PROJECT EXPERIENCE

Aboriginal and Cultural Heritage
Boundary Road Aboriginal Archaeological Due Diligence Assessment
Camden Lakeside and Gledswood Aboriginal Archaeological Assessment
Raby Road Leppington Heritage Impact Statement

Arborist Assessment
West Connex Arborist Assessment
Heathcote Station Arborist Assessment
Penrith Station Arborist Assessment

Biobanking and Biocertification Assessment
Sapphire Windfarm Biodiversity Offset Strategy
Windermere Biobank Assessment
Rockview South Biobank Assessment
White Rock Wind Farm Offset Package and Biobank Assessment
Mt Gilead Stage 1 Biocertification Assessment
Governors Hill Biocertification Assessment

Bushfire
FNAP Bushfire Attack Level (BAL) Identification (Newcastle to Nowra)
Jordon Springs Stage 1 BAL certificates
Box Hill Stage 1, 2 & 3 BAL mapping and BAL certificates
Willowdale Bushfire Emergency and Evacuation Plan
ANSTO Preliminary Design Advice – Bushfire Constraints

Oran Park Bushfire Prone Land Mapping Update
Catherine Park Bushfire Prone Land Mapping Update
Woorong Park Bushfire Protection Assessment

Ecological Assessment
Boundary Road Review of Environmental Factors
Blacktown Workers Club Flora and Fauna Assessment
West Belconnen Project – Heath Goanna Habitat Assessment
Parramatta North Urban Transformation – Ecological Assessment
Scarborough Ponds Review of Environmental Factors
West Dapto Flora and Fauna Assessment

Planning and Assessment
Sutherland to Cronulla Active Transport Link
Sydney Drinking Water Catchment Audit
Eurobodalla Flying-fox Management Plan
Wolli Creek GHFF Management Plan

Restoration Ecology
Riley's Creek Riparian Corridor Vegetation Management Plan
Environmental Management, Avon Road, Pymble
Alex Ave, Schofields Vegetation Management Plan
M2 Vegetation Management Plan Update
El Caballo Golf Course Vegetation Management Plan Implementation
Little Bay Wetland Regeneration and Weed Control

Appendix B: Planning proposal application

Provided on following page

Appendix C: Response to submissions report

Provided as Attachment 3 to Council Report

Mt Gilead Planning Proposal

January 2015

Campbelltown City Council

Figures

Tables

Appendices

N Noise Assessment
Wilkinson Murray

O Air Quality Assessment
Wilkinson Murray

P Stormwater Management and Flooding Assessment
Worley Parsons

Q Infrastructure Services Report
Worley Parsons

R Water and Wastewater Servicing Straetgy
Worley Parsons

S Social and Economic Needs/ Impact Assessment
MacroPlan Dimasi

T Agricultural Investigation
AgEconPlus Consulting

U Draft Infrastructure Services Delivery Strategy

1.0 Introduction

1.1 Background

A planning proposal was submitted to Campbelltown City Council (CCC) by Mt Gilead Pty Ltd and S & A Dzwonnik (the landowners) requesting that the land described as Part Lot 1 and Part Lot 2 in DP 807555, and Lots 59 and 61 in DP 752042 at Appin Road, Mt Gilead (the site) be rezoned to predominantly residential land. The proposal accords with NSW government strategic objectives for the release of greenfield land in the Sydney Metropolitan Region for residential development. By logically extending the urban footprint of Campbelltown for future residential development the proposal seeks to enhance and expand housing choice and supply close to the Campbelltown-Macarthur Regional Centre.

This proposal follows CCC"s endorsement on 3 July 2012 of a preliminary planning proposal for the site and the subsequent Gateway Determination made by the Director-General of the then Department of Planning and Infrastructure on 7 September 2012 to proceed with a planning proposal subject to conditions (see Gateway Determination at **Appendix A** which includes the Alteration of Gateway Determination to extend the date for completion of the planning proposal until 7 September 2015).

Please note that at the time that the original planning proposal was submitted to Council it was anticipated that the proposed rezoning of the subject land would be effected through an amendment to *Campbelltown (Urban Area) Local Environmental Plan 2002* (CLEP 2002). However, as Council is now in the process of replacing CLEP 2002 with *Campbelltown Local Environmental Plan 2014* (CLEP 2014), this planning proposal has been prepared as an amendment to CLEP 2014.

In his determination, the then Director-General required detailed investigation of a range of issues in support of the rezoning process as well as consultation with various public authorities. In response to the Gateway Determination and CCC"s requirements for additional technical studies, the landowners, in consultation with CCC, commissioned a team of expert consultants to prepare detailed assessments of the following planning issues:

- flora and fauna;
- conservation of ecological and riparian corridors
- Aboriginal heritage;
- non-indigenous heritage;
- bushfire risk;
- traffic, transport and access;
- noise;
- air quality;
- contamination;
- geotechnical conditions and mine subsidence;
- infrastructure, stormwater and sewer services;
- visual impact;
- agricultural land impacts;
- economic impacts; and
- social impacts.

This final planning proposal addresses these issues and also establishes the key development standards and planning controls for the Mt Gilead land to inform the proposed local environmental plan amendment.

In addition, an indicative structure plan and site-specific development controls have been prepared for the land to supplement controls in *Campbelltown (Sustainable City) Development Control Plan 2014*. Draft voluntary planning agreements for the delivery of local and regional infrastructure (respectively) will be publicly exhibited in due course.

This planning proposal has been prepared in accordance with section 55 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the guidelines prepared by the Department of Planning and Infrastructure titled "*A guide to preparing planning proposals*", dated October 2012.

1.2 The Need for the Planning Proposal

The land the subject of this planning proposal has been identified for some time on the former Metropolitan Development Program (MDP) as future greenfield release land. By providing new land use zoning and key development standards for the site, the planning proposal facilitates the strategic outcomes of the MDP and, more currently, the draft *Metropolitan Strategy for Sydney 2031, a Plan for Growing Sydney* and State government policies in relation to housing supply. Furthermore, the planning proposal is consistent with regional, sub-regional and local strategic planning objectives and outcomes (as discussed in **Section 2.0**).

The MDP had set the minimum development yield of the Mt Gilead site at 1500 lots. However, the studies detailed in this planning proposal show that the land and the surrounding road network are capable of accommodating and supporting up to 1700 dwellings. This development yield will incorporate a range of lot sizes (375 square metres to 1000 square metres) with an average area of 600 square metres so providing a variety of housing types to facilitate choice in the Campbelltown local government area (LGA).

By extending the established urban footprint of Campbelltown, the site will not sit as an unconnected, stand-alone residential development. Rather, it expands the existing residential land to the immediate north and will utilise any excess capacity in existing community infrastructure and services such as schools, recreation facilities, shops and the like.

The planning proposal is required to facilitate the above outcomes as the land is currently not zoned for the proposed residential development. The planning proposal seeks to zone the majority of the site to Residential R2 (approximately 149ha), along with smaller areas for open space (approximately 31ha) (including riparian corridors and provision of a sports field), and roads, in accordance with the Standard Instrument – Principal Local Environmental Plan and consistent with draft CLEP 2014. In addition, a small area is intended to be zoned as a neighbourhood centre in order to facilitate the future delivery of a community centre, and approximately 29ha will remain as rural land.

1.3 Council and Stakeholder Involvement

A joint Landowner-Council Working Group was established to advance and oversight the preparation of the planning proposal.

The public will have an opportunity to comment on the proposal during the public notification period.

In accordance with the Gateway Determination, consultation with public authorities under section 56(2)(d) of the EP&A Act will be undertaken by CCC during the exhibition of the planning proposal. Notwithstanding this, the landowners and/or CCC have consulted with the following entities to inform the preparation of the planning proposal:

- Roads and Maritime Services – in relation to traffic and road infrastructure;
- Transport for NSW – in relation to traffic, roads and public transport;
- NSW Office of Water – in relation to drainage and riparian corridors;
- Heritage Office – in relation to non-indigenous heritage (Mt Gilead Homestead and surrounds);
- Aboriginal Groups including Cubbitch Barta and Tharawal Local Aboriginal Land Council – in relation to Aboriginal heritage;
- Rural Fire Service – in relation to bushfire risk management;
- Sydney Water – in relation to water and sewer infrastructure;
- Endeavour Energy – in relation to electricity supply and infrastructure;
- Jemena – in relation to gas supply.

The outcomes of the above consultation are reflected, where relevant, in the appended specialist assessments and in **Section 5.0**.

2.0 Strategic Planning Context

The Mt Gilead site is included broadly and specifically in relevant State, regional and local strategic planning documents, and has been identified as contributing to the Government housing targets for the Sydney metropolitan area. The relevant strategic planning framework is discussed below.

2.1 New South Wales 2021: A Plan to Make NSW Number One

NSW 2021: A Plan to Make NSW Number One is a long-term plan to deliver services in NSW, which sets clear priorities to guide government decision-making and resource allocation.

NSW 2021 is based around five strategies to rebuild the economy, provide quality services, renovate infrastructure, restore government accountability, and strengthen our local environment and communities. The rezoning of the site for residential uses would be consistent with the strategy in that it could contribute to the aim of improving housing affordability and availability, and assist in facilitating the goal of delivering 25,000 new dwellings per year.

2.2 Metropolitan Strategy

2.2.1 Metropolitan Plan for Sydney 2036

The *Metropolitan Plan for Sydney 2036* aims to provide an integrated planning framework to manage Sydney's growth to 2036. Since its release in December 2010, the strategy has been reviewed and a draft *Metropolitan Strategy for Sydney to 2031* has been released. This draft strategy establishes the most up-to-date strategic framework for Sydney, and is addressed further below.

2.2.2 Draft Metropolitan Strategy for Sydney to 2031

The draft *Metropolitan Strategy for Sydney 2031* was publicly exhibited until 31 May 2013 and was the new strategic plan to guide Sydney"s growth, superseding the 2036 Plan. The draft strategy sets the framework for Sydney"s growth and prosperity to 2031 and beyond. It has a strong focus on boosting housing and jobs growth, and includes targets and actions to facilitate investment and growth in NSW.

The draft 2031 strategy anticipates that Sydney"s population will grow by 1.3 million people by 2031 taking the population to 5.6 million. Notably the number of people over 65 will be double that at present, and there will be more than one million people under 15 years of age. Relevantly, Greater Western Sydney will be home to more than half of Sydney"s population.

To drive sustainable growth, the draft strategy is built around five key outcomes for Sydney including balanced growth; a liveable city; productivity and prosperity; a healthy and resilient environment; and accessibility and connectivity. The draft strategy sets employment and housing targets across six subregions and new housing is encouraged in areas close to existing and planned infrastructure in both infill and greenfield sites.

The Campbelltown LGA, in which Mt Gilead is situated, is classified as part of the South West Subregion and Campbelltown–Macarthur is a major centre under this plan servicing the South West Subregion.

Table 1 lists a number of targets contained in the Draft Strategy and relevant to this proposal.

Table 1 – Draft Metropolitan Strategy South West Sydney targets

Area	Current	Target to 2021	Target to 2031
Population	829,000	1,048,000 (218,000)	1,298,000 (469,000)
Housing	286,000	346,000 60,000)	427,000 (141,000)
Employment	298,000	362,000 (64,000)	432,000 (134,000)

*Brackets denote the increase from existing numbers

More specifically, the Campbelltown-Macarthur Major Centre will continue as the regional focus for office, retail, entertainment, cultural, public administration and services developments, and is projected to provide capacity for at least an additional 10,000 jobs until 2031.

The planning proposal is consistent with, and directly supports, the strategic objectives of the draft Metropolitan Strategy in relation to boosting housing supply, and indirectly in facilitating jobs growth in the South West Subregion.

2.2.3 Draft South West Subregional Strategy

The draft *South West Subregional Strategy* (SWSS) is applicable to the Campbelltown LGA and sets actions for the subregion to ensure local delivery of the objectives set out within the *Metropolitan Plan for Sydney to 2036*. The proposal is consistent with several of the key directions in the draft SWSS in that:

- it will unlock land for the development of residential dwellings, directly contributing to the growth of housing in the South West subregion;
- it will support the provision of dwellings in the vicinity of new centres identified in the South West subregion such as the Campbelltown centre; and
- it recognises and respects the rural character of the subregion through limiting the extent of the proposed residential zoning.

2.2.4 A Plan for Growing Sydney

The draft *Metropolitan Strategy for Sydney to 2031* has been finalised in the strategy document *A Plan for Growing Sydney* which was released in December 2014. Campbelltown-Macarthur is now recognised in this strategy as one of three Regional City Centres outside of the Sydney and Parramatta Central Business Districts.

To achieve the vision for Sydney to be a strong global city *A Plan for Growing Sydney* has set the following goals:

- a competitive economy with world-class services and transport;
- a city of housing choice with homes that meet our needs and lifestyles;
- a great place to live with communities that are strong, healthy and well connected; and
- a sustainable and resilient city that protects the natural environment and has a balanced approach to the use of land and resources.

It is considered that the proposal is consistent with these goals particularly with regard to assisting in the delivery of new housing to meet the needs of Sydney"s growing population. It is noted that the subject site at Mt Gilead is included in the land defined as the Macarthur South Investigation Area. However, it is assumed that as a Gateway determination has been given for the subject site, it is only included in this investigation area as a component to be considered in the overall assessment proposed to be undertaken for the Macarthur South Area.

2.3 Campbelltown Council Strategic Policies

2.3.1 Campbelltown 2025 – Looking Forward

Campbelltown City Council has adopted *Campbelltown 2025 – Looking Forward*, an overarching planning strategy that sets social, environmental and economic foundations for the growth of the LGA. The document articulates a vision to provide a sustainable city by 2025, and sets out six strategic directions which include desired outcomes and focus areas that will need to be considered in future development within Campbelltown. The proposal"s consistency with these strategic directions is explored below.

Growing the Regional City

This focus area sets out a vision to ensure a sustainable future for Campbelltown city as a strong regional centre with regional facilities and employment opportunities. By supplying a range of residential lots, on average 600 square metres in area, development of the Mt Gilead site can make Campbelltown more attractive for people seeking employment in the area, so encouraging growth and investment in new enterprises and infrastructure.

Building a Distinctive Campbelltown Sense of Place
Campbelltown is to grow into a place that is distinctive in terms of natural and built environment, offering residents a relaxed, safe and scenic environment. The proposal at Mt Gilead will facilitate a community that will have high civic pride with a built form that responds and capitalises on the site"s natural landscape features. The future community should contain an ambience of growth, prosperity and contemporary style.

Getting Around the City
The development of the city is to be planned and integrated around transport needs. Future planning is to increase opportunities for accessibility and reduce the need for private cars with increased use of existing public transportation within the city. Mt Gilead will be linked by bus to Campbelltown City Centre, ensuring that accessibility is created to an existing activity node.

Building and Maintaining Quality Infrastructure
New development is to satisfy its own infrastructure requirements by means of direct provision on site or contributing proportionately to the broader infrastructure upgrades by Council. The site is capable of being serviced to support the incoming community.

Creating Education, Employment and Entrepreneurial Opportunities
The city"s vision is to retain and create jobs to grow the supply of skilled and adaptable workers within the city. By catering for the mid to upper end of the housing market, Mt Gilead can facilitate the city"s growth in professional and business jobs.

2.3.2 Campbelltown Local Planning Strategy

The *Campbelltown Local Planning Strategy* (CLPS) is a background document which informed the preparation of the draft *Campbelltown Local Environmental Plan 2014*. The aim of the CLPS is to provide a strategic land use planning direction to deliver the strategic vision documented in *Campbelltown 2025 - Looking Forward*. It also acknowledges the growth targets within the draft *South West Subregional Strategy* (SWSS) and establishes a basis for achieving those targets.

Specifically it refers to the potential of the Mt Gilead site as an area that could be developed to assist in meeting the 4,700 „greenfield" dwelling target nominated in the draft SWSS for the Campbelltown LGA.

2.3.3 Campbelltown Residential Development Strategy

The *Campbelltown Residential Development Strategy* (CRDS) seeks to identify dwelling opportunities to address the projected population growth of the Campbelltown LGA, and has thus provided valuable input into the preparation of the CLPS. The CRDS seeks to manage the anticipated future residential growth required for the Campbelltown LGA through the forms of both „infill" and „greenfield" development. It further notes that the Mt Gilead site could provide a potential yield of 1,500 dwellings.

2.4 Residential Land Supply

Metropolitan Development Program

The *Metropolitan Development Program* (MDP) was a key NSW Government program to maintain housing supply in the Sydney metropolitan region, and its main function was to manage land supply to meet new housing needs from urban renewal and greenfield sites in Sydney. The program rolled forward annually and included assessing future land supply to meet housing needs, and maintaining housing and land supply databases. The MDP identified the Mt Gilead site as greenfield release land that was yet to be zoned.

Currently, monitoring of supply of new home sites to accommodate Sydney"s growing population is reported via MDP reports which provide up to date information on greenfield land and dwelling supply.

The land at Mt Gilead the subject of this planning proposal is the same as that originally identified for release under the then MDP.

Supply of housing in Campbelltown

The Department of Planning and Environment released updated population projections in June 2014. These projections identified that Greater Sydney requires one million more homes by 2031 to house Sydney"s growing population. The Campbelltown LGA is expected to grow at a rate of 1.8% per annum,

with an increase in population of 64,600 (42.7%) between 2011 and 2031. An additional 24,846 homes will be needed in Campbelltown by 2031 to accommodate the expected population increase[1] (*2014 NSW Population Projections data, Department of Planning and Environment*).

As discussed above, Campbelltown-Macarthur is now a Regional City Centre. It is understood that, accordingly, CCC wishes to stimulate and broaden the area's economic base and range of business opportunities. A limitation in housing choice could limit the attractiveness of the Campbelltown area as a place to live for professional and business people. The proposed range in lot sizes at Mt Gilead could help redress this issue, so contributing to the growth of Campbelltown-Macarthur as a Regional City Centre.

[1] Expected population increase divided by the average Sydney household size.

3.0 Site Description and Context

3.1 Land to be Rezoned

The site subject to this planning proposal is essentially a triangle extending south of Campbelltown"s urban footprint. The western boundary of the site diagonally bisects Lot 1 in DP 807985 ending at the south eastern boundary of Lot 2 in DP 807555. The eastern boundary is Appin Road. The total land area of the site is 210ha.

3.2 Legal Description and Ownership

The site consists of four lots owned by two land owners as shown in **Figure 1.**

- Part Lots 1 and 2 in DP 807555 and Lot 59 DP 752042, owned by Mt Gilead Pty Ltd, a company of the MacArthur Onslow family that has held property around the area since the 1940s.
- Lot 61 DP 752042, owned by S & A Dzwonnik who have held the land since the 1980s.

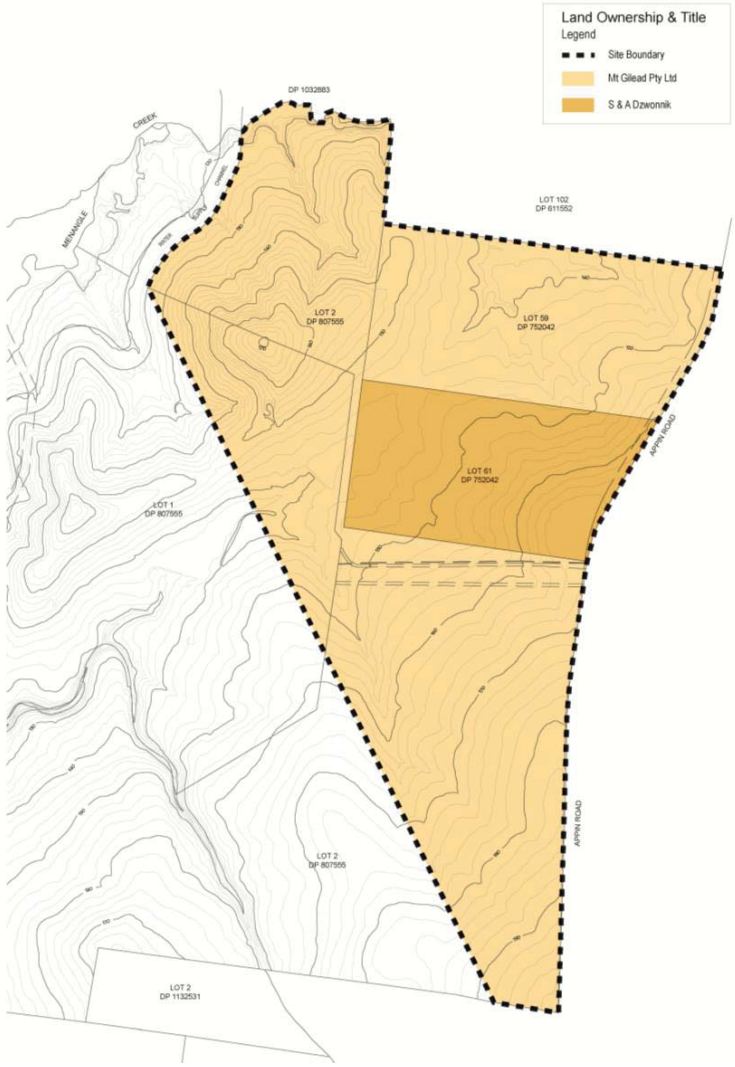

Figure 1 – Land Title and Ownership

Source: Cox Richardson

3.3 Current Zoning

The site is currently zoned No 1 (Non Urban) under the *City of Campbelltown Interim Development Order No 15* (IDO 15) (see **Figure 2**). Under IDO 15, the proposed residential development of the Mt Gilead site is not permissible.

IDO 15 does not permit subdivision in Zone 1 unless a minimum area of 100 hectares can be achieved. It includes several provisions relating to agricultural and rural land uses and seeks to retain large lots for these purposes.

CCC is currently finalising the preparation of draft *Campbelltown Local Environmental Plan (LEP) 2014* (CLEP 2014). While the draft CLEP 2014 covers the majority of the Campbelltown LGA, some areas of land within IDO 15, including the Mt Gilead land release site, are identified as deferred matters within the draft LEP.

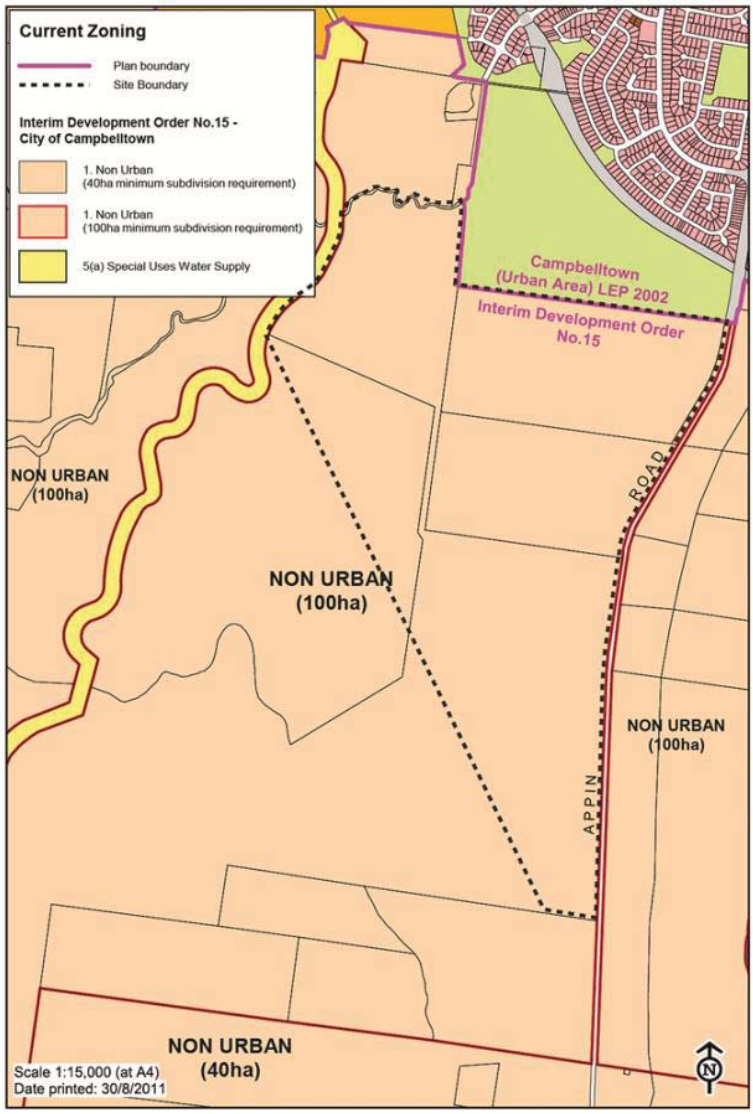

Figure 2 – Map indicating the current zoning of the subject site

3.4 Location and Context

The Mt Gilead site, as defined by the MDP, is located in the Campbelltown LGA approximately 7 kilometres south of the Campbelltown city centre. Mt Gilead covers a total area of approximately 210 hectares, part of which is the long-established Mt Gilead rural property (see **Figure 3**).

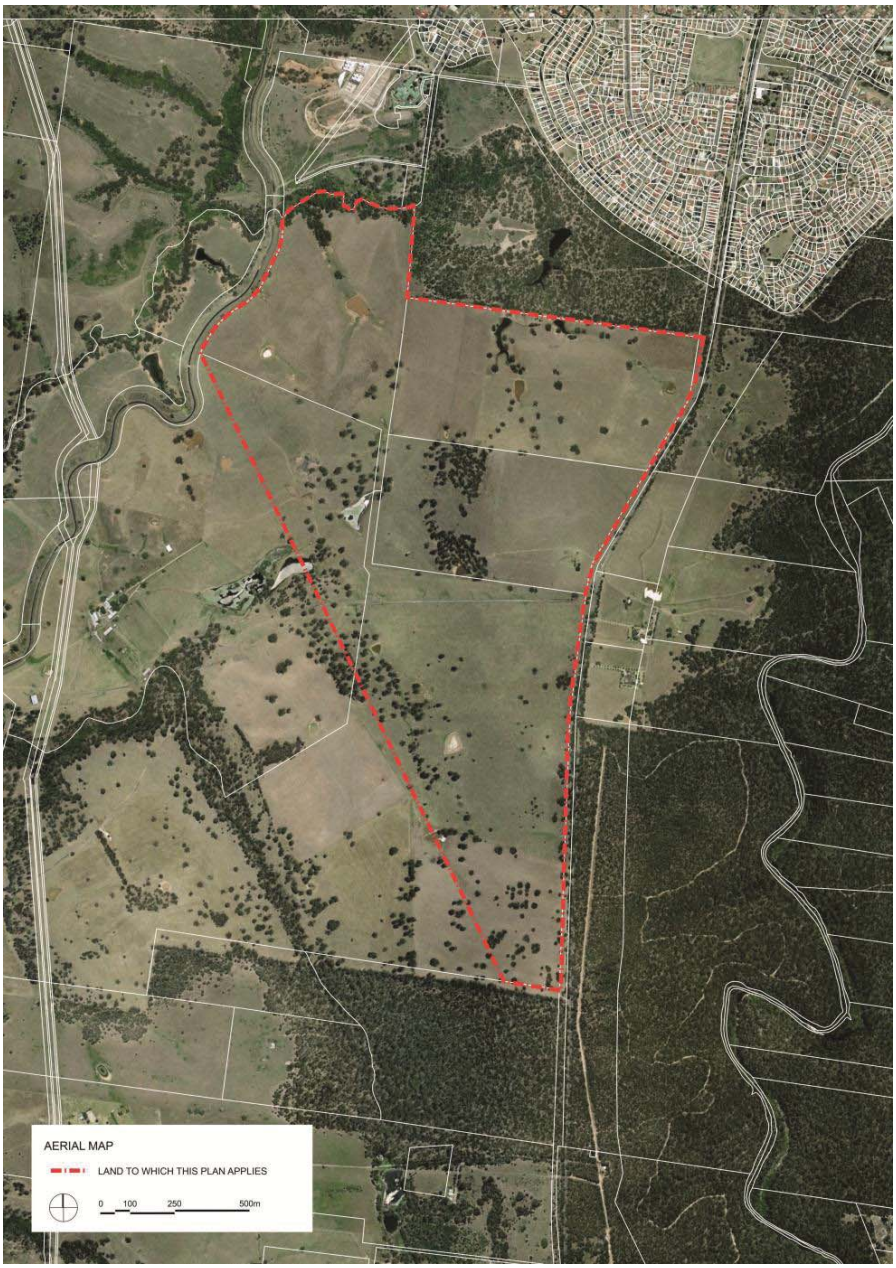

Figure 3 – Aerial photograph of the site

Source: Cox Richardson

The site is immediately bounded by:

- Appin Road to the east;
- Noorumba Reserve and Non-Urban land to the north;
- the Sydney Water Supply Canal (the Upper Canal) in the north west;
- rural land to the west and the associated Mt Gilead Homestead, Old Mill and the Artificial Lake all of which date back to the early construction and use of the Mt Gilead estate; and
- part of the Beulah Biobanking Reserve/ Humewood Forest to the south.

Access to the respective landholdings is from Appin Road.

More broadly, the surrounding locality includes (see **Figure 4** to **Figure 7**):

- the low density residential suburbs of Rosemeadow and St Helens Park (including the Gilead Retirement Village) located around one kilometre to the north;
- the M31 motorway (previously known as the M5) beyond the Mt Gilead Homestead and farm to the west;
- the Nepean River about 2 kilometres to the west of the Mt Gilead Homestead;
- a number of rural land parcels along the eastern side of Appin Road adjoining the Dharawal State Conservation Area located south east of the site;
- the Georges River approximately one kilometre to the east of Appin Road; and
- the Beulah Estate and rural residential land further to the south.

Figures 5 to **7** illustrate the surrounding locality.

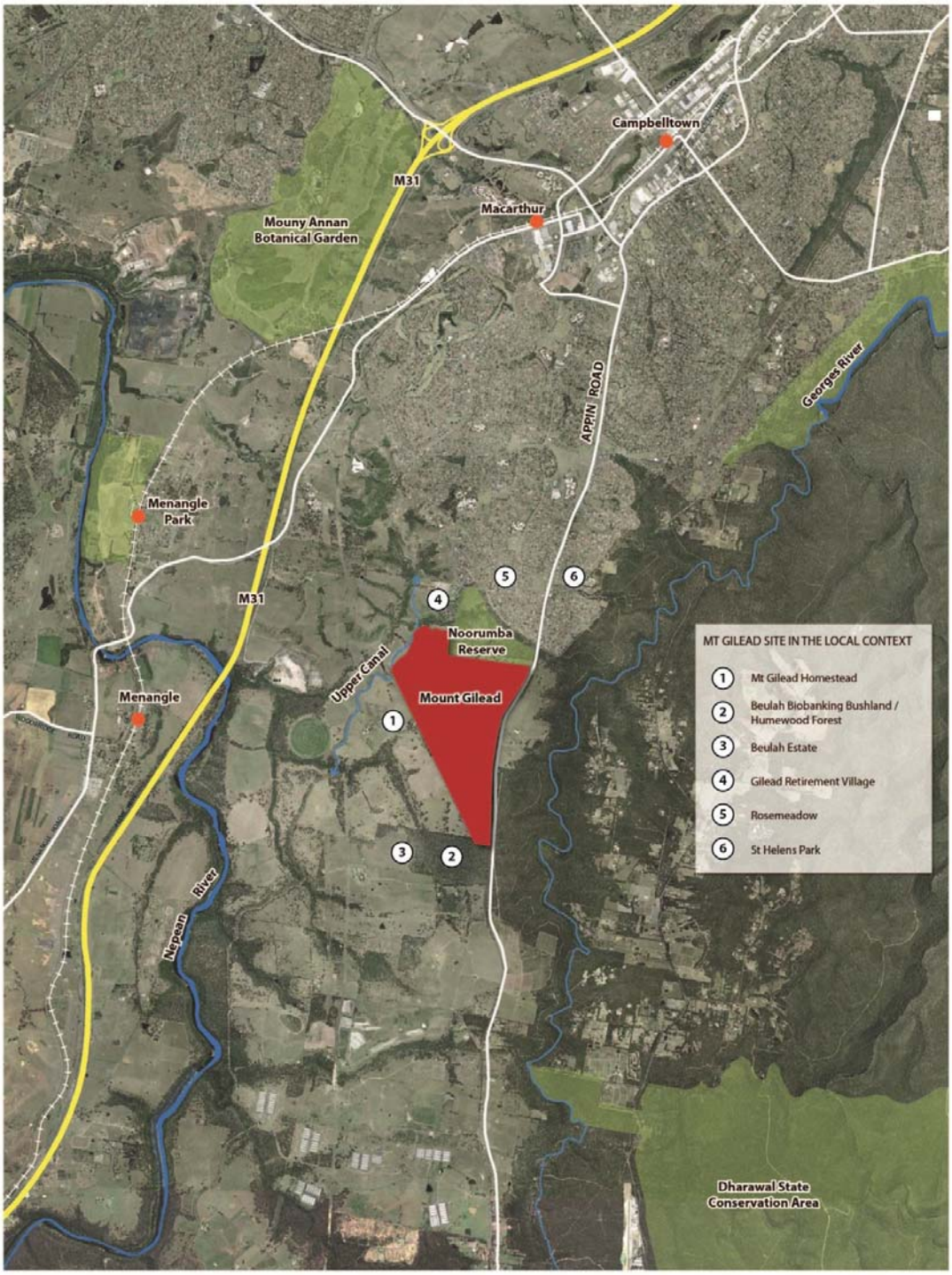

Figure 4 – Site context

Source: Cox Richardson

Figure 5 – Beulah Bio-banking Reserve/Humewood Forest to the south of the site

Figure 6 – The Old Mill with Mt Gilead farm manager"s house in the foreground

Figure 7 – Mt Gilead outbuildings (former coach house)

3.4.1 Relationship to Surrounding Development

The urban areas to the north of the site are predominately residential, forming the southern extent of residential development in Campbelltown. This land is generally categorised by low density, single dwelling development, while the non-urban zoned land to the immediate north and north-west of the site has been developed for seniors living. As the Mt Gilead site is located less than 1km to the south of the above development, the proposed rezoning will provide a logical addition to the residential area.

The Noorumba Reserve which part forms the northern boundary of the site is a significant local natural resource in that it contains Cumberland Plain Woodland including 39 plant species of regional significance.

3.5 Site Characteristics

Located within a semi-urban area, the site has historically been used for agricultural purposes and thus contains cleared paddocks with improved pastures. Pockets of residual vegetation are located along drainage lines and steeper slopes. The site comprises remnant and degraded native vegetation and exotic pastures.

There are no buildings or other improvements on the land, other than a number of farm dams, fencing and a track to the Mt Gilead homestead. The land is currently approximately 95% cleared for grazing and is currently used for cattle production (see **Figures 8 to11)**.

Figure 8 – Pasture land

Figure 9 – Access to the Mt Gilead property from Appin Road

Figure 10 – Looking west at constructed dam towards the middle of the site

Figure 11 – North-west boundary and the highest point of the site looking north-west

3.5.1 Topography and Drainage Corridors

Topographically, the majority of the site is generally undulating and consists of gentle rises, rounded crests and ridges with slopes generally less than 5 degrees (see **Figure 12**). The land generally slopes north-west into a shallow valley at the foot of the ridge line in the north-west. The ridge line has a hill with steeper gradients up to 25 degrees.

There are several surface water features on the site consisting of small farm dams and drainage channels. The major drainage channels are:

- a steep gully to the north-west trending north and a shallow gully to the north-east trending north which form part of the Menangle Creek Catchment; and
- a shallow gully to the south-west trending north-west that forms part of the Woodhouse catchment and eventually flows out to the Nepean River.

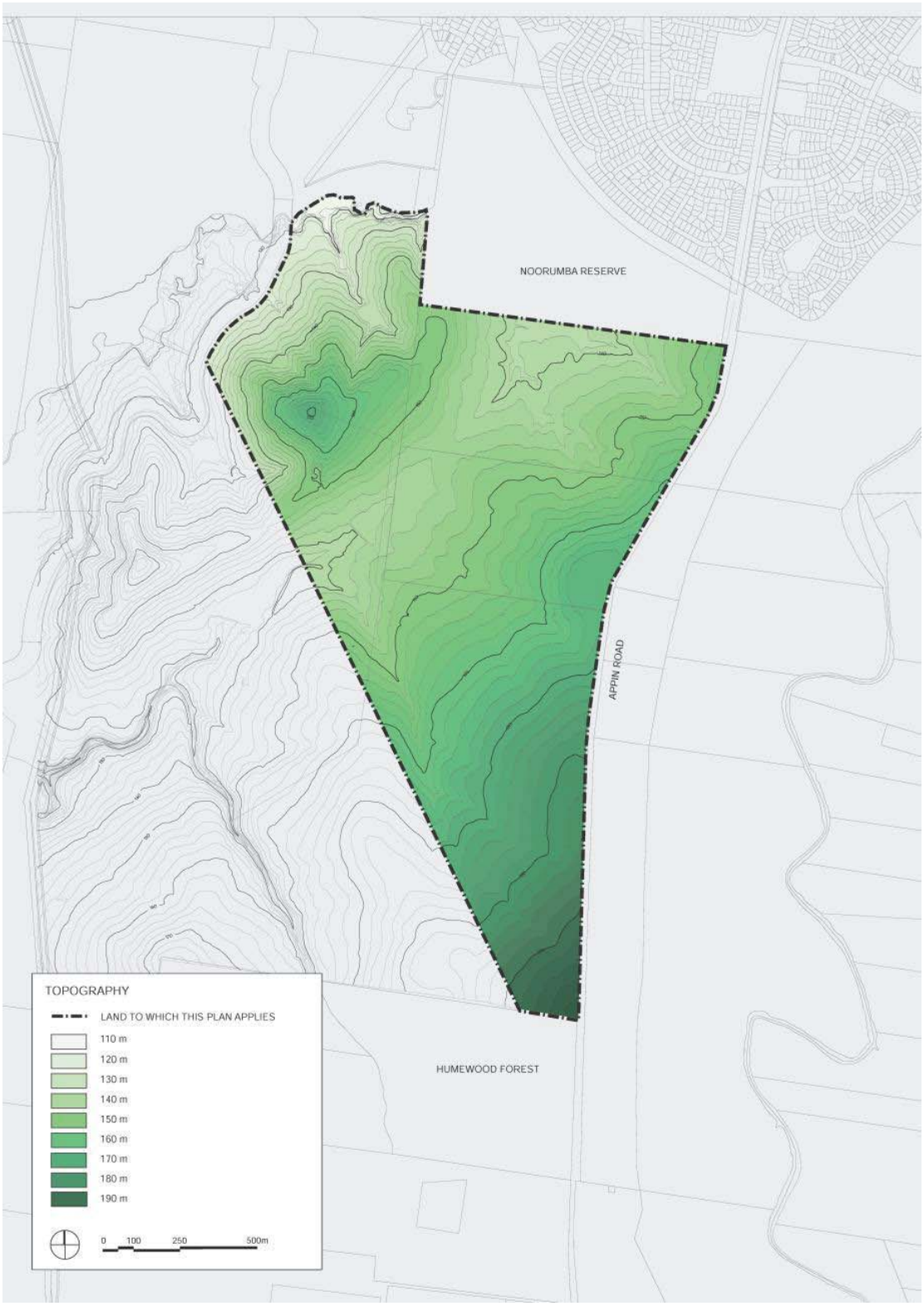

Figure 12 – Topography of the site

Source: Cox Richardson

3.5.2 Flora and Fauna

Essentially agricultural land, the site has a long history of grazing, pasture improvement and weed invasion. Eco Logical Australia has surveyed and described the existing flora and fauna on the site (see Ecological Assessment Report at **Appendix F**).

A total of 154 flora species were identified on the site, comprising 67 native and 87 introduced species; and no threatened flora was recorded during field surveys. The site contains three native vegetation communities:

- Cumberland Plain Woodland – a Critically Endangered Ecological Community under both Commonwealth and NSW legislation, with three localised clumps located along the northern and western borders of the site.
- Shale Sandstone Transition Forest – a Critically Endangered Ecological Community (EEC) under both Commonwealth and NSW legislation, and represented by two pockets in the middle of the site.
- River-flat Eucalypt Forest – listed as an EEC under NSW legislation, and represented by a small patch in the north western corner of the site.

In relation to avifauna, a total of 58 bird species were recorded on the site, including one vulnerable and one migratory species. Few native mammals were identified during field surveys - 13 native bat species including six vulnerable species and a lone wallaby. Domestic livestock graze throughout the site.

These matters are discussed further in **Section 5.1** of this report.

3.5.3 Geology and Soils

The site is underlain by the Triassic Ashfield Shale of the Wianamatta Group deposited over the Hawkesbury Sandstone. In general there are only limited bedrock outcrops across this area, with shale underlying the northern portion of the site and sandstone the southern portion of the site (refer to URS report at **Appendix G**).

The area is covered by Blacktown group soils derived from Wianamatta Shale, ranging from shallow to moderately deep Red Podzolic Soils and Brown Podzolic Soils on crests, upper slopes and well drained areas, to deep Yellow Podzolic Soils and Soloths on the lower slope and in the drainage depressions and areas of poor drainage. Soils derived from Wianamatta Shale will generally exhibit a subsoil profile of moderately reactive high plasticity clay.

The site is considered to present a very low risk of Potential Acid Sulphate Soils (PASS).

In terms of salinity, the local soil types are expected to yield negligible salinity.

3.5.4 Geotechnical Observations

In general, the site was found by URS to have no significant observable geohazards. Although, several areas of potential hazard were identified, in general the overall stability of the site was considered good with only surficial soils instabilities on the steeper northern area and minor rock fall potential localised to the former quarry (URS, **Appendix G**).

3.5.5 Heritage

Non-indigenous Heritage

A number of non-indigenous heritage items are located in close proximity to, or abutting, the site. These are:

- The Sydney Water Supply Upper Canal System, also known as the Upper Canal, forms the north-western boundary of the site. It is listed on the NSW State Heritage Register.
- The Mt Gilead Homestead and surrounding buildings and structures, including the Old Mill are outside of, but in close proximity to, the site to the west. The Homestead group is a local heritage item listed in Campbelltown IDO No 15 and on the Register of the National Trust of Australia (NSW). A small part of the Artificial Lake (dam), which is part of the group, is located on the site.

- The Beulah Estate lies approximately 0.5 to one kilometre to the south of the site. Beulah, a cultural landscape containing early colonial structures and an important garden layout, is listed on the State Heritage Register. It is shielded from the site by bushland in the Beulah Biobanking area.
- The Humewood Forest lies to the immediate south of the site and is part of the Beulah Biobanking area. Humewood, a stand of trees associated with the former home of the Hume family (see Meadowvale below), is a local heritage item listed in IDO 15 and is significant because of the landscape value of its vegetation.
- Meadowvale (formerly known as Humewood) is situated south of the Beulah Biobanking bushland. Meadowvale, a house with colonial characteristics and a local heritage item listed in IDO 15, stands on the original land grant made to Andrew Hume, the colonial explorer of NSW.

In addition to the above, the archaeological remnants of the early Hillsborough homestead, located within the site, is considered to have local significance but is not listed in any statutory instrument.

Indigenous Heritage

There are twelve items of indigenous significance located on the site, comprising three artefact scatters; two isolated finds; one modified tree; and six Potential Archaeological Deposits.

3.6 Site Opportunities and Constraints

In summary, from the foregoing examination the site presents a number of opportunities and constraints for future residential development - as follows and as illustrated in **Figure 13.**

- Opportunities:
  - Close to physical, social and employment infrastructure in the Campbelltown City Centre;
  - Identified as a greenfield land release area within the Metropolitan Development Program;
  - Has sufficient area for provision of open space and community facilities;
  - Provides potential for views and vistas in a rural setting;
  - Largely cleared of vegetation;
  - Retained existing vegetation creates opportunities for biodiversity corridors;
  - Land generally level or gently undulating;
  - No geotechnical or geological issues.
- Constraints;
  - Steep slope in the north west corner of the site;
  - Drainage lines traverse the site;
  - Proximity to heritage items.

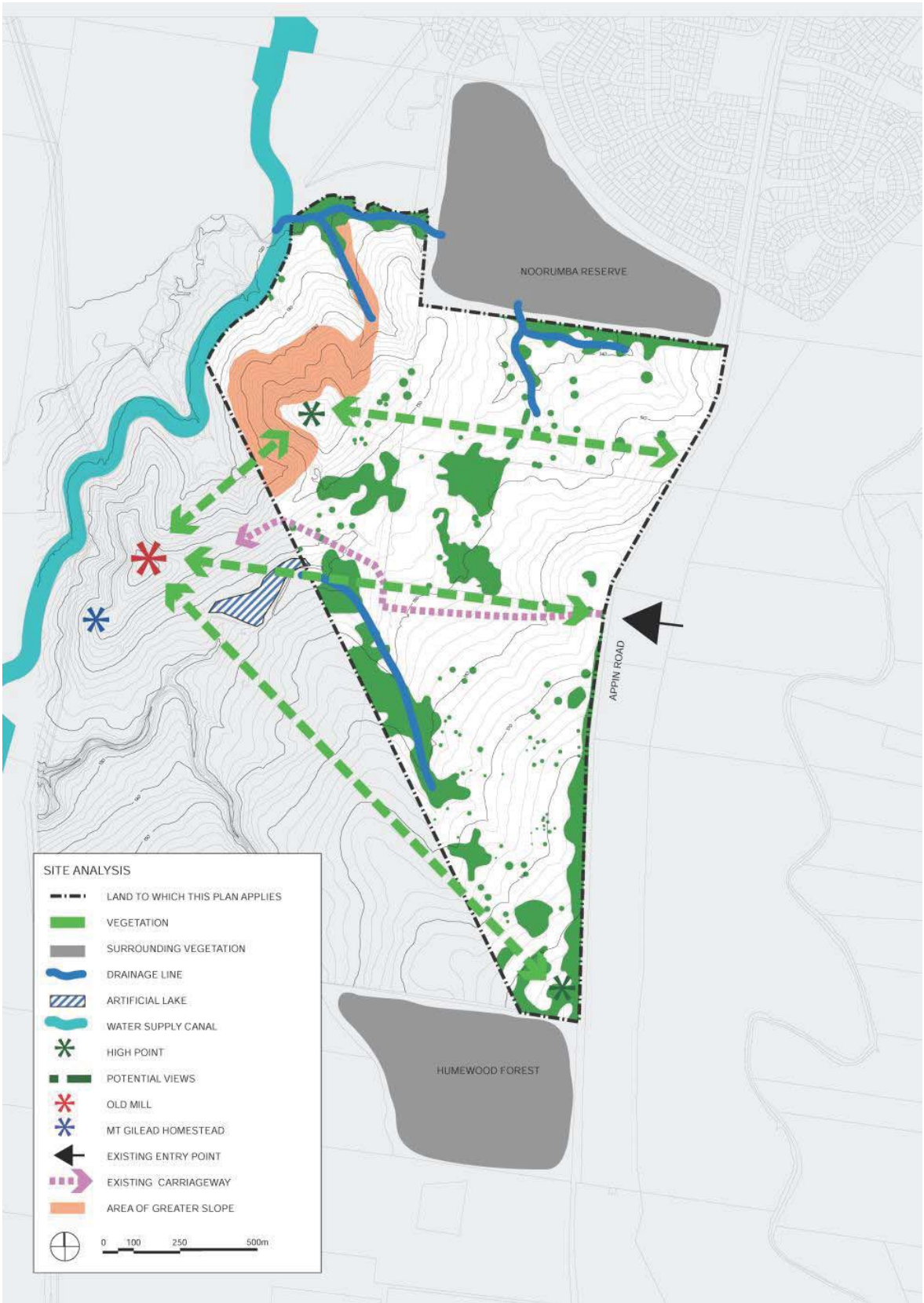

Figure 13 – Site Analysis

Source: Cox Richardson

4.0 Planning Proposal

This planning proposal has been prepared in accordance with the *A guide to preparing planning proposals* (Department of Planning & Infrastructure, October 2012) and in accordance with Section 55(2) of the EP&A Act.

4.1 Objectives and Intended Outcomes

The primary outcome of the planning proposal is residential development of the 210 ha Mt Gilead site in close proximity to the social and community assets within the Campbelltown LGA that respects the heritage and ecological significance of adjoining land.

The objectives of the planning proposal are to:

- Permit low density residential development supported by public open space and community facilities, including a small retail centre.
- Protect environmentally sensitive land and provide an environmental bushland corridor that links the Noorumba Reserve with the Beulah biobanking site and the Nepean River corridor.
- Respect the heritage significance of the Mount Gilead homestead site including the outbuildings, mill and dam and their setting.
- Respect the environmental significance of the Beulah biobanking site.
- Reserve land for acquisition by Roads and Maritime Services for future road infrastructure (widening of Appin Road).
- Increase the supply of housing within the Campbelltown LGA with the addition of up to 1700 new dwellings.

4.2 Explanation of Provisions

The proposed outcome will be achieved by:

- Amending draft *Campbelltown Local Environmental Plan 2014* (CLEP 2014) prior to it being made, or if it is made before this planning proposal is finalised, by amending the new CLEP 2014.
- Adopting the provisions within draft CLEP 2014.
- Including a number of local provisions in relation to minimum lot size and protection of terrestrial biodiversity as explained below.

4.2.1 Land to which the Plan will Apply

The planning proposal applies to the land at Appin Road, Gilead, in the Campbelltown LGA, known as Part Lot 1 DP 807555, Part Lot 2 DP 807555, Lot 59 DP 752042 and Lot 61 DP 752042 (see **Figure 14**).

4.2.2 Relationship to Existing Local Planning Instruments

The land to which this planning proposal applies falls within the provisions of the *City of Campbelltown Interim Development Order No. 15* (IDO 15), which has been identified as a deferred matter within draft CLEP 2014. The planning proposal will be either a post exhibition amendment of draft CLEP 2014, or the first amendment to the new CLEP 2014.

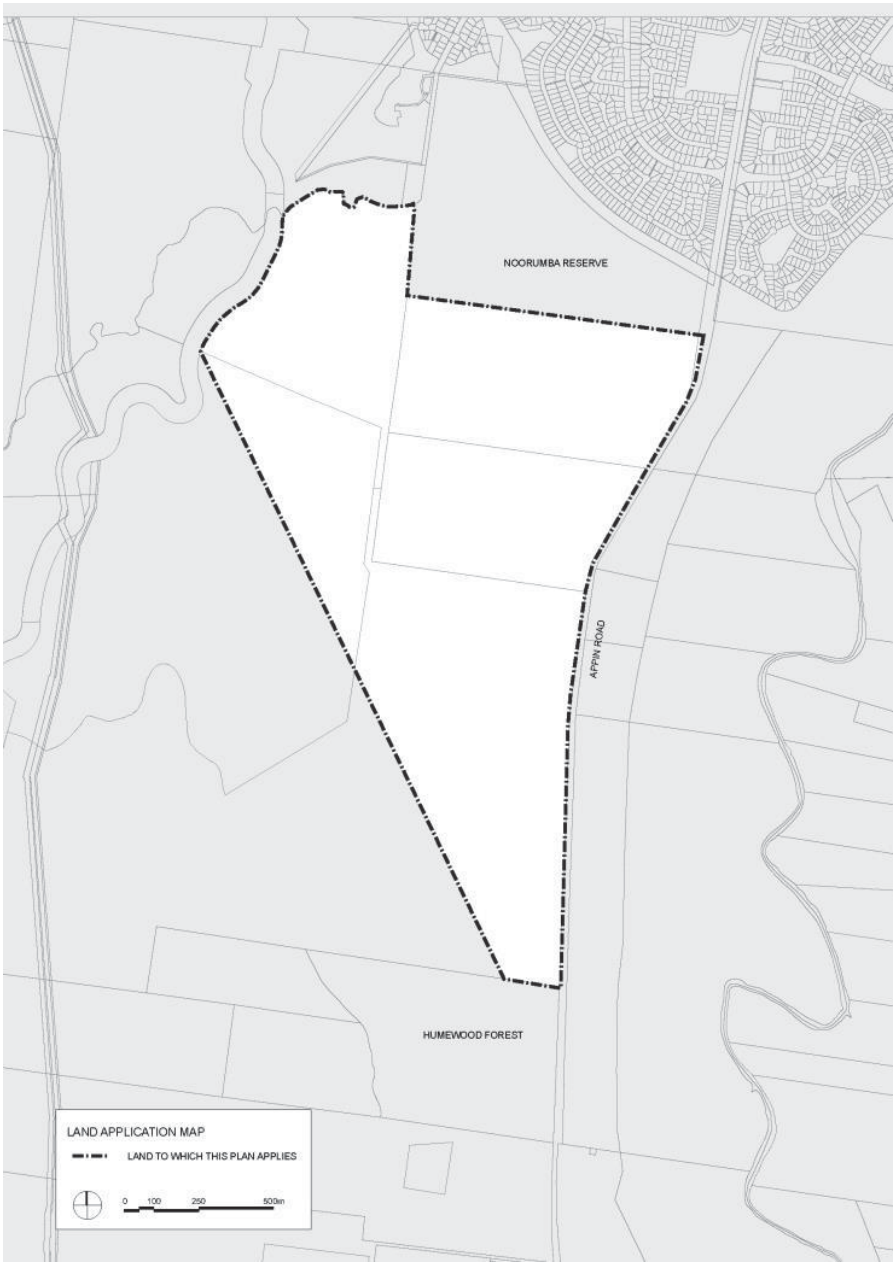

Figure 14 – Land to which the planning proposal applies

4.2.3 Land Use Zones

The Mt Gilead site is proposed to be zoned (in accordance with the Standard Template) as follows:

- R2 Low Density Residential;
- RU2 Rural Landscape;
- B1 Neighbourhood Centre;
- RE1 Public Recreation;
- SP2 Infrastructure.

The proposed zoning is shown on the Land Zoning Map appended at **Appendix B** and illustrated in **Figure 15.**

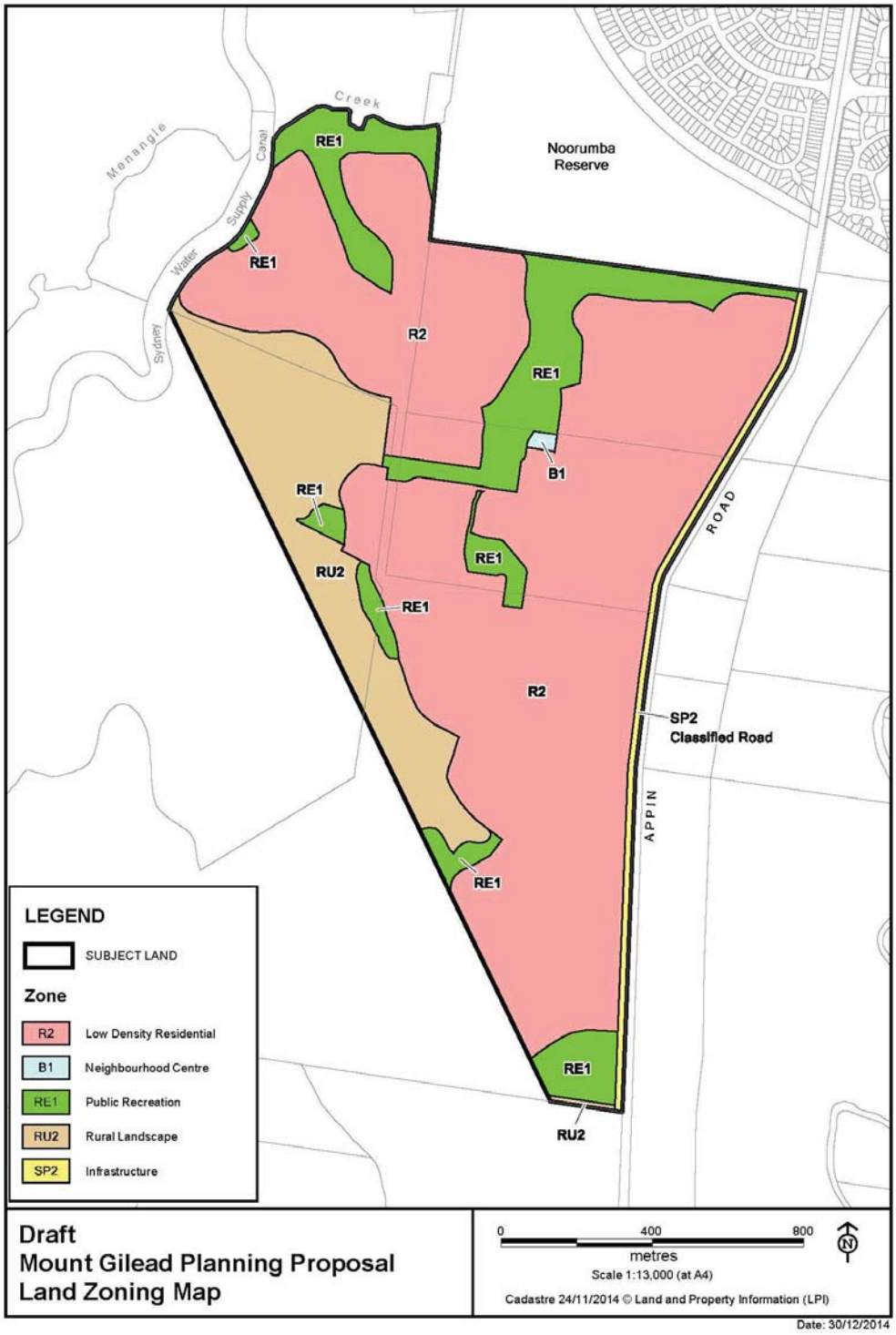

Figure 15 – Proposed zoning

4.2.4 Proposed Provisions

It is proposed that all the provisions within draft CLEP 2014, including proposed land uses, will apply to the land the subject of this planning proposal. It is further proposed that additional provisions be inserted into the CLEP 2014 in order to:

- enable an exception to the minimum lot size; and
- maximise the retention and enhancement of native biodiversity.

Minimum subdivision lot size

It is proposed to include an additional clause to permit lot sizes smaller than the minimum in recognition of the need for greater housing choice within the Sydney Metropolitan Region.

In order to provide a range of dwelling sizes and types to suit the diverse needs of the incoming population, it is intended that in specific circumstances subdivision to allow lots less than 450 square metres in area, but with a minimum area of 375 square metres. This provision applies to a small area of land in the centre of the site (shown as Area 13 on the Lot Size Map appended at **Appendix B**) and is subject to the resultant lot(s) satisfying all of the following conditions:

- the lot(s) being for the purpose of a single dwelling; and
- there being no more than three lots less than 450 square metres in area contiguous with each other on a street; and
- the lot(s) not being located on a bus route; and
- the lots(s) being within 200 metres of a bus route, the community hub or open space area.

In addition, the maximum number of lots less than 450 square metres able to be created is capped at 65. The proposed provision, to be inserted into clause 4.1A of the draft CLEP 2014, is appended at **Appendix C.**

Terrestrial Biodiversity

In order to protect and encourage the recovery of significant flora and fauna and their habitats, and retain and enhance native biodiversity, it is intended that some ecologically sensitive land proposed to be zoned RE1 and RU2 receives special protection. A clause to this effect, titled Terrestrial Biodiversity, is to be incorporated in „Part 7 - Additional Local Provisions" of the draft CLEP 2014, and is appended at **Appendix C.** The relevant land is identified on the Terrestrial Biodiversity Map and is appended at **Appendix B**.

4.2.5 Key Development Standards

The proposed development standards that will apply to the Mt Gilead land are generally consistent with those applying across the rest of the Campbelltown LGA as set out in draft CLEP 2014 and shown on the maps in **Appendix B** and are as follows:

- R2 Low Density Residential
  - Minimum lot sizes – 450 square metres; 500 square metres; and 700 square metres.
  - Maximum building height – 8.5 metres. Note a small area is restricted to 6 metres to protect views from the Mt Gilead Homestead site.
  - Maximum floor space ratio – 0.55:1
- RU2 Rural Landscape
  - Minimum lot size – 100ha
  - Maximum building height – 9 metres
- B1 Neighbourhood Centre
  - Maximum building height – 9 metres

4.3 Justification

The matters justifying this planning proposal, as required by *A guide to preparing planning proposals*, are covered in Section 6 of this report.

4.4 Mapping

The land to which this planning proposal applies is illustrated in **Figure 14** above and on the maps located at **Appendix B**.

LEP maps

The following draft LEP maps are included with this planning proposal and are attached at **Appendix B:**

- Land Zoning Map
- Lot Size Map;
- Height of Buildings Map;
- Floor Space Ratio Map;
- Land Acquisition Reservation Map;
- Terrestrial Biodiversity Map; and
- Heritage Map.

4.5 Additional Development Controls

4.5.1 Campbelltown (Sustainable City) Development Control Plan 2014

To support the planning proposal and to reflect the special characteristics of the Mt Gilead site, an amendment to *Campbelltown (Sustainable City) Development Control Plan 2014* (DCP) is proposed. The amendment (see **Appendix D),** to be incorporated as Part 4 in Volume 2 of the DCP, sets the vision and key development objectives for Mt Gilead, and provides additional site specific development principles and controls in relation to:

- heritage protection;
- protection of key views;
- the street network and public transport;
- open space and landscaping;
- residential subdivision; and
- residential development.

4.5.2 Indicative Site Structure Plan

The DCP amendment incorporates an Indicative Site Structure Plan as well as a section covering the proposed landscape palette for Mt Gilead, including street trees.

The Indicative Site Structure Plan, shown in **Figure 16** and appended at **Appendix D** has been developed to support the planning proposal and provide a framework for the future subdivision and development of the Mt Gilead site. The plan shows:

- the indicative layout of roads, including the proposed main bus route through the site;
- transport access points off Appin Road;
- the distribution of public open space and the indicative location of detention basins;
- the location of riparian corridors; and
- the general location for a future sports field and neighbourhood centre.

4.6 Community Consultation

It is proposed that the community will be consulted regarding the planning proposal during the formal statutory notification and exhibition period.

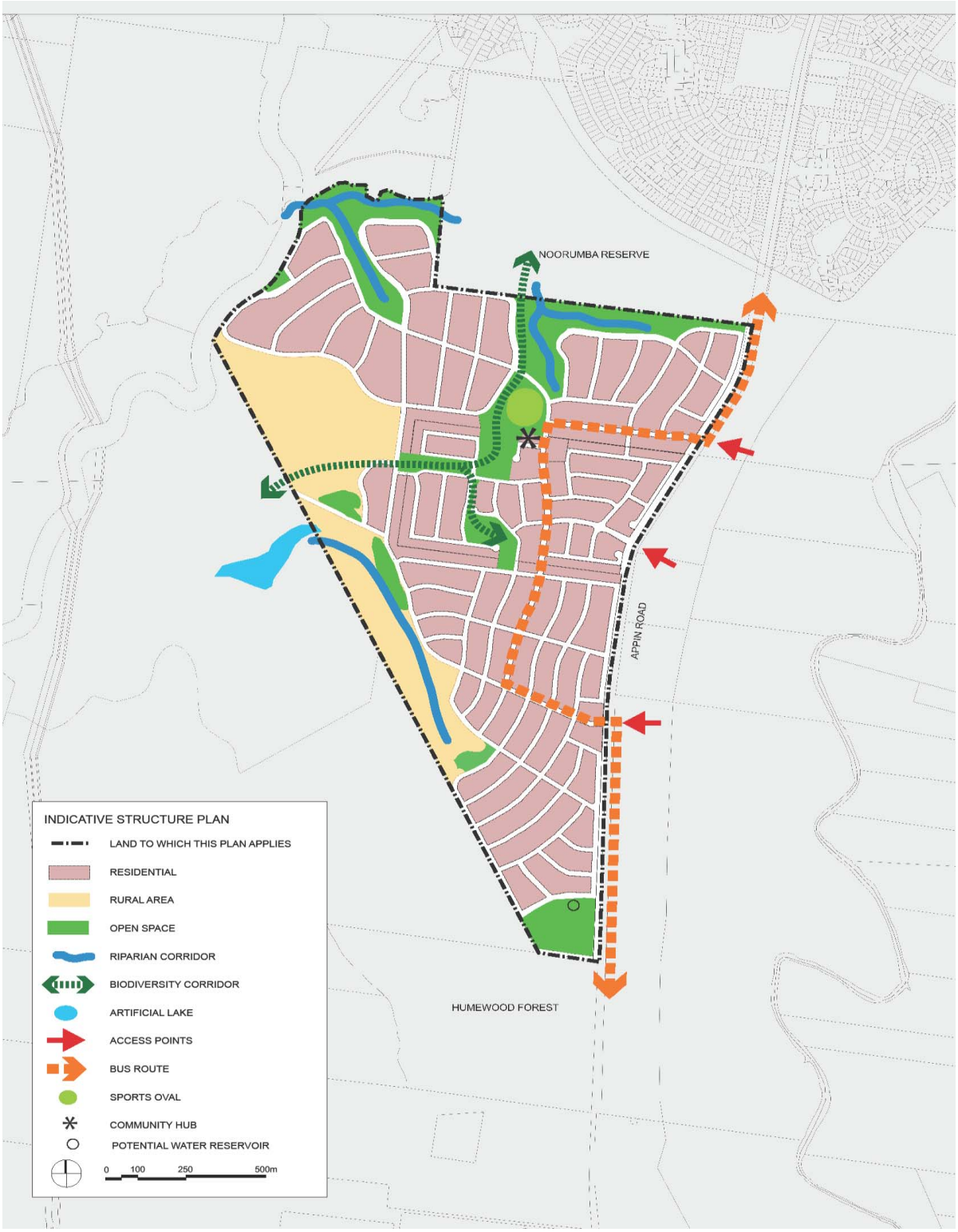

Figure 16 – Indicative Site Structure Plan

Source: Cox Richardson

5.0 Key Planning Issues

This section of the report addresses the planning issues listed for assessment in the Gateway Determination (see **Appendix A**) and further augmented by CCC"s requirements for additional technical studies. The detailed technical reports are appended to this report.

5.1 Ecology

The site and its surrounds currently contains areas of native vegetation and exotic pastures. As such, Eco Logical Australia has prepared a detailed Ecological Assessment Report for the planning proposal (refer **Appendix F**).This report identifies the existing site conditions and provides an assessment of the acceptability of rezoning the land for residential purposes. The following is a summary of the key issues.

5.1.1 Fauna

Context

A total of 58 bird species (including three introduced species) were recorded on the site during bird census and opportunistic observations, including one vulnerable species, *Glossopsitta pusilla*, and one migratory species, *Ardea ibis*. No evidence of nocturnal bird activity was found.

During site surveys 13 microbat species were identified. A single Swamp wallaby - *Wallabia bicolor* - was observed along the eastern boundary adjacent to native vegetation. Domestic livestock, (cows and ponies) were grazing on the site and one feral mammal, the European fox, was recorded.

No koalas were identified on the site.

Issues and Assessment

Seven threatened fauna species and one migratory species were identified on site. Potential habitat for hollow dependant bat species was also identified in the form of hollow bearing trees. Eco Logical Australia has recommended that these trees should be retained where possible. No other potential habitat areas were identified as substantial.

While no koalas were identified on the site, some scattered koala habitat trees - *Corymbia maculata* and *Eucalyptus crebra* - are present. Importantly, the coverage of potential koala habitat trees does not exceed the 15% threshold under *State Environmental Planning Policy No 44—Koala Habitat Protection* (SEPP 44) and therefore the site is not classified as potential koala habitat. Despite this, Eco Logical recommends that these trees should be retained where possible, and management plans should be developed to reduce the impact of domestic pets on koalas in the surrounding area.

Eco Logical has confirmed that the rezoning of the site will not have any adverse impact on existing fauna species. There is limited fauna habitat, but where scattered hollow trees do occur, they should be retained if possible.

Planning Proposal Response

It is considered that the proposed rezoning of the subject site will not have any adverse impacts on threatened or endangered fauna species. The future design of residential development on the site – as shown in the Indicative Site Structure Plan incorporates the retention of potential fauna habitat trees.

5.1.2 Flora

Context

The site comprises both remnant and degraded native vegetation and exotic pastures, and three native vegetation communities are located within the boundaries of the site:

- Cumberland Plain Woodland (CPW) – 9 hectares;
- Shale Sandstone Transition Forest (SSTF) – 24.5 hectares; and
- River-flat Eucalypt Forest (RFEF) – one (1) hectare.

CPW is listed as a critically endangered ecological community (CEEC) under both the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act) and the *NSW Threatened Species Conservation Act 1995* (TSC Act). SSTF is also listed as a critically endangered ecological community (EEC) under both these Acts, and RFEF is listed as endangered under the TSC Act. A detailed description of the existing flora within, and surrounding the site, is provided in the Ecological Assessment Report at **Appendix F**.

Issues and Assessment

A total of 154 flora species were identified within the site including 67 native and 87 introduced species. Nine weed species listed as noxious in the Campbelltown LGA and four Weeds of National Significance were identified on the site. No threatened flora was recorded.

The proposed rezoning of land does not trigger any particular mechanisms of the TSC Act. Matters relating to threatened species, endangered populations and endangered ecological communities are typically considered in the plan-making stage to ensure subsequent development can be undertaken without having a significant impact on these matters. If a development is likely to have a significant impact on these matters, a Species Impact Statement (SIS) must be prepared and submitted with the development application.

An alternative approach is Biodiversity Certification which removes the need to undertake a SIS with a development application. To provide the option of Biodiversity Certification, an assessment consistent with the Biodiversity Certification Assessment Methodology (BCAM) was undertaken by Eco Logical Australia to determine if the „improve or maintain" test is met by the proposed rezoning. Biodiversity Certification of the site is currently under consideration.

The site has been divided into three categories for the purposes of the BCAM:

- land for biodiversity certification (extent of the development) – 152 hectares;
- land for conservation/riparian/open space – 41 hectares; and
- land maintaining its current land use (rural) – 17 hectares.

Under the BCAM the development footprint will impact 1.8 hectares of the SSTF CEEC which is „red flagged". The „improve or maintain" outcome will not be met unless a variation is obtained from the NSW Office of Environment and Heritage (OEH) prior to any future development occurring. Overall, the envisaged future development will involve the retention of 83% of CPW, 49.6% of SSTF and 100% of RFEF. The rezoning will remove 1.5 hectares of CPW and 12.5 hectares of SSTF, both largely comprising scattered trees.

In light of the small area of SSTF likely to be removed, and the area of CEEC proposed to be protected, it is considered by Eco Logical Australia that a red flag variation request could be considered favourably by OEH.

The BCAM compares the impact of a proposal to the conservation benefits. This comparison is measured using Biobanking credits which are attributed for the extent of the existing vegetation, or for factors such as how land will be managed or protected. Based on the existing site conditions, a total of 192 credits are required. A total of 366 credits are expected to be generated, resulting in a surplus of 174 credits.

Future applications for development on the site which impact any EECs or CEECswill be required to be referred to the Commonwealth Government under the *Environment Protection and Biodiversity Conservation Act 1999*.

Overall, the ecological assessment concluded that the balance between development and conservation is achievable and that the planning proposal adequately addresses ecological issues.

Planning Proposal Response

The planning proposal proposes to retain significant areas of vegetation within public open space areas. The site"s ecological values are proposed to be addressed by either Biodiversity Certification or via a Species Impact Statement submitted with future development applications.

Moreover, the proposed LEP amendment protects the ecological values of the site in the following ways:

- Ecologically sensitive land proposed to be zoned RE1 and RU2 will receive special protection via a clause to this effect, titled Terrestrial Biodiversity (as shown in **Appendix C**), which is proposed to be incorporated in „Part 7 of draft CLEP 2014. The relevant land is identified on the Terrestrial Biodiversity Map.
- The land proposed to be zoned RE1 in the north of the site connects with Noorumba Reserve and there are generally connections between all the areas of RE1 zoned land so facilitating the passage of native fauna.

5.2 Bushfire Risk

The site is identified as bushfire prone on the Campbelltown Bush Fire Prone Land Map and therefore a Bushfire Assessment has been undertaken by Eco Logical Australia (**Appendix H**). This assessment investigates the capability and suitability of the site for future residential development with regard to the relevant bushfire planning legislation and policies.

Context

Eco Logical Australia has undertaken site specific and surrounding vegetation mapping, identifying vegetation formations including Sclerophyll (Dry) and Grassy Woodland. To the east and south of the site are areas of forest, whilst smaller pockets of forest, woodland and grassland are contained within the site. The majority of the site has a gentle slope with areas of steeper slopes in the northern western portion of the site.

While the majority of the site is proposed for residential development, portions of existing bushland will be retained as open space.

Issues and Assessment

The existing vegetation on the site has been classified as „forest" or „grassland" which presents a hazardous risk of bushfire. To ensure protection from bushfire risk, Eco Logical has established indicative Asset Protection Zones (APZ) to provide a buffer to future residential development with calculations based on the vegetation of the site and slope of the land.

Eco Logical has identified other bushfire protection measures including the provision of adequate access, water supply for fire fighting, the safe installation of utilities, and building construction standards for future dwellings. These measures would be implemented as part of future applications for residential development.

Planning Proposal Response

The Bushfire Assessment has demonstrated that the site is capable of accommodating future subdivision and land development subject to appropriate bushfire protection measures. The recommendations provided in Section 5 of the Bushfire Assessment would be implemented in the future planning of the site and in the detailed design of the new residential development.

The NSW Rural Fire Service has advised that it has no objection to the planning proposal in principle but notes that any future development will need to comply with the requirements of *Planning for Bush Fire Protection 2006* (see correspondence at **Appendix E**). Accordingly, the site is considered suitable for rezoning for future residential use.

5.3 Ecological and Riparian Corridors

The current vegetation on the site provides opportunities for creating effective biodiversity corridors thereby linking vegetation to the north, south and east. This, along with the preservation of riparian corridors, was assessed as part of the aforementioned Ecological Assessment Report prepared by Eco Logical Australia (see Section 5.1 above and **Appendix F**).

5.3.1 Ecological Corridors

Issues and Assessment

The nature of current vegetation on the site and its proposed retention/removal is discussed in Section 5.1.2 above.

There is currently connectivity within the site to areas of vegetation to the north and south via a fragmented series of islands or stepping stones of vegetation. The ecological assessment concluded that while the planning proposal would remove some areas of scattered trees, it would at least maintain the interrupted connectivity with surrounding vegetation to the north (Noorumba Reserve) and south (the Beulah Biobanking area).

The report further notes that as an outcome of the planning proposal the fragmented patches of vegetation would be consolidated through improved management and revegetation. At a broader landscape scale, connectivity between Noorumba Reserve and Beulah is via the vegetation to the east of Appin Road which, with the exception of Appin Road, provides a contiguous linkage of vegetation in a very good condition with low disturbance.

Planning Proposal Response

Together, the planning proposal, the Indicative Structure Plan and proposed conservation measures are intended to enhance the condition of retained patches of woodland so reducing the degree of fragmentation. As discussed earlier, it is intended that significant areas of vegetation be retained on the site within areas of public open space. In addition, the proposed LEP amendment fosters the retention and creation of ecological corridors in the following ways:

- The land proposed to be zoned RE1 in the north of the site connects with Noorumba Reserve, and all the areas of RE1 zoned land are generally connected (as shown indicatively in **Figure 17**).
- Ecologically sensitive land proposed to be zoned RE1 and RU2 will receive further protection via a Terrestrial Biodiversity clause (as shown in **Appendix C**) which is to be incorporated in „Part 7 of the draft Campbelltown LEP 2014. The relevant land is identified on the Terrestrial Biodiversity Map.

Riparian Corridors

Issues and Assessment

There are several streams and drainage lines across the site, particularly in the north and towards the western boundary.

All streams and drainage lines were categorised and mapped by Eco Logical Australia following the „Guidelines for controlled activities" set out by the NSW Office of Water (NOW) (see **Appendix F**). This methodology utilises the Strahler Stream Order classification which identifies riparian corridor widths as measured from the top of bank and minimum vegetated riparian zone widths.

Drainage lines that were not classified in the assessment were deemed to be of limited riparian value or did not meet the definition of a river. In some situations the watercourses have been significantly disturbed and in some areas display no true bed and bank characteristics.

The mapping of top of bank and stream order is presented in **Figure 18**. The majority of the watercourses are considered to range from slightly to substantially modified, with clearing of vegetation within the catchment and along the tops of banks. Aquatic habitat is limited due to the modification of the watercourses, and even in unmodified watercourses the aquatic vegetation is generally of marginal quality. Eco Logical Australia concluded that the overall rating of riparian and aquatic conditions varies from degraded to moderate.

Planning Proposal Response

Riparian zones have been defined to the top of bank and appropriate vegetated riparian zones mapped (see **Figure 18**), noting that the NSW Office of Water has agreed that since some previously mapped first order Strahler streams/channels do not meet the definition of „waterfront land" they can be removed.

Wherever possible, development and subsequent asset protection zones will not occur in areas mapped as riparian corridor or vegetated riparian zone. As shown in **Figure 17**, the majority of mapped watercourses on the site will be contained within areas of proposed open space or on retained rural land, which are to be zoned RE1 and RU2 respectively. Moreover, as explained above, further protection is provided via the terrestrial biodiversity clause and attendant biodiversity overlay map to be incorporated in the draft Campbelltown LEP 2014.

Eco Logical Australia has made a series of recommendations in relation to the future management of riparian corridors. These cover matters such as:

- the determination of stream ordering downstream;
- the determination of riparian corridor widths;
- future maintenance, rehabilitation and vegetation of riparian corridors;
- measurement of the top of bank of any proposed new constructed channels;
- the permissibility of cycleways and paths within the outer vegetated riparian zone;
- the permissibility of detention basins within the outer vegetated riparian zone, and associated equivalent offset areas.

These requirements will be taken into account in the planning proposal or will be implemented as part of subsequent development applications.

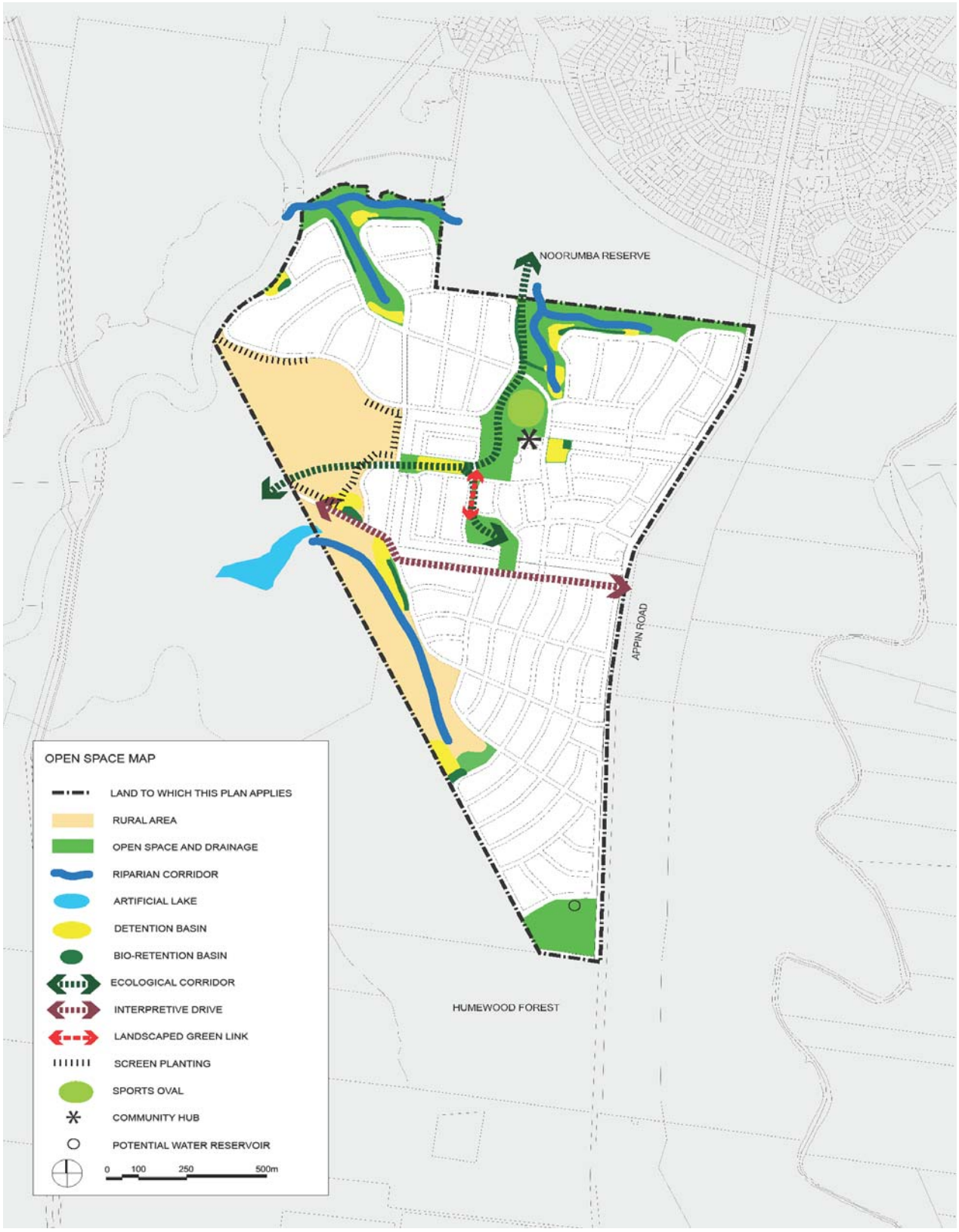

Figure 17 – Indicative open space strategy illustrating riparian and ecological corridors

Source: Cox Richardson

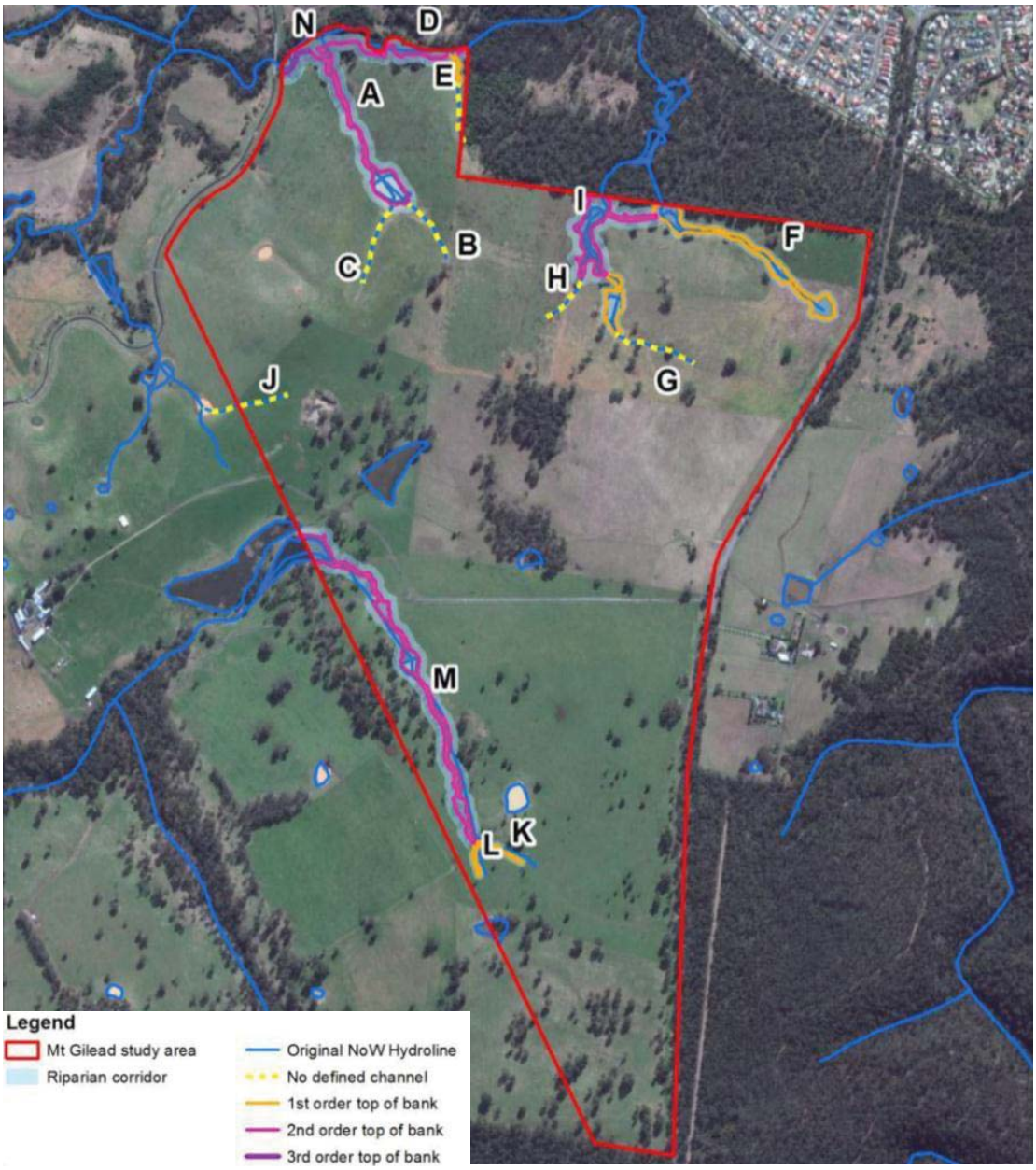

Figure 18 – Classification of riparian corridors

Source: Eco Logical Australia

5.4 Soils and Geotechnical Conditions

The proposed rezoning of the site for future residential uses requires an assessment of the existing soil and geotechnical considerations to identify any potential risks. As such, URS has prepared a Phase 1 Environmental and Geotechnical Site Assessment (**Appendix G**).

Context

The site generally slopes north-west into a shallow valley at the foot of a ridge line in the north-west. The ridge line comprises a hill with steeper gradients. The site contains a number of small farm dams with three major drainage channels.

The northern portion of the site is underlain by Ashfield Shale, while Hawkesbury Sandstone underlies the southern portion of the site. Soils on the site are shallow to moderately deep (<1.5 m) and are expected to be moderately reactive high plasticity clay.

Issues and Assessment

Geotechnical observations by URS identified five areas of potential hazard, including hilly areas of the site, gullies and a quarry. The overall stability of the site has been confirmed by URS as „good" with only surficial soil instabilities on the steeper northern area and minor rock fall potential localised to the quarry. URS has noted that areas proposed for residential zoning are not located in these areas.

The existing soils on the site are cohesive and potentially have low bearing strength when wet. URS has suggested compaction of soil will enhance the bearing strength of the founding soil. It has been recommended that the site should be graded and site drains should be designed to prevent ponding or channelling of water across the soil horizons.

An investigation by URS of surface soils (0-300mm depth) across the site identified that all surface soil samples were non-saline. A review of the available Acid Sulphate Soil Risk Map and an assessment of the topography and lithology of the site also confirmed there is a very low risk of potential acid sulphate soils (PASS).

Given the topography and lithology of the site, URS considers no further assessment is required to provide an appropriate characterisation of acid sulphate soil risk and that consideration of PASS is not necessary in relation to future development.

Planning Proposal Response

URS has confirmed that the site is acceptable for residential land uses as there are no significant geohazards. It has been recommended that targeted geotechnical testing occur with future applications for development to support the detailed design of the residential development.

5.5 Mine Subsidence

Subsidence as a result of future coal mining is a potential issue for the site. Accordingly, a Mine Subsidence Report has been prepared by Mine Subsidence Engineering Consultants (MSEC) and is provided at **Appendix I**. The report predicts subsidence parameters and the potential impacts on the future development.

Context

The site is located within the Coal Exploration Authorisation Area A248, associated with the Bulli and Balgownie Coal Seams. The Bulli Seam, containing coking coal, lies approximately 500-590 metres below the surface, whilst the Balgownie Seam, containing thermal coal, is approximately 610 metres below the surface.

BHP Billiton plans to operate a mine in the Bulli Seam south of the site, and whilst not currently planned, there is potential for mining to continue north below the Mt Gilead site. Despite this potential, MSEC is of the opinion that part of the coal seams below the site are unlikely to be mined due to the presence of faults in the seams. Based on current technology, the Balgownie Seam is unlikely to be mined in the near future due to extraction constraints.

As well as containing coal resources, the site lies within the Petroleum Exploration Licence Area PEL2 and contains significant gas reserves which could potentially be extracted through gas wells. The owner of the exploration licence, AGL, has recently suspended expansion of nearby gas extraction projects due to community concern and legislation prohibiting wells being established within two kilometres of residential dwellings. As such, the extraction of gas is not considered an issue for the site.

Issues and Assessment

Potential impacts from future mining activities are predicted to include subsidence, tilts, strains and curvatures. As no specific mining activities are currently proposed, MSEC has assumed a scenario of longwall mining with a width of 320 metres and chain pillars between longwalls of 45 metres width. This scenario involves the mining of the Bulli Seam only, due to the unlikely capability of mining the Balgownie Seam.

In consultation with BHP Billiton and based on the above scenario, MSEC has identified the potential for subsidence and maximum tilt, curvature and strain. The potential impacts comprise:

- maximum predicted subsidence varies from 1120mm to 1440mm;

- maximum predicted tilt is 7mm/m at the perimeter of the subsidence trough and 2 to 3mm/m within the bottom of the trough;
- maximum predicted strains are 1.1mm/m, tensile, and 2.3mm/m, compressive; and
- maximum predicted curvature is 6.4 kilometres radius.

Although the above figures represent the maximum potential impact, the presence of faults within the coal seams will restrict the layout of any future longwall mining activities. As such, the Mt Gilead site will be outside, or on the edge of, any subsidence trough. The level of subsidence on the site is therefore expected to be lower than these maximums.

Likewise unlikely, if advancements in technology allow the Balgownie Seam to be mined, the maximum subsidence is expected to be approximately 750mm to 850mm. Cumulatively, this would result in a vertical subsidence of approximately two metres. This level of subsidence is unlikely to cause damage to buildings, with maximum tilt, curvature and strain being the most relevant impacts.

The Mine Subsidence Board has established building guidelines to be followed when constructing moderately sized housing. These guidelines embody provisions of the Building Code of Australia (BCA), Australian Standards and good building practices. Based on these guidelines, MSEC has established a range of subsidence parameters which should be implemented in the future construction of residential development on the site.

Planning Proposal Response

Based on the above assessment, the site is capable of being developed for residential purposes if the relevant guidelines and standards for residential buildings are followed and the level of construction is commensurate with the established subsidence parameters. These matters will be further addressed in future applications for development on the site.

5.6 Contamination

Past and current agricultural uses on the site can result in a risk of soil or groundwater contamination via the release of chemicals through leaks and spills. URS has prepared a Phase 1 Environmental and Geotechnical Site Assessment to assess these risks and confirm the suitability of the site for future residential development (**Appendix G**).

Context

The ownership of the site has changed on several occasions since 1890, and the land has been used for farming and grazing prior to 1954 and to the present.

Issues and Assessment

Low levels of contamination associated with previous and current uses are expected on the site based on the preliminary environmental and historical review undertaken by URS. This contamination could be attributed to various chemicals such as arsenic and organochlorine pesticides (OCPs) associated with sheep and cattle grazing activities.

A single instance of an asbestos cement pipe was identified on the site by URS in 2006. No asbestos was observed during the most recent site inspection.

URS has suggested that the migration of onsite contaminants to adjacent receptors should be able to be adequately controlled by the use of surface drainage. A Phase 2 investigation should also be undertaken to reduce the risk of unexpected findings during the future development. This is capable of being undertaken as part of future applications for development.

Planning Proposal Response

URS has confirmed there is minimal likelihood of significant chemical contamination of the site that would compromise development for residential purposes. Any further investigations and mitigation measures can be undertaken during the preparation of detailed applications for the future residential development.

5.7 Non-indigenous Heritage

The presence of several historical sites within and adjacent to the site necessitates an assessment of non-indigenous heritage. Navin Officer and Tropman & Tropman Architects (the heritage consultants) have jointly prepared a European Heritage Assessment in relation to the historical significance of the site and to confirm the appropriateness of future residential development (refer to **Appendix J**).

Context

There are no items of state heritage significance within the site. However, the Upper Canal System located adjacent to the site and part forming the north western boundary is listed on the State Heritage Register.

The following items on the site are listed as, or considered to be of, local heritage significance:

- Part of the Artificial Lake (dam) - listed as a heritage item in the Campbelltown IDO 15 as part of the „Mt Gilead Group".
- The archaeological remnants of the early „Hillsborough" homestead is considered (by the attached heritage assessment) to be of local heritage significance, as are significant and endangered ecological features on the surrounding land.

The history of these items and their significance are detailed in the joint report at **Appendix J**.

In addition, as identified in **Section 3.5.5**, the following heritage items are located outside, but in the immediate vicinity, of the site:

- the Mt Gilead Homestead and surrounding buildings and structures (listed in Campbelltown IDO No 15 and on the Register of the National Trust of Australia (NSW));
- the Beulah Estate (listed on the State Heritage Register);
- Humewood Forest (listed in IDO 15); and
- Meadowvale (listed in IDO 15).

Issues and Assessment

The heritage consultants have undertaken an assessment of the impacts of the planning proposal on the heritage significance of the local and state listed items on and within the vicinity of the site as summarised below.

Upper Canal System
The Upper Canal – is a system of tunnels, aqueducts and open canals which transport water from the Appin area to the Prospect Reservoir, has historic and architectural significance and is listed on four heritage registers: NSW State Heritage Register; IDO 15; the Sydney Catchment Authority's Heritage and Conservation Register; and the Register of the National Trust of Australia (NSW).

The proposal will indirectly impact the aesthetic qualities of the Upper Canal System by partially removing the bushland setting.

Artificial Lake (Dam)
The Mt Gilead Group – the group of stone buildings, homestead, stables, granary and windmill without sails (referred to as the Old Mill) is listed in IDO 15 and on the Register of the National Trust of Australia (NSW - Classified). Neither listing defines the area of the item, but the description from both demonstrates that they focus on the Homestead Complex and Old Mill, with the IDO 15 also including a dam which is assumed to be the Artificial Lake. Other than a small area of the lake, none are within the site.

The proposal has the potential to impact the heritage significance of the Artificial Lake as it is partially located within the site.

Site of early Hillsborough homestead
The site of the early homestead known as Hillsborough has been identified as a site of local archaeological significance.

Remnant tracks
An assessment of remnant access tracks and a carriageway to the Mt Gilead Homestead was undertaken to identify if these contained any heritage significance. It was determined that these tracks and the

carriageway do not satisfy any state or local level criteria for significance. Despite this, any possible interpretation of the extent of the carriageway has been encouraged to reflect the historic quality of the site.

Mt Gilead Homestead Complex
The heritage assessment concluded that historically, the Mt Gilead Homestead Complex and Windmill (the Old Mill), together with the Artificial Lake to the east, had been considered to be part of a single picturesque vista. The views to and from these items are considered important in the context of their heritage significance and as such, where practicable and feasible, it is considered desirable that the current rural landscape setting for these two items be retained.

The consultants note that the overall heritage significance of these two items is not considered to be affected by the proposal. Views to the Mt Gilead Homestead Complex and the Old Mill from the proposed residential development are not considered to have a significant, or otherwise unacceptable, impact on the heritage values of these items.

Neighbouring items
The heritage items listed above in the vicinity of the site are not identified as being affected by the planning proposal.

Planning Proposal Response

The heritage conservation provisions in clause 5.10 of draft Campbelltown LEP 2014 will apply to the site and protect the heritage values of the site and its surrounds. In addition, further measures are proposed as described below.

Upper Canal
The proposal will indirectly impact the aesthetic qualities of the Upper Canal System, a State heritage item, by replacing part of the bushland setting with residential development. As the Canal has its own corridor of „bushland setting" which will not be impacted by the proposal, the overall heritage significance of the item will not be detrimentally impacted.

Notwithstanding this, to address any potential impacts, it is proposed that a statement of heritage impact (SOHI) be prepared prior to any development application for works adjacent to the Upper Canal. The SOHI should clearly document the extent of visual or aesthetic impacts and all necessary controls to minimise or avoid heritage impacts.

Approval from the NSW Heritage Council should be sought for any development impacts within, or directly adjacent to, the bushland corridor of the Upper Canal.

Views and Vistas
The residential use of the site is considered acceptable by the heritage consultants subject to the incorporation of the heritage assessment recommendations and subdivision guidelines provided in the European Heritage Assessment (see **Appendix J**). These recommendations and guidelines will generally be applied in relation to the preparation of future applications for residential development on the site.

More specifically, the planning proposal has responded to the issues in relation to significant vistas from, and views to, the Mt Gilead Homestead complex in the following ways:

- The land to the north east of the Mt Gilead Homestead is to retain a rural zone and is proposed to be zoned RU2, so protecting and retaining the landscape setting of the Mt Gilead group.
- Views to the north-east from the Homestead to the hill (within the RU2 zone), known as „One Tree Hill" would generally be protected as the parklike backdrop and surrounds are not proposed to be disturbed with residential development. It is proposed that future residential development to the east will be screened with the planting of trees. „One Tree Hill" will be retained as a grassed knoll with a single tree.
- The rural, parklike setting of the Old Mill will be retained within the proposed RU2 zone of draft CLEP 2014.

These measures are further supplemented with a series of provisions in the site specific DCP in relation to retaining and interpreting heritage and views. Moreover, the Indicative Structure Plan interprets the significance of the historic alignment of the Mt Gilead carriageway off Appin Road by generally setting it on the axis of the Old Mill. Particular elements of the alignment, such as the gateway off Appin Road and the curve of the road around the Artificial Lake are retained where possible, as are views of the Old Mill.

Artificial Lake (Dam)
The integrity of that part of the Artificial Lake within the site is generally not compromised as it will continue to be surrounded by rural land by virtue of the proposed RU2 zone along the western boundary of the site, and the whole lake is to remain in one ownership.

In addition, a heritage curtilage is to be provided around the Artificial Lake to mitigate any potential impacts and only the construction of a stormwater detention basin within the curtilage would be acceptable. Construction outside of the curtilage area would have no impact on the item.

If the Artificial Lake was to be visually or functionally impacted or if impacts were to occur adjacent to it, a SOHI and a conservation management plan (CMP) would be developed for the lake prior to any development application. The CMP would establish whether any impact(s) may or may not occur to the item during and post construction, and serve to manage them.

The heritage assessment further recommends that the Artificial Lake should be considered for State heritage listing, as well as for inclusion in Campbelltown"s LEP rather than it being part of the general Mt Gilead listing as is currently the case.

Hillsborough Homestead
The site of the Hillsborough cottage will be recorded and interpreted in the subdivision design of the site, as shown in the Indicative Structure Plan, and existing archaeological evidence of the cottage will be recorded and interpreted.

Beulah Biobanking Site
The southern boundary of the site adjoins land at Beulah which has been established as a biobanking site. In recognition of the environmental significance of this biobanking site, an area of 3.5 hectares of public recreation land has been included on the draft zoning map (refer to **Appendix B**) in order to provide a buffer between the Beulah site and proposed future residential development.

5.8 Aboriginal Heritage

The generally undisturbed nature of the subject site results in potential for Aboriginal cultural heritage sites and areas of archaeological sensitivity. As such, Navin Officer has prepared an Archaeological Assessment and Aboriginal Consultation Report (refer to **Appendix K**) which examines the significance of existing Aboriginal Archaeological Sites on the site and provides an assessment on the potential impact of permitting residential development.

Context

Three artefact scatter sites (MGA13, MGA26 and MGA27) have been identified as possessing moderate scientific significance. Two isolated finds (MGA12 and MGIF3) are of low scientific significance at a local level. One culturally modified tree (MGMT1) has been assessed to have high scientific and cultural significance at a local level. Further information on six potential archaeological deposits (PADs) (MG PAD42, MG PAD43, Mt Gilead Property PAD, MG PAD44, MG PAD45 and MG PAD46) was not identifiable at this time, but it is acknowledged by Navin Officer that an Aboriginal Heritage Impact Permit (AHIP) would be required in the future if any disturbance was proposed to the PADs.

A copy of the assessment report was forwarded to the Office of Environment and Heritage in September 2013. The Office indicated that it will defer comment until the formal notification period.

Issues and Assessment

A comprehensive consultation process was undertaken by Navin Officer in accordance with the OEH document *„Aboriginal cultural heritage consultation requirements for proponents 2010'*. This involved correspondence with Local Aboriginal Land Councils, government agencies and various Indigenous relations groups. A field assessment of the site and various desktop searches were also undertaken by Navin Officer to inform the assessment.

On the assumption that all of the identified items, Aboriginal sites and PADs will be directly affected by future development, Navin Officer has determined that the future development of the site for residential purposes will have an impact on items of Aboriginal significance, and that future construction on the site would have a high degree of harm and result in the removal of all items of significance.

Navin Officer has not precluded the proposed rezoning of the site but has recommended that the following mitigation measures, detailed in the report at **Appendix K,** should be implemented in the future development of the site:

- implementation of conservation areas;
- subsurface testing of archaeological deposits;
- surface salvage of Aboriginal objects;
- care and management of recovered artefacts; and
- ongoing consultation with Aboriginal stakeholders.

Planning Proposal Response

The heritage conservation provisions in clause 5.10 of draft Campbelltown LEP 2014 will apply to the site and are considered adequate to protect the Aboriginal significance of the site.

The culturally modified tree will continue to be protected by virtue of its location on land proposed to be zoned RU2.

The mitigation measures outlined above should be implemented by CCC in relation to future applications for development.

5.9 Landscape Character and Visual Impact

As detailed above in Section 5.7 there are existing features of the site and surrounding landscape elements that have been identified as having heritage significance. The proposed rezoning of the land for residential purposes has the potential to materially affect the rural agricultural nature of the site and its associated heritage features – in particular the Mt Gilead Homestead Complex and surrounding land. Accordingly, Clouston Associates were commissioned to undertake a Landscape Character and Visual Impact Assessment (see **Appendix L)** to assess the extent of the impacts of the planning proposal and establish whether and how such impacts can be mitigated.

Context

A number of elements associated with 19th Century English landscapes are present both within and surrounding the site. Of particular relevance are:

- the Homestead Complex and the Old Mill and associated landscape – including the Artificial Lake (dam) and One Tree Hill;
- historic references which indicate that the landscape character of the property in the 19th century was „park-like" and resembled an „English country seat"; and
- landscape elements such as individual tree specimens within a grazing landscape, ironbark fencing, a backdrop of native timber and extensive views.

While some of these elements are missing from today's property, the core elements commonly associated with the 19th Century romantic English landscapes remain – that is, a parkland style landscape of individual and groups of trees in a rolling pasture and extensive district views, providing the context and curtilage for the heritage listed structures and buildings.

The combination of these elements creates the landscape character significance and establishes a wider landscape context for the identified heritage items.

The Upper Nepean/Sydney Water Supply Canal is also identified as an important heritage element of the landscape but has limited visual presence from the site.

Issues and Assessment

Clouston Associates originally identified numerous visual receptors grouped into public domain views, private domain views, views to and from the site, and views within the site. Of these, six locations were identified which best demonstrate any effect of future residential development.

An assessment of these viewpoints has identified impacts ranging from moderate/high to moderate and negligible. In essence, the future residential development on the site may have impacts on significant landscape and visual elements if not appropriately mitigated.

The Visual Impact Assessment (VIA) identifies two broad areas of landscape character and visual significance that require specific mitigation measures:

- The core visual catchment from the Old Mill looking north and from the access road to the Mt Gilead Homestead looking north east (both with a moderate/high visual impact rating).
- The approaches to the site on Appin Road along the eastern boundary of the site which would change as a result of the removal of existing vegetation along the eastern side of Appin Road to facilitate road widening so revealing the physical features of new urban development (moderate visual impact rating).

Other identified receptor locations were considered to be of such distance from the core heritage elements, or the view cones of any part of the site so narrow, that any change was expected to be barely visible and thus mitigation measures were not deemed to be warranted.

The view from the Gilead Aged Care Facility (located to the north of the site) would also potentially be significantly impacted by the proposed rezoning, but the approved development of the Gilead retirement village currently in construction on the adjoining site will entirely obscure this view; thus impacts from this receptor were discounted.

Planning Proposal Response

Clouston Associates has identified a range of mitigation measures to be considered in the future residential development of the site framed around the key principles of avoidance, reduction, alleviation, compensation and management. The VIA sets out specific mitigation principles and measures to manage the impacts of the residential development that would flow from the planning proposal, and indicates that if these are implemented in relation to the above two areas of impact, the visual impact rating would reduce to moderate/low.

More specifically:

- In relation to the visual catchment from the Old Mill looking north and from the access road to the Mt Gilead Homestead looking north east, the core mitigation principles for these receptors would be to:
  - retain the „bald" character of One Tree Hill as a grassed knoll with a single landmark tree;
  - maintain the skyline of the tree and grassed crest uninterrupted by planting or built form;
  - ensure that only native vegetation and no built form is visible on the lower flanks of One Tree Hill; and
  - maintain views to the Artificial Lake (dam) with a vegetated backdrop and no visible built form.
- In relation to the loss of vegetation along Appin Road and views of new urban development, the core mitigation principles would be to:
  - establish a sense of the former character of, and arrival experience at, the Mt Gilead property driveway entrance through simple landmark tree planting and landscape design; and
  - re-establish, through new roadside native planting and landscape design, a roadside character evocative of the former rural approach to the Mt Gilead property along Appin Road from both north and south.

The recommended landscape and design measures will be implemented via the proposed site specific provisions in the site specific DCP. In addition, the proposed land use zones listed in Section 5.7 above, the proposed larger lots in the north west corner of the site (as shown on the Lot Size Map) and the proposed limit to building height on the northern side of One Tree Hill (as shown on the Height of Buildings Map) will further mitigate any impacts on the views from the Homestead and the Old Mill.

The rezoning of the site to permit residential development is thus considered acceptable as there are sufficient mitigation measures available to appropriately reduce landscape character and visual impacts.

5.10 Transport, Traffic and Access

The appended Traffic, Transport & Access Study prepared by Parsons Brinckerhoff (see **Appendix M**) was designed to assess the effects on traffic of the proposed rezoning for a range of dwelling numbers (1500-1700). The traffic study was undertaken in accordance with the requirements of CCC, Transport for New South Wales(TfNSW) and Roads and Maritime Services (RMS) and the road and intersections included in the traffic study were accepted by TfNSW and RMS. The consultation with these authorities is detailed in the report at **Appendix M.**

Context

The site is located adjacent to Appin Road which is a State Road. Other important surrounding roads include Narellan Road, Oxley Street and the Hume Motorway. Appin Road carries approximately 21,500 vehicles daily south of Woodland Road, Bradbury. No formal pedestrian paths are located on Appin Road along its boundary with the subject site. A review of crash data on Appin Road in close proximity to the site indicates a total of 17 reported crashes in the five year period (2007-2012).

Two bus services (Route 887 and 888) operate within close proximity of the site with Route 887 travelling past the site on Appin Road.

Issues and Assessment

The road and intersections assessed in the traffic study included Appin Road from Appin to Narellan Road, Narellan Road from Appin Road to Gilchrist Drive and the major intersections along these routes. The study area included 13 existing intersections and three proposed intersections along Appin Road directly accessing the site. Annual increases in background traffic in addition to the potential increased traffic that would be generated as a result of the planning proposal traffic growth were factored into the traffic assessment, ensuring a conservative and true assessment of the future situation.

Various development scenarios were modelled: 1,500 and 1,700 dwellings by 2026, and an interim scenario of 50% of these dwellings being constructed by 2021.

The traffic, transport and access study confirmed that the proposed rezoning for residential development will further contribute traffic to intersections along Appin Road into the future. Several of the intersections were operating at or near capacity in 2013 and will further deteriorate on the basis of background traffic growth into 2021 and 2026. Likewise, several intersections are expected to operate near, at or over capacity due to the addition of traffic from the Mt Gilead site. As such, additional capacity would be required at the following intersections in order to improve intersection performance to acceptable levels of service:

- Appin Road, Kellerman Drive and Copperfield Drive;
- Appin Road and St Johns Road; and
- Appin Road, Oxley Street, Narellan Road and The Parkway.

In addition, the mid-block capacity assessment of the capacity of Appin Road to handle the expected traffic increases determined that Appin Road would need to be upgraded – including adding turning lanes, slip lanes and augmenting the carriageway to two lanes.

A range of mitigation measures are set out in the Traffic, Transport & Access Study (**Appendix M**) to address the impacts of the planning proposal on the road network. These include:

- providing a bus service to the site;
- accommodating a walking and cycle network in the site;
- investigating car share schemes;
- developing a residential travel plan; and
- upgrades to specific intersections and Appin Road (see below).

TfNSW and RMS have reviewed the Traffic, Transport and Access Study and have confirmed that the mitigation measures are acceptable to mitigate the impacts of the Mt Gilead rezoning (refer to letter dated 21 May 2014 at **Appendix E**). TfNSW and RMS have also advised that they have no objection to the Mt

Gilead Planning Proposal being publicly exhibited provided the following conditions have been met (refer to letter dated 13 January 2015 at **Appendix E**):

- Development is set back 20 metres from the existing Appin Road western boundary providing for a future road corridor of 40 metres.
- The land required for road widening is dedicated at no cost to Government through an appropriate agreement.
- The land required for road widening is shown as SP2 Infrastructure „Classified Road" on the Mount Gilead Planning Proposal Land Zoning and Land Reservation Acquisition Maps.

Planning Proposal Response

It is considered that the site is capable of being developed for residential purposes with the implementation of the mitigation measures identified in the Parson Brinkerhoff study and confirmed by TfNSW and RMS. Specifically, the road infrastructure upgrades identified in the recommendations in the report aim to overcome the congestion anticipated to be caused by both background growth and the Mt Gilead development and thus enable the development of the site for up to 1700 dwellings. The planning proposal maps reflect the conditions required by the traffic authorities.

The funding and staging of road infrastructure works will be the subject of a regional voluntary planning agreement (VPA) between the landowners and the State government, which will also address land dedications matters as referred to by TfNSW and RMS in their correspondence dated 13 January 2015 (refer **Appendix E**).

With regard to public transport, the Indicative Structure Plan shows a bus route through the site and the intersections with Appin Road will be designed to accommodate buses. The decision to run a private bus service to and from the site will ultimately lie with TfNSW.

5.11 Noise

The site is potentially susceptible to noise impacts as it adjoins Appin Road and is located in close proximity to a number of industrial uses. As such, a Noise Assessment has been prepared by Wilkinson Murray to assess the potential noise impact from surrounding industrial uses and traffic on the Mt Gilead site (see **Appendix N**). The predicted noise impact from traffic generated by the development of Mt Gilead on surrounding residential areas has also been addressed.

Context

Wilkinson Murray conducted noise monitoring at the site to determine existing background levels and traffic noise levels from Appin Road. The existing background noise levels of the site are similar to those of a rural context. Noise levels of surrounding uses, such as the Rosalind Park Gas Plant and Menangle Quarry, were also identified for consideration in the noise assessment. It should be noted that subsequent to the completion of the acoustic assessment advice was given that the proposed Leaf"s Gully power station would not be proceeding. Accordingly the noise impacts of the power station are no longer relevant to this planning proposal.

Issues and Assessment

The surrounding industrial activities are potential catalysts for noise intrusions on the future residential development at Mt Gilead. However, as a result of on-site noise monitoring, it was determined that the surrounding industrial uses are barely audible on the site. This is due to both the considerable distance of the uses from the site and the topographical shielding between the uses and the site.

Based on the identified traffic noise levels from Appin Road, Wilkinson Murray assessed the suitability of the site for residential development. Noise level criteria were established for future residential development based on the Department of Planning"s document *Development Near Rail Corridors and Busy Roads – Interim Guideline* and the requirements of *State Environmental Planning Policy (Infrastructure) 2007*. If new residential development was to be constructed without any mitigation measures but set back approximately 30 metres from Appin Road, it would not comply with the relevant noise criteria. As such, Wilkinson Murray has suggested measures such as glazing specifications and acoustic door seals to achieve the relevant noise levels.

Traffic noise generated by the proposal was determined using criteria set in the NSW Road Noise Policy (March 2011) and the expected traffic generation from the future residential development. The expected traffic generation on Appin Road will result in an increase of 2.4dBA for the peak hour, and between 2.0 –

2.2dBA over a fifteen hour period. The NSW Road Noise Policy specifies that an increase of 2dBA is barely discernible, therefore the proposal is not expected to have any impact on surrounding residential areas.

Planning Proposal Response

The noise impacts both on the proposal and resulting from the proposal will not be significant and are capable of being appropriately addressed in future design and development stages. Noise impacts do not preclude the rezoning of the site for residential purposes.

Moreover, it is noted that the Indicative Structure Plan for the site proposes a substantial buffer between residential development and Appin Road.

5.12 Air Quality

The proximity of the site to several industrial uses increases the potential for adverse air quality impacts on any future development. Wilkinson Murray has performed a qualitative air quality impact review to determine the viability of the proposed planning proposal (see **Appendix O**). The review addressed the potential impact on air quality from surrounding industrial facilities and road traffic on the future residential development that would eventuate as a result of the planning proposal.

Context

The existing air quality environment at the Mt Gilead site is expected to be good due to its location away from significant urban development; however the following surrounding uses could influence air quality at the site:

- Appin Road;
- the M31 motorway - approximately 1.8 kilometres to the west;
- Menangle Quarry - approximately 1.2 kilometres to the west;
- Rosalind Park Gas Plant - approximately 1 kilometre to the west; and
- poultry farms (Ingham"s Broiler Complex) - approximately 4 kilometres to the south.

It should be noted that subsequent to the completion of the air quality assessment, advice was given that the proposed Leaf"s Gully power station would not be proceeding. Accordingly, any potential air quality impacts of the power station are no longer relevant to this planning proposal.

Current data from nearby quality monitoring stations indicates that the regional air quality is below the target levels established for New South Wales. As such, there is capacity within the region for additional development.

Issues and Assessment

Wilkinson Murray have identified that potential impacts on the air quality of the Mt Gilead site could arise from elevated levels of particulate matter, carbon monoxide, nitrogen dioxide, sulphur dioxide and ozone. An assessment concentrating on the impact of the surrounding uses listed was undertaken with each of the surrounding uses expected to operate within the relevant air quality levels established by the NSW Environment Protection Authority (EPA). Two of these uses, the Rosalind Park Gas Plant and Ingham Broiler Complex, operate under environmental protection licenses, which ensure that they are continually monitored by the EPA for compliance with air quality targets.

The substantial distance of all of these uses from the Mt Gilead site further diminishes the likelihood of any air quality impacts on the future residential development. Prevailing winds within the region will contribute to disbursing any air quality impacts, such as dust or odour, away from the site.

Likewise, the separation distance of the site from Appin Road is sufficient to ensure that no air quality impacts are experienced on the site. Wilkinson Murray have noted that even with widening of Appin Road, a minimum of 30 metres will be achieved between the roadway and the nearest dwelling, appropriately mitigating any air quality impacts.

Planning Proposal Response

In light of the above assessment, Wilkinson Murray have identified that there will not be any significant impact on air quality at the Mt Gilead site from surrounding industrial uses and traffic. The site will be suitable for residential development from an air quality perspective and thus capable of being rezoned for this purpose.

5.13 Stormwater and Flooding

Worley Parsons has prepared a Stormwater Management and Flooding Assessment of the site (see **Appendix P**) covering the future management of the stormwater quality and quantity and flood risk post rezoning (and as a result of development).

Context

The site consists predominantly of open pasture land currently used for grazing livestock. The existing land surface grades generally towards the north-west with some steep areas, particularly in the north-western corner of the site. A number of low order ephemeral watercourses drain the site and discharge to four identifiable points along the site boundary.

Issues and Assessment

Stormwater quality
The objectives of the strategy for the management of stormwater quality agreed with CCC are to preserve the state of existing watercourses and to ensure that post-development pollutant loads are consistent with Council"s stormwater pollutant load reduction targets. The pollutant reduction targets that were adopted for Mt Gilead are stricter than the baseline targets in Council"s draft parameters for MUSIC modelling, but are considered appropriate given the proximity of the site to the Upper Canal and the Nepean River.

Separate MUSIC models were prepared to reflect the existing catchment and site conditions and the post development scenario as shown in the Indicative Site Master Plan. The modelled treatment train consisted primarily of end-of-line stormwater treatment devices such as gross pollutant traps (GPTs) and bio-retention systems located in areas of public open space. The results of detailed water quality modelling indicate that the proposed treatment train achieves Council"s requirements in relation to stormwater quality.

Stormwater quantity
The focus of the strategy to manage the quantity of stormwater was to demonstrate that stormwater runoff under post-development conditions can be managed so that post-development peak flow rates do not exceed pre-development peak flow rates at each of the site"s discharge points, and to ensure that flows up to the 100 year ARI event can be accommodated; safe passage of the probable maximum flood (PMF) is provided; and, development does not result in water runoff causing flooding or erosion on adjacent properties.

XP-RAFTS software was used to develop a hydrologic model of the catchments that drain through the site which was then used to simulate a range of design storms and predict peak flow rates under existing and post-development scenarios. Required stormwater detention storage volumes were calculated to ensure that post-development peak flow rates would be less than, or equal to, pre-development peak flow rates at each of the proposed bio-retention systems for events up to the 1% Annual Exceedance Probability (AEP) event.

The results established the volume of stormwater detention that would be required at each bio-retention system to limit discharges so that post-development peak discharge rates do not exceed pre-development peak discharge rates for storm events up to the 1% AEP event.

Flooding
The objective of the flood assessment was to provide information regarding potential flood constraints that could affect development of the site and to identify potential flood management measures. The assessment was informed by various Australian and NSW flood plain management guidelines and policies.

One-dimensional flood modelling of the major creek lines within the Mt Gilead site was undertaken to define flood characteristics, with the HEC-RAS software used to develop flood models of each tributary.

These were then used to simulate the 1% AEP and PMF events, and to determine preliminary flood extents and potential constraints that flooding may pose on future development.

The results indicated that the 1% AEP flood and PMF flood extents would generally be contained within riparian corridors and outside of proposed development areas. Where future residential development could be affected by the PMF, the indicative road layout shown on the Indicative Site Structure Plan was considered to provide sufficient capacity for flood free evacuation.

Planning Proposal Response

The strategy for the management of stormwater quality has been developed so that the land parcels under different ownership are able to achieve the agreed stormwater quality objectives independently of each other, so enabling them to be developed at different times.

The overall stormwater management strategy involves the implementation of a treatment train to satisfy the agreed pre-determined stormwater quality objectives and includes rainwater tanks, GPTs and bio-retention systems. The bio-retention basins and/or swales will collect surface runoff from roads and general urban areas and, as shown in the Indicative Site Structure Plan, are to be located in open space areas adjacent to, and generally outside of, riparian corridors.

Stormwater detention structures with multi-staged outlets will be provided adjacent to the proposed bio-retention systems to ensure that post-development peak discharges are equal to or less than pre-development peak discharges.

Flooding up to the PMF is not predicted to impact on most areas proposed for residential development. Where residential development is proposed within flood affected areas, minimum habitable floor levels and flood free evacuation routes will need to be considered at development application stages in accordance with Council and State policies. A more detailed assessment of flood behaviour and flood impacts will be necessary at DA stage based on proposed lot layouts and site grading.

In summary, the results of detailed water quality modelling documented in the Worley Parsons report indicates that the proposed treatment train achieves CCC"s requirements in relation to the management of both stormwater quantity and quality. The risk of flooding is low and is not a constraint to the proposed rezoning of the site for residential uses.

5.14 Utility Services

Worley Parson has investigated and documented the future utility servicing requirements for the site. This is summarised below and documented in detail in the Infrastructure and Services Report at **Appendix Q** and the Water and Wastewater Servicing Strategy at **Appendix R**.

Existing services and future requirements

Potable water
There is currently no potable water reticulation infrastructure in the vicinity of the site. However, the site is located adjacent to Sydney Water"s Rosemeadow reservoir zone.

The preferred potable water servicing involves connection to the Rosemeadow elevated system and construction of a new reservoir zone to service high level lots within Mt Gilead, including construction of a water main connecting to the Rosemeadow system, a main parallel to Appin Road, a water pumping station at the north-eastern corner of the site and an elevated security reservoir at the south-eastern corner of the site.

Waste water
There is currently no wastewater reticulation system in the vicinity of the site with the nearest wastewater infrastructure being Sydney Water"s reticulation system that services the suburb of Rosemeadow to the north of Mt Gilead.

Worley Parsons investigated various wastewater servicing options for the site and have proposed that the site be connected to the Glenfield-Liverpool gravity wastewater system. This would require a new 310 kW wastewater pumping station; two rising mains; and, a gravity sewer which would ultimately convey wastewater from Rosemeadow to the Glenfield wastewater system.

Electricity
The site is located within Endeavour Energy"s area of operation. There is currently no existing electricity infrastructure within the vicinity of the site.

Initial discussions with Endeavour Energy suggest that future development can be supplied from the Ambarvale Zone Substation. It is expected that a new substation will be required and two new 11 kV feeders would need to be installed. The existing power poles running along Appin Road cannot accommodate the new 11kV feeders.

Gas
There is no reticulated gas service in the immediate vicinity of the site. Initial discussions with Jemena have established that there is sufficient capacity within existing infrastructure to service the proposed development, and it is likely that the gas connection would be made within Rosemeadow and run down Appin Road and into the site.

The nearest gas main to the site is the „Eastern Gas Pipeline", a 457mm diameter high pressure main that is the major gas supply line between Sydney and the Gippsland Basin in Victoria. This main is located approximately 600 metres from the western site boundary. A direct connection from the Eastern Gas Pipeline is unlikely to be a feasible option for servicing the development.

Telecommunications
Existing copper and fibre optic cabling is located in existing residential areas to the north of Mt Gilead. Telstra telephone exchanges are located at St Helens Park and Menangle. A high intensity copper main line runs north-south through the Mt Gilead site and an optic fibre line is located along the eastern side of Appin Road.

Telecommunications services would be provided by Telstra under the Universal Service Obligation arrangement referenced under the *Telecommunications Act (1997*). Existing Telstra infrastructure would need to be extended from the north via Appin Road to reach the site. Initial discussions with NBN Co indicate that the proposed development may be eligible for the National Broadband Network

Planning Proposal Response

As indicated above, the site is capable of being serviced through the extension/augmentation of existing utility infrastructure or the provision of new infrastructure. The provision of appropriate lead in works will be addressed as part of future development applications and in consultation with the relevant service providers. Sydney Water has advised that whilst all work with regard to water and wastewater services is not yet complete it supports the public exhibition of the planning proposal. Please see copy of letter from Sydney Water in **Appendix E**.

5.15 Economic and Social Impacts

5.15.1 Social and Economic needs

The scale of the future envisaged residential development on the site will result in potential social and economic impacts. As such, MacroPlan Dimasi has prepared a Social and Economic Needs/ Impact Assessment (**Appendix S**).

Context

An expected yield of 1,400 to 1,700 dwellings by 2026 was used in predicting the future population on the site. Based on an occupancy rate of three people per household, the population at Mt Gilead is expected to lie between 4,188 and 5,088 persons by 2026 - an increase equivalent to 0.3% of the overall Campbelltown LGA population per annum, reflecting the minor nature of the increase in the LGA context.

Issues and Assessment

The projected population is expected to have a negligible impact on demand for employment land. Based on existing labour force rates in outer south western Sydney, between 2,115 and 2,568 working residents are expected to reside within the site. MacroPlan Dimasi suggests there is no causal relationship between employment land increase and population growth, rather employment land is linked to broader market forces.

The only need for employment land is expected to be for minor services such as retail facilities for local residents. Furthermore, there is an abundance of existing employment land to satisfy demand in South West Sydney.

The existing retail opportunities in the context of the site have informed an assessment of the retail needs. Based on the expected population and surrounding context, no large supermarket facility is required to service the site. A small convenience store is expected to be suitable to service the future population in addition to the existing facilities in the surrounding locality.

The scale of envisaged development on the site does not produce a substantial demand for social and community infrastructure and open space, and the expected additional population will have a nominal impact on local and regional services which are expected to be able to cater to the demands of the new population. The future residential population could not support a new government funded school or hospital and would not generate a significant demand for district or regional open space for organised sporting and recreational activities. It is thus anticipated that the existing wider provision of services will cater for the incoming Mt Gilead population elsewhere in the catchment.

The size and type of neighbourhood services and social infrastructure required to support the Mt Gilead release area has been measured against relevant benchmarks for the Sydney Growth Centres and other national standards. MacroPlan Dimasi recommends that the following provision be accommodated at Mt Gilead to meet the needs of the new population:

- a small convenience store;
- a Neighbourhood Community Centre (on approximately 1500 square metres of land)
- 2.5ha Neighbourhood Park
- 14.39ha of open space generally.

Planning Proposal Response

The aforementioned study confirms that the population likely to result from the planning proposal is able to be serviced by existing social and economic infrastructure within the Campbelltown LGA and there are no social or economic obstacles to the proposed rezoning.

Moreover, in accordance with the above recommendations, the planning proposal makes specific further provision with the following:

- The zoning of a small area of land adjacent to proposed open space as B1 Neighbourhood Centre. The land uses within this zone permit a community centre and neighbourhood shop.
- The zoning of almost 31ha of land as RE1 Public Recreation. Both active and passive recreation uses are permissible in this zone.

In addition, the Indicative Structure Plan for the site shows the location of a 2.9ha sports field as well as a „community hub" that would accommodate a community centre and convenience store/ kiosk (approximately 0.21ha). The provision of open space and a community centre are the subject of a VPA between the landowners and CCC.

5.15.2 Impacts on Agricultural Land

The site is classified as Agricultural Land Class 3 and has been, and currently is, used for agricultural purposes. Accordingly, an Agricultural Investigation has been prepared by AgEconPlus Consulting to determine the strategic importance of land for agricultural production (see **Appendix T**).

Context

The site is mostly cleared and gently sloping with three creeks. The soil is predominately shallow and composed of a clay base and shale rock beneath. The average rainfall is 767.4mm with an even monthly distribution. Previously, the site was used for beef cattle grazing and dairy cattle milk production. It is now used for cattle grazing purposes.

Issues and Assessment

Feasible forms of food production based on the agricultural land classification include horticulture not dependent on irrigation water, such as olive or wine crops, or livestock grazing. Producing crops such as olives or wines is not feasible as these crops are currently oversupplied and prices are depressed. The

grazing of livestock on the site is also undesirable as more intense forms of grazing and animal production are currently carried out in areas west of the Great Dividing Range, with significantly more suitable sites than Mt Gilead for such activities.

In regard to the availability of land for food production in the Sydney Basin and NSW, the site represents 0.2% and 0.01% of Class 3 agricultural land respectively. As such, the site is not critical to the vitality of the agricultural industry of Sydney or NSW. If the site was not used for beef cattle grazing, there would be a lost opportunity of 125 additional beef cattle grazed in NSW. The beef cattle industry in NSW currently comprises over six million cattle; therefore the minor reduction of 125 cattle from the site would be negligible.

Planning Proposal Response

The site does not play a critical role in the agricultural industry of Sydney or NSW, with limited value for a select range of agricultural activities. The rezoning of the site for residential purposes will not adversely affect food production in Sydney or NSW.

6.0 Summary and Conclusion

6.1 Need for Planning Proposal

Is the planning proposal a result of any strategic study or report?

The planning proposal seeks to rezone land in accordance with the intent of, and land identified within, the Metropolitan Development Program (MDP). The MDP had earmarked the site for the expansion of the existing residential land situated to the north of the site.

The MDP had set the development yield of the Mt Gilead site at 1500 lots. Subsequently the assessments undertaken for the planning proposal have demonstrably indicated that the land and relevant infrastructure have the capacity to accommodate more dwellings. This planning proposal has established that the site has the capacity to accommodate up to 1700 dwellings.

The planning proposal responds directly to the MDP and also contributes to the target of 60,000 new homes by 2021 in the South West Subregion.

Is the planning proposal the best means of achieving the objectives or intended outcomes, or is there a better way?

The planning proposal to rezone the Mt Gilead site from Rural to Residential land is the most efficient means of achieving the State and regional planning objectives and strategic outcomes.

6.2 Relationship to Strategic Planning Framework

Is the planning proposal consistent with the objectives and actions of the applicable regional or sub-regional strategy (including the Sydney Metropolitan Strategy and exhibited draft strategies)?

As set out in **Section 2**, the proposal is consistent with applicable regional and subregional strategic documents, including all draft strategies, prepared by the NSW Government and Campbelltown City Council as summarised below.

Metropolitan Plan for Sydney 2036
As described in **Section 2**, the *Metropolitan Plan for Sydney 2036* aims to provide an integrated planning framework to manage Sydney's growth to 2036. Since its release in December 2010, the strategy has been reviewed and a *Draft Metropolitan Strategy for Sydney to 2031* has been released. As this new draft strategy represents the most up-to-date strategic planning policy in Sydney, the proposal has been assessed against this new strategy.

Draft Metropolitan Strategy for Sydney to 2031
As set out in **Section 2**, the *Draft Metropolitan Strategy for Sydney 2031* establishes the latest strategic directions for the Sydney Metropolitan Region. The proposal is consistent with the draft Metropolitan Plan in that it will provide additional dwellings to contribute to the delivery of the targeted 427,000 dwellings in South West Sydney by 2031. By unlocking the Mt Gilead land for residential development, the proposal will indirectly stimulate and support employment growth and jobs closer to home.

Draft South West Subregional Strategy
The proposal is consistent with the *Draft South West Subregional Strategy* as it will unlock land for the development of residential dwellings, contributing to the supply of housing in the South West subregion, and supporting the Campbelltown-Macarthur Major Centre.

A Plan for Growing Sydney
It is considered that the proposal is consistent with the goals of *A Plan for Growing Sydney* particularly with regard to assisting in the delivery of new housing to meet the needs of Sydney"s growing population.

Is the planning proposal consistent with the council's strategy or other local strategic plan?

As mentioned in **Section 2**, the planning proposal is consistent with Council"s strategic documents *Campbelltown 2025 – Looking Forward, Campbelltown Local Planning Strategy and Campbelltown Residential Development Strategy*. The proposal will enhance Campbelltown as a growing Regional

Centre by addressing the need to provide for future residential development, maintaining protection of sensitive environments, utilising existing transport and traffic infrastructure into Campbelltown City, and improving the diversity and choice of housing.

Is the planning proposal consistent with applicable State Environmental Planning Policies?

The consistency of the proposal with the relevant State Environmental Planning Policies (SEPPs) is outlined in **Table 2**.

Table 2 – Consistency of the proposal with the relevant SEPPs

SEPP	Requirement	Proposal	Complies
SEPP 19 – Bushland in Urban Areas	SEPP 19 aims to protect bushland in urban areas identified in Schedule 1 of the SEPP. Campbelltown is listed in Schedule 1 and therefore a Plan of Management is to be developed where bushland is zoned or reserved for public open space purposes.	The urban bushland within the site is to be dedicated to CCC. Plans of Management for future bushland within the site will be prepared at the time of relevant development as required by CCC.	Yes
SEPP 44 – Koala Habitat Protection	Campbelltown is identified as a local government area with the potential for providing koala habitat. This Policy aims to encourage the proper conservation and management of areas that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline.	The number of Koala habitat trees does not exceed the 15% threshold under the SEPP and therefore the site is not considered potential Koala habitat.	Yes
SEPP 55 – Remediation of Land	SEPP 55 requires a planning authority to consider whether land is contaminated, and if so whether it is, or can be made suitable for proposed residential use.	This planning proposal indicates that the land is not contaminated and is suitable for future residential development	Yes
SEPP (Infrastructure) 2007	The aim of this Policy is to facilitate the effective delivery of infrastructure across the State.	Future development of the site will need to be consistent with the relevant provisions of this SEPP, with future development applications referred to the RMS where necessary.	Yes
SEPP (BASIX) 2004	The overall aim of this Policy is to encourage sustainable residential development through establishing targets for thermal comfort, energy and water use.	DAs for all future residential development will need to comply with the targets established under BASIX.	Yes
SEPP (Housing for Seniors or People with a Disability) 2004	The aim of this policy is to encourage the provision of housing which increases the supply and diversity of residencies that meets the needs of seniors or people with a disability.	The planning proposal does not preclude the provision of housing for seniors and people with a disability.	Yes
SEPP Mining, Petroleum production and extractive industries 2007	The aims of this Policy are to support petroleum production and extractive industries to provide and manage development of mineral, petroleum and extractive material resources for promoting the social and economic welfare of the State.	The planning proposal does not impede potential mining of coal resources.	Yes
SEPP Affordable Rental Housing 2009	The aims of this Policy are to provide an overall consistent planning regime for the provision of affordable rental housing.	The planning proposal does not preclude the provision of affordable rental housing	Yes
SEPP Exempt and Comply	The aims of this Policy are to provide exempt and complying development codes that have State-wide application.	The planning proposal is not inconsistent with this SEPP which would apply to future development	Yes
SREP 20 Hawkesbury Nepean River	The aims of this plan is to protect the environment of the Hawkesbury-Nepean River system by ensuring that the impacts of future land uses are considered in a regional context.	The assessments undertaken for this planning proposal have addressed the environment of the Hawkesbury Nepean system. The inclusion of proposed LEP provisions in relation to the Terrestrial Biodiversity (see **Section 4**), and the delivery of water quality and quantity infrastructure ensure the protection of the Hawkesbury Nepean system	Yes

Is the planning proposal consistent with applicable Ministerial Directions (s.117 directions)?

The consistency of the proposal with the relevant Section 117 Directions is outlined in **Table 3**.

Table 3 – Consistency of the proposal with the relevant Section 117 Directions

Section 117 Direction	Summary / Implications	Proposal	Complies
1.1 Business and Industrial Zones	This direction applies when a relevant planning authority prepares a planning proposal that will affect land within an existing or proposed business or industrial zone. A planning proposal must ensure that proposed new employment areas are in accordance with a strategy that is approved by the Director-General of the Department of Planning	The area proposed to be rezoned to Zone B1 Neighbourhood Centre is approximately 3,200m^2 and is proposed to accommodate a community centre and small convenience store/kiosk. This planning proposal is thus considered to be justifiably inconsistent with this direction as it is of minor significance due the small area proposed for business purposes.	Yes
1.2 Rural Zones	This direction applies when a council prepares a draft LEP that creates, removes or alters a Rural Zone or provision. Any rezoning of Rural land needs to be justified by an environmental study or is in accordance with the relevant Regional Strategy prepared by the Department of Planning and Infrastructure.	As noted previously, the site was identified for rezoning on the Metropolitan Development Program. The planning proposal reflects the outcomes of extensive environmental studies and accords with relevant regional strategies as set out in this report.	Yes
1.3 Mining, Petroleum Production	Any future extraction of State or regionally significant reserves of coal, other mineral, petroleum and extractive materials are not compromised by inappropriate development.	Faults within the coal seam below the site will restrict any future mining activities, whilst the remainder of the seam will still be capable of being extracted.	Yes
2.1 Environment Protection Zones	This direction seeks to ensure the protection and conservation of environmentally sensitive areas.	Environmentally sensitive land is protected and conserved by way of provisions in a proposed Terrestrial Biodiversity clause in the draft LEP for the site (see **Section 4**)	Yes
2.3 Heritage Conservation	This direction applies to the conservation of heritage items, areas, objects and places of environmental heritage significance and indigenous heritage.	The heritage report has recommended appropriate mitigation measures to ensure that existing heritage is protected.	Yes
3.1 Residential Zones	This direction applies when Council prepares a draft LEP that creates, removes or alters a Residential Zone or provision. Any draft LEP will need to ensure that residential development is adequately serviced with water and sewerage.	The options for the provision of water and sewer infrastructure have been investigated and will be delivered as part of future applications for subdivision	Yes
3.3 Home Occupations	This direction encourages the carrying out of low-impact small businesses in dwelling houses.	The provisions in the draft LEP are consistent with CCC LGA-wide practice and do not preclude the carrying out of low-impact small businesses in dwelling houses	Yes
3.4 Integrated Land Use and Transport	This direction aims to ensure that urban structure, building forms, land use locations, development design, subdivision and street layouts achieve improved access to housing, jobs and support viable public transport.	The proposal seeks to deliver new housing in close proximity to existing residential urban land with access to public transport.	Yes
4.1 Acid Sulphate Soils	This direction aims to avoid significant adverse environmental impacts from the use of land that has a probability of containing acid sulphate soils	Previous studies on site indicated that Acid Sulphate Soils were considered to present low risk. No further assessment is required	Yes
4.2 Mine Subsidence and Unstable Land	This direction aims to prevent damage to life, property and the environment on land that may be unstable or subject to mine subsidence.	The Mine Subsidence Report has confirmed that any subsidence related issues can be managed.	Yes
4.3 Flood Prone Land	This direction aims to ensure that development is consistent with flooding policies and includes consideration of potential floor impacts.	The site subject to this proposal is not identified as flood prone land.	Yes

Section 117 Direction	Summary / Implications	Proposal	Complies
4.4 Planning for Bushfire Protection	This direction aims to protect life, property and the environment from bush fire hazards, and to encourage sound management of bush fire prone areas. The direction requires that a Council shall consult with the Commissioner of the NSW Rural Fire Service prior to undertaking community consultation on a draft LEP, and take into account any comments made. It also requires that the draft local environmental plan shall have regard to *Planning for Bushfire Protection 2006*, and introduce controls that avoid placing inappropriate developments in hazardous areas.	Any future development on site will have regard to *Planning for Bushfire Protection 2001*. Council has consulted with the NSW RFS who advise that it has no objection to the planning proposal in principle. See copy of letter at **Appendix E**.	Yes
6.1 Approval and Referral Requirements	This direction aims to ensure that LEP provisions encourage the efficient and appropriate assessment of development.	No new unnecessary referral or concurrence conditions are proposed as part of the planning proposal.	Yes
6.2 Reserving Land for Public Purposes	This direction aims to facilitate the provision of public services and facilities by reserving land for public purposes.	The planning proposal includes the reserving of land to enable the widening of Appin Road which is classified as a State Road. Road and Maritime Services has advised that it will be the responsible public authority for the acquisition of the land dedicated for the road widening. See copy of letter at **Appendix E**.	Yes
7.1 Implementation of the Metropolitan Plan for Sydney 2036	Planning proposals shall be consistent with the NSW Government"s Metropolitan Plan for Sydney 2036 published in December 2010.	The planning proposal achieves the overall intent of the Plan and does not undermine the achievement of its vision, land use strategy, policies, outcomes or actions.	Yes

6.3 Environmental, Social and Economic Impact

Is there any likelihood that critical habitat or threatened species, populations or ecological communities, or their habitats, will be adversely affected as a result of the proposal?

There is no critical habitat on the site.

Seven threatened bat species were identified on the site. The ecological assessment carried out for the planning proposal concludes that these species will not be affected by the proposal.

The following ecological communities are located within the boundaries of the site: Cumberland Plain Woodland (CPW) – a critically endangered ecological community; Shale Sandstone Transition Forest (SSTF) – a critically endangered ecological community; and River-flat Eucalypt Forest (RFEF) - an endangered ecological community.

The proposal involves the retention of 83% of CPW, 49.6% of SSTF and 100% of RFEF, with 1.5 hectares of CPW and 12.5 hectares of SSTF to be removed - both largely comprising scattered trees.

Any adverse effects as a result of the removal of CPW and SSTF will be addressed either via a Species Impact Statement submitted with future development applications, or offset with Biodiversity Certification as detailed in the Ecological Assessment at **Appendix F.** The proposal is capable of achieving the test of „improving or maintaining" the current vegetation on the site, subject to a red-flag variation being granted by OEH. The landowners have committed to achieving bio-banking offsets and substantial land has been set aside for this purpose.

Also as noted in clause 5.1.2, the proposed LEP amendment protects the ecological values of the site in the following ways:

- Ecologically sensitive land proposed to be zoned RE1 and RU2 will receive special protection via a clause to this effect, titled Terrestrial Biodiversity (as shown in **Appendix C**), which is proposed to be incorporated in „Part 7 of the draft Campbelltown LEP 2014. The relevant land is identified on the Terrestrial Biodiversity Map.

- The land proposed to be zoned RE1 in the north of the site connects with Noorumba Reserve and there are generally connections between all the areas of RE1 zoned land so facilitating the passage of native fauna.

Are there any other likely environmental effects as a result of the planning proposal and how are they proposed to be managed?

The environmental effects as a result of the planning proposal are detailed in Section 5 of this report and the appended specialist reports, and involve impacts on:

- non-indigenous heritage views and vistas;
- Aboriginal heritage;
- native vegetation; and
- traffic.

None of the impacts are considered of sufficient magnitude to preclude the land uses the subject of the planning proposal. All will be managed by:

- proposed LEP provisions;
- proposed development controls in Campbelltown (Sustainable City) DCP 2014;
- the provision of State road infrastructure to be delivered via a regional voluntary planning agreement between the landowners and the State government;
- the retention of significant stands of trees within open space areas; and
- provision of Biobanking offsets and/or other measures to protect the biodiversity of the site as determined by SIS assessments at development application stage.

Has the planning proposal adequately addressed any social and economic effects?

The planning proposal has considered the potential social and economic effects of the rezoning for future residential development. While local community and recreation facilities will be provided within the site, as noted in **Section 5.15**, the incoming population will be able to access all other social services in neighbouring suburbs where there is excess capacity (eg schools, health services, retail, entertainment, etc).

The site will accommodate a range of lot sizes, so providing choice in housing form and size which would respond to a variety of living situations and lifestyle choices. This has the potential to attract new residents who could, in turn, stimulate employment growth within the Campbelltown LGA.

6.4 State and Commonwealth Interests

Is there adequate public infrastructure for the planning proposal?

Utility Services Infrastructure

The full range of utility services needed to support the site has been investigated, covering electricity, telecommunication, gas, water, waste water and stormwater drainage. The site is able to be serviced with all of the above utility infrastructure as set out in **Section 5.14**.

Transport Infrastructure

The site is capable of absorbing and supporting public transport and provision has been made for a bus route within the site. The street layout within the site, as proposed in the Indicative Structure Plan, facilitates local traffic movements as well as walking and cycling. Local roads will be constructed as part of future development applications.

The need for road and intersection upgrades has been set out in the Traffic, Transport & Access Study (see **Appendix M**) and discussed in **Section 5.10**. Various intersection and road upgrades will be required to address capacity deficits which are forecast to occur as a result of the planning proposal and background growth. These will be the subject of a regional voluntary planning agreement between the landowners and the State government.

What are the views of State and Commonwealth public authorities consulted in accordance with the Gateway determination?

All the authorities listed in the Gateway Determination will be consulted by CCC in accordance with section 56(2)(d) of the EP&A Act. The inputs and views of the following entities were sought either by the landowners and/or their consultants or CCC during preparation of the planning proposal.

- **Sydney Water** supports the exhibition of the planning proposal and has indicated that it will support the finalisation of the planning proposal once its requirements for determining the servicing strategy have been met (see letter at **Appendix E).**
- **Transport for NSW** and **Roads and Maritime Services** have confirmed that the measures proposed to mitigate the traffic impacts of the planning proposal are acceptable. They also do not object to the public exhibition of the planning proposal (see letters at **Appendix E)**.
- The **Office of Environment and Heritage** has indicated that it will consider and respond to the Indigenous Heritage Assessment during the formal notification period.
- The **NSW Office of Water** responded to questions about the classification of the streams on the site and agreed to the removal of a number of 1st order streams mapped on the site (see correspondence at **Appendix E**).
- The **NSW Rural Fire Service** has no objection to the planning proposal in principle but advises that any future development will need to comply with the requirements of *Planning for Bush Fire Protection 2006* (see correspondence at **Appendix E**).

6.5 Conclusion

The studies undertaken in support of this planning proposal have confirmed that the Mt Gilead site is suitable for residential development. The proposal will enable the 210 ha site to be rezoned for low density residential development on land that is generally unconstrained by biophysical and ecological features.

The planning proposal will facilitate development that would have demonstrable social and economic benefits for the region. With up to 1700 new dwellings in a low density environment, the proposal will deliver positive outcomes for housing supply to the South West Region and the Campbelltown-Macarthur Regional City Centre, and with a range of lot sizes, 600 square metres on average, it will expand the type and choice of dwellings available in the Campbelltown LGA. This outcome is consistent with local and regional strategies and objectives to promote housing diversity.

The land is proposed to be rezoned (in accordance with the Standard Instrument – Principal Local Environmental Plan and consistent with draft CLEP 2014) to a predominantly R2 residential zone along with smaller areas for public open space and roads. In addition, a small area is intended to be zoned as a neighbourhood centre in order to facilitate the future delivery of a community centre. 29ha is to be retained as rural land. Ecologically sensitive vegetation will be protected.

In accordance with the Gateway Determination a range of planning and environmental issues were considered in preparing the planning proposal. They demonstrate that the proposed rezoning can proceed with few, if any, adverse effects. Impacts in relation to sensitive vegetation; heritage; and traffic and transport infrastructure are able to be managed and mitigated by a combination of additional LEP provisions, site-specific development controls, the provision of road infrastructure through a VPA, and the offsetting of the loss of vegetation.

The proposed rezoning makes provision on site for local passive and active open space, community facilities and a small area of retail development. For those social and economic services and facilities that will not be provided on site, it is considered that there is sufficient capacity in the neighbouring areas to accommodate the needs of the incoming community.

The site is able to be serviced with necessary water, waste water and other utility services.

It is considered that there is sufficient information available to give Council the confidence to publically exhibit and formally notify this planning proposal and associated LEP amendment in accordance with the *Environmental Planning and Assessment Act 1979.*

However, it is noted that Council will require assurance that the State Government will provide the necessary resources needed for the widening of Appin Road. The proposed voluntary planning

agreement between the traffic authorities and the proponents will include an apportionment of funds payable by the proponents for the road works considered attributable to the need that will be generated by the Mt Gilead URA. This is anticipated to be approximately 50% of a total cost of approximately $20M. However, Council has not received any advice from the State authorities confirming that they will fund the remaining 50%. Without this contribution from the State Government there is no capacity for the development to remain economically feasible should the development itself be made responsible for funding what is essentially the regional co-contribution to facilitate road and traffic infrastructure.

Appendix D: Threatened species likelihood tables and assessment of candidate species

The table below lists the threatened species known or considered likely to occur within the BCAA based on previous surveys, Atlas, EPBC Act Protected Matters Search, Biodiversity certification credit calculator tool and/or expert opinion. Those species categorised as 'species credit' species (all threatened flora species and approximately half of all threatened fauna species) that were filtered into the BCAA by the biocertification credit calculator version 1.9 and validated as species credit species against the threatened species profile ecological data from the BioNet Atlas of NSW Wildlife (Step 1 of section 4.3 of the BCAM) are indicated. At this stage of the candidate species assessment, additional species are added to the list if they have been recently listed in the TSC Act, there are records on the Atlas or have been recorded in past ecological surveys/reports (Step 2 of section 4.3 of the BCAM). A Wildlife Atlas search was undertaken by ELA on 23rd April 2015 to identify any additional species to be added to the table.

The 'Likelihood' and 'Justification' columns justifies the culled list of candidate species for further assessment and the 'Additional survey required' indicates whether additional survey is required to complete a formal Biocertification assessment (Step 3 of section 4.3 of the BCAM).

Five categories for likelihood of occurrence of species are used in this report and are defined below. Assessment of likelihood was based on species' locality records, presence or absence of suitable habitat features within the BCAA, results of previous studies, on site field surveys and professional judgement.

- known/yes - the species is known to occur within suitable habitat within the BCAA.
- likely - a medium to high probability that a species occupies or uses habitat within the BCAA.
- potential - suitable habitat for a species occurs within the BCAA, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur.
- unlikely - a very low to low probability that a species occupies or uses habitat within the BCAA.
- no - habitat within the BCAA and in the immediate vicinity is unsuitable for the species, or, in the case of plants, the species was not located during searches of the BCAA.

TSC/EPBC Act Status

- CE = Critically Endangered species, population or ecological community.
- E = Endangered species, population (E2) or ecological community (E3).
- V = Vulnerable species, population or ecological community.

Threatened flora

Scientific name	Common name	TSC Act	EPBC Act	Data source	Habitat association	Recorded on site	Likelihood	Justification	Additional survey required
Acacia bynoeana	Bynoe's Wattle	E	V	BCAM, Atlas, PMST	*Acacia bynoeana* is found in central eastern NSW, from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains, and has recently been found in the Colymea and Parma Creek areas west of Nowra. It is found in heath and dry sclerophyll forest, typically on a sand or sandy clay substrate, often with ironstone gravels (OEH 2015d).	No	No	No suitable habitat present.	No. Already surveyed for by ELA (2014 2015a and b). Also not recorded during additional survey in 2015 and 2016 undertaken for this biocertification assessment (**Figure 8**).
Acacia pubescens	Downy Wattle	V	V	BCAM	*Acacia pubescens* occurs on the NSW Central Coast in Western Sydney, mainly in the Bankstown-Fairfield-Rookwood area and the Pitt Town area, with outliers occurring at Barden Ridge, Oakdale and Mountain Lagoon. It is associated with Cumberland Plains Woodlands, Shale / Gravel Forest and Shale / Sandstone Transition Forest growing on clay soils, often with ironstone gravel (OEH 2015d).	No	No	Marginal habitat present.	No. Already surveyed for by ELA (2014 2015a and b). Also not recorded during additional survey in 2015 and 2016 undertaken for this biocertification assessment (**Figure 8**).
Allocasuarina glareicola		-	E	PMST	*Allocasuarina glareicola* is primarily restricted to the Richmond district on the north-west Cumberland Plain, with an outlier population found at Voyager Point. It grows in Castlereagh woodland on lateritic soil (OEH 2015d).	No	No	No habitat present and outside known range.	No
Asterolasia elegans		E	E	PMST	*Asterolasia elegans* is restricted to a few localities on the NSW Central Coast north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby LGAs. It is found in sheltered forests on mid- to lower slopes and valleys, in or adjacent to gullies (OEH 2015d).	No	No	No habitat present and outside known range.	No
Caladenia tessellata	Thick Lip Spider Orchid	E	V	PMST	*Caladenia tessellata* occurs in grassy sclerophyll woodland, often growing in well-structured clay loams or sandy soils south from Swansea, usually in sheltered moist places and in areas of increased sunlight. It flowers from September to November (OEH 2015d).	No	No	Outside known range	No
Cryptostylis hunteriana	Leafless Tongue Orchid	V	V	PMST	*Cryptostylis hunteriana* is known from a range of vegetation communities including swamp-heath and woodland. The larger populations typically occur in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black Sheoak (*Allocasuarina littoralis*); where it appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (*C. subulata*) and the Tartan Tongue Orchid (*C. erecta*). Coastal Plains Scribbly Gum Woodland and Coastal Plains Smoothed-barked Apple Woodland is potential habitat on the Central Coast. Flowers between November and	No	No	No suitable habitat present.	No

Scientific name	Common name	TSC Act	EPBC Act	Data source	Habitat association	Recorded on site	Likelihood	Justification	Additional survey required
					February, although may not flower regularly (OEH 2015d).				
Cynanchum elegans	White-flowered Wax Plant	E	E	BCAM, PMST	*Cynanchum elegans* is a climber or twiner with a variable form, and flowers between August and May, peaking in November. It occurs in dry rainforest gullies, scrub and scree slopes, and prefers the ecotone between dry subtropical rainforest and sclerophyll woodland/forest. The species has also been found in littoral rainforest; *Leptospermum laevigatum – Banksia integrifolia* subsp. *integrifolia* coastal scrub; *Eucalyptus tereticornis* open forest/ woodland; *Corymbia maculata* open forest/woodland; and *Melaleuca armillaris* scrub to open scrub (OEH 2015d).	No	No	No suitable habitat present.	No. Already surveyed for by ELA (2014 2015a and b). Also not recorded during additional survey in 2015 and 2016 undertaken for this biocertification assessment (**Figure 8**).
Dillwynia tenuifolia		V		BCAM	The core distribution is the Cumberland Plain from Windsor and Penrith east to Dean Park near Colebee. Other populations in western Sydney are recorded from Voyager Point and Kemps Creek in the Liverpool LGA, Luddenham in the Penrith LGA and South Maroota in the Baulkham Hills Shire.In western Sydney, may be locally abundant particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays (OEH 2015d).	No	No	Marginal habitat present.	No. Already surveyed for by ELA (2014 2015a and b). Also not recorded during additional survey in 2015 and 2016 undertaken for this biocertification assessment (**Figure 8**).
Epacris purpurascens var. *purpurascens*		V		BCAM	Found in a range of habitat types, most of which have a strong shale soil influence (OEH 2015d).	No	No	Marginal habitat present.	No. Already surveyed for by ELA (2014 2015a and b). Also not recorded during additional survey in 2015 and 2016 undertaken for this biocertification assessment (**Figure 8**).
Eucalyptus benthamii	Camden White Gum	V	V	BCAM	*Eucalyptus benthamii* occurs in wet open forest on well drained sandy alluvial soils along stream channels, small terraces and alluvial flats on valley floors (OEH 2015d).	No	No	No suitable habitat present.	No. Already surveyed for by ELA (2014 2015a and b). Also not recorded during additional survey in 2015 and 2016 undertaken for this biocertification assessment (**Figure 8**).
Genoplesium baueri	Bauer's Midge Orchid	V	-	PMST	Known from coastal areas from northern Sydney south to the Nowra district. Previous records from the Hunter Valley and Nelson Bay are now thought to be erroneous. Grows in shrubby woodland in open forest on shallow sandy soils (OEH 2015d).	No	No	No suitable habitat present.	No
Grevillea juniperina subsp. *juniperina*	Juniper-leaf Grevillea	V		BCAM	Endemic to Western Sydney. Grows on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary alluvium (often with shale influence), typically containing lateritic gravels. Recorded from Cumberland Plain	No	No	Marginal habitat present.	No. Already surveyed for by ELA (2014 2015a and b). Also not recorded during additional survey in 2015 and 2016

Scientific name	Common name	TSC Act	EPBC Act	Data source	Habitat association	Recorded on site	Likelihood	Justification	Additional survey required
					Woodland, Castlereagh Ironbark Woodland, Castlereagh Scribbly Gum Woodland and Shale/Gravel Transition Forest (OEH 2015d).				undertaken for this biocertification assessment (**Figure 8**).
Grevillea parviflora subsp. *parviflora*	Small-flower Grevillea	V	V	BCAM, Atlas, PMST	*Grevillea parviflora* subsp. *parviflora* is sporadically distributed throughout the Sydney Basin mainly around Picton, Appin and Bargo. Separate populations are also known further north from Putty to Wyong and Lake Macquarie and Cessnock and Kurri Kurri. It grows in sandy or light clay soils over thin shales, often with lateritic ironstone gravels. It often occurs in open, slightly disturbed sites such as tracks (OEH 2015d).	No	No	Marginal habitat present.	No. Already surveyed for by ELA (2014 2015a and b). Also not recorded during additional survey in 2015 and 2016 undertaken for this biocertification assessment (**Figure 8**).
Grevillea parviflora subsp. *supplicans*		E		BCAM	Has a very restricted known distribution (approximately 8 by 10 km) and is confined to the north-west of Sydney near Arcadia and the Maroota–Marramarra Creek area, in Hornsby and Baulkham Hills LGAs. Occurs in heathy woodland associations on skeletal sandy soils over massive sandstones (OEH 2015d).	No	No	Outside range and no suitable habitat present.	No. Already surveyed for by ELA (2014 2015a and b). Also not recorded during additional survey in 2015 and 2016 undertaken for this biocertification assessment (**Figure 8**).
Gyrostemon thesioides		E		BCAM	Within NSW, has only ever been recorded at three sites, to the west of Sydney, near the Colo, Georges and Nepean Rivers. Grows on hillsides and riverbanks and may be restricted to fine sandy soils (OEH 2015d).	No	No	Outside range and no suitable habitat present.	No. Already surveyed for by ELA (2014 2015a and b). Also not recorded during additional survey in 2015 and 2016 undertaken for this biocertification assessment (**Figure 8**).
Haloragis exalata subsp. *exalata*	Wingless Raspwort	V	V	PMST	Square Raspwort occurs in 4 widely scattered localities in eastern NSW. It is disjunctly distributed in the Central Coast, South Coast and North Western Slopes botanical subdivisions of NSW. It appears to require protected and shaded damp situations in riparian habitats (OEH 2015d).	No	No	No suitable habitat present.	No
Hibbertia sp. Bankstown		CE	CE	BCAM	This species is endemic to New South Wales and is currently known to occur in only one population at Bankstown Airport in Sydney's southern suburbs, in the Bankstown LGA (OEH 2015d).	No	No	Outside of range.	No
Hibbertia superans		E		BCAM	Occurs from Baulkham Hills to South Maroota in the northern outskirts of Sydney, where there are currently 16 known sites. The species occurs on sandstone ridgetops often near the shale/sandstone boundary (OEH 2015d).	No	No	Outside of range and marginal habitat present.	No. Already surveyed for by ELA (2014 2015a and b). Also not recorded during additional survey in 2015 and 2016 undertaken for this biocertification assessment (**Figure 8**).
Hypsela sessiliflora		E	Ex	BCAM	Currently known from only two adjacent sites on a single private property at Erskine Park in the Penrith LGA. Known to grow in damp places, on the Cumberland Plain, including freshwater wetland, grassland/alluvial	No	No	Outside of range.	No

Scientific name	Common name	TSC Act	EPBC Act	Data source	Habitat association	Recorded on site	Likelihood	Justification	Additional survey required
					woodland and an alluvial woodland/shale plains woodland ecotone (OEH 2015d).				
Leucopogon exolasius	Woronora Beard-heath	V	V	Atlas, PMST	*Leucopogon exolasius* is found along the upper Georges River area and in Heathcote National Park. It is associated with Sydney Sandstone Gully Forest on rocky hillsides and creek banks (OEH 2015d).	No	No	No suitable habitat present.	No
Leucopogon fletcheri subsp. *fletcheri*		E		BCAM	Restricted to north-western Sydney between St Albans in the north and Annangrove in the south, within the local government areas of Hawkesbury, Baulkham Hills and Blue Mountains. Occurs in dry eucalypt woodland or in shrubland on clayey lateritic soils, generally on flat to gently sloping terrain along ridges and spurs (OEH 2015d).	No	No	Outside range and marginal habitat present.	No. Already surveyed for by ELA (2014 2015a and b). Also not recorded during additional survey in 2015 and 2016 undertaken for this biocertification assessment (**Figure 8**).
Melaleuca deanei	Deane's Paperbark	V	V	BCAM, Atlas, PMST	Found in heath on sandstone, and also associated with woodland on broad ridge tops and slopes on sandy loam and lateritic soils (OEH 2015d).	No	No	No suitable habitat present.	No. Already surveyed for by ELA (2014 2015a and b). Also not recorded during additional survey in 2015 and 2016 undertaken for this biocertification assessment (**Figure 8**).
Pelargonium sp. *striatellum*	Omeo's Stork's Bill	E	E	PMST	The species is known to occur in habitat usually located just above the high water level of irregularly inundated or ephemeral lakes. During dry periods, the species is known to colonise exposed lake beds. It is not known if the species' rhizomes and/or soil seedbank persist through prolonged inundation or drought (OEH 2015d).	No	No	No suitable habitat present.	No
Persicaria elatior	Knotweed	V	V	BCAM	This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance (OEH 2015d).	No	No	Marginal habitat present.	No. Already surveyed for by ELA (2014 2015a and b). Also not recorded during additional survey in 2015 and 2016 undertaken for this biocertification assessment (**Figure 8**).
Persoonia bargoensis	Bargo Geebung	E	V	BCAM, PMST	Associated with woodland to dry sclerophyll forest, on sandstone and clayey laterite on heavier, well-drained, loamy, gravelly soils of the Hawkesbury Sandstone and Wianamatta Shale in the catchments of the Cataract, Cordeaux and Bargo Rivers (OEH 2015d).	No	Unlikely	Marginal habitat present.	No. Already surveyed for by ELA (2014 2015a and b). Also not recorded during additional survey in 2015 and 2016 undertaken for this biocertification assessment (**Figure 8**).
Persoonia hirsuta	Hairy Geebung	E	E	BCAM, Atlas, PMST	*Persoonia hirsuta* occurs from Singleton in the north, south to Bargo and the Blue Mountains to the west. It grows in dry sclerophyll eucalypt woodland and forest on sandstone (OEH 2015d).	No	No	No suitable habitat present.	No. Already surveyed for by ELA (2014 2015a and b). Also not recorded during additional survey in 2015 and 2016 undertaken for this biocertification assessment (**Figure 8**).

Scientific name	Common name	TSC Act	EPBC Act	Data source	Habitat association	Recorded on site	Likelihood	Justification	Additional survey required
Persoonia nutans	Nodding Geebung	E	E	BCAM	Associated with dry woodland, Castlereagh Scribbly Gum Woodland, Agnes Banks Woodland and sandy soils associated with tertiary alluvium, occasionally poorly drained. Endemic to the Western Sydney (OEH 2015d).	No	No	No suitable habitat present.	No. Already surveyed for by ELA (2014 2015a and b). Also not recorded during additional survey in 2015 and 2016 undertaken for this biocertification assessment (**Figure 8**).
Pimelea curviflora var. *curviflora*		V	V	BCAM, PMST	*Pimelea curviflora* var. *curviflora* is confined to the coastal area of Sydney between northern Sydney in the south and Maroota in the north-west. It grows on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands (OEH 2015d).	No	Unlikely	Marginal habitat present.	No. Already surveyed for by ELA (2014 2015a and b). Also not recorded during additional survey in 2015 and 2016 undertaken for this biocertification assessment (**Figure 8**).
Pimelea spicata	Spiked Rice-flower	E	E	BCAM, PMST	In western Sydney, *Pimelea spicata* occurs on an undulating topography of well structured clay soils, derived from Wianamatta shale. It is associated with Cumberland Plains Woodland (CPW), in open woodland and grassland often in moist depressions or near creek lines. Has been located in disturbed areas that would have previously supported CPW (OEH 2015d).	No	Unlikely	Marginal habitat present.	No. Already surveyed for by ELA (2014 2015a and b). Also not recorded during additional survey in 2015 and 2016 undertaken for this biocertification assessment (**Figure 8**).
Pomaderris brunnea	Rufous Pomaderris	V	V	Atlas, PMST	*Pomaderris brunnea* occurs in a limited area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. It also occurs near Walcha on the New England tablelands and in far eastern Gippsland in Victoria It grows in moist woodland or forest on clay or alluvial soils of floodplains and creek lines (OEH 2015d).	No, although found to the west in Stage 2 Mt Gilead along creek	No	Marginal habitat present.	No. Already surveyed for by ELA (2014 2015a and b). Also not recorded during additional survey in 2015 and 2016 undertaken for this biocertification assessment (**Figure 8**).
Pterostylis saxicola	Sydney Plains Greenhood	E	E	BCAM, PMST	Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. The vegetation communities above the shelves where *Pterostylis saxicola* occurs are sclerophyll forest or woodland on shale/sandstone transition soils or shale soils. Restricted to western Sydney between Freemans Reach in the north and Picton in the south. There are very few known populations and they are all very small and isolated (OEH 2015d).	No	No	No suitable habitat present.	No. Already surveyed for by ELA (2014 2015a and b). Also not recorded during additional survey in 2015 and 2016 undertaken for this biocertification assessment (**Figure 8**).
Pultenaea pedunculata	Matted Bush-pea	E	-	BCAM, Atlas	In NSW, *Pultenaea pedunculata* is known from three disjunct populations, in the Cumberland Plains in Sydney, the coast between Tathra and Bermagui and the Windellama area south of Goulburn. It grows in woodland vegetation but plants have also been found on road batters and coastal cliffs. It is largely confined to loamy soils in dry gullies in populations in the Windellama area (OEH 2015d).	No	No	Marginal habitat present.	No. Already surveyed for by ELA (2014 2015a and b). Also not recorded during additional survey in 2015 and 2016 undertaken for this biocertification assessment (**Figure 8**).

Scientific name	Common name	TSC Act	EPBC Act	Data source	Habitat association	Recorded on site	Likelihood	Justification	Additional survey required
Streblus pendulinus	Siah's backbone	-	E	PMST	On the Australian mainland, Siah's Backbone is found in warmer rainforests, chiefly along watercourses. The altitudinal range is from near sea level to 800 m above sea level. The species grows in well developed rainforest, gallery forest and drier, more seasonal rainforest (OEH 2015d).	No	No	No suitable habitat present.	No
Tetratheca glandulosa		V		BCAM	Restricted to Baulkham Hills, Gosford, Hawkesbury, Hornsby, Ku-ring-gai, Pittwater, Ryde, Warringah, and Wyong LGAs. Associated with shale-sandstone transition habitat where shale-cappings occur over sandstone (OEH 2015d).	No	No	Outside known range and marginal habitat present.	No. Already surveyed for by ELA (2014 2015a and b). Also not recorded during additional survey in 2015 and 2016 undertaken for this biocertification assessment (**Figure 8**).
Thesium australe	Austral Toadflax	V	V	PMST	Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast (OEH 2015d).	No	No	Outside known range.	No
Thelymitra sp. Kangaloon	Kangaloon Sun-orchid	CE	CE	PMST	*Thelymitra* sp. *Kangaloon* is only known to occur on the southern tablelands of NSW in the Robertson / Kangaloon / Fitzroy Falls area at 550-700 m above sea level. It is thought to be a short-lived perennial, flowering in late October and early November. It is found in swamps in sedgelands over grey silty grey loam soils. It is known to occur at three swamps that are above the Kangaloon Aquifer, and that are a part of the ecological community "Temperate Highland Peat Swamps on Sandstone" which is listed under the EPBC Act.	No	No	Outside known range.	No

Threatened fauna

Group	Scientific name	Common name	TSC Act	EPBC Act	Data Source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required
Invertebrate	*Meridolum corneovirens*	Cumberland Plain Land Snail	E	-	BCAM, Atlas	Species	Associated with open eucalypt forests, particularly Cumberland Plain Woodland. Found under fallen logs, debris and in bark and leaf litter around the trunk of gum trees or burrowing in loose soil around clumps of grass. Urban waste may also form suitable habitat (OEH 2015d).	Unlikely	Despite records across Appin Road, along Woodhouse Creek and in Noorumba Reserve, no leaf litter accumulation present	No. Habitat assessed by ELA (2014) as unsuitable
Amphibian	*Heleioporus australiacus*	Giant Burrowing Frog	V	V	Atlas, PMST	Species	Forages in woodlands, wet heath, dry and wet sclerophyll forest. Associated with semi-permanent to ephemeral sand or rock based streams, where the soil is soft and sandy so that burrows can be constructed (OEH 2015d).	No	No suitable habitat present	No
Amphibian	*Litoria aurea*	Green and Golden Bell Frog	E	V	BCAM, PMST	Species	This species has been observed utilising a variety of natural and man-made waterbodies such as coastal swamps, marshes, dune swales, lagoons, lakes, other estuary wetlands, riverine floodplain wetlands and billabongs, stormwater detention basins, farm dams, bunded areas, drains, ditches and any other structure capable of storing water. Preferable habitat for this species includes attributes such as shallow, still or slow flowing, permanent and/or widely fluctuating water bodies that are unpolluted and without heavy shading. Large permanent swamps and ponds exhibiting well-established fringing vegetation (especially bulrushes–Typha sp. and spikerushes–Eleocharis sp.) adjacent to open grassland areas for foraging are preferable. Ponds that are typically inhabited tend to be free from predatory fish such as Mosquito Fish (*Gambusia holbrooki*) (OEH 2015d). Recorded at Birwiri Creek, 7km to north of BCAA, in 2015	Unlikely	No suitable habitat present	No. All potential habitat surveyed and species not recorded (**Appendix H**).
Amphibian	*Litoria littlejohnii*	Littlejohn's Tree Frog	V	V	PMST	Species	Littlejohn's Tree Frog occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops. It appears to be restricted to sandstone woodland and heath communities at mid to high altitude (OEH 2015d).	No	No suitable habitat present	No
Amphibian	*Litoria raniformis*	Southern Bell Frog	E	V	PMST	Not listed in Bionet	Relatively still or slow-flowing sites such as billabongs, ponds, lakes or farm dams, especially where Typha sp., Eleocharis sp. and Phragmites sp. (Bulrushes) are present. This species is common in lignum shrublands, black box and River Red Gum woodlands, irrigation channels and at the periphery of rivers in the southern parts of NSW. This species occurs in vegetation types such as open grassland, open forest and ephemeral and permanent non-saline marshes and swamps. Open grassland and ephemeral permanent non-saline marshes and swamps have also been associated with this species (OEH 2015d).	No	No suitable habitat present	No
Amphibian	*Pseudophryne australis*	Red-crowned Toadlet	V		Atlas	Species	Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings (OEH 2015d).	No	No suitable habitat present	No

Group	Scientific name	Common name	TSC Act	EPBC Act	Data Source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required
Reptile	*Hoplocephalus bungaroides*	Broad-headed Snake	E	V	Atlas, PMST	Species	Typical sites consist of exposed sandstone outcrops and benching where the vegetation is predominantly woodland, open woodland and/or heath on Triassic sandstone of the Sydney Basin. They utilise rock crevices and exfoliating sheets of weathered sandstone during the cooler months and tree hollows during summer (OEH 2015d).	No	No suitable habitat present	No
Reptile	*Varanus rosenbergi*	Rosenberg's Goanna	V	-	BCAM, Atlas	Species	Associated with Sydney sandstone woodland and heath land. Rocks, hollow logs and burrows are utilised for shelter (OEH 2015d).	No	No suitable habitat present	No. Already surveyed for by ELA (2014)
Birds	*Anthochaera phrygia*	Regent Honeyeater	E	E & M	BCAM, PMST	Species	Associated with temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts, and riparian forests of River Oak (*Casuarina cunninghamiana*). Areas containing Swamp Mahogany (*Eucalyptus robusta*) in coastal areas have been observed to be utilised. The Regent Honeyeater primarily feeds on nectar from box and ironbark eucalypts and occasionally from banksias and mistletoes. As such it is reliant on locally abundant nectar sources with different flowering times to provide reliable supply of nectar (OEH 2015d).	Unlikely	Marginal habitat present	No. Bird surveys already undertaken by ELA (2014)
Birds	*Botaurus poiciloptilus*	Australasian Bittern	V	-	PMST	Species	Terrestrial wetlands with tall dense vegetation, occasionally estuarine habitats. Reedbeds, swamps, streams, estuaries (OEH 2015d).	No	No suitable habitat present	No. Bird surveys already undertaken by ELA (2014)
Birds	*Burhinus grallarius*	Bush Stone-curlew	E	-	BCAM	Ecosystem	Associated with dry open woodland with grassy areas, dune scrubs, in savanna areas, the fringes of mangroves, golf courses and open forest / farmland. Forages in areas with fallen timber, leaf litter, little undergrowth and where the grass is short and patchy. Is thought to require large tracts of habitat to support breeding, in which there is a preference for relatively undisturbed in lightly disturbed (OEH 2015d).	No	No suitable habitat present	No. Bird surveys already undertaken by ELA (2014)
Birds	*Callocephalon fimbriatum*	Gang-gang Cockatoo	V	-	BCAM, Atlas	Ecosystem	During summer in dense, tall, wet forests of mountains and gullies, alpine woodlands. In winter they occur at lower altitudes in drier more open forests and woodlands, particularly box-ironbark assemblages. They sometimes inhabit woodland, farms and suburbs in autumn/winter (OEH 2015d).	No	No suitable habitat present	No. Bird surveys already undertaken by ELA (2014)
Birds	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V	-	Atlas	Ecosystem	Associated with a variety of forest types containing Allocasuarina species, usually reflecting the poor nutrient status of underlying soils. Intact drier forest types with less rugged landscapes are preferred. Nests in large trees with large hollows (OEH 2015d).	No	No suitable habitat present	No. Bird surveys already undertaken by ELA (2014)
Birds	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subspecies)	V	-	BCAM, Atlas	Ecosystem	Distributed through central NSW on the western side of the Great Dividing Range and sparsely scattered to the east of the Divide in drier areas such as the Cumberland Plain of Western Sydney, and in parts of the Hunter, Clarence, Richmond and Snowy River valleys. The Brown Treecreeper occupies eucalypt woodlands, particularly open woodland lacking a dense understorey. It is sedentary and nests in tree hollows within permanent territories (OEH 2015d).	Unlikely	Marginal habitat present	No. Bird surveys already undertaken by ELA (2014)

Group	Scientific name	Common name	TSC Act	EPBC Act	Data Source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required
Birds	*Daphoenositta chrysoptera*	Varied Sittella	V	-	BCAM, Atlas	Ecosystem	Distribution includes most of mainland Australia except deserts and open grasslands. Prefers eucalypt forests and woodlands with rough-barked species, or mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods from bark, dead branches, or small branches and twigs (OEH 2015d).	Unlikely	Marginal habitat present	No. Bird surveys already undertaken by ELA (2014)
Birds	*Dasyornis brachypterus*	Eastern Bristlebird	E	E	PMST	Species	Habitat is characterised by dense, low vegetation and includes sedgeland, heathland, swampland, shrubland, sclerophyll forest and woodland, and rainforest, as well as open woodland with a heathy understorey. In northern NSW occurs in open forest with tussocky grass understorey. All of these vegetation types are fire prone, aside from the rainforest habitatas utilised by the northern population as fire refuge. Age of habitat since fires (fire-age) is of paramount importance to this species; Illawarra and southern populations reach maximum densities in habitat that has not been burnt for at least 15 years; however, in the northern NSW population a lack of fire in grassy forest may be detrimental as grassy tussock nesting habitat becomes unsuitable after long periods without fire; northern NSW birds are usually found in habitats burnt five to 10 years previously (OEH 2015d).	No	No suitable habitat present	No. Bird surveys already undertaken by ELA (2014)
Birds	*Ephippiorhynchus asiaticus*	Black-necked Stork	E	-	Atlas	Species	Associated with tropical and warm temperate terrestrial wetlands, estuarine and littoral habitats, and occasionally woodlands and grasslands floodplains. Forages in fresh or saline waters up to 0.5m deep, mainly in open fresh waters, extensive sheets of shallow water over grasslands or sedgeland, mangroves, mudflats, shallow swamps with short emergent vegetation and permanent billabongs and pools on floodplains (OEH 2015d).	No	No suitable habitat present	No. Bird surveys already undertaken by ELA (2014)
Birds	*Glossopsitta pusilla*	Little Lorikeet	V	-	BCAM, Atlas	Ecosystem	In New South Wales Little Lorikeets are distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Little Lorikeets mostly occur in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes. They feed primarily on nectar and pollen in the tree canopy, particularly on profusely-flowering eucalypts, but also on a variety of other species including melaleucas and mistletoes (OEH 2015d).	Recorded	Recorded by ELA (2014)	No as already recorded and an ecosystem species
Birds	*Hieraaetus morphnoides*	Little Eagle	V	-	BCAM, Atlas	Ecosystem	Utilises open eucalypt, sheoak and acacia forest, woodland or open woodland. Uses tall trees for nesting, with a large stick nest being built. Lays eggs in spring, and young fledge in early summer. Preys on birds, reptiles and mammals, and occasionally feeds on large insects or carrion (OEH 2015d).	Potential	Suitable habitat present	No. Bird surveys already undertaken by ELA (2014) and species is an ecosystem species
Birds	*Lathamus discolor*	Swift Parrot	E	E	BCAM, Atlas, PMST	Ecosystem	Breeds in Tasmania between September and January. Migrates to mainland in autumn, where it forages on profuse flowering Eucalypts. Hence, in this region, autumn and winter flowering eucalypts are	Potential	Suitable habitat present	No. Bird surveys already undertaken by ELA (2014) and

Group	Scientific name	Common name	TSC Act	EPBC Act	Data Source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required
							important for this species. Favoured feed trees include winter flowering species such as Swamp Mahogany (*Eucalyptus robusta*), Spotted Gum (*Corymbia maculata*), Red Bloodwood (*C. gummifera*), Mugga Ironbark (*E. sideroxylon*), and White Box (*E. albens*) (OEH 2015d).			species is an ecosystem species
Birds	*Lophoictinia isura*	Square-tailed Kite	V	-	BCAM, Atlas	Ecosystem	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses (OEH 2015d).	Potential	Suitable habitat present	No. Bird surveys already undertaken by ELA (2014) and species is an ecosystem species
Birds	*Melanodryas cucullata cucullata*	Hooded Robin (south-eastern form)	V	-	BCAM	Ecosystem	Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas (OEH 2015d)	Potential	Suitable habitat present	No. Bird surveys already undertaken by ELA (2014) and species is an ecosystem species
Birds	*Melithreptus gularis gularis*	Black-chinned Honeyeater (eastern subspecies)	V	-	BCAM	Ecosystem	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Inland Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) and Forest Red Gum (*E. tereticornis)* (OEH 2015d).	Unlikely	Prefers other habitats	No. Bird surveys already undertaken by ELA (2014)
Birds	*Neophema pulchella*	Turquoise Parrot	V	-	BCAM	Ecosystem	Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland (OEH 2015d).	Unlikely	Prefers other habitats	No. Bird surveys already undertaken by ELA (2014)
Birds	*Ninox connivens*	Barking Owl	V	-	BCAM	Ecosystem	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas (OEH 2015d).	Potential	Suitable habitat present	No. Species is an ecosystem species
Birds	*Ninox strenua*	Powerful Owl	V	-	BCAM, Atlas	Ecosystem	The Powerful Owl is associated with a wide range of wet and dry forest types with a high density of prey, such as arboreal mammals, large birds and flying foxes. Large trees with hollows at least 0.5m deep are required for shelter and breeding (OEH 2015d).	Potential	Suitable habitat present	No. Species is an ecosystem species
Birds	*Petroica boodang*	Scarlet Robin	V	-	BCAM, Atlas	Ecosystem	Occurs from the coast to the inland slopes in NSW. After breeding (July-Jan), some disperse to the lower valleys and plains of the tablelands and slopes. Primarily resides in dry eucalypt forests and woodlands, with usually open and grassy understorey, with scattered shrubs. Abundant logs and fallen timber are important habitat components. In autumn and winter many Scarlet Robins live in open grassy woodlands, and grasslands or grazed paddocks with scattered trees, and may join mixed flocks of other small insectivorous birds (OEH 2015d).	Unlikely	Prefers other habitats	No. Bird surveys already undertaken by ELA (2014)
Birds	*Rostratula australis*	Painted Snipe (Australian subspecies)	E	V	PMST	Ecosystem	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. Breeding is often in response to local conditions; generally occurs from September to December. Forages nocturnally on mud-flats and in	No	No suitable habitat present	No. Bird surveys already undertaken by ELA (2014)

Group	Scientific name	Common name	TSC Act	EPBC Act	Data Source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required
							shallow water. Feeds on worms, molluscs, insects and some plant-matter (OEH 2015d).			
Birds	*Stagonopleura guttata*	Diamond Firetail	V	-	BCAM, Atlas	Ecosystem	Typically found in grassy eucalypt woodlands, but also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. It is often found in riparian areas and sometimes in lightly wooded farmland. Appears to be sedentary, though some populations move locally, especially those in the south (OEH 2015d).	Unlikely	Prefers other habitats	No. Bird surveys already undertaken by ELA (2014)
Birds	*Stictonetta naevosa*	Freckled Duck	V	-	Atlas	Ecosystem	Associated with a variety of plankton-rich wetlands, such as heavily vegetated, large open lakes and their shores, creeks, farm dams, sewerage ponds and floodwaters (OEH 2015d).	Unlikely	Marginal habitat present	No. Bird surveys already undertaken by ELA (2014)
Birds	*Tyto novaehollandiae*	Masked Owl	V	-	BCAM, Atlas	Ecosystem	Lives in dry eucalypt forests and woodlands from sea level to 1100 m (OEH 2015d).	Potential	Suitable habitat present	No as ecosystem species
Mammal	*Cercartetus nanus*	Eastern Pygmy-possum	V	-	Atlas	Species	Found in wet and dry eucalypt forest, subalpine woodland, coastal banksia woodland and wet heath. Pygmy-Possums feed mostly on the pollen and nectar from banksias, eucalypts and understorey plants and will also eat insects, seeds and fruit. Small tree hollows are favoured as day nesting sites, but nests have also been found under bark, in old birds nests and in the branch forks of tea-trees (OEH 2015d).	No	No suitable habitat present	No
Mammal	*Dasyurus maculatus* *Dasyurus maculatus maculatus*	Spotted-tailed Quoll Spotted-tailed Quoll (SE mainland population)	V -	- E	BCAM, Atlas, PMST	Ecosystem	The Spotted-tailed Quoll inhabits a range of forest communities including wet and dry sclerophyll forests, coastal heathlands and rainforests, more frequently recorded near the ecotones of closed and open forest. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites. Maternal den sites are logs with cryptic entrances; rock outcrops; windrows; burrows (OEH 2015d).	No	Marginal habitat present	No. Already surveyed for by ELA (2014)
Mammal	*Isoodon obesulus*	Southern Brown Bandicoot	E	E	PMST	Species	This species is associated with heath, coastal scrub, heathy forests, shrubland and woodland on well drained soils. This species is thought to display a preference for newly regenerating heathland and other areas prone to fire (OEH 2015d).	No	No suitable habitat present	No
Mammal	*Petaurus norfolcensis*	Squirrel Glider	V	-	Atlas	Species	Associated with dry hardwood forest and woodlands. Habitats typically include gum barked and high nectar producing species, including winter flower species. The presence of hollow bearing eucalypts is a critical habitat value (OEH 2015d).	Potential	Recorded in Woodhouse Creek, 2016	No
Mammal	*Petrogale penicillata*	Brush-tailed Rock-wallaby	E	V	PMST	Species	Rocky areas in a variety of habitats, typically north facing sites with numerous ledges, caves and crevices (OEH 2015d).	No	No suitable habitat present	No
Mammal	*Phascolarctos cinereus*	Koala	V	V	BCAM, Atlas, PMST	Species	Associated with both wet and dry Eucalypt forest and woodland that contains a canopy cover of approximately 10 to 70%, with acceptable Eucalypt food trees. Some preferred Eucalyptus species are: *Eucalyptus tereticornis, E. punctata, E. cypellocarpa, E. viminalis* (OEH 2015d)	Potential	Marginal habitat present	No additional survey required. Species has been assumed

Group	Scientific name	Common name	TSC Act	EPBC Act	Data Source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required
										to be present in study area
Mammal	*Pseudomys novaehollandiae*	New Holland Mouse	-	V	PMST	Ecosystem	A small burrowing native rodent with a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Inhabits open heathlands, open woodlands with a heathland understorey and vegetated sand dunes. A social animal, living predominantly in burrows shared with other individuals. The home range of the New Holland Mouse ranges from 0.44 ha to 1.4 ha and the species peaks in abundance during early to mid stages of vegetation succession typically induced by fire (OEH 2015d).	No	No suitable habitat present	No
Mammal-bat	*Chalinolobus dwyeri*	Large-eared Pied Bat	V	V	BCAM, Atlas, PMST	Species credit (Breeding habitat)	The Large-eared Pied Bat has been recorded in a variety of habitats, including dry sclerophyll forests, woodland, sub-alpine woodland, edges of rainforests and wet sclerophyll forests. This species roosts in caves, rock overhangs and disused mine shafts and as such is usually associated with rock outcrops and cliff faces. Found in well-timbered areas containing gullies (OEH 2015d).	Recorded	Marginal habitat present	No breeding habitat present within BCAA
Mammal-bat	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V	-	BCAM, Atlas	Ecosystem	Prefers moist habitats with trees taller than 20m. Roosts in tree hollows but has also been found roosting in buildings or under loose bark (OEH 2015d).	Recorded	Recorded by ELA (2014)	No as already recorded and species is an ecosystem species
Mammal-bat	*Miniopterus australis*	Little Bentwing Bat	V	-	BCAM, Atlas	Ecosystem and Species (breeding)	East coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub (OEH 2015d).	Potential	Suitable habitat present	No as ecosystem species and no suitable breeding habitat
Mammal-bat	*Miniopterus schreibersii oceanensis*	Eastern Bent-wing Bat	V	-	BCAM, Atlas	Ecosystem and Species (breeding	Associated with a range of habitats such as rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland. It forages above and below the tree canopy on small insects. Will utilise caves, old mines, and stormwater channels, under bridges and occasionally buildings for shelter (OEH 2015d).	Recorded	Recorded by ELA (2014)	No as already recorded and species is an ecosystem species. There is no suitable breeding habitat present
Mammal-bat	*Mormopterus norfolkensis*	Eastern Freetail Bat	V	-	BCAM, Atlas	Ecosystem	Most records of this species are from dry eucalypt forest and woodland east of the Great Dividing Range. Individuals have, however, been recorded flying low over a rocky river in rainforest and wet sclerophyll forest and foraging in clearings at forest edges. Primarily roosts in hollows or behind loose bark in mature eucalypts, but have been observed roosting in the roof of a hut (OEH 2015d).	Recorded	Recorded by ELA (2014)	No as already recorded and species is an ecosystem species
Mammal-bat	*Myotis macropus*	Southern Myotis	V	-	BCAM, Atlas	Ecosystem and Species (breeding	The Large-footed Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. Will occupy most habitat types such as mangroves, paperbark swamps, riverine monsoon forest, rainforest, wet and dry sclerophyll forest, open woodland and River Red Gum woodland, close to water. While roosting (in groups of 10-15) is most commonly associated with caves, this	Recorded	Recorded by ELA (2014)	Potential breeding habitat (hollow bearing trees within 200m of permanent water) searched during breeding

Group	Scientific name	Common name	TSC Act	EPBC Act	Data Source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required
							species has been observed to roost in tree hollows, amongst vegetation, in clumps of Pandanus, under bridges, in mines, tunnels and stormwater drains, however with specific roost requirements. Forages over streams and pools catching insects and small fish. In NSW females have one young each year usually in November or December (OEH 2015d)			season (Appendix H).
Mammal-bat	*Pteropus poliocephalus*	Grey-headed Flying-Fox	V		BCAM, Atlas, PMST	Ecosystem and Species (breeding	Inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas. Camps are often located in gullies, typically close to water, in vegetation with a dense canopy (OEH 2015d).	Potential	Suitable habitat present	No as ecosystem species and no suitable breeding habitat
Mammal-bat	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail Bat	V		Atlas	Ecosystem	Found in almost all habitats, from wet and dry sclerophyll forest, open woodland, open country, mallee, rainforests, heathland and waterbodies. Roosts in tree hollows; may also use caves; has also been recorded in a tree hollow in a paddock and in abandoned sugar glider nests. The Yellow-bellied Sheathtail-bat is dependent on suitable hollow-bearing trees to provide roost sites, which may be a limiting factor on populations in cleared or fragmented habitats (OEH 2015d).	Recorded	Recorded by ELA (2014)	No as already recorded and species is an ecosystem species
Mammal-bat	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V		BCAM, Atlas	Ecosystem	Associated with moist gullies in mature coastal forest, or rainforest, east of the Great Dividing Range, tending to be more frequently located in more productive forests. Within denser vegetation types use is made of natural and man-made openings such as roads, creeks and small rivers, where it hawks backwards and forwards for prey (OEH 2015d).	Recorded	Recorded by ELA (2014)	No as already recorded and species is an ecosystem species
Migratory	*Apus pacificus*	Fork-tailed Swift		M	PMST	Ecosystem	Sometimes travels with Needletails. Varied habitat with a possible tendency to more arid areas but also over coasts and urban areas.	Potential	Species may use site on occasion	No as ecosystem species
Migratory	*Ardea alba*	Great Egret		M	PMST	Ecosystem	The Great Egret is common and widespread in Australia. It forages in a wide range of wet and dry habitats including permanent and ephemeral freshwaters, wet pasture and estuarine mangroves and mudflats.	Potential	Suitable wetland areas present	No as ecosystem species
Migratory	*Ardea ibis*	Cattle Egret		M	PMST	Ecosystem	Cattle Egrets forage on pasture, marsh, grassy road verges, rain puddles and croplands, but not usually in the open water of streams or lakes and they avoid marine environments. Some individuals stay close to the natal heronry from one nesting season to the next, but the majority leave the district in autumn and return the next spring. Cattle Egrets are likely to spend the winter dispersed along the coastal plain and only a small number have been recovered west of the Great Dividing Range.	Recorded	Recorded by ELA (2014)	No as already recorded and species is an ecosystem species
Migratory	*Gallinago hardwickii*	Latham's Snipe		M	PMST	Ecosystem	A variety of permanent and ephemeral wetlands, preferring open fresh water wetlands with nearby cover. Occupies a variety of vegetation around wetlands including wetland grasses and open wooded swamps.	No	No suitable habitat present	No
Migratory	*Haliaeetus leucogaster*	White-bellied Sea Eagle		M	PMST	Ecosystem	Forages over large open fresh or saline waterbodies, coastal seas and open terrestrial areas. Breeding habitat consists of tall trees, mangroves, cliffs, rocky outcrops, silts, caves and crevices and is located along the	No	No suitable habitat present	No

Group	Scientific name	Common name	TSC Act	EPBC Act	Data Source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required
							coast or major rivers. Breeding habitat is usually in or close to water, but may occur up to a kilometre away.			
Migratory	*Hirundapus caudacutus*	White throated Needletail		M	PMST	Ecosystem	Forages aerially over a variety of habitats usually over coastal and mountain areas, most likely with a preference for wooded areas. Has been observed roosting in dense foliage of canopy trees, and may seek refuge in tree hollows in inclement weather.	Potential	Species may use site on occasion	No as this is an ecosystem species
Migratory	*Merops ornatus*	Rainbow Bee-eater		M	PMST	Ecosystem	Resident in coastal and subcoastal northern Australia; regular breeding migrant in southern Australia, arriving September to October, departing February to March, some occasionally present April to May. Occurs in open country, chiefly at suitable breeding places in areas of sandy or loamy soil: sand-ridges, riverbanks, road-cuttings, sand-pits, occasionally coastal cliffs. Nest is a chamber a the end of a burrow, up to 1.6 m long, tunnelled in flat or sloping ground, sandy back or cutting.	Likely	Suitable open and wetland habitats available	No as this is an ecosystem species
Migratory	*Monarcha melanopsis*	Black-faced Monarch		M	PMST	Ecosystem	Rainforest and eucalypt forests, feeding in tangled understorey.	No	No suitable habitat present	No
Migratory	*Myiagra cyanoleuca*	Satin Flycatcher		M	PMST	Ecosystem	Wetter dense forest.	No	No suitable habitat present	No
Migratory	*Pandion cristatus*	Eastern Osprey	V	M	PMST	Ecosystem	Favour coastal areas, especially the mouths of large rivers, lagoons and lakes.	No	No suitable habitat present	No
Migratory	*Rhipidura rufifrons*	Rufous Fantail	-	M	PMST	Ecosystem	The Rufous Fantail is a summer breeding migrant to southeastern Australia. The Rufous Fantail is found in rainforest, dense wet eucalypt and monsoon forests, paperbark and mangrove swamps and riverside vegetation. Open country may be used by the Rufous Fantail during migration.	No	No suitable habitat present	No

Appendix E: Supplementary Green and Golden Bell Frog and Myotis breeding habitat surveys

Supplementary *Myotis macropus* and Green and Golden Bell Frog survey – October 2016

Dr Rodney Armistead, Eco Logical Australia, 16 December 2016.

A supplementary assessment of the presence of Myotis breeding habitat and Green and Golden Bell Frog habitat within the Mt Gilead Biocertification Assessment Area (BCAA) was undertaken in November and December 2016 to augment the draft Biocertification assessment report submitted to Campbelltown Council October 2015 and 2016. The additional assessment followed advice from the Office of Environment and Heritage (OEH) on the assessment requirements for *Myotis macropus* as a species credit species.

Following consultation with Office of Environment and Heritage (OEH) in September 2016 regarding how to assess the presence of breeding Myotis, it was agreed that the following methodology would meet OEHs requirements

- Identification of potential breeding habitat (i.e. any hollow bearing tree within a 200m buffer of permanent water/suitable foraging areas)
- Diurnal assessments during the breeding season (November-February) of hollow bearing trees within the potential habitat polygon for signs of bat activity/use
- Visual inspections of accessible hollows by an ecologist (in a cherry picker) with an optical scope and camera
- Stag watching hollow bearing trees (HBT) at dusk, over two suitable nights (warm temperature (10 - 20ºC), moderate wind with a low likelihood of rain) for signs of bats leaving potential roost sites (observing for the characteristic flight patterns of Myotis) with concurrent anabat recording calls to assist in the determination of species

In additional, a targeted *Litoria aurea* (Green and Golden Bell Frog (GGBF)) survey was also conducted whilst on site to further address the potential presence (or absence) of the GGBF in the BCAA following a recent December 2013 and April 2015 records of this species from Biriwiri Creek, approximately 7 km north of the BCAA.

A potential breeding habitat polygon was derived for the BCAA by mapping all of the farm dams and other waterways with permanent water and identifying any HBTs within the 200m buffer that are proposed for development for inspection (**Figure 1**).

The aim of this survey was to determine if breeding female *Myotis macropus* (Large-footed Myotis) are roosting among the hollow bearing trees (HBTs) located within the subject site (**Figure 1**). This survey was conducted on the 30 November, 7 and 12 of December 2016.

Myotis macropus

Hollow bearing tree survey

Searches for HBTs were conducted by walking and driving throughout the subject site. The location of each HBT was marked on a GPS (error margin ±5m). The type and approximate location, height, and size of each hollow was recorded.

Internal hollow assessment

Each hollow that could be accessed with a 20m high cherry picker was searched for evidence of fauna occupancy (fur, down, eggs, nest, downy feathers or living animals (**Plate 1** and **2**). Shallow hollows were visually assessed, whilst bright torches and a burrow scope was used to search the deeper hollows. Finally, an anabat recorder was placed in each hollow, with the hope of recording calls from those microbat that might have been disturbed during this process.

Stag watch and anabat ultra-sonic microbat call surveys

The stag watch surveys involved having an ecologist positioned at least 20 m from the base of single or groups of HBTs, watching for microbats as they leave their roosts in the evening to forage. The surveys were undertaken in accordance with DEC (2004) by starting the survey at least half an hour before dusk and continued for an hour afterwards. A total of six HBTs or groups of HBTs were surveyed (**Figure 1 and Plates 1 - 8).**

Hand-held ultra-sonic anabat microbat recorders were used during these surveys to verify the identity of observed microbat species. A total survey effort 13.5 stag watch and anabat recording hours was achieved during this survey. The recorded calls were analysed by Dr Rodney Armistead and where necessary, reviewed by Alicia Scanlon.

The anabat recorders used and a brief description of each HBT surveyed is provided below:

- Wednesday 30 November 2016
    - N82275 was positioned to survey microbat activity at HBT 6 and 7 (**Figure 1**). HBT 6 had six hollows whilst HBT 7 had 10 hollows (**Table 2**)
    - SN81781 (Michael) was positioned to survey microbat activity at HBT 8 and 9 **(Figure** 1). This HBT 8 had multiple spouts and HBT had multiple spouts and one large stem hollow.
    - SN81147 was positioned to survey microbat activity at HBT 10 and 11 **(Figure** 1). HBT 10 had 1 hollow, whilst HBT 11 had eleven hollows (**Table 2**).
    - SN81997 was positioned to survey microbat activity at HBT 19 and 20 (**Figure 1**). HBT 19 had one single medium sized spout with one opening whilst HBT 20 had one large and one small hollow (**Table 2**).
    - SN81081 was positioned to survey microbat activity at HBT 25 and 26 (**Figure 1)**. HBT 25 was dead and had numerous spouts and medium sized hollow entrances that lead into a single hollow stem whilst HBT 26 had two shallow stem hollows (**Table 2**).
- Wednesday 7 December 2016
    - SN81781 was positioned to survey microbat activity at HBT 2 (**Figure 1**). This HBT had 14 hollows, mostly spouts and funnels (**Table 2**).
    - SN82275 was positioned to survey microbat activity at HBT 6 and 7 (**Figure 1**). HBT 6 had six hollows whilst HBT 7 and had 10 (**Table 2**)

- SN81147 was positioned to survey microbat activity at HBT 10 and 11 **(Figure** 1). These HBTs had 1 (HBT10) and 14 hollows (HBT11) (**Table 2**).
- SN81997 was positioned to survey microbat activity at HBT 19 and 20 (**Figure 1**). HBT 19 had at least 2 hollows in the main stem. HBT 19 had one single medium sized spout with one opening whilst HBT 20 had one large and one small hollow (**Table 2**).
- SN81081 (Rod) was positioned to survey microbat activity at HBT 25 and 26 (**Figure 1)**. HBT 25 was dead and had numerous spouts and medium sized hollow entrances that lead into a single hollow stem whilst HBT 26 had two shallow stem hollows (**Table 2**).

Climatic conditions

Temperatures fluctuated from minimums of 9.3 Cº and maximums of 35.8 Cº during the days before and after each survey (**Table 1**). Wind speeds were mild and little rainfall was recorded the week prior to and during the survey period (**Table 1**).

Table 1. Climatic conditions leading up, during and after the each anabat and Green and Golden Bell Frog survey from the Campbelltown (Mount Annan – Station 06257) weather station

Date	Minimum Temperature (Cº)	Maximum temperature (Cº)	Rain fall (mm)	Wind direction and speed	Relative humidity (%)	Rainfall (mm) seven days prior to survey
24 Nov	9.3	24.6	0	SW / 39km/hr	35	0
25 Nov	8.8	27.1	0	E / 33km/hr	38	0
26 Nov	12.2	30.3	0	NE / 35km/hr	20	0
27 Nov	16.0	26.4	0	E / 31km/hr	52	0
28 Nov	18.0	32.4	0	N / 26km/hr	36	0
29 Nov	19.7	26.8	0	ENE / 30km/hr	51	0
30 Nov	15.9	27.4	0	ESE / 35km/hr	49	0
1 Dec	14.9	33.6	0	ESE / 33km/hr	83	0
2 Dec	14.4	35.8	0.8	SW / 39km/hr	40	0.8
3 Dec	19.5	29.2	0	ESE / 31km/hr	61	0.8
4 Dec	15.4	31.0	0	N / 31km/hr	64	0.8
5 Dec	20.6	34.2	0.6	NNW / 52km/hr	74	1.4
6 Dec	19.8	25.8	9.6	NNE / 17km/hr	73	12
7 Dec	15.7	26.8	0	ESE / 31km/hr	72	12

Results

Habitat bearing tree survey

Twenty-nine (29) HBTs were recorded within the subject site (**Table 2**). Of these 25 were living and four were dead stags. A total of 113 hollows were recorded among these 29 HBTs (**Table 2**).

Internal hollow assessment

Of the 113 hollows recorded among the 29 HBTs, 25 HBTs with 75 hollows were internally searched for Large-footed Myotis and other fauna species (**Table 2**). No Large-footed Myotis were recorded. No microbat species were recorded in any of the hollows inspected. Nesting *Sturnis tristis* (Common Myna), *Cacatua galerita* (Sulphur Crested Cockatoos) and *Falco cenchroides* (Nankeen Kestrel) were recorded (**Table 2**). Several *Eulamprus tenuis* (Bar-sided Forest Skink) were observed in HBT 8 and 9. Whist the scats of this species were observed in HBT 14 (**Plate 7**).

Stag watch and anabat ultra-sonic microbat call surveys

Bat activity across both surveys nights was relatively low. Only a relatively small number of bats were observed and their calls were recorded as they flew through the subject site. Two bats were observed leaving a daytime roost (HBT 19). HBT 19 had a large spout over a dam and could not be reached by the cherry picker for inspection as per **Table 2**. These bats were identified, using the calls on the anabat recorders as *Chalinolobus gouldii* (Gould's Wattled Bat).

Fewer foraging bats were observed on the 7 December than on the 30 November. This was unexpected as heavy rains preceded the 7 December survey. It has been assumed that this heavy rain would have encouraged microbat activity.

There were 90 sequences recorded across the two survey periods. Of these, 49 (65.55%) were of sufficient quality or length to enable positive identified to genus or species. The remaining 41 sequences were either to short or of low quality, thus preventing positive identification.

There were at least 10 species identified in this survey. This includes three species that were are listed as vulnerable under the NSW *Threatened Species Conservation Act 1995* (TSC Act) (**Table 3, Table 9** and **Figure 5 - Figure 12**). One threatened species, *C. dwyeri* (Large-eared Pied Bat) listed on the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) was recorded. The threatened species recorded during this survey were:

- *Chalinolobus dwyeri* (large-eared Pied Bat) (definite record)
- *Myotis macropus* (Large-footed Myotis) (definite record)
- *Mormopterus (Micronomus) norfolkensis*) (definite record)

The most commonly recorded and widespread species included *Chalinolobus gouldii* (Gould's Wattled Bat) and *Mormopterus* (*Ozimops*) *planiceps* (South-eastern Freetail Bat) (**Table 2** – **Table 9**). One definite Myotis call was recorded at HBT 2. No bats were seen flying from this HBT, suggesting that this bat may have flown through and not have been roosting at the site. One Myotis or *Nyctophilus* spp. call was recorded at HBT 19 and 20. The calls of *Nyctophilus* spp. and the

Large Footed Myotis can be difficult to separate, however, where high quality recordings are obtained, can be confidently assigned to one or the other species.

The species diversity did not differ greatly across the survey sites with between three to eight species being recorded (**Table 2**). The most diverse survey site was HBT 19 and 20, with at least eight microbat species being recorded (**Table 2**).

Most of the bat calls that were recorded during this survey were clear, often long and easily interpreted. No feeding buzzes were observed in the data set, just search phase pulses. This indicating that even at this early period of the night, bats were only conducted searches of the study site.

A small number of TSC Act and EPBC Act listed *Pteropus poliocephalus* (Grey-headed Flying-fox) were observed flying high in a south-west direction over the subject site whilst the stag watch surveys were being undertaken.

The high flight patterns suggest that these bats still had some distance to fly before they were going to reach their foraging sites.

Survey Limitations

Calls were only positively identified when defining characteristics were present such as call shape and when the characteristic frequency allowed discrimination of a species. In this survey, there were a number of species call profiles that due to similarities among species could not be positively identified to species level. Where this was apparent, those species with similar call profiles were lumped together into groups of two or three potential species depending on the recorded and defining call characteristics. When this occurred these calls were assigned to the lowest certainty level of 'possible' **(Table 3)**

In this survey, the calls of Gould's Wattle Bat and Free-tail Bat species were recorded that were difficult to separate. Calls were identified as Eastern Freetail Bat if the call shape was flat and the frequency was between 28.5 – 31.5 kHz whilst Gould's Wattled Bat was distinguished by a frequency of 27.5 – 33 kHz with alternation in call frequency between pulses. When no distinguishing characteristics were present calls were assigned as follows (Gould's Wattle Bat / Free-tail Bat Species).

The calls of Chocolate Wattled Bat and *Vespadelus spp.* (Forest Bats) can be difficult to separate in the range 50.5 – 53 kHz. Calls were identified as *C. morio* when a down-sweeping tail was present within the call profiles. Alternatively, calls with up-sweeping tails that had an end frequency below 51 kHz were generally identified as a Forest Bat species. When no distinguishing characteristics were present within the calls, they were assigned as Chocolate Wattled Bat / Forest Bat.

The calls of *Falsistrellus tasmaniensis* (Eastern False Pipistrelle), *Scoteanax rueppellii* **(**Greater Broad-nosed Bat) and *Scotorepens orion* (Eastern Broad-nosed Bat) can be difficult to separate in this geographic region as their call frequencies and some other call characteristics overlap falling between 32 and 40 kHz. Calls were only positively identified when defining characteristics were present such as call shape and when the characteristic frequency allowed discrimination of a

species. There were a number of calls that it was not possible to identify to species and they remain grouped together in groups of two or three potential species depending on recorded characteristics. Calls from *S. orion* were recorded during this survey.

The calls of Large-footed Myotis are very similar to all *Nyctophilus* species and it is often difficult to separate these species. Calls were identified as *Nyctophilus* spp. when the time between calls (TBC) was higher than 95 ms and the initial slope (OPS) was lower than 300. Calls were identified as Large-footed Myotis when the TBC was lower than 75 ms and the OPS was greater than 400.

The call profiles that were difficult to separate are not shown in this document as all of the species discussed were positively identified.

Green and Golden Bell Frog survey results

Methods

The GGBF surveys involved a daylight visual assessment of each dam within or adjacent to land proposed for certification to determine their suitability to support GGBFs (**Figure 2**). An assessment of the suitability of the retained creek lines was also undertaken. A search was also conducted for the invasive *Gambusia affinis* (Mosquito Fish). Mosquito Fish are recognised as Key Threatening Process to GGBFs and generally their presence, typifies an absence in GGBFs.

Those dams deemed likely to support GGBFs, due to the presence of suitable habitats, and an absence of Mosquito Fish, were searched at night using spotlights and hand held torches (**Figure 2**). These searches were undertaken immediately after the stag watch surveys. In addition to the spotlight searches, call play back surveys were conducted. Call play back surveys involved playing recorded male GGBF calls through a loud hailer and / or speaker, with the hope of encouraging other male GGBFs to call in response. The playing of recorded GGBF calls began at dusk. Calls were played over 15 minutes and then followed by a 15-minute listening period.

Results

Of the eleven water bodies, two were deemed to contain suitable GGBF habitat to warrant spotlight and call play back surveys (**Figure 2, Plate 9 - 11).** Most dams present within the subject site lacked the riparian, emergent and floating vegetation that GGBF use for basking, foraging and to call from, due to heavy stocking of cattle and horses (**Plates 9 – 11**). Whilst those dams with riparian and emergent vegetation were found to be infested by Mosquito Fish. As discussed, this fish impacts on GGBFs and generally if they are present within a waterway, it is deemed unlikely that GGBFs will be present.

Nine dams were surveyed at night using GGBFs call play back and spotlighting. None were recorded during these surveys. Three species of frog were observed or heard recorded calling. This were *Crinia signifera* (Common Froglet), *L. dentata* (Bleating Frog) and *L. peronii* (Peron's Tree Frog) (**Plates 12** and **13**).

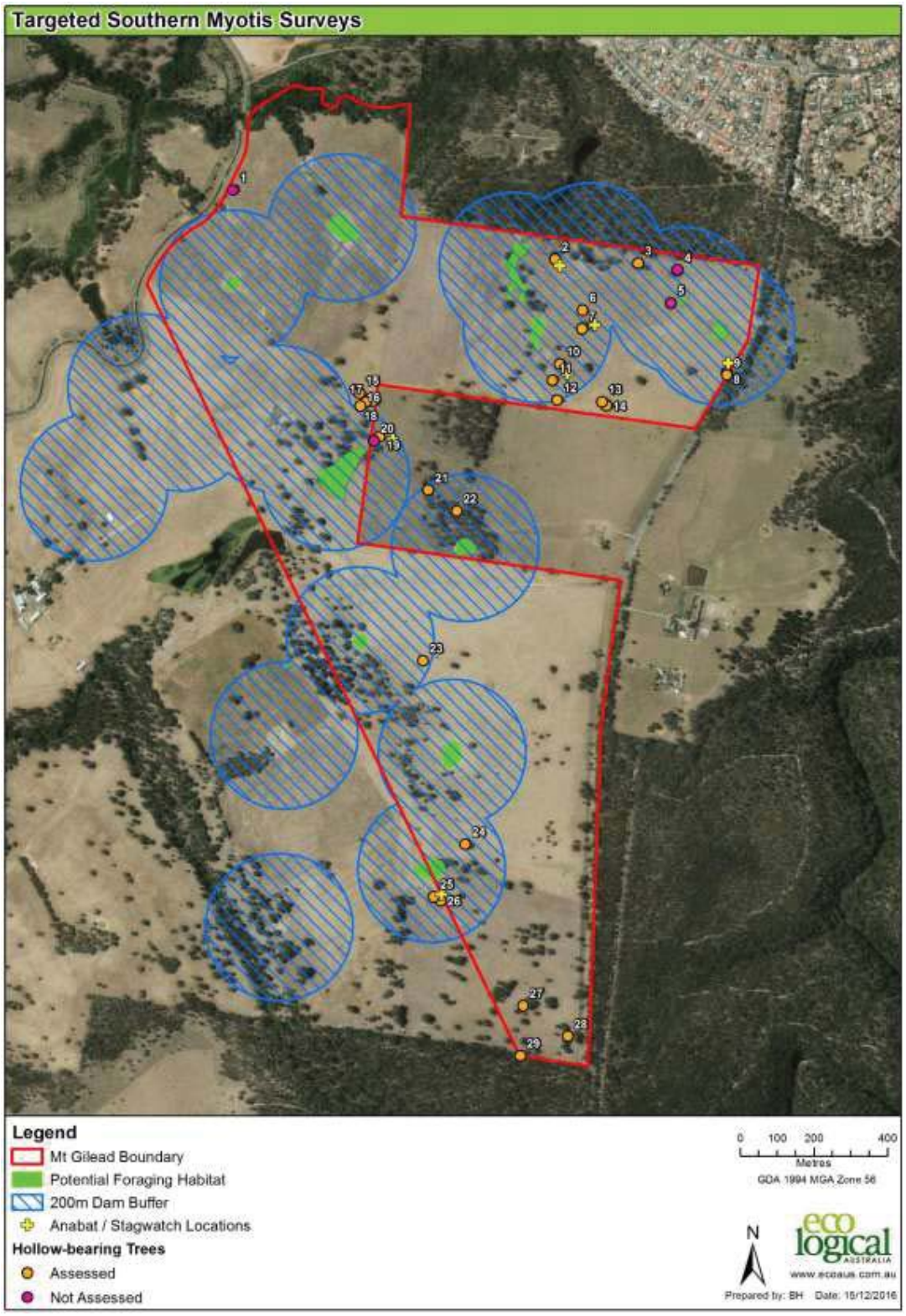

Figure 1. Locations of trees targeted during the Southern Myotis surveys and associated farms dams (potential foraging habitat)

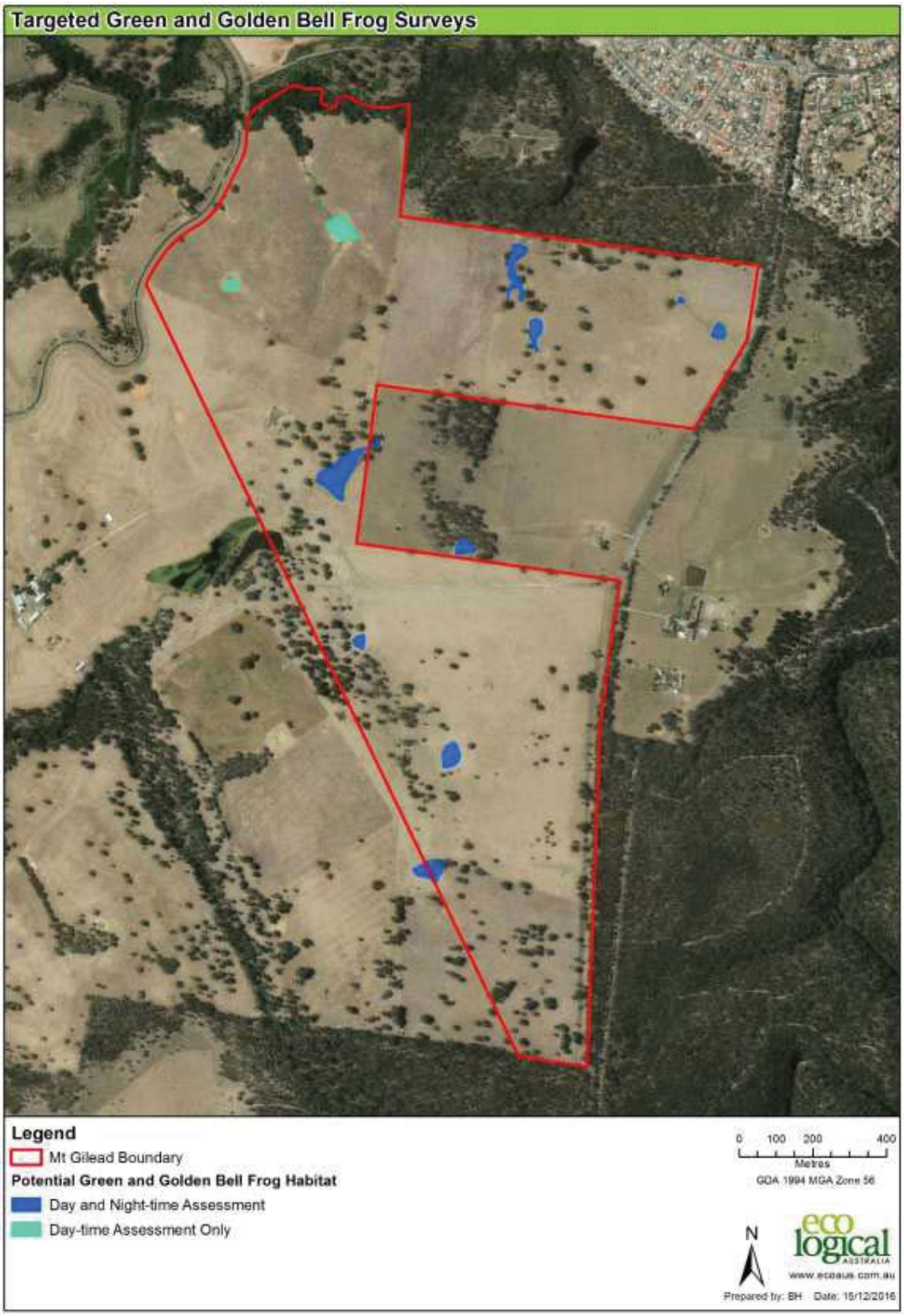

Figure 2. Locations of farm dams targeted during the Green and Golden Bell Frog surveys

Table 2. Habitat bearing trees, number of hollows and results of the hollow assessment

Habitat bearing tree (HBT) identification number from unknown arborist report	Species name	Common name	Number of hollows total	Number of Hollows assessed from cherry picker	Results	Comments
1	*Eucalyptus tereticornis*	Forest Red Gum	5	0	No microbats were observed	This tree was not assessed using cherry picker due to limited access by the cherry picker due to the terrain. No fauna observed.
2 (00422)	*Eucalyptus tereticornis*	Forest Red Gum	8	6	No microbats were observed	Two empty bird nests. The two hollows that were not assessed were left due a large broken branch dangerously hanging from the tree. No fauna observed.
3 (00421)	*Eucalyptus tereticornis*	Forest Red Gum	1	1	No microbats were observed	No fauna observed.
4	Eucalyptus fibrosa	Small leafed Ironbark	1	1	No microbats were observed	Hollow was present in the base of tree, which enabled it to surveyed from the ground. No fauna observed.
5	*Eucalyptus tereticornis*	Forest Red Gum	2	2	No microbats were observed	Two openings leading into a dead vertical spout. Could not be accessed by cherry picker. No fauna observed.
6 (00429)	*Eucalyptus moluccana*	Grey Box	4	2	No microbats were observed	No fauna recorded.
7 (00425)	*Eucalyptus moluccana*	Grey Box	10	6	No microbats were observed	Old disused bird nest.

Habitat bearing tree (HBT) identification number from unknown arborist report	Species name	Common name	Number of hollows total	Number of Hollows assessed from cherry picker	Results	Comments
8	*Eucalyptus moluccana*	Grey Box	5	4	No microbats were observed	Two *Eulamprus tenuis* (Bar-sided Forest Skink) in hollows.
9	*Eucalyptus tereticornis*	Forest Red Gum	1	1	No microbats were observed	Old disused bird nest. All hollows were infested by small ants. *Eulamprus tenuis* (Bar-sided Forest Skink) seen in small spout.
10 (00666)	*Eucalyptus fibrosa*	Small leafed Ironbark	1	1	No microbats were observed	One small hollow that was only 20cm deep and two baby Starlings in a nest.
11	*Eucalyptus moluccana*	Grey Box	9	5	No microbats were observed	Old disused bird nests only. No fauna observed.
12 (00433)	*Eucalyptus tereticornis*	Forest Red Gum	4	3	No microbats were observed	Old disused bird nests only. No fauna observed.
13 (00432)	*Eucalyptus tereticornis*	Forest Red Gum	2	1	No microbats were observed	No fauna recorded.
14 (00431)	*Eucalyptus tereticornis*	Forest Red Gum	2	2		*Eulamprus tenuis* (Bar-sided Forest Skink) scats present at opening of spout.
15 (00463)	Eucalyptus moluccana	Grey Box	6	4	No microbats were observed	Some of the hollows could not be assessed due to safety reasons. No fauna observed.
16 (00461)	*Eucalyptus tereticornis*	Forest Red Gum	2	2	Nothing recorded	No fauna observed. Entire tem of tree appeared to be hollow.

Habitat bearing tree (HBT) identification number from unknown arborist report	Species name	Common name	Number of hollows total	Number of Hollows assessed from cherry picker	Results	Comments
17 (00459)	Eucalyptus moluccana	Grey Box	10	6	No microbats were observed	Lots of hollow spouts that appeared to go deep into the stem of the tree. Possibly the best habitat tree on site. No fauna observed.
18	*Eucalyptus tereticornis*	Forest Red Gum	2	2	No microbats were observed	No fauna observed.
19	*Eucalyptus fibrosa*	Small leafed Ironbark	1	1	No microbats were observed	One medium sized spout that could not be accessed due to position and direction of opening. Spout was pointing over the top of the dam. No access for cherry picker.
20	*Eucalyptus tereticornis*	Forest Red Gum	2	2	No microbats were observed	Disused bird nest in large hollow. No fauna observed.
21	*Eucalyptus tereticornis*	Forest Red Gum	1	0	No microbats were observed	Feather down of bird chick was present in this hollow suggesting that it had been used as a nest.
22	*Eucalyptus fibrosa*	Small leafed Ironbark	1	0	No microbats were observed	Feather down of bird chick was present in this hollow suggesting that it had been used as a nest. No fauna observed.
23	Dead stag		5	4	No microbats were observed	No fauna observed.
24	Dead stag		4	3	No microbats were observed	No fauna observed.

Habitat bearing tree (HBT) identification number from unknown arborist report	Species name	Common name	Number of hollows total	Number of Hollows assessed from cherry picker	Results	Comments
25	Dead stag		8	5	Spouts leading into a hollow stem	Spouts leading into a hollow stem. A Nankeen Kestrel on three eggs was observed on one of the spouts.
26	*Dead Stag*		2	2	No microbats were observed	Disused bird nest in one of the hollows. No fauna observed.
27	*Corymbia maculata*	*Spotted Gum*	2	1	No microbats were observed	Disused bird nest in one of the hollows. No fauna observed.
28	*Corymbia maculata*	*Spotted Gum*	10	6	No microbats were observed	One very large tree present in an area that has been mapped as being retained. *Sturnis tristis* (Common Myna) and *Cacatua galerita* (Sulphur Crested Cockatoo) found nesting in two of the hollows.
29	*Eucalyptus fibrosa*	Small leafed Ironbark	2	2	No microbats were observed	Nothing recorded

Table 3. Microbat species diversity recorded during the anabat microbat ultra-sonic call survey undertaken between 30 November and 7 December 2016

Species name	Common name	HBT 2		HBT 6 and 7		HBT 8 AND 9		HBT 10 and 11		HBT 19 and 20		HBT 22, 23 and 24	
		SN811781 (30 Nov)		SN82275 (30 Nov) and SN81147 (7 Dec)		SN81081 (30 Nov)		SN81147 (30 Nov) and SN82243 (7 Dec)		SN81997 (30 Nov and 7 Dec)		SN81997 (12 Oct) and SN82275 (19 Oct)	
		Positively identified	Possibly present	Positively identified	Possibly present	Positively identified	Possibly present	Positively identified	Possibly present	Positively identified	Possibly present	Positively identified	Possibly present
Austronomus australis	White-Striped Freetail Bat											X	
Chalinolobus dwyeri[1]	Large-eared Pied Bat			X									
Chalinolobus gouldii	Gould's Wattled Bat					X			X	X		X	
Chalinolobus morio	Chocolate Wattled Bat				X		X		X	X		X	
*Mormopterus (Micronomus) norfolkensis**	Eastcoast Freetail Bat									X			
Mormopterus (Ozimops) *ridei*	Eastern Freetail Bat			X			X		X	X		X	
*Myotis macropus**	Large-footed Myotis	X			X						X		
Nyctophilus spp.	Long-eared Bats				X						X		
Scotorepens orion	Eastern Broad Nosed Bat	X								X			
Vespadelus vulturnus	Little Forest Bat	X				X		X		X		X	
Species Diversity (Positive identification)		3		2		2		1		6		5	
Species Diversity (Possible)			0		3		2		3		2		0
Total (at least) number of species		3		5		4		4		8		5	

* Threatened species listed under TSC Act

Table 4. Anabat results for SN81781 at HBT 2 on the 7 December 2016 recorded over a single evening stag watch

Species Name	Common name	Positively identified	Potential	Possible	Total
*Myotis macropus**	Large-footed Myotis	1	0	0	1
Scotorepens orion	Eastern Broad-nosed Bat	2	0	0	2
Vespadelus vulturnus	Little Forest Bat	2	0	0	2
Low					0
Short					5
Useable calls					**5**
Total Calls					**10**
Percentage usable calls					**50.00**

*Threatened species listed under the TSC Act

Table 5. The combined Anabat results for SN82275 (30 November) and SN81147 (7 December) positioned at HBT 6 and 7 over two evening stag watches.

Species Name	Common name	Positively identified	Potential	Possible	Total
Chalinolobus dwyeri[11]	Large-eared Pied Bat	1	0	0	1
Chalinolobus morio / *Vespadelus vulturnus*	Chocolate Wattled Bat / Little Forest Bat	0	0	2	2
Mormopterus (*Ozimops*) *ridei*	Eastern Freetail Bat	1	0	0	1
Nyctophilus spp. / *Myotis macropus**	Long-eared Bat / Large-footed Myotis	0	0	1	1
Low					0
Short					1
Useable calls					**5**
Total Calls					**6**
Percentage usable calls					**83.33**

*Threatened species listed under the TSC Act and [1] identifies those species listed under the EBPC Act

Table 6. Anabat results for SN81081 positioned at HBT 8 and 9 on the 30 November 2016 recorded over a single evening stag watch

Species Name	Common name	Positively identified	Potential	Possible	Total
Chalinolobus gouldii	Gould's wattled Bat	1	0	0	1
Chalinolobus morio	Chocolate Wattled Bat	0	0	1	1
Mormopterus (*Ozimops*) *ridei*	Eastern Freetail Bat	0	1	0	1
Low					2
Short					0
Useable calls					**3**
Total Calls					**5**
Percentage usable calls					**60%**

Table 7. Anabat results for SN81147 (30 November) and SN82243 (7 December) positioned at HBT 10 and 11 over two even stag watches

Species Name	Common name	Positively identified	Potential	Possible	Total
Chalinolobus gouldii	Gould's wattled Bat	0	1	0	4
Chalinolobus morio / *Vespadelus vulturnus*	Chocolate Wattled Bat / Little Forest Bat	0	0	1	2
Mormopterus (*Ozimops*) *ridei*	Eastern Freetail Bat	0	0	2	2
Vespadelus vulturnus	Little Forest Bat	1	2	0	1
Low					0
Short					2
Useable calls					**9**
Total Calls					**11**
Percentage usable calls					**81.81**

Table 8. Anabat results for SN81997 (30 November and 7 December) positioned at HBT 19 and 20 over two even stag watches

Species Name	Common name	Positively identified	Potential	Possible	Total
Chalinolobus gouldii	Gould's wattled Bat	4	3	1	8
Chalinolobus morio	Chocolate Wattled Bat	2	0	0	2
Chalinolobus morio / Vespadelus vulturnus	Chocolate Wattled Bat / Little Forest Bat	0	0	1	1
*Mormopterus (Micronomus) norfolkensis**	Eastcoast Freetail Bat	1	0	0	1
Mormopterus (*Ozimops*) *ridei*	Eastern Freetail Bat	3	0	0	3
Nyctophilus spp. / *Myotis macropus**	Long-eared Bat / Large-footed Myotis	0	0	1	1
Scotorepens orion	Eastern Broad Nosed Bat	2	1	0	3
Vespadelus vulturnus	Little Forest Bat	3	1	0	4
Low					3
Short					18
Useable calls					**23**
Total Calls					**44**
Percentage usable calls					**52.27**

*Threatened species listed under the TSC Act

Table 9. Anabat results for SN81781 (30 November) and SN81081 (7 December) positioned at HBT 25 and 26 over two even stag watches

Species Name	Common name	Positively identified	Potential	Possible	Total
Austronomus australis	White-Striped Freetail Bat	1	0	0	1
Chalinolobus gouldii	Gould's wattled Bat	1	1	0	2
Chalinolobus morio	Chocolate Wattled Bat	1	1	0	2
Chalinolobus morio / Vespadelus vulturnus	Chocolate Wattled Bat / Little Forest Bat	0	0	2	2
Mormopterus (*Ozimops*) *ridei*	Eastern Freetail Bat	3	0	0	3
Vespadelus vulturnus	Little Forest Bat	4	0	0	4
Low					0
Short					0
Useable calls					14
Total Calls					14
Percentage usable calls					100

Call profiles

Figure 3. Call profile for *Austronomus australis* (White-Striped Freetail Bat) recorded at HBT 25 and 26 at 20.52 (pm), 30 November 2016

Figure 4. Call profile for *Chalinolobus dwyeri* (Larger-eared Pied Bat) recorded HBT 6 and 7 at 19.52 (pm), 30 November 2016

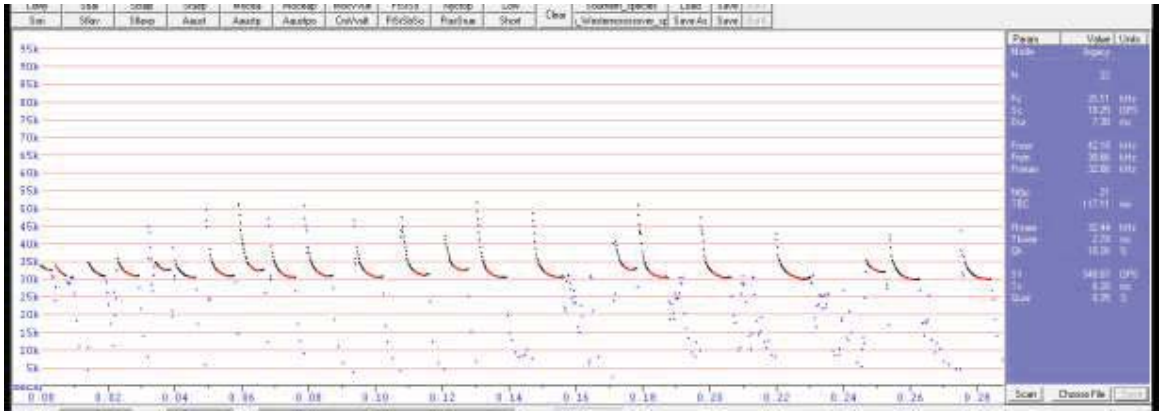

Figure 5. Call profile for *Chalinolobus gouldii* (Gould's Wattled Bat) recorded HBT 19 and 20 at 20.52 (pm), 7 October 2016

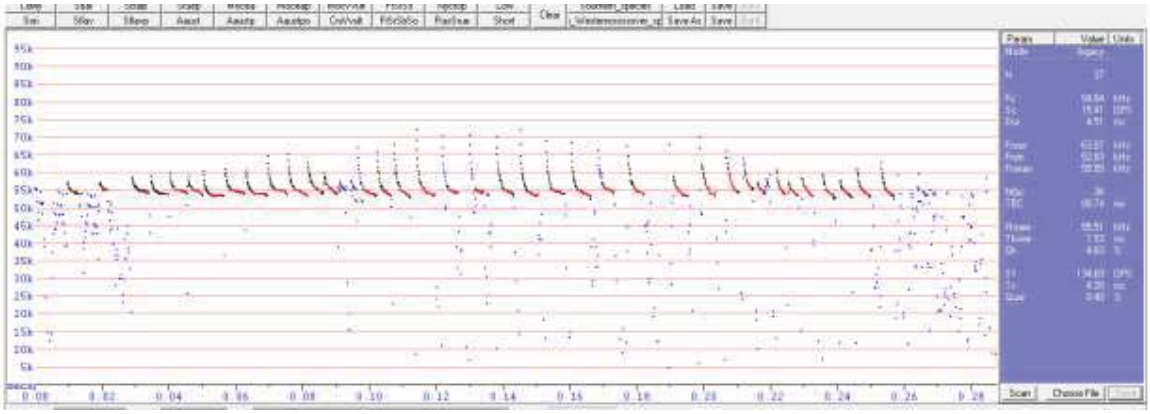

Figure 6. Definite call profile for *Chalinolobus morio* (Chocolate Wattled Bat) recorded at HBT 19 and 20 at 20.44 (pm), 12 October 2016

Figure 7. Call profile for *Mormopterus* (*Micronomus*) *norfolkensis* (Eastcoast Freetail Bat) recorded at HBT 19 and 20 at 20.53, 30 November 2016.

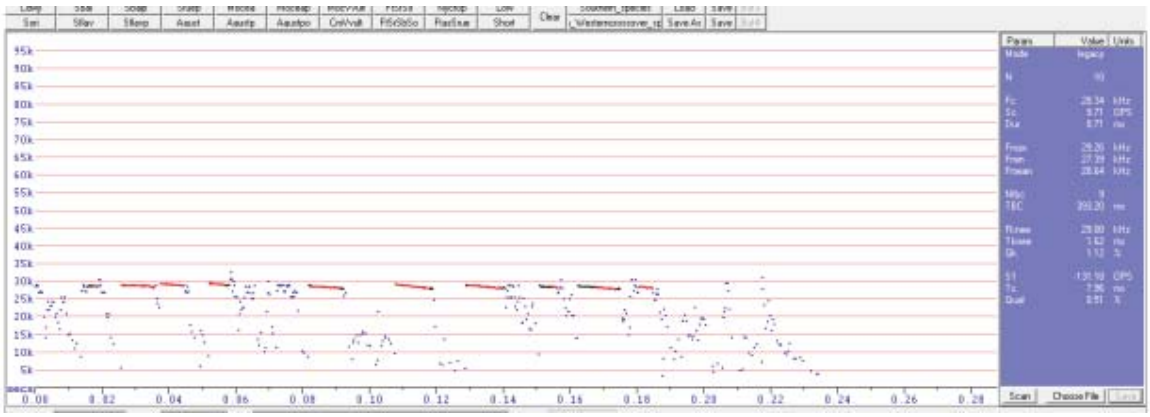

Figure 8. Call profile for *Mormopterus* (*Ozimops*) *ridei* (Eastern Freetail Bat) recorded at HBT 25 and 26 at 21.04 (pm) 30 November 2016

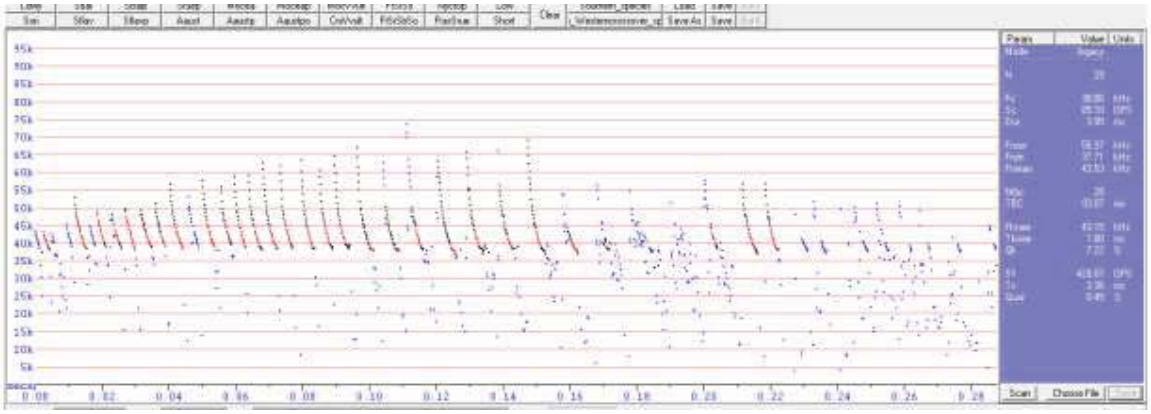

Figure 9. Call profile for *Myotis macropus* (Large-footed Myotis) recorded at HBT 2, at 21.01 (pm), 7 December 2016

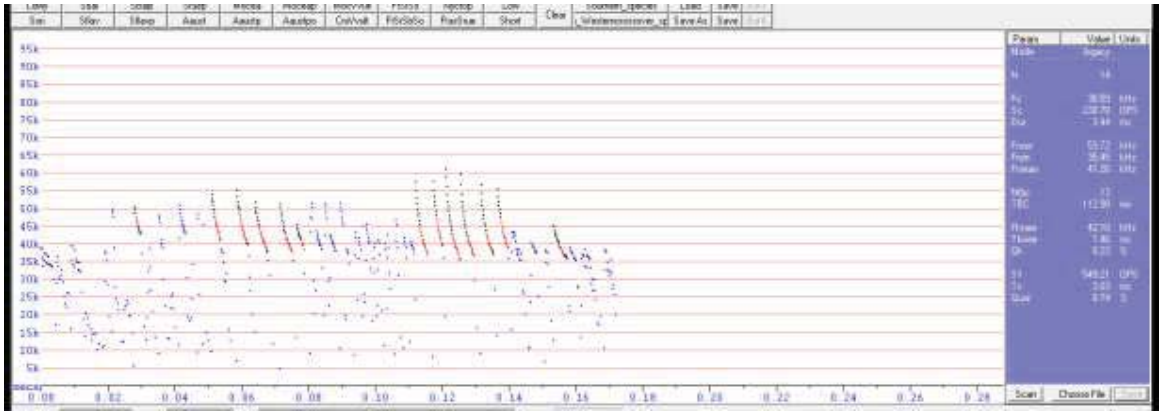

Figure 10. Possible call profile for *Myotis macropus* (Large-footed Myotis) and *Nyctophilus spp.* (Long-eared Bat) recorded at HBT 19 and 20 at 20.35 (pm) 7 December 2016

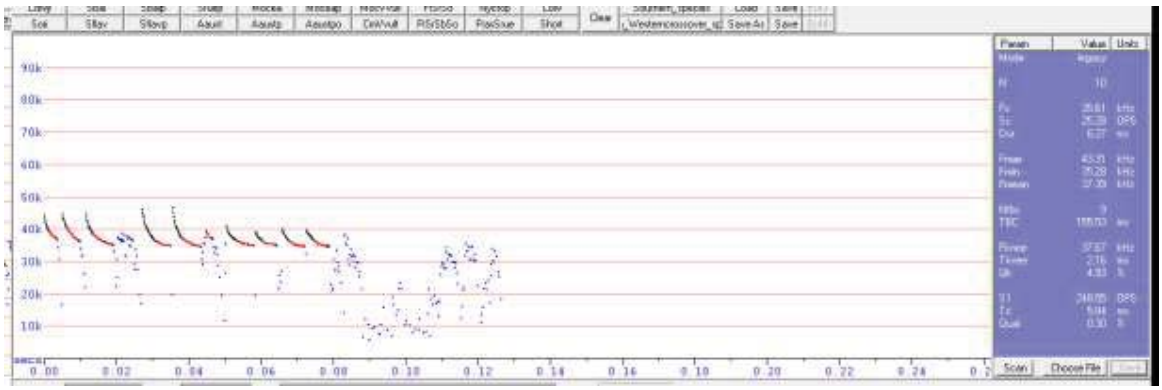

Figure 11. Call profile for *Scotorepens orion* (Eastern broad-nosed Bat) at HBT 2 at 20.49 (pm), 7 December 2016

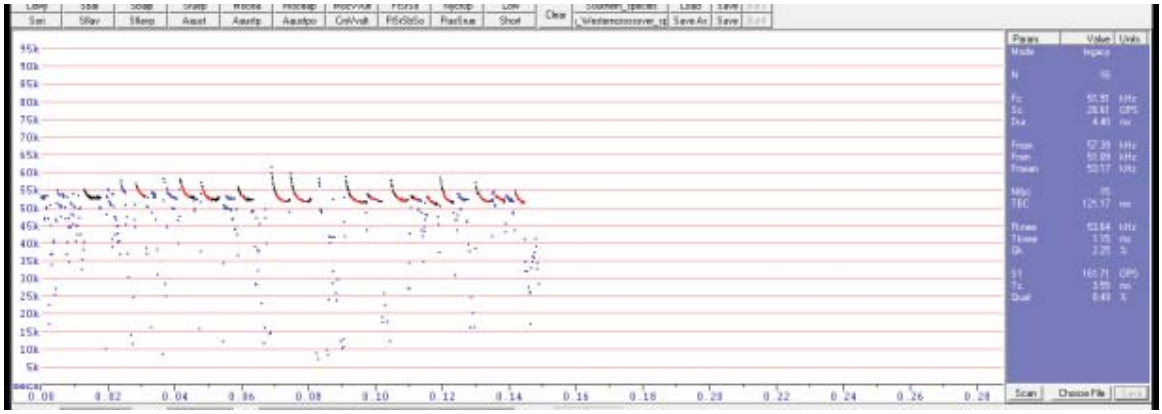

Figure 12. Call profile for *Vespadelus vulturnus* (Little Forest Bat) recorded at HBT 25 and 26 at 20.46 (pm) 30 November 2016

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Plate 1. 20m Cherry picker used to conduct the hollow assessments.

Plate 2. View from cherry picker at HBT 8 showing spouts that are shown in Plate 4.

Plate 3. View of HBT 8 and 9 from ground showing spouts viewed from behind in Plate 2 and internally in Plat 4.

Plate 4. Disused bird nest in HBT 9 observed in shallow spout

Plate 5. Spouts in HBT 10

Plate 6. The shallow hollows in HBT 2.

Plate 7. A spout in HBT 14 with skink scats

Plate 8. Nesting Sulphur Crested Cockatoos in HBT 28.

Plate 9. View of the only dam with vegetated banks. Mosquito Fish were seen in this waterway.

Plate 10. Edge of large pond near HBT 19 and 20.

Plate 11. Farm Dam showing the livestock damaged edges and lack of GGBF. This level of stock damage was typical of most dams within the subject site.

Plate 12. *Litoria dentata* (Bleating Frog) captured during the GGBF surveys (photograph taken by Jack Talbert)

Plate 13. ***Litoria peronii*** **(Peron's Tree Frog) captured during the GGBF surveys (photograph taken by Jack Talbert)**

Appendix F: Vegetation type profiles

Biometric Vegetation Type	**HN526 -Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion**
	
Description	This community mostly had a woodland structure. The mid stratum was uniformly present within this vegetation type and was quite dense. The ground stratum was extremely sparse and there was a fair amount of leaf litter build up and fallen logs present.
Location and habitat	This community occurred in the north of the BCAA along a second/ third order stream, which is an intermittent tributary that flows into Menangle Creek. The creek banks varied from steep banks with active erosion to areas of gentle slope.
Ancillary codes	One ancillary codes was identified for this vegetation type: sparse..
Sampling locations	Sparse – A01
Upper stratum	The canopy of this vegetation type was comprised of *Eucalyptus moluccana* (Grey Box) and *E. tereticornis* (Forest Red Gum).
Midstorey	This was dominated by exotic species, mostly *Ligustrum lucidum* (Large-leaved Privet), *Ligustrum sinense* (Small-leaved Privet), and *Olea europaea* var. *cuspidata* (African Olive).
Groundcovers	The under-storey was extremely sparse having been shaded by the shrub layer, and species richness was low. It included a mix of native and introduced species: *Oplismenus aemulus* (Australian Basket Grass) and *Einadia hastata* (Berry Saltbush), and *Rubus fruiticosus* sp. aggregate (Blackberry), *Cirsium vulgare* (Spear Thistle), and *Conyza bonariensis* (Fleabane).
Corresponding vegetation type	River-Flat Eucalypt Forest
Threatened Species	No threatened flora or fauna were recorded within this BVT, although it is likely that threatened bat species use the community.

Biometric Vegetation Type	**HN528 - Grey Box - Forest Red Gum grassy woodland on flats of the southern Cumberland Plain, Sydney Basin Bioregion**
	 
Description	This community had a woodland structure. The mid stratum was present in some areas and absent in others. The ground stratum included a combination of grasses and herbs. The community has been subject to a long history of disturbance; it was degraded in areas, with erosion and compaction of soils evident.
Location and habitat	The community occurred in the northern half of the BCAA and was contiguous with native vegetation of the same type as well as other vegetation types (River-Flat Eucaypt Forest). The patches occurred on gentle slopes at low topography on clay soils.
Ancillary codes	Three different ancillary codes were identified for this vegetation types as follows: • Olive – applied to the north western patch which was in moderate to good condition due to the presence of fallen logs and trees with hollows, and had a mid-storey dominated by *Olea europaea* var. *cuspidata*. • Native - applied to the north eastern patch which lacked a mid-storey layer and had a ground layer dominated by native grasses. • Scattered Paddock Trees – applied to remaining areas where the community occurred. These areas were comprised of canopy species with an exotic groundcover. No mid-storey was present in these areas.
Sampling locations	Olive – B01, B02 Native – D01, D02 Scattered Paddock Trees – B1_2013, C2_2013 (undertaken by ELA 2014)
Upper stratum	The canopy of this vegetation type was dominated by *Eucalyptus tereticornis* (Forest Red Gum), although *E. creber* (Narrow-leaved Ironbark) and *E. moluccana* were also present.
Midstorey	A shrub layer was absent through most of the BCAA. Where present, it was largely composed of the introduced species *Olea europaea* var. *cuspidata* (African Olive), with a small amount of native *Bursaria spinosa* (Blackthorn) present.
Groundcovers	The ground cover diversity was generally very poor. It was composed of native and exotic grasses: *Austrostipa elegantissima* (Feather Speargrass), *Aristida ramosa* (Purple Wiregrass), *Microlaena stipoides* (Weeping Grass), *Bothriochloa macra* (Redleg Grass), *Rytidosperma* sp., *Eragrostis brownii* (Brown's Lovegrass), *Ehrharta erecta* (Panic Veldtgrass), *Pennisetum clandestinum* (Kikuyu), *Paspalum dilatatum* (Paspalum), with common native sedges, herbs and scramblers, including *Cyperus gracilis* (Slender Flat-sedge), *Glycine clandestina*, *Dichondra repens* (Kidney Weed), *Einadia* spp., and *Oxalis perennans*, also present.
Corresponding vegetation type	Cumberland Plain Woodland
Threatened Species	No threatened flora or fauna were recorded within this BVT but a number of threatened bat species were recorded.

Biometric Vegetation Type	**Hn556 - Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion**
	 
Description	This community had a woodland structure. The mid stratum was absent across much of the community, but was present within Dzwonniks land, which contains land proposed for conservation. The ground stratum included a combination of grasses and herbs. The community has been subject to a long history of disturbance, through clearing, prolonged grazing, and fertilizer application, although Dzwonniks land, which contains land proposed for conservation, has been subject to lower levels of disturbance.
Location and habitat	The community occurred in the southern portions of the BCAA and was contiguous with native vegetation of the same type in some areas, or occurred as scattered patches. The community occurred on gentle slopes at low topography on transitional soils. Sandstone outcrops were evident in the community.
Ancillary codes	Eight different ancillary codes were identified for this vegetation types as follows: • Good North – applied to approximately three quarters of the northern patch (eastern side) within Dzwonniks land. This was in moderate to good condition and had a native mid-storey and low incidence of weeds. It also contained trees with hollows, and had all canopy species regenerating. • Thinned South - applied to a small portion of the southern patch (western side) within Dzwonniks land. This was in moderate to good condition but had a thinned canopy and mid-storey and a moderate incidence of weeds. • Thinned North - applied to approximately one quarter of the northern patch (western side) within Dzwonniks land. This was in moderate to good condition but had a thinned canopy and mid-storey and a higher incidence of weeds. • Good South – applied to the majority of the southern patch (eastern side) within Dzwonniks land. This was in low condition and had a sparse native mid-storey and moderate incidence of weeds. • Native – applied to a small patch along the western boundary of the BCAA, and a strip along the eastern boundary of the BCAA. This patch was in low condition, had a native dominated ground layer and was less subject to disturbance through grazing. • Exotic - applied to a larger patch along the western boundary of the BCAA which was in low condition and had a ground layer dominated by exotic species, although some native species were nevertheless present. • Scattered Paddock Trees – applied to remaining areas where the community occurred. These areas were in low condition and comprised of canopy species with an exotic groundcover. • Cleared – applied to areas around the northern and southern patches within Dzwonniks land that will be revegetated. These areas were in low condition, lacked a canopy and mid-storey, and had a high incidence of weeds.
Sampling locations	Good North – D1_2013 (undertaken by ELA 2014) Thinned South – F3_2013 (undertaken by ELA 2014) Thinned North – F2_2013 (undertaken by ELA 2014) Good South – F1_2013 (undertaken by ELA 2014) Native – G01, H01, H02 Exotic – E01, E02, E03 Scattered Paddock Trees – A1_2013 (undertaken by ELA 2014), A5 2016, A6 2016

	Cleared – D2_2013 (undertaken by ELA 2014)
Upper stratum	The canopy of this vegetation type was dominated by *Eucalyptus creber* (Narrow-leaved Ironbark), *E. tereticornis* (Forest Red Gum), *E. punctata* (Grey Gum), and *E. moluccana* (Grey Box).
Midstorey	A shrub layer was absent due to the grazing across the BCAA.
Groundcovers	The ground cover diversity was generally very poor. It was composed of native and exotic grasses: *Microlaena stipoides* (Weeping Grass), *Eragrostis brownii* (Brown's Lovegrass), Cynodon dactylon (Couch), Sporobolus creber (Western Rat-tail Grass), *Pennisetum clandestinum* (Kikuyu), *Setaria parviflora*, and *Paspalum dilatatum* (Paspalum), although the majority was composed of the exotic grass, *Pennisetum clandestinum*. Besides grasses, there were a few herbs/low shrubs present, including *Dichondra repens* (Kidney Weed) and the introduced *Sida rhombifolia* (Paddy's Lucerne).
Corresponding vegetation type (Biolink 2013)	Shale Sandstone Transition Forest
Threatened Species	No threatened flora or fauna were recorded within this BVT but a number of threatened bat species were recorded.

Appendix G: Flora species recorded in Biometric plots

Vegeation Community					Zone 1	Zone 2		Zone 3		Zone 4		Zone 5	Zone 6	Zone 7	Zone 8	Zone 9			Zone 10			Zone 11																							
Scientific Name	**Common Name**	**Origin**	**Noxious Weed**	**WONS**	**A01**	**B01**	**B02**	**D01**	**D02**	**B1 2013**	**C2 2013**	**D1 2013**	**F3 2013**	**F2 2013**	**F1 2013**	**G01**	**H01**	**H02**	**E01**	**E02**	**E03**	**A1 2013**	**A6 2016**	**A6 2016**	**A2 2013**	**A3 2013**	**A4 2013**	**B2 2013**	**B3 2013**	**B4 2013**	**C01**	**C1 2013**	**C3 2013**	**C4 2013**	**C5 2013**	**D2 2013**	**D3 2013**	**D4 2013**	**E1 2013**	**F01**	**F02**	**BB09**	**BB13**
Acacia decurrens	Black Wattle	Native																x																									
Acacia implexa	Hickory Wattle	Native															x																									
Ajuga australis	Austral Bugle	Native											x	x	x		x	x											x													
Alternanthera denticulata	Lesser Joyweed	Native									x					x				x									x													
Alternanthera sp.		Native												x															x													
Amaranthus sp.		Exotic				x	x				x											x				x	x	x	x	x		x			x							
Anagallis arvensis	Scarlet Pimpernel	Exotic											x	x			x	x	x	x		x	x	x		x			x												x
Anisyia servicflora		Exotic			x	x						x																	x												
Arctotheca calendula	Capeweed	Exotic																							x	x							x								
Aristida ramosa	Purple Wiregrass	Native						x	x			x	x	x	x			x										x		x					x			x			
Aristida vagans		Native											x		x																										
Arthropodium milleflorum	Pale Vanilla-lily	Native										x	x		x																										
Asparagus asparagoides	Bridal Creeper	Exotic	x	x		x	x																					x	x												
Aspenula conferta	Common Woodruff	Native											x																x												
Asteraceae sp.		Native				x																																			
Asteraceae weed 1		Exotic				x	x												x	x	x																		x	x	
Asteraceae weed 2		Exotic				x																																			
Astroloma humifusum	Native Cranberry	Native												x																							x				
Austrostipa elegantissima	Feather Speargrass	Native				x																																			
Austrostipa sp.		Native													x		x							x																	
Avena sp.		Exotic																				x																			
Axonopus fissifolius	Narrow-leafed Carpet Grass	Exotic											x	x	x		x							x			x								x	x	x				
Axonopus sp.		Exotic														x			x	x	x																	x			
Bidens bipinnata	Bipinnate Beggar's Ticks	Exotic																											x								x			
Bidens pilosa	Cobbler's Pegs	Exotic				x	x		x		x						x		x	x		x	x			x	x		x		x	x		x						
Bidens subalternans	Greater Beggar's Ticks	Exotic															x						x																		
Bothriochloa macra	Red Leg Grass	Native					x	x									x	x		x							x		x	x			x				x				x
Brassicaceae		Exotic																																x							
Briza minor	Shivery Grass	Exotic												x																											
Briza subaristata		Exotic																																			x				
Bromus carthaticus	Prairie Grass	Exotic					x				x			x					x			x			x	x			x			x			x						
Brunoniella australis	Blue Trumpet	Native				x	x						x	x	x			x								x				x											
Brunoniella pumilio	Dwarf Blue Trumpet	Native						x																																	
Bursaria spinosa	Blackthorn	Native				x	x	x	x				x	x	x	x			x											x		x										
Calotis lappulacea	Yellow Burr Daisy	Native																								x															x
Capsella bursa-pastoris	Shepherd's Purse	Exotic																						x					x	x			x	x	x						x
Carex inversa		Native											x	x	x											x				x								x				x
Carex sp.																														x											
Carthamus lanatus	Saffron Thistle	Exotic																											x				x	x	x						
Carthamus sp.		Exotic																	x												x										
Cassinia sp.		Native										x																	x												
Cayratia clematidea	Native Grape	Native					x												x																						
Cenbrurum sp.		Exotic											x	x																											
Centella asiatica	Pennywort	Native																		x																					
Cerastium glomeratum	Mouse-ear Chickweed	Exotic											x											x																	x
Chellanthes sieberi		Native											x	x															x					x							
Chenopodium cristatum	Crested Goosefoot	Native							x																																
Chenopodium murale	Nettle-leaf Goosefoot	Exotic				x													x								x		x	x			x		x					
Chloris sp.		Native					x																	x					x												x
Chloris truncata	Windmill Grass	Native						x	x		x								x									x												
Chloris ventricosa	Plump Windmill Grass	Native										x	x	x	x		x	x							x																
Chrysocephalum apiculatum	Common Everlasting	Native												x												x															
Cirsium vulgare	Spear Thistle	Exotic			x	x	x		x		x	x	x		x				x			x	x	x	x			x	x	x	x		x		x		x				
Clematis aristata	Old Man's Beard	Native				x						x																	x	x											
Conyza bonariensis	Fleabane	Exotic			x	x	x		x										x	x		x																		
Conyza sp.		Exotic												x	x		x	x							x		x		x								x	x			
Corymbia maculata	Spotted Gum	Native															x	x				x	x		x	x															
Cotula australis	Common Cotula	Native										x	x	x	x		x						x	x		x	x	x	x						x						x
Crassula sp.		Native																																							x
Cymbopogon refractus	Barbed Wire Grass	Native																																			x			
Cynodon dactylon	Couch	Native						x			x			x	x	x				x	x					x	x			x	x		x	x	x	x		x		x
Cyperus eragrostis	Umbrella Sedge	Exotic														x				x																				
Cyperus gracilis	Slender Flat-sedge	Native				x	x		x							x	x	x																						
Cyperus sp.		Native							x												x																				
Dactylis glomerata	Cocksfoot	Exotic															x								x															
Daucus glochidiatus	Native Carrot	Native																x																						
Daviesia ulicifolia	Gorse Bitter Pea	Native											x																											
Desmodium brachypodum	Large Tick-trefoil	Native																											x										
Desmodium varians	Slender Tick-trefoil	Native					x					x	x	x	x	x		x								x			x								x			x
Dianella longifolia	Blueberry Lily	Native															x												x											
Dichelachne micrantha	Shorthair Plumegrass	Native													x																									
Dichelachne sp.		Native															x												x						x	x	x			
Dichondra repens	Kidney Weed	Native				x	x	x	x	x		x	x	x	x	x	x		x	x	x				x	x			x								x			x
Digitaria parviflora	Small-flowered Finger Grass	Native																				x																		
Digitaria sanguinalis	Summer Grass	Exotic																				x					x													
Digitaria sp.		Exotic																											x			x	x	x						
Dodonaea viscosa	Sticky Hop-bush	Native											x	x	x																									
Echinochloa crus-galli	Barnyard Grass	Exotic																				x																		
Echinochloa esculenta	Japanese Millet	Exotic																				x																		
Echinochloa sp.		Exotic									x																x				x										
Echinopogon sp.	Hedgehog Grass	Native																		x																				
Echinopogon caespitosus	Bushy Hedgehog-grass	Native										x	x		x																									
Echinopogon ovatus	Forest Hedgehog-grass	Native																											x										
Echium plantagineum	Paterson's Curse	Exotic	x																										x	x										
Echium sp.		Exotic																								x															
Ehrharta erecta	Panic Veldtgrass	Exotic			x	x	x		x			x						x	x	x		x				x			x	x							x			x
Ehrharta sp.		Exotic											x		x																										
Einadia hastata	Berry Saltbush	Native			x	x									x		x	x											x											
Einadia nutans	Climbing Saltbush	Native				x				x		x		x	x		x	x			x	x							x	x										x
Einadia polygonoides		Native															x						x																	x
Einadia trigonos	Fishweed	Native				x	x		x							x			x		x					x														
Eleusine indica	Indian Goosegrass	Exotic																														x								
Eleusine tristachya	Goose Grass	Exotic								x	x					x										x	x	x					x					x	x	
Elymus scaber		Native																x																						
Eragrostis brownii	Brown's Lovegrass	Native					x	x								x	x	x	x	x	x																x	x		
Eragrostis curvula	African Lovegrass	Exotic										x						x																						
Eragrostis leptostachya	Paddock Lovegrass	Native										x													x	x	x		x								x			
Eragrostis sp.		Exotic													x																		x		x					
Erodium cirratum	Blue Storksbill	Native																											x				x	x						
Eucalyptus creber	Narrow-leaved Ironbark	Native							x			x					x				x	x				x	x		x											x
Eucalyptus fibrosa	Red Ironbark	Native										x	x	x	x		x							x											x					
Eucalyptus moluccana		Native								x									x										x	x							x			
Eucalyptus punctata		Native																		x																				
Eucalyptus tereticornis	Forest Red Gum	Native				x	x	x		x						x			x								x		x								x			
Eucalyptus/Angophora sp.		Native																			x																			
Euchiton/Gnaphalium sp.		Native														x			x	x											x									
Euchiton sphaericus		Native											x	x	x														x					x							x
Facelis retusa	Annual Trampweed	Exotic												x																					x					
Gamochaeta sp.		Exotic												x			x					x	x																		
Galinsoga parviflora	Potato Weed	Exotic																	x										x		x	x		x						

Wahlenbergia communis	Tufted Bluebell	Native											x																																
Wahlenbergia sp.		Native											x	x			x	x							x					x			x												
Xanthium spinosum	Bathurst Burr	Exotic	x							x																					x														
Zornia sp.		Native																								x																				

Appendix H: Fauna species recorded in BCAA

Fauna group	Scientific name	Common name
Frogs	*Crinia signifera*	Clicking Froglet
Frogs	*Litoria dentata*	Bleating Frog
Frogs	*Litoria fallax*	Eastern Sedge Frog
Frogs	*Litoria peronii*	Peron's Tree Frog
Frogs	*Uperoleia laevigata*	Smooth Toadlet
Reptiles	*Eulamprus quoyii*	Eastern Water Skink
Fish	*Cyprinus carpio**	Common Carp
Fish	*Gambusia holbrooki**	Eastern Gambusia
Birds	*Alisterus scapularis*	King Parrot
Birds	*Anas gracilis*	Grey Teal
Birds	*Anas superciliosa*	Pacific Black Duck
Birds	*Anthochaera carunculata*	Red Wattlebird
Birds	*Anthus novaeseelandiae*	Australasian Pipit
Birds	*Ardea ibis* ^	Cattle Egret
Birds	*Ardea pacifica*	White-necked Heron
Birds	*Aythya australis*	Hardhead
Birds	*Cacatua galerita*	Sulphur-crested Cockatoo
Birds	*Cacatua sanguinea*	Little Corella
Birds	*Calyptorhynchus funereus*	Yellow-tailed Black Cockatoos
Birds	*Carduelis carduelis* *	European Goldfinch
Birds	*Chenonetta jubata*	Australian Wood Duck
Birds	*Cisticola exilis*	Golden-headed Cisticola
Birds	*Colluricincla harmonica*	Grey Shrike-thrush
Birds	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike
Birds	*Corcorax melanorhamphos*	White-winged Chough
Birds	*Corvus coronoides*	Australian Raven
Birds	*Cracticus tibicen*	Australian Magpie
Birds	*Cracticus torquatus*	Grey Butcherbird
Birds	*Cygnus atratus*	Black Swan
Birds	*Egretta novaehollandiae*	White-faced Heron
Birds	*Elseyornis melanops*	Black-fronted Dotterel

Fauna group	Scientific name	Common name
Birds	*Eolophus roseicapillus*	Galah
Birds	*Falco cenchroides*	Nankeen Kestrel
Birds	*Fulica atra*	Eurasian Coot
Birds	*Geopelia humeralis*	Bar-shouldered Dove
Birds	*Glossopsitta concinna*	Musk Lorikeet
Birds	*Glossopsitta pusilla*	Little Lorikeet
Birds	*Grallina cyanoleuca*	Magpie-lark
Birds	*Hirundo neoxena*	Welcome Swallow
Birds	*Leucosarcia picata*	Wonga Pigeon
Birds	*Lichenostomus chrysops*	Yellow-faced Honeyeater
Birds	*Malurus cyaneus*	Superb Fairy-wren
Birds	*Manorina melanocephala*	Noisy Miner
Birds	*Manorina melanophrys*	Bell Miner
Birds	*Meliphaga lewinii*	Lewin's Honeyeater
Birds	*Myiagra inquieta*	Restless Flycatcher
Birds	*Neochmia temporalis*	Red-browed Finch
Birds	*Ocyphaps lophotes*	Crested Pigeon
Birds	*Pardalotus punctatus*	Spotted Pardalote
Birds	*Pardalotus striatus*	Striated Pardalote
Birds	*Philemon corniculatus*	Noisy Friarbird
Birds	*Platycercus elegans*	Crimson Rosella
Birds	*Platycercus eximius*	Eastern Rosella
Birds	*Poliocephalus poliocephalus*	Hoary-headed Grebe
Birds	*Porphyrio porphyrio*	Purple Swamphen
Birds	*Psephotus haematonotus*	Red-rumped Parrot
Birds	*Psophodes olivaceus*	Eastern Whipbird
Birds	*Ptilonorhynchus violaceus*	Satin Bowerbird
Birds	*Rhipidura albiscapa*	Grey Fantail
Birds	*Rhipidura leucophrys*	Willie Wagtail
Birds	*Strepera graculina*	Pied Currawong
Birds	*Sturnus tristis* *	Common Myna
Birds	*Sturnus vulgaris* *	Common Starling
Birds	*Tachybaptus novaehollandiae*	Australasian Grebe

Fauna group	Scientific name	Common name
Birds	*Threskiornis molucca*	Australian White Ibis
Birds	*Threskiornis spinicollis*	Straw-necked Ibis
Birds	*Todiramphus sanctus*	Sacred Kingfisher
Birds	*Trichoglossus haematodus*	Rainbow Lorikeet
Birds	*Vanellus miles*	Masked Lapwing
Mammals (excluding bats)	*Bos taurus* *	Domestic Cattle
Mammals (excluding bats)	*Equus ferus caballus* *	Domestic Horse
Mammals (excluding bats)	*Oryctolagus cuniculus* *	European Rabbit
Mammals (excluding bats)	*Vulpes vulpes* *	European Red Fox
Mammals (excluding bats)	*Wallabia bicolor*	Swamp Wallaby
Mammals - bats	*Chalinolobus dwyeri*#	Large-eared Pied Bat
Mammals - bats	*Chalinolobus gouldii*	Gould's Wattled Bat
Mammals - bats	*Chalinolobus morio*	Chocolate Wattled Bat
Mammals - bats	*Falsistrellus tasmaniensis* #	Eastern False Pipistrelle
Mammals - bats	*Miniopterus schreibersii oceanensis* #	Eastern Bentwing Bat
Mammals - bats	*Mormopterus norfolkensis* #	East-coast Freetail Bat
Mammals - bats	*Mormopterus sp2*	Eastern Freetail Bat
Mammals - bats	*Myotis macropus* #	Large-footed Myotis
Mammals - bats	*Nyctophilus spp.*	Long-eared Bat
Mammals - bats	*Saccolaimus flaviventris* #	Yellow-bellied Sheathtail Bat
Mammals - bats	*Scoteanax orion*	Eastern Broad-nosed Bat
Mammals - bats	*Scoteanax rueppellii* #	Greater Broad-nosed Bat
Mammals - bats	*Tadarida australis*	White-striped Freetail Bat
Mammals - bats	*Vespadelus regulus*	Eastern forest Bat
Mammals - bats	*Vespadelus vulturnus*	Little Forest Bat

* Denotes introduced species, # Denotes threatened species, ^ Denotes migratory species.

Appendix I: 2013 Anabat results

Mt Gilead.

4 Anabat nights 10-11 April 2013.

Bat calls were analysed using the program AnalookW (Version 3.8 25 October 2012, written by Chris Corben, www.hoarybat.com). Call identifications were made using regional based guides to the echolocation calls of microbats in New South Wales (Pennay et al. 2004); and south-east Queensland and north-east New South Wales (Reinhold et al. 2001) and the accompanying reference library of over 200 calls from north-eastern NSW. Available: (http://www.forest.nsw.gov.au/research/bats/default.asp).

Bat calls are analysed using species-specific parameters of the call profile such as call shape, characteristic frequency, initial slope and time between calls (Rinehold et al. 2001). To ensure reliable and accurate results the following protocols (adapted from Lloyd et. al. 2006) were followed:

- Search phase calls were used in the analysis, rather than cruise phase calls or feeding buzzes (McKenzie et al. 2002)
- Recordings containing less than three pulses were not analysed and these sequences were labeled as short (Law et al. 1999)
- Four categories of confidence in species identification were used (Mills et al. 1996):
    - definite – identity not in doubt
    - probable – low probability of confusion with species of similar calls
    - possible – medium to high probability of confusion with species with similar calls
    - unidentifiable – calls made by bats which cannot be identified to even a species group.
- Nyctophilus spp. are difficult to identify confidently from their calls and no attempt was made to identify this genus to species level (Pennay et al. 2004)
- Sequences not attributed to microbat echolocation calls were labeled as junk or non-bat calls and don't represent microbat activity at the site
- Sequences labelled as low were of poor quality and therefore not able to be identified to any microbat species, they can however be used as an indicator of microbat activity at the site

Over 320 sequences were recorded from Anabat detectors placed at four separate locations on 10 and 11 April 2013 within the study area at Mt Gilead. Approximately 64% of sequences submitted were able to be identified to species with the remainder being too short or of low quality preventing positive identification of species. General microbat activity was moderate with calls recorded more often than every ten minutes but less often than every two minutes. Feeding buzzes and foraging activity were occasionally recorded.

There were a minimum of 13 species identified including **six vulnerable** species listed under the NSW TSC Act 1987 (Tables 1 - 4). The most commonly recorded species were the threatened ***Mormopterus norfolkensis* (East-coast Freetail Bat)** and *Chalinolobus gouldii* (Goulds Wattled Bat), accounting for over 66% of positively identified sequences. Only ***M. norfolkensis*** was found at every Anabat location surveyed. In addition ***M. norfolkensis*** was commonly one of the first species to be recorded at each Anabat location and on three out of four evenings, also the last species to be recorded. These results are indicative of a nearby roost for ***M. norfolkensis***.

Calls of the threatened ***Miniopterus schreibersii oceanensis*** **(Eastern Bentwing Bat)** overlap in frequency with those of *Vespadelus darlingtoni* (Large forest bat) and *V. regulus (*Southern Forest Bat*)* in the Sydney region. Calls were identified as ***M.s.oceanensis*** when there was a down-sweeping tail, drop of more than 2kHz in the pre-characteristic section, and the pulse shape and time between calls was variable.

The calls of *C. gouldii, Mormopterus sp 2* (Eastern Freetail Bat) and ***M. norfolkensis*** can be difficult to separate if *C. gouldii* and ***M. norfolkensis*** are not alternating. Calls were identified as *M. sp 2* when the call shape was flat and the frequency was between 28.5 – 30 kHz. *C. gouldii* and ***M. norfolkensis*** were distinguished by alternation in call frequency between pulses and differences in their characteristic frequencies.

Calls of the threatened ***Myotis macropus*** **(Large-footed Myotis**) are very similar to all Nyctophilus species and it is often difficult to separate these species. Calls were identified as Nyctophilus spp. when the time between calls (TBC) was higher than 95ms and the initial slope (OPS) was lower than 300. Calls were identified as ***M. macropus*** when the TBC was lower than 75ms and the OPS was greater than 400.

Calls of the threatened **Eastern falsistrelle (*Falsistrellus tasmaniensis*)**, are very similar to those of the threatened **Greater broad-nosed bat** (***Scoteanax rueppellii***) and Eastern broad-nosed bat (*Scotorepens orion*). Calls were identified as ***F. tasmaniensis*** when characteristics of the call sequence eliminated the other two species and /or based upon the down sweeping tail of the calls and on the length of the pre-characteristic section.

Table 1: Species recorded within the study area at Mt Gilead, Anabat 1 on 10 March 2013.

Scientific name	Common name	Number of calls	Definite	Probable	Possible
Chalinolobus gouldii / Mormopterus spp.	Gould's Wattled Bat / a Freetail Bat	1			
Chalinolobus gouldii	Gould's Wattled Bat	10	8	2	
*Miniopterus schreibersii oceanensis**	Eastern Bentwing Bat	4	1	2	1
*Mormopterus norfolkensis**	East-coast Freetail Bat	37	35	2	
*Mormopterus species 2 / norfolkensis**	Eastern Freetail Bat / East-coast Freetail Bat	2			
Mormopterus species 2	Eastern Freetail Bat	3	3		
*Myotis macropus** / *Nyctophilus spp.*	Large-footed Myotis / A long eared bat	4			
*Myotis macropus**	Large-footed Myotis	7	6		1

Scientific name	Common name	Number of calls	Definite	Probable	Possible
*Scoteanax rueppellii**	Greater Broad-nosed Bat	1	1		
Tadarida australis	White-striped Freetail Bat	1	1		
Vespadelus regulus	Eastern Forest Bat	2		1	1
*Vespadelus regulus / Miniopterus schreibersii oceanensis**	Eastern Forest Bat / Eastern Bentwing Bat	2			
Low		4			
Short		56			
Total sequences		134			

*Threatened species

Table 2: Species recorded within the study area at Mt Gilead, Anabat 1 on 11 March 2013.

Scientific name	Common name	Number of calls	Definite	Probable	Possible
*Miniopterus schreibersii oceanensis**	Eastern Bentwing Bat	4	3	1	
*Mormopterus norfolkensis**	East-coast Freetail Bat	17	17		
Mormopterus spp.	a Freetail bat	1			
*Vespadelus regulus / Miniopterus schreibersii oceanensis**	Eastern Forest Bat / Eastern Bentwing Bat	1			
*Myotis macropus** / *Nyctophilus spp.*	Large-footed Myotis / A long eared bat	8			
*Myotis macropus**	Large-footed Myotis	1	1		
Vespadelus vulturnus	Little Forest Bat	2	2		
Low		8			
Short		29			
Total sequences		71			

*Threatened species

Table 3: List of species recorded within the study area at Mt Gilead, Anabat 2 on 10 March 2013.

Scientific name	Common name	Number of calls	Definite	Probable	Possible
Chalinolobus gouldii / Mormopterus spp.	Gould's Wattled Bat /a Freetail Bat	3			
Chalinolobus gouldii	Gould's Wattled Bat	31	31	1	2
Chalinolobus morio	Chocolate Wattled Bat	1	1		
*Falsistrellus tasmaniensis**	Eastern falsistrelle	1	1		
*Falsistrellus tasmaniensis** / *Scoteanax rueppellii** / *Scotorepens orion*	Eastern falsistrelle / Greater Broad-nosed Bat / Eastern Broad-nosed Bat	1			
*Mormopterus norfolkensis**	East-coast Freetail Bat	5	3		2
Mormopterus species 2	Eastern Freetail Bat	1	1		
*Myotis macropus**	Large-footed Myotis	3	2		1
*Saccolaimus flaviventrus**	Yellow-bellied Sheathtail Bat	2	2		
Vespadelus vulturnus	Little Forest Bat	1	1		
Low		1			
Short		37			
Total sequences		87			

*Threatened species

Table 4: List of species recorded within the study area at Mt Gilead, Anabat 2 on 11 March 2013.

Scientific name	Common name	Number of calls	Definite	Probable	Possible
Chalinolobus gouldii	Gould's Wattled Bat	25	25		
*Mormopterus norfolkensis**	East-coast Freetail Bat	17	14	1	2
Mormopterus spp.	a Freetail bat	7			
*Myotis macropus** / *Nyctophilus spp.*	Large-footed Myotis / A long eared bat	5			
Nyctophilus spp.	A long eared bat	1	1		
*Scoteanax rueppellii**	Greater Broad-nosed Bat	1	1		
Tadarida australis	White-striped Freetail Bat	2	2		
Vespadelus regulus / *Miniopterus schreibersii oceanensis**	Eastern Forest Bat / Eastern Bentwing Bat	1			
Low		11			
Short		37			
Total sequences		107			

*Threatened species

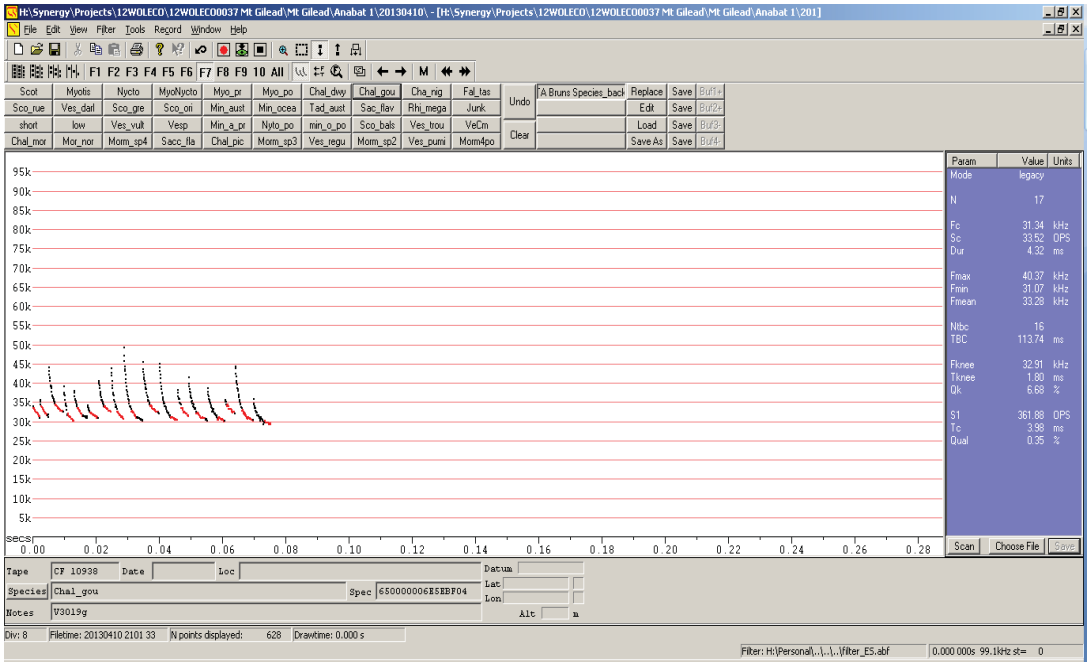

Figure 1: Call profile for *Chalinolobus gouldii* recorded at Mt Gilead at 21:01 on 10 April 2013.

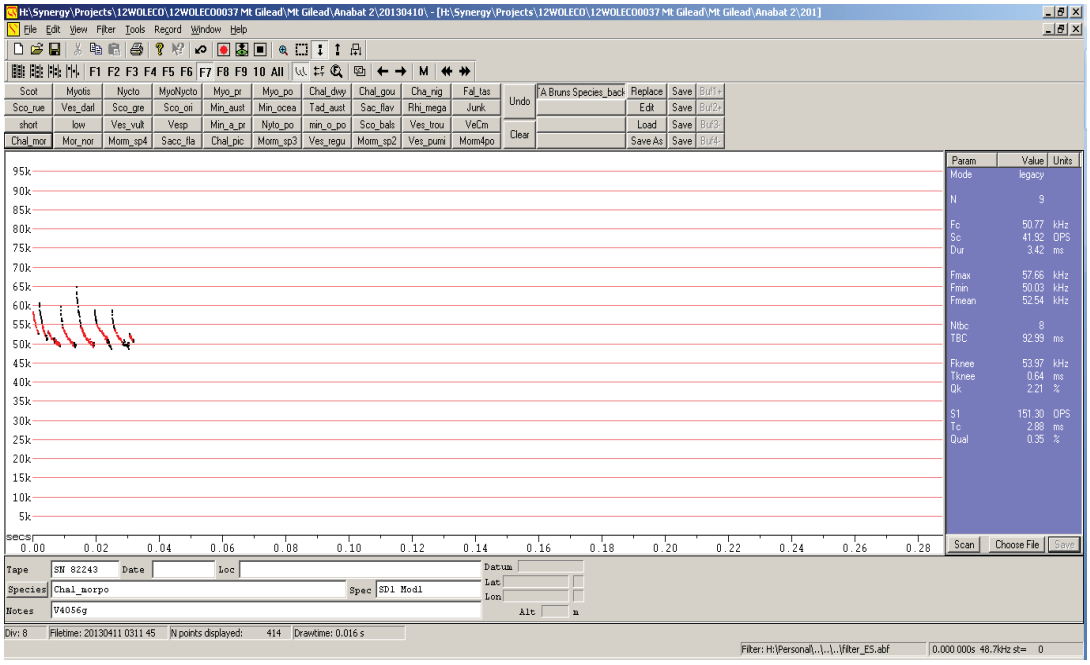

Figure 2: Call profile for *Chalinolobus morio* recorded at Mt Gilead at 03:11 on 11 April 2013.

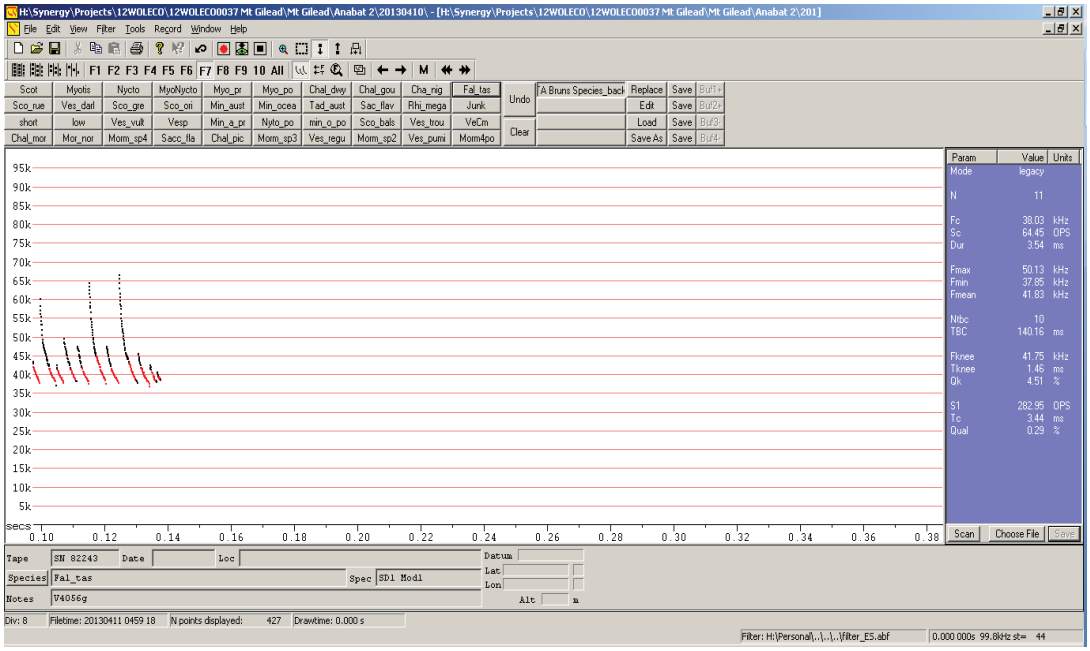

Figure 3: Possible call profile for *Falsistrellus tasmaniensis* recorded at Mt Gilead at 04:59 on 11 April 2013.

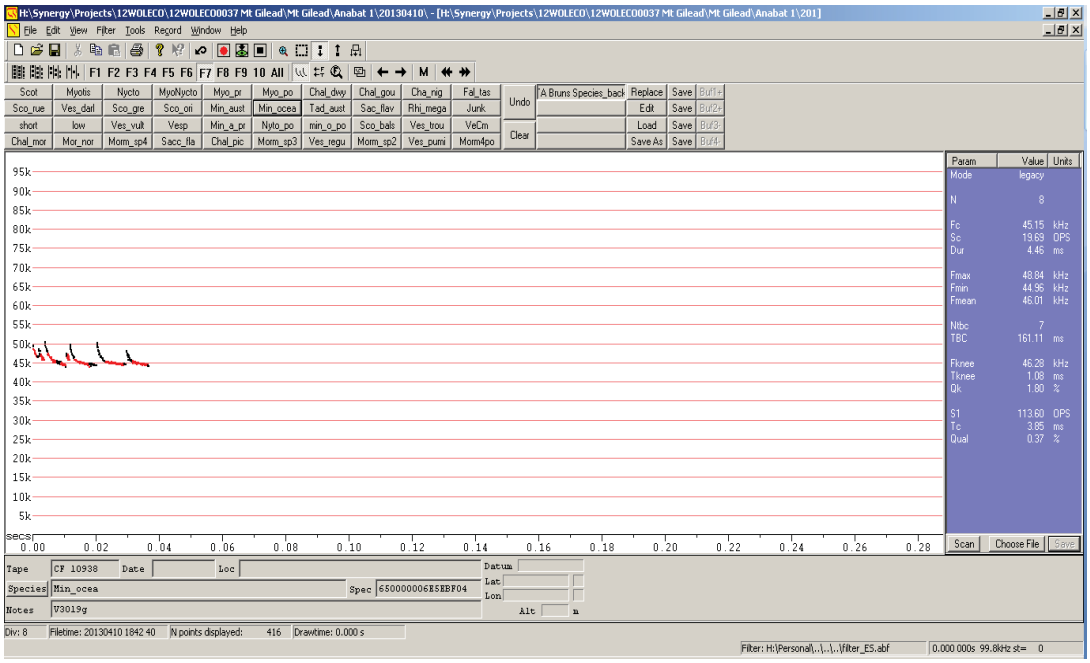

Figure 4: Possible call profile for *Miniopterus schreibersii oceanensis* recorded at Mt Gilead at 18:42 on 10 April 2013.

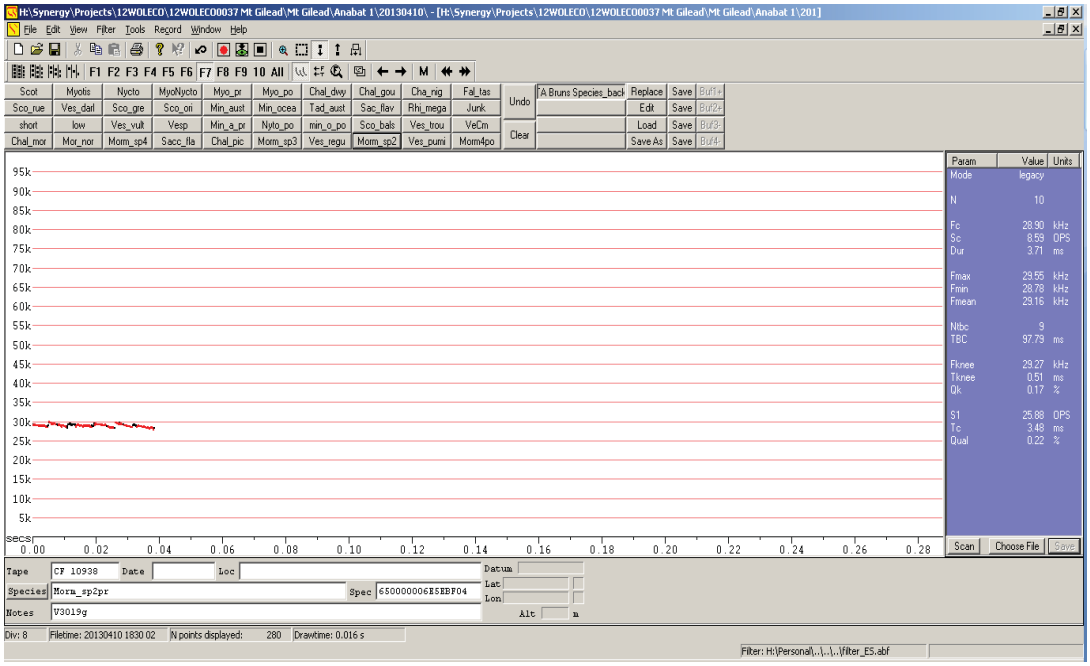

Figure 5: Probable call profile for *Mormopterus species 2* recorded at Mt Gilead at 18:30 on 10 April 2013.

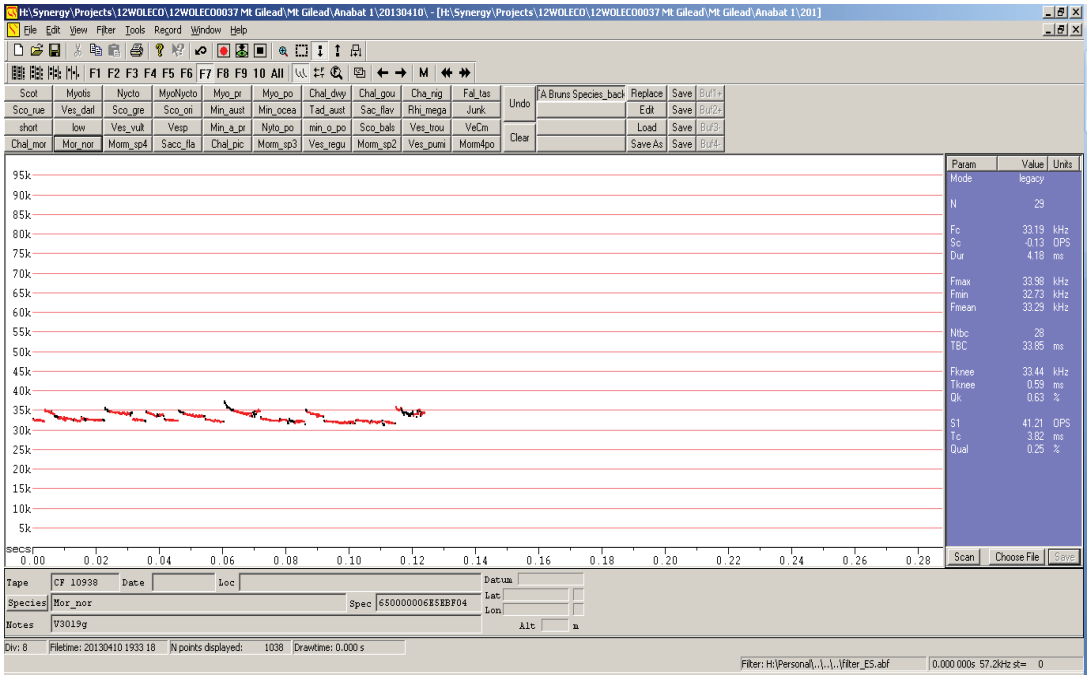

Figure 6: Call profile for *Mormopterus norfolkensis* recorded at Mt Gilead at 19:33 on 10 April 2013.

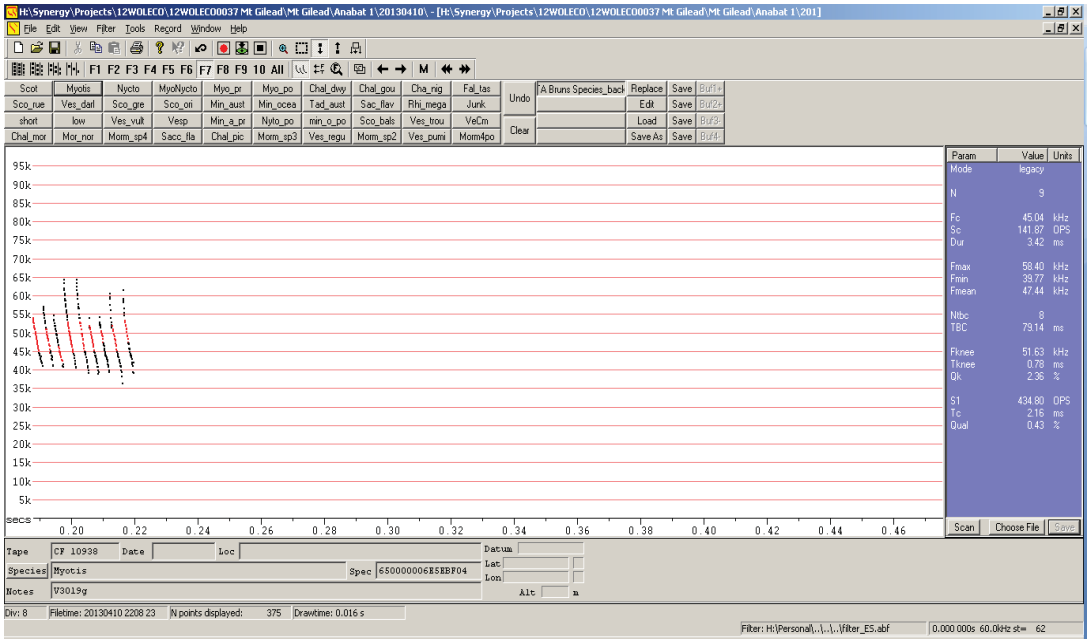

Figure 7: Call profile for *Myotis macropus* recorded at Mt Gilead at 22:08 on 10 April 2013.

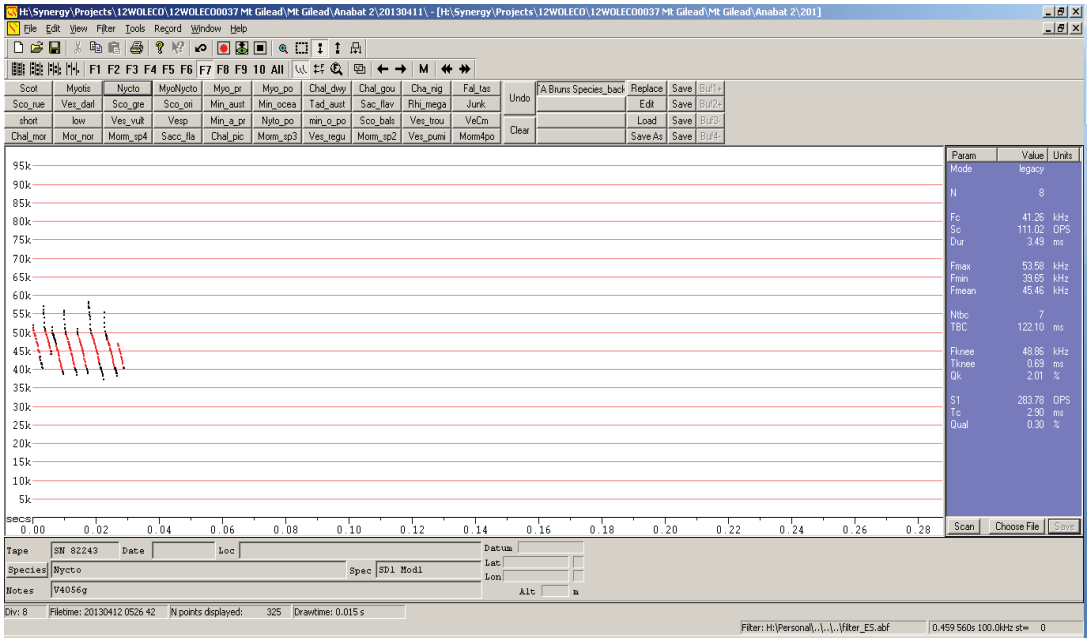

Figure 8: Call profile for *Nyctophilus spp.* recorded at Mt Gilead at 05:26 on 12 April 2013.

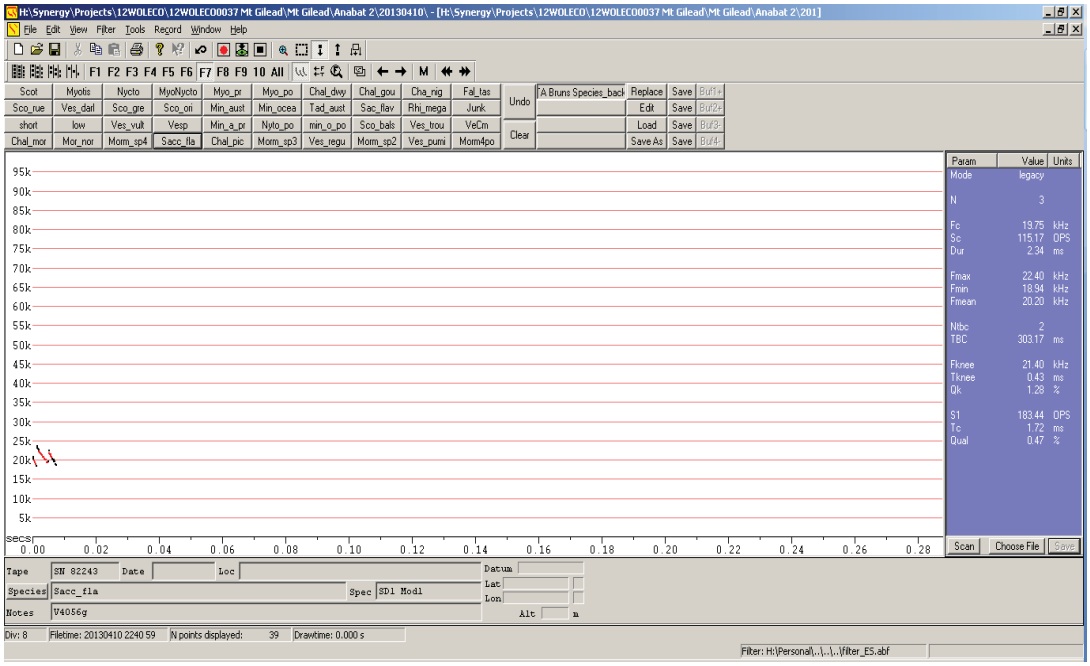

Figure 9: Call profile for *Saccolaimus flaviventrus* recorded at Mt Gilead at 22:40 on 10 April 2013.

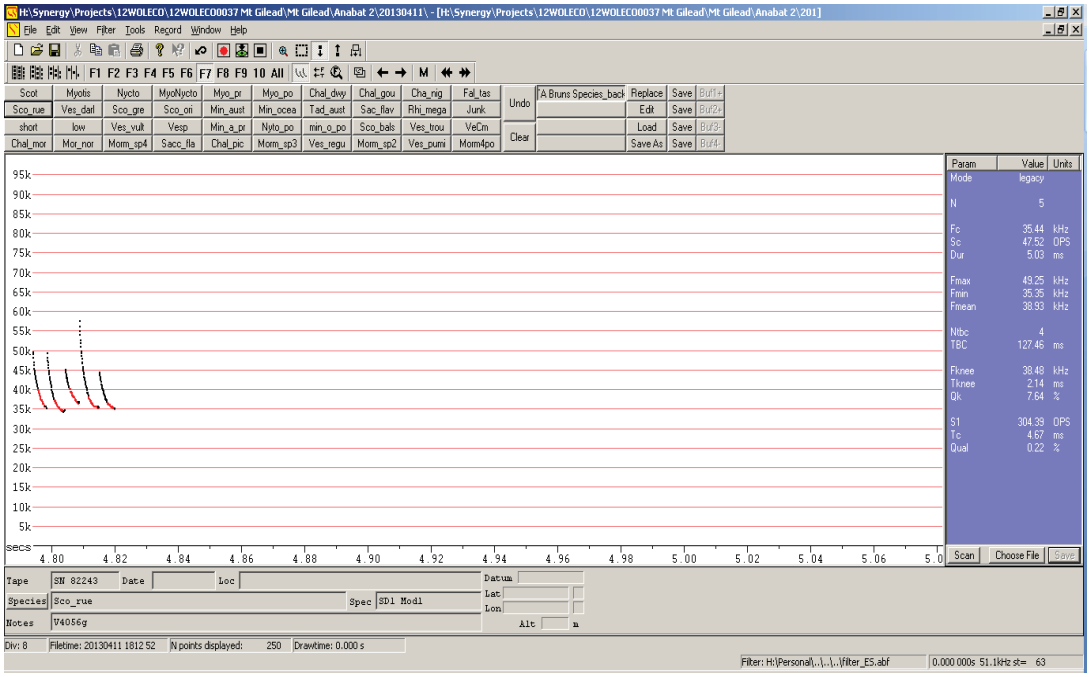

Figure 10: Call profile for *Scoteanax rueppellii* recorded at Mt Gilead at 18:12 on 11 April 2013.

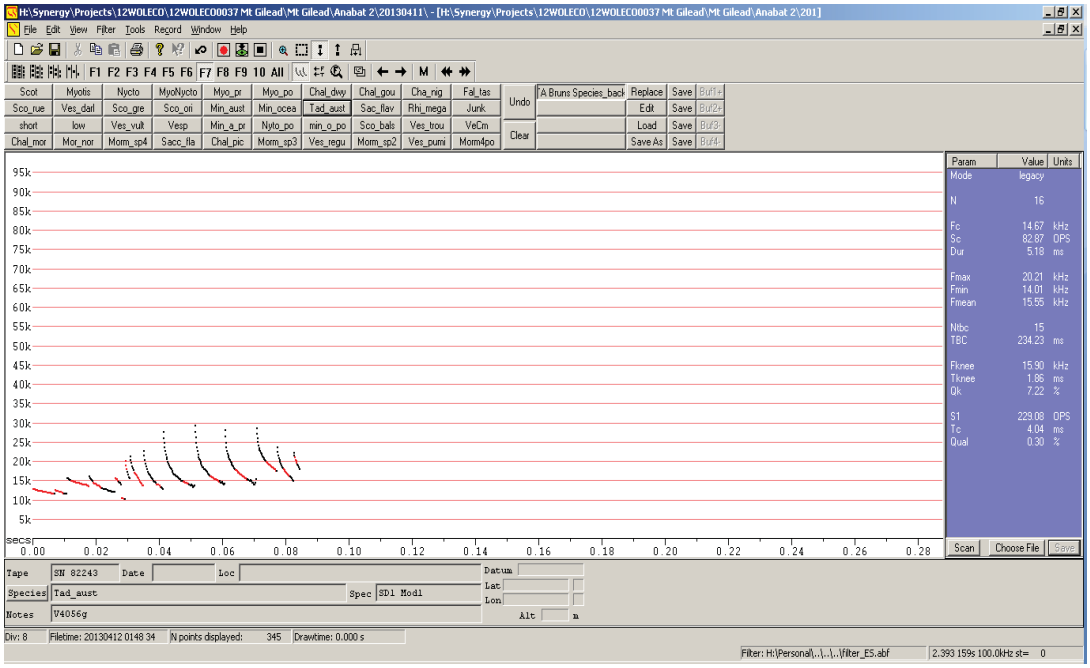

Figure 11: Call profile for *Tadarida australis* recorded at Mt Gilead at 01:48 on 12 April 2013.

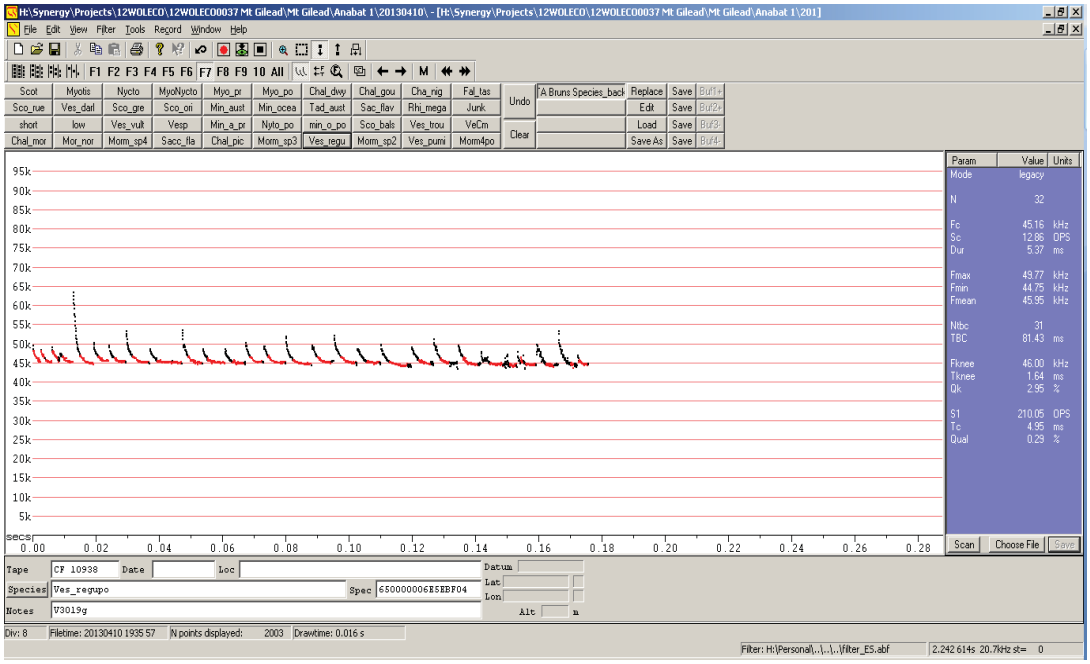

Figure 12: Call profile for *Vespadelus regulus* recorded at Mt Gilead at 19:35 on 10 April 2013.

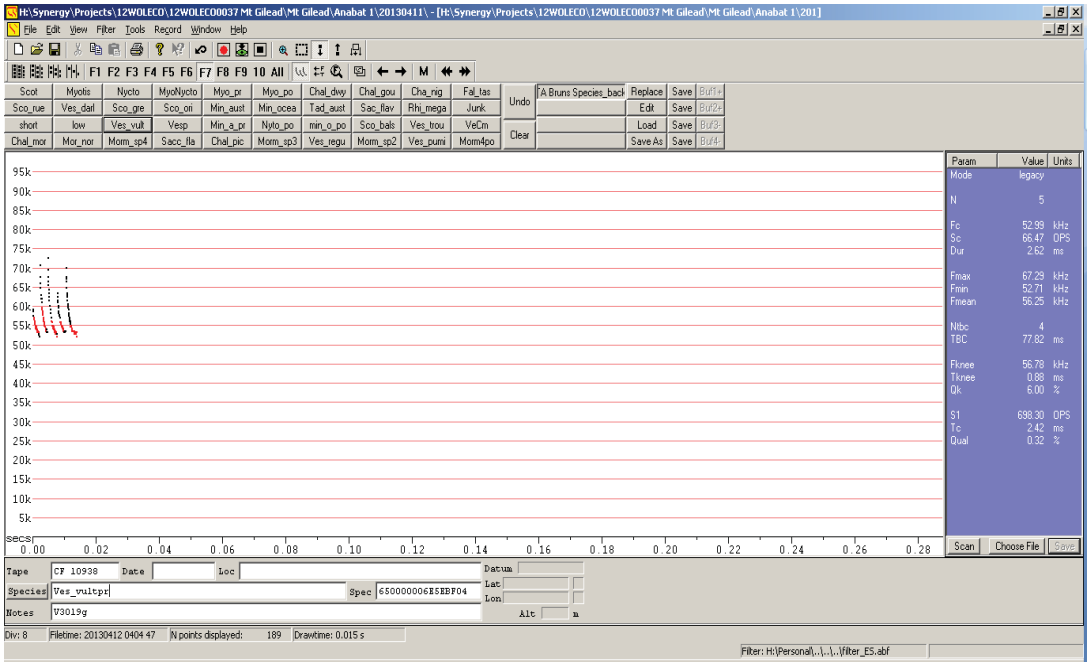

Figure 13: Call profile for *Vespadelus vulturnus* recorded at Mt Gilead at 04:04 on 12 April 2013.

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Appendix J: Transect/plot data

Vegetation Zone 1: Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Low (Sparse)

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
A01	5	2	0	2	0	0	60	0	0	61	295459	6222898	56

Vegetation Zone 2: Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion – Moderate to good (Olive)

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
B01	18	9.5	0	16	0	14	55.5	1	0	25	295526	6222778	56
B02	17	5.5	0	26	0	12	62.5	1	0	35	295646	6222853	56

Vegetation Zone 3: Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Low (Native)

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
D01	18	8	0	74	0	2	4	0	0.67	4	296243	6222510	56
D02	15	7	0	50	0	12	8	0	0.67	0	296373	6222494	56

Vegetation Zone 4: Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Low (Scattered paddock trees)

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
B1_2013	10	9	0	2	0	2	100	1	0	1	295607	6222033	56
C2_2013	4	0	0	22	0	2	98	1	0	8	296265	6222382	56

Vegetation Zone 5: Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion – Moderate to good (Good North)

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
D1_2013	27	20.5	7	89	14	40	4	4	1	5	295999	6221958	56

Vegetation Zone 6: Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion - Moderate to good (Thinned South)

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
F3_2013	37	6.6	0.7	84	0	4	18	0	0.5	9	295888	6222040	56

Vegetation Zone 7: Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion - Moderate to good (Thinned North)

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
F2_2013	32	10.4	8.9	84	4	12	40	0	0.67	1	295863	6221847	56

Vegetation Zone 8: Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion - Low (Good South)

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
F1_2013	29	20.2	1	74	0	12	28	0	0	3	295988	6221720	56

Vegetation Zone 9: Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion - Low (Native)

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
G01	17	6	0	46	0	6	24	0	1	0	295495	6221652	56
H01 2016	21	0.3	0	32	0	6	64	0	1	0	296294	6200532	56
H02 2016	25	9.7	0	46	0	10	32	0	1	0	296309	6221057	56

Vegetation Zone 10: Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion - Low (Exotic)

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
E01	14	19	0.5	0	0	2	66	1	0	32	295824	6221042	56
E02	17	7	0	10	0	0	68	1	0	25	295767	6221229	56
E03	13	4	0	42	0	0	44	0	0	6	295604	6221477	56

Vegetation Zone 11: Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion - Low (Scattered paddock trees)

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
A1_2013	5	13	0	0	0	2	100	1	0	0	296126	6220624	56
A5 2016	4	17.5	0	0	0	6	68	1	0	0	296220	6220382	56
A6 2016	5	0.1	0	4	0	8	88	0	0	0	296183	6222165	56

Appendix K: Macarthur Onslow – Mt Gilead Biobank Site Credit Assessment Report

BioBanking credit report

NSW GOVERNMENT | Office of Environment & Heritage

This report identifies the number and type of credits required at a BIOBANK SITE

Date of report: 16/01/2018 Time: 2:53:20PM Calculator version: v4.0

Biobank details

Proposal ID:	0156/2015/1813B
Proposal name:	Macarthur-Onslow Mt Gilead Biobank Site
Proposal address:	901 Appin Road Gilead NSW 2560
Proponent name:	Mt Gilead Pty Ltd
Proponent address:	C/- Nexia Australia Level 16, 1 Market Street Sydney NSW 2000
Proponent phone:	0400 483 141
Assessor name:	Enhua Lee
Assessor address:	Greater Sydney Branch Parramatta NSW 2150
Assessor phone:	9585 6302
Assessor accreditation:	176

Additional information required for approval:

☐ Use of local benchmark

- Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion
- Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion
- Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion

☐ Expert report...

☐ Request for additional gain in site value

Ecosystem credits summary

Plant Community type	Area (ha)	Credits created
Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	11.98	120.00
Total	11.98	120

Credit profiles

1. Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion, (HN556)

Number of ecosystem credits created	89
IBRA sub-region	Cumberland - Hawkesbury/Nepean

2. Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion, (HN556)

Number of ecosystem credits created	31
IBRA sub-region	Cumberland - Hawkesbury/Nepean

Species credits summary

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Koala	Phascolarctos cinereus	11.98	85

Additional management actions

Additional management actions are required for:

Vegetation type or threatened species	Management action details
Koala	Exclude miscellaneous feral species
Koala	Slashing
Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Exclude commercial apiaries
Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Exclude miscellaneous feral species
Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Feral and/or over-abundant native herbivore control
Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Fox control
Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Slashing

Appendix L: Noorumba – Mt Gilead Biobank Site Credit Assessment Report

BioBanking credit report

NSW GOVERNMENT | Office of Environment & Heritage

This report identifies the number and type of credits required at a BIOBANK SITE

Date of report: 20/04/2018 Time: 11:45:26AM Calculator version: v4.0

Biobank details

Proposal ID:	0156/2015/1820B
Proposal name:	Noorumba-Mt Gilead Biobank Site
Proposal address:	901 Appin Road Gilead NSW 2560
Proponent name:	Mt Gilead Pty Ltd
Proponent address:	C/- Nexia Australia Level 16, 1 Market Street Sydney NSW 2000
Proponent phone:	0400 483 141
Assessor name:	Enhua Lee
Assessor address:	Greater Sydney Branch Parramatta NSW 2150
Assessor phone:	9585 6302
Assessor accreditation:	176

Additional information required for approval:

☐ Use of local benchmark

- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion

☐ Expert report...

☐ Request for additional gain in site value

Ecosystem credits summary

Plant Community type	Area (ha)	Credits created
Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	0.44	4.00
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	6.27	74.00
Total	6.71	78

Credit profiles

1. Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion, (HN526)

Number of ecosystem credits created	4
IBRA sub-region	Cumberland - Hawkesbury/Nepean

2. Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion, (HN528)

Number of ecosystem credits created	57
IBRA sub-region	Cumberland - Hawkesbury/Nepean

3. Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion, (HN528)

Number of ecosystem credits created	17
IBRA sub-region	Cumberland - Hawkesbury/Nepean

Species credits summary

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Koala	Phascolarctos cinereus	6.71	48

Additional management actions

Additional management actions are required for:

Vegetation type or threatened species	Management action details
Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Exclude commercial apiaries
Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Exclude miscellaneous feral species
Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Feral and/or over-abundant native herbivore control
Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Fox control
Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Slashing
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Exclude commercial apiaries
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Exclude miscellaneous feral species
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Feral and/or over-abundant native herbivore control
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Fox control
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Slashing
Koala	Exclude miscellaneous feral species
Koala	Slashing

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