



Biobanking Agreement Credit Assessment Report

Noorumba-Mt Gilead Biobank Site

Prepared for
Mt Gilead Pty Ltd

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Abbreviations

Abbreviation	Description
AW	Alluvial Woodland
BACAR	Biobank Agreement Credit Assessment Report
BBAM 2014	BioBanking Assessment Methodology 2014
BVT	BioMetric Vegetation Type
CEEC	Critically Endangered Ecological Community
CMA	Catchment Management Area
CPSWSGTF	Cumberland Plain Shale Woodland and Shale-Gravel Transition Forest
CPW	Cumberland Plain Woodland
DECCW	Department of Environment, Climate Change and Water (now OEH)
EEC	Endangered Ecological Community
ELA	Eco Logical Australia Pty Ltd
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)</i>
LGA	Local Government Area
Mt Gilead	Mt Gilead Pty Ltd
NPWS	National Parks and Wildlife Service
OEH	NSW Office of Environment and Heritage
Old Mill Properties	Old Mill Properties Pty Ltd
PCL	Priority Conservation Lands
PCT	Plant Community Types
RFEF	River-Flat Eucalypt Forest
SHW	Shale Hills Woodland
SPW	Shale Plains Woodland
SSTF	Shale Sandstone Transition Forest
TSC Act	<i>Threatened Species Conservation Act 1995</i>

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), to prepare Biobank Agreement Credit Assessment Reports and Management Plans for the establishment of two Biobank sites within a selected portion of a property owned and referred to by Mt Gilead as the MDP lands, located in Gilead on Appin Road in the Campbelltown Local Government Area (LGA). The MDP lands are comprised of several lots (Lots 59 and 61//DP 752042, and parts of Lots 1 and 2//DP 807555), and have been subject to a proposal to rezone parts of the land holdings from rural land to residential land under the Campbelltown draft Local Environment Plan (LEP) 2014. A Biocertification Assessment Report and Biocertification Strategy is currently in preparation for the proposed development of the MDP lands and the land subject to this Biobank application is being treated as 'retained land' with existing conservation obligations within the Biocertification assessment.

Generally, biocertification assessments and strategies are undertaken, with commitments around conservation measures (e.g. registering biobank sites) given, prior to assessing, applying and registering biobank sites. Biobank sites are generally established after land is certified and the certification process is complete. However, registering biobank sites in advance or in parallel to the biocertification process for Mt Gilead will assist in streamlining the formal biocertification process (as the conservation areas will already be secured and available to meet the offset obligations), and generate additional value to the land holders due to the ability to retain any surplus credits generated.

The areas within the MDP lands proposed to be established as Biobank sites are referred to as the 'Noorumba-Mt Gilead Biobank Site' (this application) and the 'Macarthur-Onslow Mt Gilead Biobank Site'. The Noorumba-Mt Gilead Biobank Site is comprised of two discrete areas in the north of the MDP lands, while the Macarthur-Onslow Mt Gilead Biobank Site is comprised of a single area on the western boundary of the MDP lands. Separate Biobank Site Assessments and Applications are being prepared and submitted for the two proposed Biobank sites as one will be retained and managed by the current land holder whilst the Noorumba –Mt Gilead Biobank site is proposed to be transferred to Campbelltown Council as an addition to the Noorumba Reserve. The Mt Gilead Biobank sites and the MDP lands are shown in **Figure 1**.

This document is the **Biobank Agreement Credit Assessment Report (BACAR)** for the Noorumba-Mt Gilead Biobank Site. It contains a detailed description of the Biobanking Assessment process, including a justification of the landscape score, mapping of plant community types, vegetation zones and management zones. The credits generated by the proposal, and their credit profiles, are also outlined.

This report has been prepared to meet the requirements of the BioBanking Assessment Methodology 2014 (BBAM 2014) (NSW Office of Environment and Heritage [OEH] 2014a) stating that a BACAR must be prepared, with the assessment made by an accredited BioBanking assessor. The accredited BioBanking assessor who prepared the assessment is Enhua Lee (assessor number: 176). Enhua was supported by Bruce Mullins (assessor number: 0156) as assessment began prior to Enhua becoming formally accredited. Version 4.0 of the calculator was used in the assessment.

The total area of the Noorumba-Mt Gilead Biobank Site is 7.81 ha. Two plant community types (PCTs), which occur as one condition class or have been divided into two condition classes, respectively, and exotic grassland, have been recorded for the assessment. The plant community types are mapped as 'Grey Box - Forest Red Gum grassy woodland on flats of the southern Cumberland Plain, Sydney Basin Bioregion' (PCT849) and 'Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of

the Cumberland Plain, Sydney Basin Bioregion' (PCT835) (OEH 2015). 'Grey Box - Forest Red Gum grassy woodland on flats of the southern Cumberland Plain, Sydney Basin Bioregion' forms part of the Cumberland Plain Woodland (CPW) Critically Endangered Ecological Community (CEEC), and was formerly recognised as the BioMetric Vegetation Type (BVT) of the same name, HN528. 'Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion' forms part of the River-Flat Eucalypt Forest (RFEF) Endangered Ecological Community (EEC), and was formerly recognised as the BVT of the same name, HN526.

There are 7.62 ha of vegetation to generate credits (there are some dams in the Noorumba-Mt Gilead Biobank Site which will not generate credits and a proposed fire trail that is not part of the Biobank site). The vegetation on site generates 88 ecosystem credits. ELA considered it likely that *Phascolarctos cinereus* (Koala) may use the site. The site currently generates 43 species credits for Koala, and restored habitat would generate a further 11 species credits. **Table 1** and **Table 2** provide a summary of ecosystem and species credits generated, with details provided in **Section 3**.

Table 1: Summary of ecosystem credits generated

Plant community type	Condition and ancillary code	Area (ha)	Credits generated	Credits/ha
<i>Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion</i>	Moderate to Good (Sparse)	1.16	11	9.48
<i>Grey-Box – Forest Red Gum grassy woodlands on flats of the southern Cumberland Plain, Sydney Basin Bioregion</i>	Moderate to Good (Olive)	2.30	28	12.17
	Moderate to Good (Native)	2.58	33	12.79
	Low (Cleared/exotic to be regenerated)	1.58	16	10.13
Total		7.62	88	11.55

Table 2: Summary of Koala species credits generated

Koala habitat	Area (ha)	Credits generated
Current	6.04	43
Restored	1.58	11
Total	7.62	54

Management of the Noorumba-Mt Gilead Biobank Site will involve the implementation of standard management actions and will include:

- The active management and reduction of weeds;
- The erection and maintenance of 1.8 km of new fencing (post and high tensile steel chain fencing) on the development side of the site, and 535 m of new fencing to a stock proof standard on the non-development side of the site;
- The application of fire, where appropriate;

- Replanting or supplementary planting where natural regeneration is not sufficient;
- Active management of human disturbance, if necessary; and
- The retention of regrowth/native vegetation, dead timber, and rocks.

Management of the Noorumba-Mt Gilead Biobank Site will also involve additional management actions, including:

- Supplementary planting including in areas where natural regeneration is occurring.
- Addition of logs.
- Control of rabbits and foxes (as required).

The management required on site, and the associated costs, are provided in the accompanying Management Plan (completed management actions template) and credit pricing spreadsheet, respectively.

1 Site Description

1.1 Location

The Noorumba-Mt Gilead Biobank Site is located in two separate areas on Lot 2//DP 807555 and Lot 59//DP 752042, which comprise a selected portion of a property owned and referred to by Mt Gilead Pty Ltd (Mt Gilead) as the MDP lands (**Figure 1**). The Noorumba-Mt Gilead Biobank Site is approximately 7.81 ha in area and the lots on which it lies are located on Appin Road in the Campbelltown Local Government Area (LGA), approximately 5 km south of Campbelltown city centre (**Figure 1**). The site lies entirely within the Cumberland subregion of the Sydney Basin IBRA region (Thackway and Creswell 1994), and is wholly within the Cumberland Plain Mitchell Landscape (**Figure 2**).

The Noorumba-Mt Gilead Biobank Site is bound by Noorumba Reserve and an unnamed 2nd/3rd order creek in the north and MDP lands in remaining areas (**Figure 1** and **Figure 3**). Dharawal National Park lies to the south east of the Noorumba-Mt Gilead Biobank Site approximately 3.5 km away. Further, the registered Beulah Biobank Site and a number of proposed biobank sites are located within 2 km of the Noorumba-Mt Gilead Biobank Site (**Figure 1**). This includes the second biobank site, the '*Macarthur-Onslow Mt Gilead Biobank Site*', proposed to offset impacts in the MDP lands which will be retained and managed by the current land holder. Note that 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 Critically Endangered Ecological Community (CEEC), Cumberland Plain Woodland (CPW), in the CPW Recovery Plan (Department of Environment, Climate Change and Water [DECCW] 2011) and updates to the layer. As such, it has been identified by the NSW Office of Environment and Heritage (OEH) as a prime site for registration of a Biobank site (OEH 2014a).

There are no covenants or conservation funding arrangements for the Noorumba-Mt Gilead Biobank Site, and the site is to be managed for ecosystem and species credits in its entirety.

1.2 Biophysical characteristics of the site

The Noorumba-Mt Gilead Biobank Site is located on gently sloping hills to flat plains, and alluvial flats, of the Cumberland Plain in western Sydney. It is mostly covered by woody vegetation, with remaining areas covered by grassland, and occurs at an elevation of between 120 m and 140 m above sea level (masl). Portions of two first order, three second order, and one third-order streams, have been mapped on the Noorumba-Mt Gilead Biobank Site (**Figure 3**).

The Noorumba-Mt Gilead Biobank Site lies on Blacktown (Bt) and Theresa Park (tp) soil landscapes. The Blacktown soil landscape lies on gently undulating rises on Wianamatta Group shales and Hawkesbury shale. Soils are shallow to moderately deep (<100 cm) red and brown podzolic soils on crests, upper sloped and well drained areas, and deep (150-300 cm) yellow podzolic soils and soloths on lower slopes and in areas of poor drainage. The Theresa Park soil landscape lies on tertiary and quaternary floodplains and terraces of the Nepean River south of Cobbitty Creek. Slopes are gently undulating, mostly <5% but range to 10% on high level terraces. Soils are highly variable and include red earths and red podzolic soils on terraces and prairie soils on floodplains. Alluvial bedding is sometimes evident with Alluvial Soils present, and solodic soils occur in drainage lines (Hazelton and Tille 1990).

1.3 Land use zoning

The Noorumba-Mt Gilead Biobank Site is not currently zoned under the draft Campbelltown Local Environmental Plan 2014 (CLEP 2014), with land where it occurs being a deferred matter for future consideration. Campbelltown City Council is in the process of rezoning the land to RE1.

1.4 Site history and current uses of property

The Noorumba-Mt Gilead Biobank Site is currently used for agricultural purposes, mainly cattle grazing. The presence of remnant native vegetation, constructed dams and improved pastures reflects the current land use.

1.5 Surrounding land uses

The Noorumba-Mt Gilead Biobank Site is surrounded by public conservation land to the north (Noorumba Reserve) and rural grazing land. Further to the south, land in the Beulah Biobank site is being managed in perpetuity for conservation; the Beulah Biobank site is a registered biobank site. There are also a number of other proposed biobank sites in the surrounding area, as shown in **Figure 1**. The *Macarthur-Onslow Mt Gilead Biobank Site* is the second biobank site currently being assessed to offset impacts in the MDP lands.

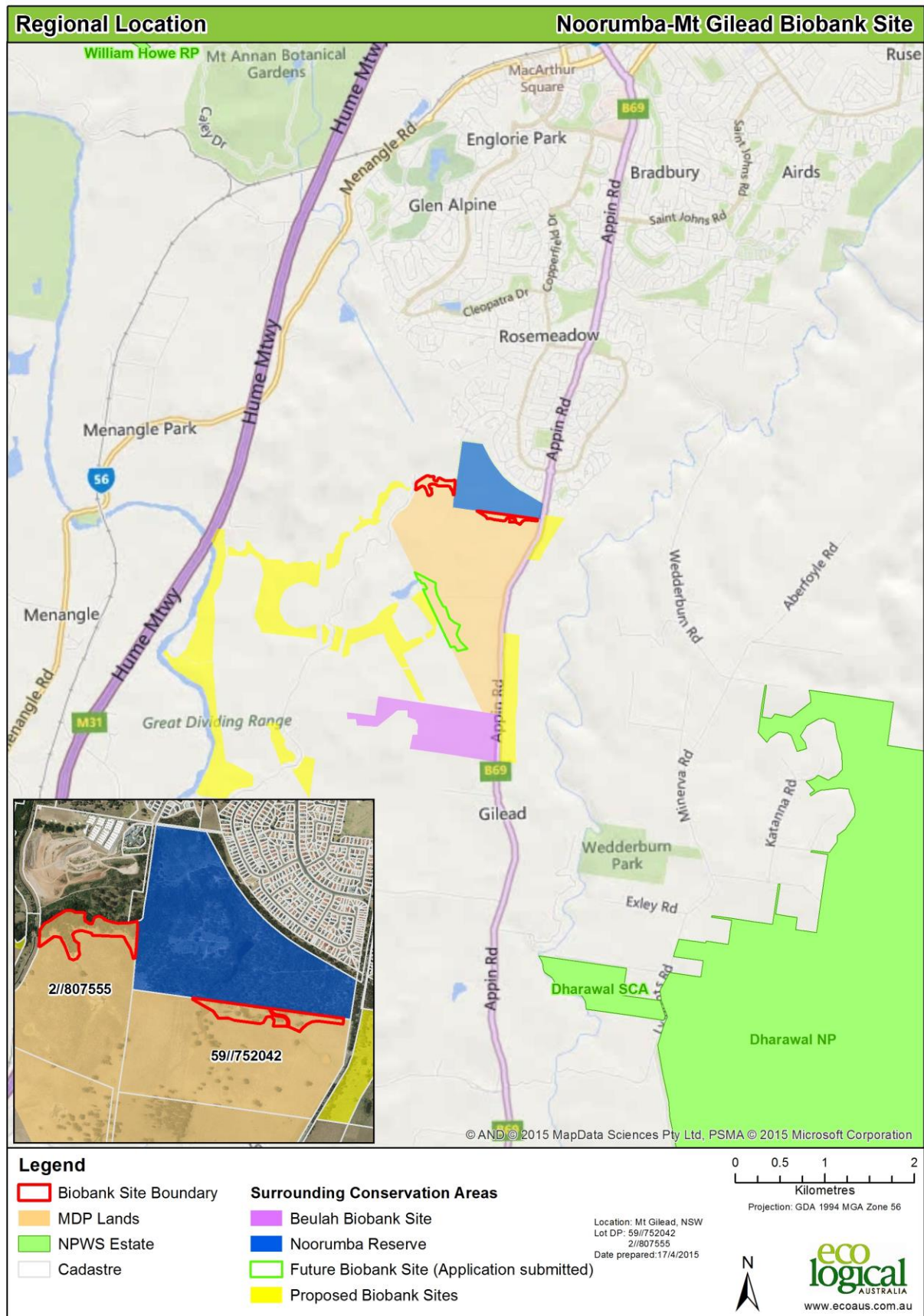


Figure 1: Regional location of the Noorumba-Mt Gilead Biobank Site

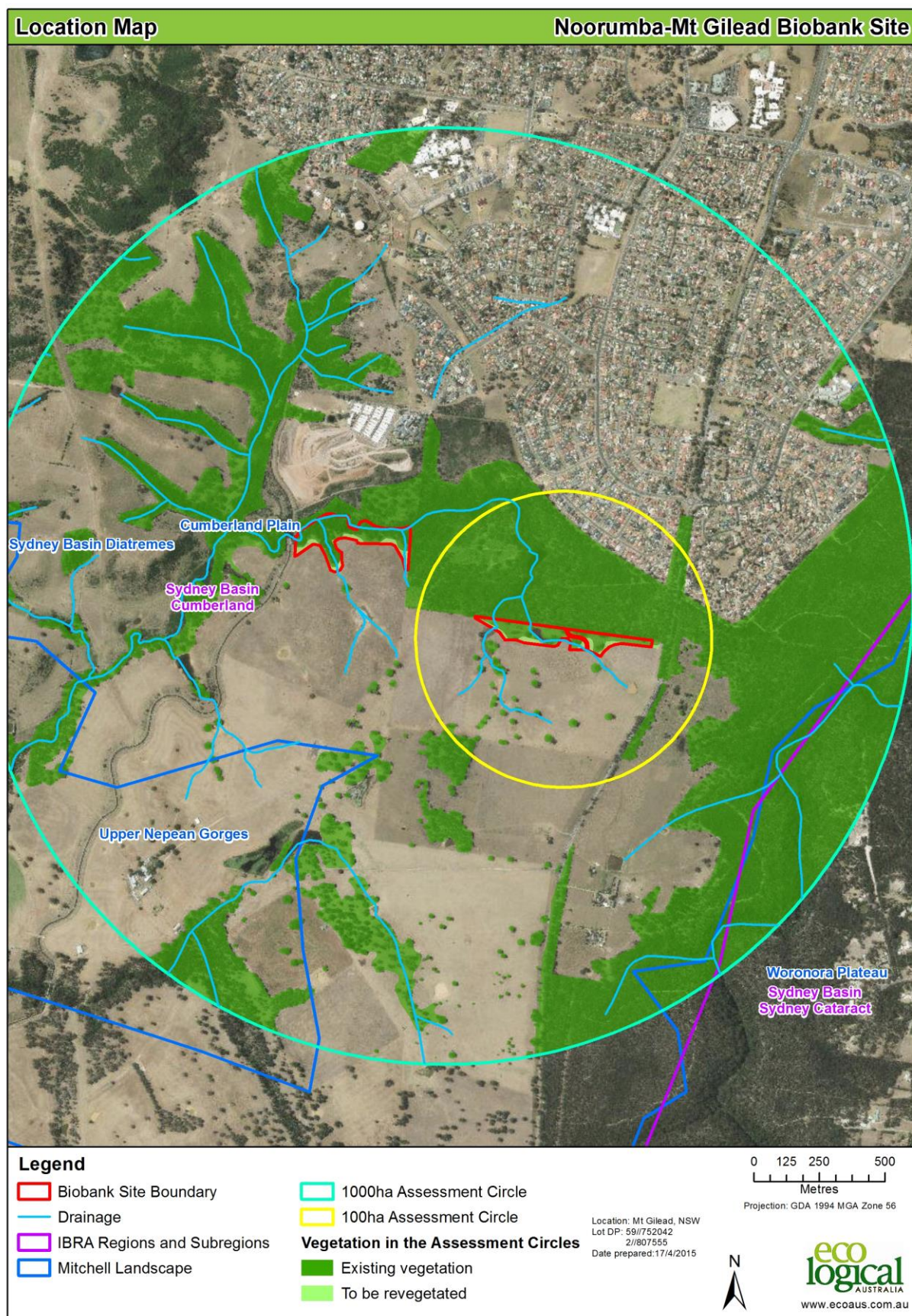


Figure 2: Location of the Noorumba-Mt Gilead Biobank Site relative to IBRA Regions/Subregions, Mitchell Landscapes, and Assessment circles (Location Map)

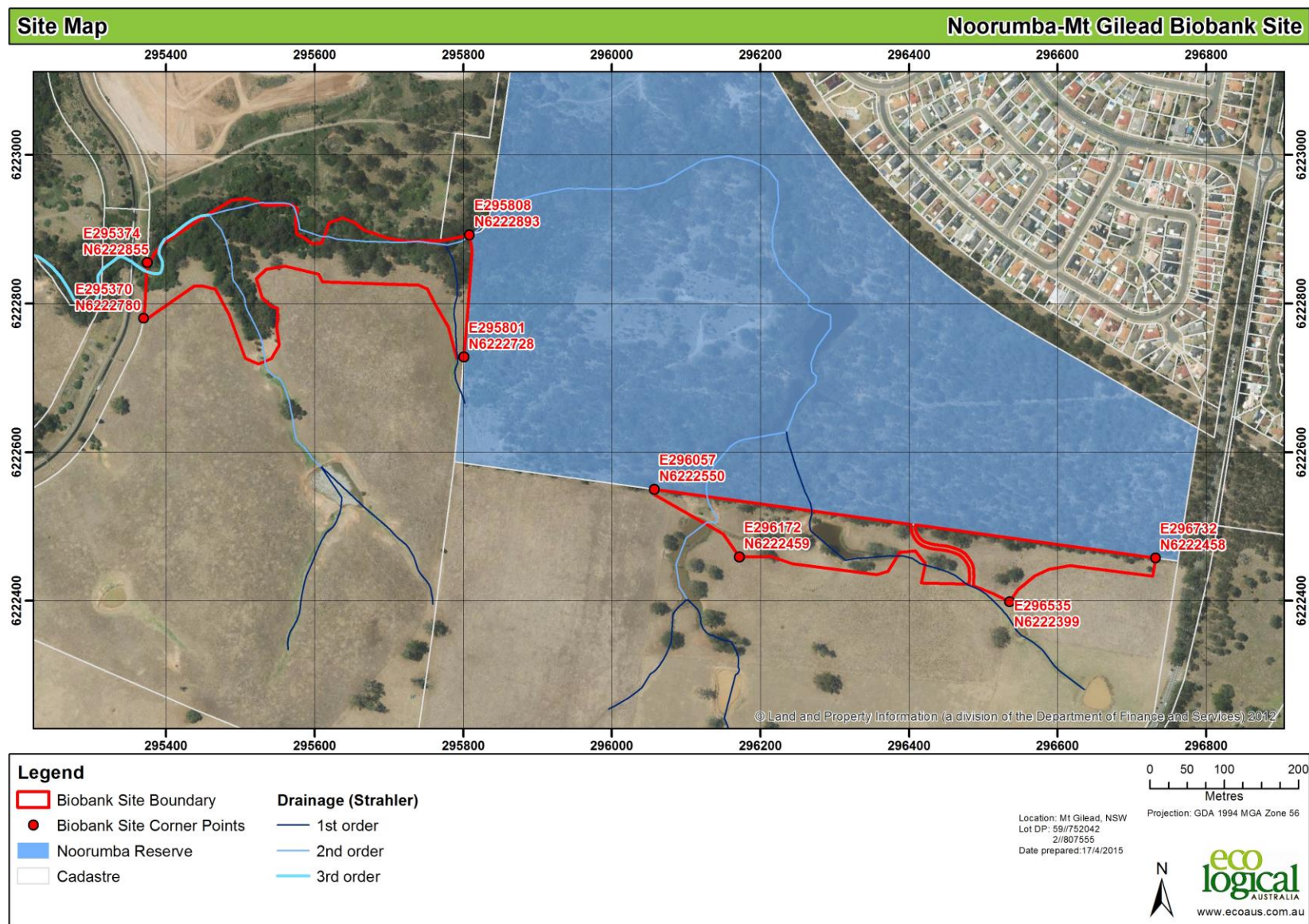


Figure 3: Noorumba-Mt Gilead Biobank Site boundary (Site map)

2 Biobank Assessment

2.1 Biobank area

The Noorumba-Mt Gilead Biobank Site covers a total of 7.81 ha. Portions of the site lie adjacent and along a second order stream in the north of the MDP lands that becomes a third order stream, while portions lie on low lying land adjacent to first and second order streams.

There are no covenants or conservation funding arrangements for the Noorumba-Mt Gilead Biobank Site, and the entire site is to be managed for ecosystem credits.

2.2 Plant Community Types

Remnant vegetation in the MDP lands was mapped primarily as Shale Sandstone Transition Forest (SSTF) by the NSW National Parks and Wildlife Service (NPWS) in its mapping of Native Vegetation of the Cumberland Plain Western Sydney (NPWS 2002). The NPWS also mapped some Shale Plains Woodland (SPW), Shale Hills Woodland (SHW), and Alluvial Woodland (AW) in the MDP lands.

Within the Noorumba-Mt Gilead Biobank Site, NPWS mapping included SSTF, AW, and a small amount of SPW (**Figure 4**). In the Cumberland Plain, SSTF occurs on soils derived from Wianamatta Shale in areas transitioning between parent geologies of Wianamatta Shale to high quartz sedimentary substrates such as Hawkesbury and Narrabeen group sandstones; AW occurs along or in proximity to minor watercourses draining soils derived from Wianamatta Shale; while SPW occurs on gently sloping and flat topography on soils derived from Wianamatta Shale or on Holocene alluvium on well-drained areas that are infrequently inundated (NPWS 2002). The equivalent Plant Community Types (PCTs) to SSTF, AW, and SPW are '*Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion*', '*Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*' and '*Grey Box - Forest Red Gum grassy woodland on flats of the southern Cumberland Plain, Sydney Basin Bioregion*', respectively (OEH 2015).

Previous field survey of the MDP lands by ELA in 2013, undertaken for a proposed rezoning of the MDP lands (ELA 2014), found vegetation within the Noorumba-Mt Gilead Biobank Site to be slightly different to that mapped by NPWS (2002). Vegetation along the second/third order stream was validated as AW as per the NPWS (2002) mapping. However, areas mapped as SSTF by NPWS (2002) were validated as SPW rather than SSTF by ELA. This was due to the dominant flora species present, flora species composition, substrate, underlying geology, and landscape position.

Field survey by ELA for the current biobank assessment confirmed the previous vegetation mapping of ELA (2014) i.e. AW was present along the second/third order stream in the west of the Noorumba-Mt Gilead Biobank Site, with SPW present in remaining areas. Field survey for the biobank assessment was undertaken over a single day on 9 April 2015. Where multiple plots were undertaken for vegetation zones, survey sampled representative areas within these and also attempted to sample the variation across vegetation zones. **Figure 5** shows the distribution of the PCTs within the Noorumba-Mt Gilead Biobank Site.

Note that quantitative analysis of plot data collected during field survey was undertaken using the OEH vegetation tool developed by Greg Steenbeeke. However, the OEH vegetation tool did not generate clear results for vegetation communities from the plot data (**Table 3**). Ratios of actual to required positive diagnostic species were all below 75. Generally, only ratios above 80 are considered to reflect

good matches with vegetation communities. The lack of clear results is likely the result of past disturbance that has degraded the vegetation communities on site.

Table 3: Summary of results (ratio of actual to required positive diagnostic species) from plot data entered into the OEH vegetation tool determining likely matches for vegetation communities. Communities with the highest ratios are highlighted per plot

Survey plot name (code) *	Ratio of actual to required positive diagnostic species in vegetation communities (after Tozer et al 2010) (%)^						
	SHW	SPW	STIF	CRFF	GMDR	WSDR	MSW
AW, Sparse (A01)	20	12	22	25	28	9	16
SPW, Olive 01 (B01)	55	46	35	75	50	32	47
SPW, Olive 02 (B02)	55	50	30	69	44	36	53
SPW, Native 01 (D01)	55	54	26	50	22	18	42
SPW, Native 02 (D02)	50	38	17	44	22	23	42

* Note that data for plot C01 are not included in the table due to this plot being located in exotic grassland.

^ Results are only shown for these seven vegetation communities. SHW = Shale Hills Woodland, SPW = Shale Plains Woodland, STIF = Sydney Turpentine Ironbark Forest, CRFF = Cumberland River Flat Forest, GMDR = Grey Myrtle Dry Rainforest, WSDR = Western Sydney Dry Rainforest, MSW = Moist Shale Woodland.

The over-storey of AW in the Noorumba-Mt Gilead Biobank Site was composed of *E. moluccana* (Grey Box). The shrub layer was composed of the introduced species *Ligustrum lucidum* (Large-leaved Privet) and *Ligustrum sinense* (Small-leaved Privet). The under-storey was extremely sparse having been shaded by the shrub layer. However, it included *Oplismenus aemulus* (Australian Basket Grass) and *Einadia hastata* (Berry Saltbush), as well as the introduced species *Rubus fruticosus* sp. aggregate (Blackberry), *Cirsium vulgare* (Spear Thistle), and *Conyza bonariensis* (Fleabane).

Generally, the over-storey of SPW in the Noorumba-Mt Gilead Biobank Site was dominated by *Eucalyptus tereticornis* (Forest Red Gum), although *E. creber* (Narrow-leaved Ironbark) and *E. moluccana* were also present. The shrub layer, where present, was largely composed of the introduced species *Olea europaea* var. *cuspidata* (African Olive), with a small amount of native *Bursaria spinosa* (Blackthorn) present. The under-storey 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. The SPW at the site had varying degrees of weed infestation, with *Olea europaea* var. *cuspidata* the most common of the shrub species. There were lower occurrences of introduced groundcover species including *Bidens pilosa* (Cobbler's Pegs), *Setaria parviflora* (Whorled Pigeon Grass), *Paspalum dilatatum*, *Sida rhombifolia* (Paddy's Lucerne), *Senecio madagascariensis* (Fireweed), and *Plantago lanceolata* (Plantain).

A flora inventory is provided in **Appendix A**.

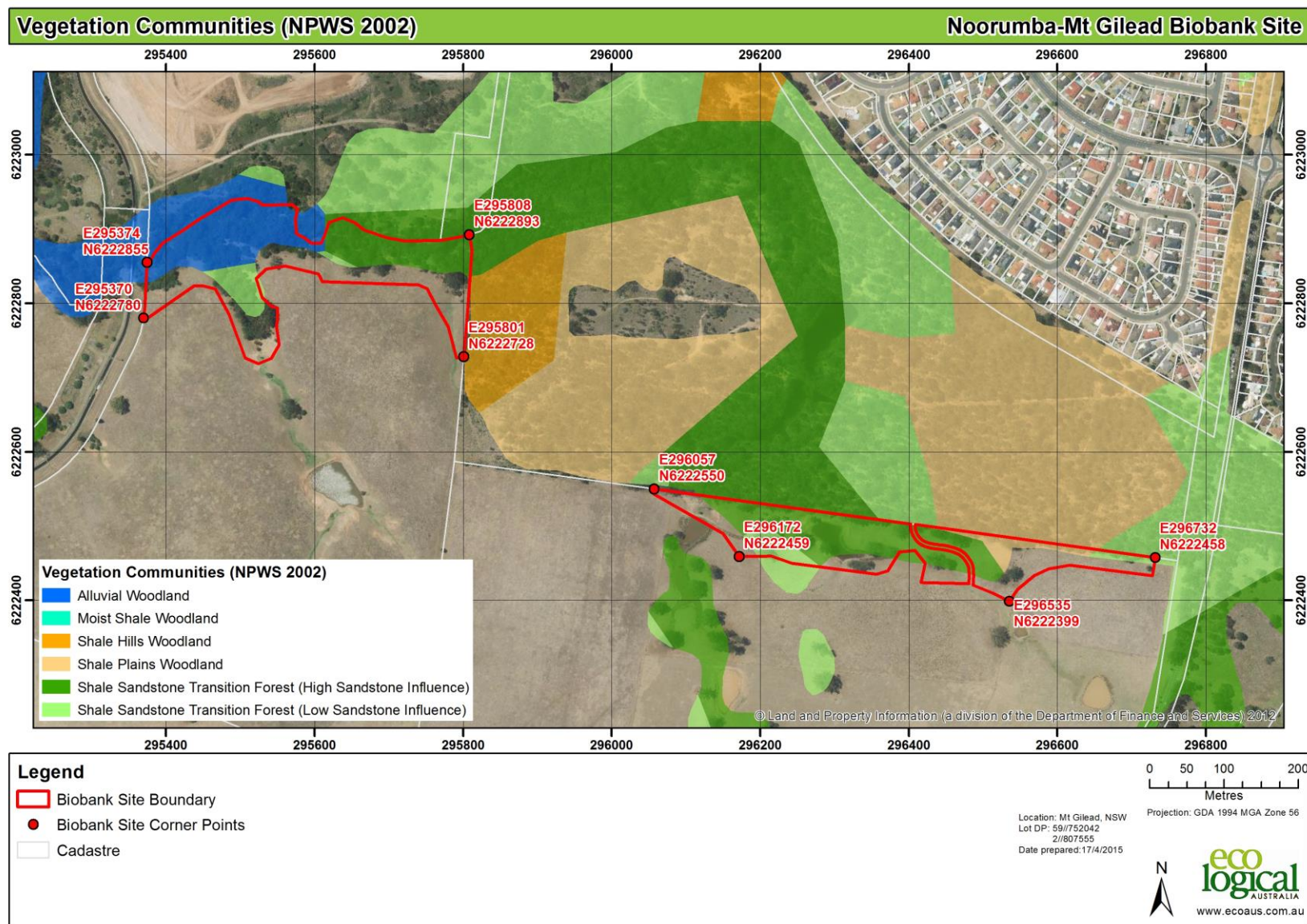


Figure 4: Vegetation communities in the Noorumba-Mt Gilead Biobank Site as mapped by NPWS (2002)

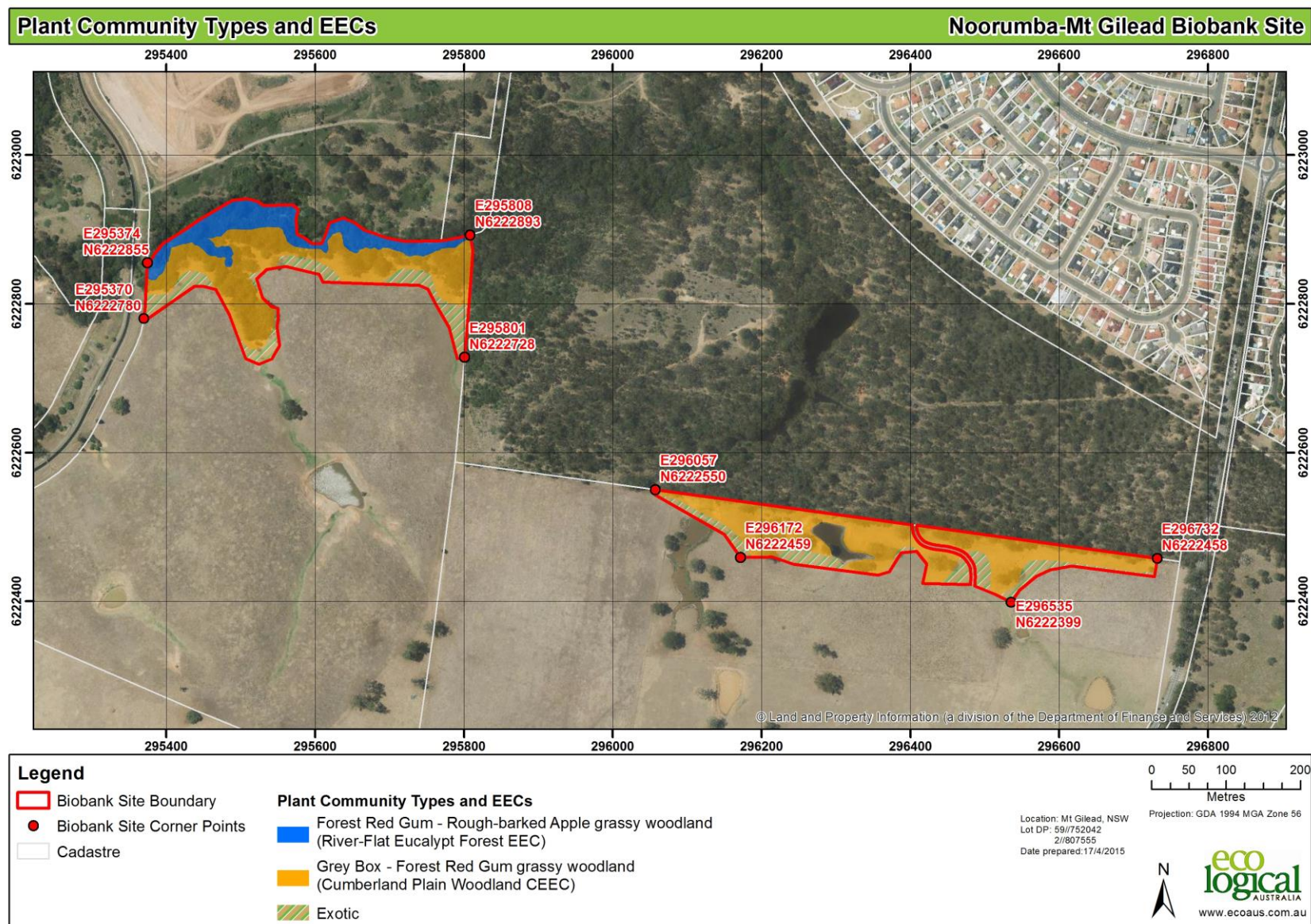


Figure 5: Plant Community Types/Endangered Ecological Communities in the Noorumba-Mt Gilead Biobank Site

2.3 Over-cleared vegetation types and Threatened Ecological Communities

2.3.1 *Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*

'Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion' is a 'highly cleared' vegetation type, identified as 95% cleared within the Hawkesbury/Nepean CMA (OEH 2015).

'Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion' also forms a component of the Endangered Ecological Community (EEC), 'River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions' (RFEF), listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act).

The distribution of 'Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion' within the Noorumba-Mt Gilead Biobank Site is shown on **Figure 5**.

2.3.2 *Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion*

'Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion' is a 'highly cleared' vegetation type, identified as 95% cleared within the Hawkesbury/Nepean Catchment Management Area (CMA) (OEH 2015).

'Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion' also forms a component of the critically endangered ecological community (CEEC), 'Cumberland Plain Shale Woodland and Shale-Gravel Transition Forest' (CPSWSGTF) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and the CEEC, 'Cumberland Plain Woodland in the Sydney Basin Bioregion' (CPW), listed under the TSC Act.

The distribution of 'Grey-Box – Forest Red Gum grassy woodland on flats of the Southern Cumberland Plain, Sydney Basin Bioregion' within the Noorumba-Mt Gilead Biobank Site is shown on **Figure 5**.

2.4 Landscape value assessment

According to the BBAM 2014 (OEH 2014b), the following steps are required in assessing the landscape value for biobank sites:

- a) Assess whether the site is in a strategic location;
- b) Assess change in connectivity value;
- c) Assess the increase in native vegetation cover; and
- d) Assess the patch size area.

A strategic location is defined in Section 4.2.6 of the BBAM 2014 as:

- part of a state or regional biodiversity link and in a plan approved by the Chief Executive of the OEH; or
- a riparian buffer area of a third order stream or higher, or an important wetland or estuarine area.

If the biobank site is in a strategic location, there is no need to further assess connectivity value i.e. step 'b' is not required.

As stated in Section 1.1, the Noorumba-Mt Gilead Biobank Site contains the riparian buffer of a portion of a third order stream (**Figure 3**). As such, the Noorumba-Mt Gilead Biobank Site has been assessed as lying in a strategic location. The following landscape value assessment follows steps a, c and d of the BBAM 2014 for assessing landscape value.

The following sections outline the data that were entered to the calculator.

2.4.1 Score for strategic location

Given the Noorumba-Mt Gilead Biobank Site includes a portion of a riparian buffer of a third order stream, with only one side of the riparian buffer on the Noorumba-Mt Gilead Biobank Site, a score of 6 was entered into the Credit Calculator.

2.4.2 Increase in native vegetation cover

The amount of vegetation currently within the 100 ha and 1000 ha assessment circles (inner and outer assessment circles, respectively) was calculated using ArcGIS at a scale of 1:10,000 (see **Figure 2** for circle placement). The amount of vegetation in the circles once the Noorumba-Mt Gilead Biobank Site is established, and managed into the future, was also estimated in ArcGIS.

The assessment for the inner circle recorded approximately 44 ha of overstorey vegetation before the establishment of the Biobank site, which represents 44% cover. After the establishment of the Biobank site, it has been assumed that the entire site will, at some stage, reach benchmark, which contributes 1 ha (1%) of additional vegetation to the total. The total amount of overstorey cover vegetation in the inner circle has increased from 44% (before establishment of the Biobank site) to 45% (after the establishment of the Biobank site).

The assessment for the outer circle recorded approximately 311 ha of overstorey vegetation before the establishment of the Biobank site, which represents 31.1% cover. After the establishment of the Biobank site, it has been assumed that the entire site will, at some stage, reach benchmark, which contributes 2 ha (0.2%) of additional vegetation to the total (note that this is different to the amount of additional vegetation in the inner assessment circle as the inner assessment circle was focussed on the area of most change and did not include the entire biobank site). The total amount of overstorey cover vegetation in the outer circle has increased from 31.1% (before the establishment of the Biobank site) to 31.3% (after the establishment of the Biobank site).

Table 4 summarises the results of the assessment for each circle. The native vegetation cover class did not change for either the inner assessment circle or the outer assessment circle. As such, in accordance with Table 26 of the BBAM 2014 (OEH 2014b), a score of 6.3 was entered into the Credit Calculator for the inner assessment circle for both before and after the establishment of the Biobank site. A score of 8.45 was entered into the Credit Calculator for the outer assessment circle for both before and after the establishment of the Biobank site.

Table 4: Area of over-storey cover in assessment circles before and after the establishment of the Noorumba-Mt Gilead Biobank Site

Assessment circle	Vegetated area before the establishment of the Biobank site (ha)	Native vegetation cover class (%)	Vegetated area after the establishment of the Biobank site (ha)	Native vegetation cover class (%)
Inner	44	41-45	45	41-45
Outer	311	31-35	313	31-35

2.4.3 Patch size

The area surrounding the Noorumba-Mt Gilead Biobank Site consists of native canopy cover with a predominately native understorey and is shown in **Figure 6**. These areas are therefore predominantly in moderate to good condition. Large intact remnants are positioned to the north and east of the site. Farmland in the surrounding area as a whole also retain patches of native over-storey vegetation. The maximum patch size assessable in the Cumberland Plain Mitchell landscape (89% cleared) is 100 ha according to the BBAM 2014. These linkages of moderate/good condition vegetation were measured at greater than 100 ha and therefore 101 hectares (a score of 12) was entered for patch size in the Credit Calculator.

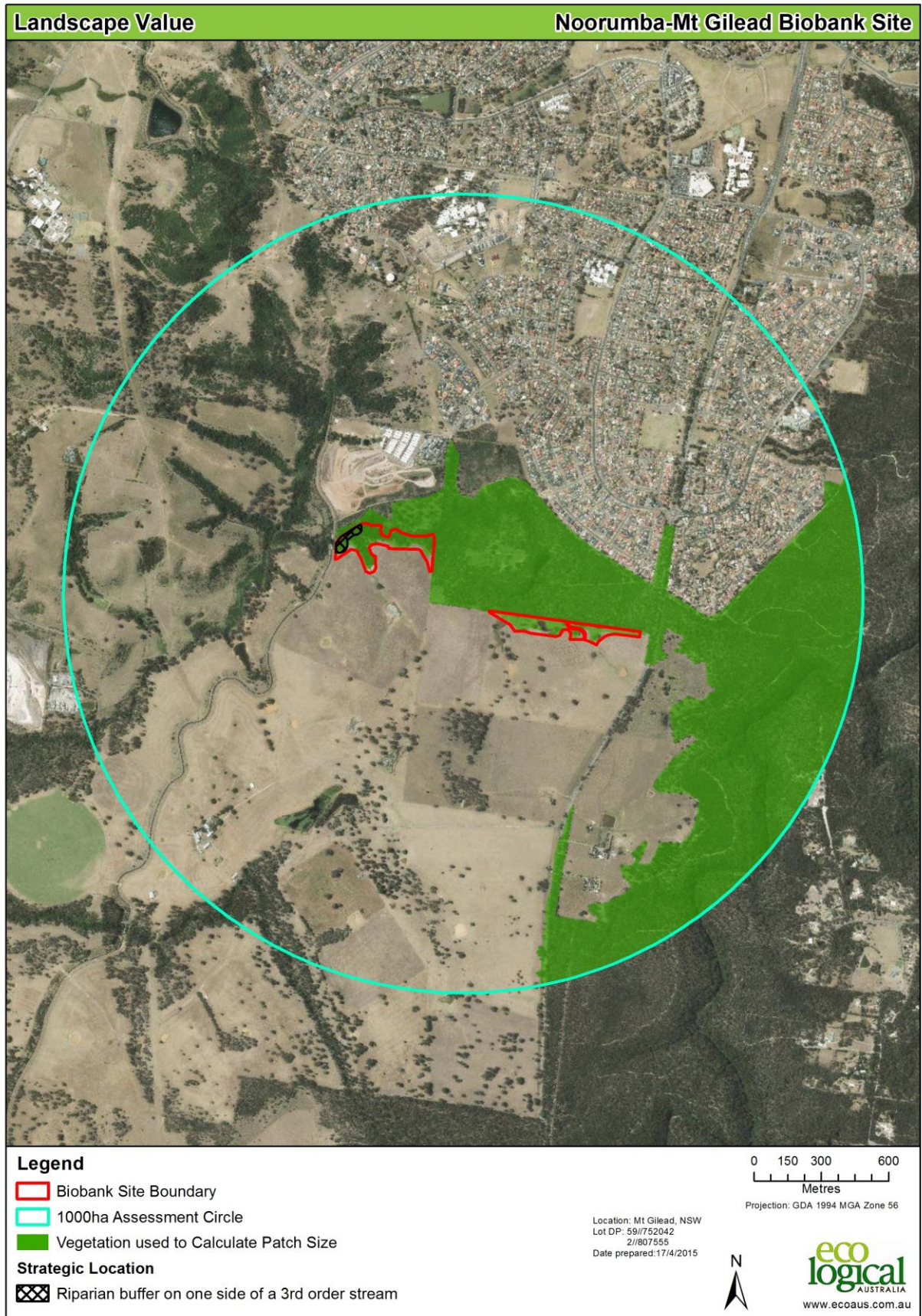


Figure 6: Vegetation to calculate the patch size

2.5 Native vegetation assessment

2.5.1 Vegetation zones

Vegetation zones are defined as areas of native vegetation that are the same PCT which have similar broad condition states (OEH 2014b).

In total, there are four vegetation zones (including cleared land to be revegetated) within the Noorumba-Mt Gilead Biobank Site. The area of each vegetation zone is provided in **Table 5**, and the spatial configuration of the vegetation zones is shown in **Figure 7**.

2.5.2 Plot and transect surveys

The BBAM 2014 (OEH 2014b) requires that Biometric plots/transects are undertaken to sample vegetation zones. The number of plots/transects undertaken for each vegetation zone is outlined in **Table 5**. Information was collected from the required number of plots/transects for all vegetation zones consistent with BBAM 2014. All plots were permanently marked with two star pickets to allow for the monitoring of vegetation condition in the future. A star-picket was placed at the beginning and end of the 50 m line transect. The locations of the star-pickets were recorded using handheld GPS units with co-ordinates in GDA94 datum. Two photographs were taken along each transect: one at the beginning of the transect and in the direction of the end of the transect, and one at the end of the transect in the direction of the start of the transect.

The location of plots/transects are shown in **Figure 7**. **Appendix A** contains the flora species recorded in each plot, while **Appendix B** contains the plot/transect data entered into the credit calculator.

Table 5: Vegetation zones and number of Biometric plots/transects required and surveyed for in the Noorumba-Mt Gilead Biobank Site

Veg zone ID	Plant community type	Condition	Ancillary code	Characteristics of vegetation zone	Area (ha)	Plots required	Plots completed
1	Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Moderate to good	Sparse	Intact remnant occurring along the northern boundary of the site, along a second/third-order stream, with a mature native over-storey dominated by <i>E. moluccana</i> . The shrub layer is composed of <i>Ligustrum</i> spp. The under-storey is extremely sparse. Native species richness is very low.	1.16	1	1 (A01)
2	Grey-Box – Forest Red Gum grassy woodlands on flats of the southern Cumberland Plain, Sydney Basin Bioregion	Moderate to good	Olive	Intact remnant occurring on gentle slopes within the site, with a mature native over-storey dominated by <i>Eucalyptus tereticornis</i> , although <i>E. creber</i> and <i>E. moluccana</i> are also present. The shrub layer is dominated by <i>Olea europaea</i> var. <i>cuspidata</i> . The under-storey is composed of a mixture of native and introduced grasses, sedges, herbs and scramblers. Native species richness is low to moderate.	2.30	2	2 (B01, B02)
3			Native	Mature over-storey of <i>E. tereticornis</i> , <i>E. creber</i> and <i>E. moluccana</i> present, with extremely sparse to absent mid-storey. Groundcover is predominantly native and comprised of grasses and herbs. Native species richness is low to moderate.	2.58	2	2 (D01, D02)
4		Low	Cleared/exotic (to be regenerated)	Exotic dominated herbs / grasses occurring on flats within the site. The dominant grass species was not identified due to the lack of flower heads, but the co-dominant grass species was <i>Paspalum dilatatum</i> . Native species richness is very low.	1.58	1	1 (C01)
Total*					7.62		

* There were dams present in the Noorumba-Mt Gilead Biobank Site covering 0.19 ha, which account for the difference in the area of the Noorumba-Mt Gilead Biobank Site and the total shown here

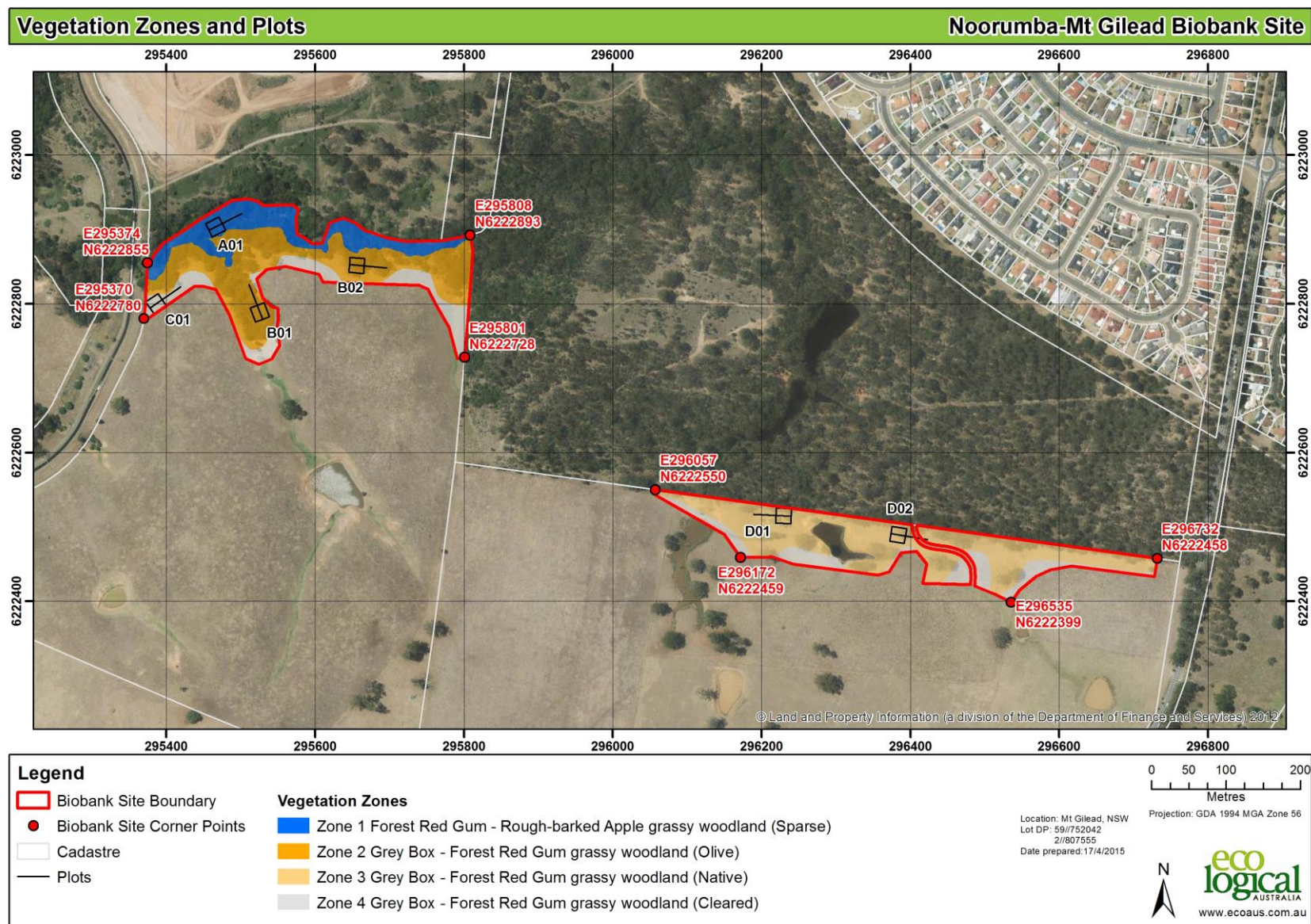


Figure 7: Vegetation zones and location of Biometric plots/transects in the Noorumba-Mt Gilead Biobank Site

2.5.3 Management zones and site value scores

Management zones combine the mapping of vegetation zones with the final management outcome on the site. They enable the assessor to increase, or decrease, the number of credits generated depending on the expected condition of the vegetation after management actions are undertaken.

The Noorumba-Mt Gilead Biobank Site contains four management zones (**Table 6** and **Figure 8**). Each management zone will be managed as an entire zone, with the management to be applied based on zone boundaries. The boundaries of the four management zones match the four vegetation zones identified.

Table 6: Area of each management zone within the Noorumba-Mt Gilead Biobank Site

Management zone ID	Plant community type	Condition	Ancillary code	Area (ha)
MZ1	<i>Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion</i>	Moderate to good	Sparse	1.16
MZ2	<i>Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion</i>	Moderate to good	Olive	2.30
MZ3			Native	2.58
MZ4		Low	Cleared/exotic (to be regenerated)	1.58
Total				7.62

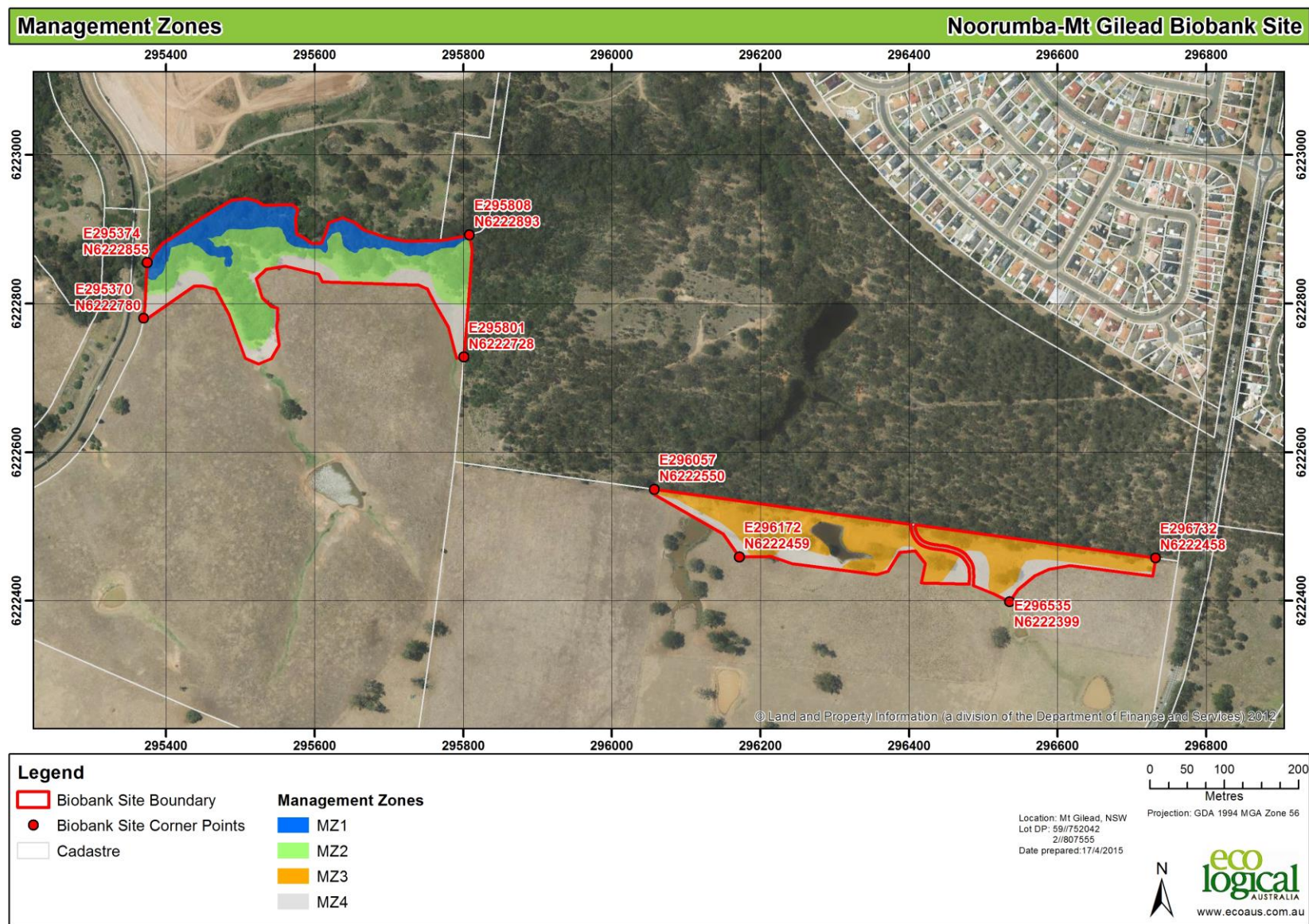


Figure 8: Management zones in the Noorumba-Mt Gilead Biobank Site

The current site value scores for each management zone, as well as the future site value scores based on the calculator's default site attribute scores after standard management actions are undertaken, are shown in **Table 7**. The current site value scores ranged between 9.90 and 42.19 for the four management zones. The site values were predicted to increase from between 13.20 and 25.53 for the four management zones based on the application of standard management actions.

Table 7: Site value scores for each management zone

Management zone ID	Current site value	Future site value	Increase in site value
MZ1	15.10	28.30	13.20
MZ2	42.19	66.41	24.22
MZ3	28.12	53.65	25.53
MZ4	9.90	23.78	13.88

Additional actions (Appendix 7 of BBAM 2014) can be included to further increase site values and the number of credits generated. There were only a few site attributes where scores could be increased from their current scores with additional actions, either due to site attributes already being at the highest scores allowed, or the BBAM 2014 rules which determine the increases allowed from current scores. Generally, the site attributes that could be increased were:

- Native plant species;
- Native over-storey cover;
- Native mid-storey cover;
- Native ground cover (grasses);
- Number of trees with hollows; and/or
- Total length of fallen logs.

Despite there being potential to increase site values through increasing the scores of the number of trees with hollows, this assessment focussed on increasing site values through increasing the scores of native plant species, native over-storey cover, native mid-storey cover, native ground cover (grass), and total length of fallen logs. Through additional management to increase the native plant species, cover of the native over-storey, mid-storey, and ground cover (grass), and the length of fallen logs, as well as decrease the cover of native ground cover (grass), site values for all management zones were increased. The additional management actions that will be undertaken are:

- Supplementary planting of over-storey species characteristic of 'Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion' (PCT 835) in Management Zone 1 to achieve an over-storey cover attribute of >50- <75% of the percent native over-story cover benchmark (i.e. between 13.75% and 20.625% cover using the lower benchmark value. Benchmark values are 27.5-32.5%);
- Supplementary planting of mid-storey species characteristic of 'Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion' (PCT 835) in Management Zone 1 to achieve a mid-storey cover attribute of >25- <50% of the percent native mid-storey cover benchmark (i.e. between 5.25% and 10.5% cover using the lower benchmark value. Benchmark values are 21-31%);
- Supplementary planting of grass species characteristic of 'Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion' (PCT

- 835) in Management Zone 1 to achieve a grass cover attribute of >10-<25% of the percent native grass cover benchmark (i.e. between 2.45% and 6.125% cover using the lower benchmark value. Benchmark values are 24.5-30.5%);
- Note that supplementary planting of over-storey, mid-storey, and grass species characteristic of '*Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*' (PCT 835) in Management Zone 1 would also achieve a species richness attribute of between 50% and 100% of the native plant species richness benchmark (i.e. between 12 and 24. The benchmark value is 24 species);
 - Supplementary planting of over-storey species characteristic of '*Grey Box - Forest Red Gum grassy woodland on flats of the southern Cumberland Plain, Sydney Basin Bioregion*' (PCT 849) in Management Zones 2, 3 and 4 to achieve:
 - an over-storey cover attribute of >50-<75% of the percent native over-storey cover benchmark for Management Zones 2 and 3 (i.e. between 10.25% and 15.375% cover using the lower benchmark value. Benchmark values are 20.5-25.5%);
 - a over-storey cover attribute of >25-<50% of the percent native over-storey cover benchmark for Management Zone 4 (i.e. between 5.125% and 10.25% cover using the lower benchmark value. Benchmark values are 20.5-25.5%);
 - Supplementary planting of mid-storey species characteristic of '*Grey Box - Forest Red Gum grassy woodland on flats of the southern Cumberland Plain, Sydney Basin Bioregion*' (PCT 849) in Management Zones 2, 3 and 4 to achieve a mid-storey cover attribute of >25-<50% of the percent native mid-storey cover benchmark (i.e. between 6.375% and 12.75% cover using the lower benchmark value. Benchmark values are 25.5-30.5%);
 - Note that supplementary planting of over-storey and mid-storey species characteristic of '*Grey Box - Forest Red Gum grassy woodland on flats of the southern Cumberland Plain, Sydney Basin Bioregion*' (PCT 849) in Management Zone 3 would also achieve a native ground cover (grass) attribute that is at benchmark (i.e. between 26.8% and 30.8% cover). This would be achieved through over-storey shading. The native ground cover of grass in Management Zone 3 is currently over benchmark and shading would thin native grass cover;
 - Supplementary planting of grass species characteristic of '*Grey Box - Forest Red Gum grassy woodland on flats of the southern Cumberland Plain, Sydney Basin Bioregion*' (PCT 849) in Management Zone 4 to achieve a grass cover attribute that is at benchmark (i.e. between 26.8% and 30.8% cover);
 - Note that supplementary planting of over-storey, mid-storey, and grass species characteristic of '*Grey Box - Forest Red Gum grassy woodland on flats of the southern Cumberland Plain, Sydney Basin Bioregion*' (PCT 849) in Management Zone 4 would also achieve a species richness attribute of between 50% and 100% of the native plant species richness benchmark (i.e. between 14 and 29. The benchmark value is 29 species).
 - Addition of logs in Management Zones 3 and 4 to achieve a length of fallen logs attribute that is >25-<50% of the length of fallen logs benchmark (i.e. between 12.5 m and 25 m. The benchmark value for the length of fallen logs in '*Grey Box - Forest Red Gum grassy woodland on flats of the southern Cumberland Plain, Sydney Basin Bioregion*' is 50 m per 0.1 ha plot i.e. 500 m/ha).

The details of the increases in values are shown in **Table 8**.

Table 8: Site value scores after additional management actions for each Management Zone within the Noorumba-Mt Gilead Biobank Site

Site attribute	Zone 1			Zone 2			Zone 3			Zone 4		
	Current score	Default increased score	Score with additional management	Current score	Default increased score	Score with additional management	Current score	Default increased score	Score with additional management	Current score	Default increased score	Score with additional management
Native plant species	1	1.5	2	2	3		2	3		1	1.5	2
Native over-storey cover	0	1	1.5	1	2	2.5	1	2	2.5	0	1	1.5
Native mid-storey cover	0	1	1.5	0	1	1.5	0	1	1.5	0	1	1.5
Native ground cover (grasses)	0	1	1.5	2	3		0	1	1.5	1	2	3
Native ground cover (shrubs)	3	3		3	3		3	3		3	3	
Native ground cover (other)	0	1		2	3		1	2		1	2	
Exotic plant cover	1	1.5		1	1.5		2	3		1	1.5	
Number trees with hollows	0	0		3	3		0	0		0	0	
Over-storey regeneration	0	0.5		0	0.5		2	3		0	0.5	
Fallen logs	3	3		2	3		0	0	0.5	0	0	0.5
Site Values	15.1	28.3	35.42	42.19	66.41	70.31	28.12	53.65	59.90	9.9	23.78	32.81

2.6 Threatened species and populations assessment

There are no threatened species or populations known within the Noorumba-Mt Gilead Biobank Site, although the ecosystem credit species, *Ninox strenua* (Powerful Owl), has been recorded just to the north of the site, and there are records of the species credit species, *Phascolarctos cinereus* (Koala) to the east and north of the site (ELA 2014).

Targeted surveys for threatened species were not undertaken. However, an expert report was prepared for the species credit species, Koala (**Appendix E**), given that ELA considered it likely that Koala would use the Noorumba-Mt Gilead Biobank Site on an occasional basis and targeted survey would be unlikely to detect the species (due to its transient and low use of the site). Also, Koala was assumed to be present in the adjacent MDP lands using scattered paddock trees in the Biocertification Assessment (currently in preparation) so Koala credits are required which could be generated in the Biobank site.

2.6.1 List of predicted threatened species

The list of threatened species (predicted to occur within ecosystem credits and those that require survey to generate species credits) is provided in **Appendix C**.

2.6.2 Threatened species habitat

ELA considered it likely that Koala would use the Noorumba-Mt Gilead Biobank Site on an occasional basis. The expert report prepared (**Appendix E**) mapped Koala habitat to be present in the Noorumba-Mt Gilead Biobank Site within areas of 'Grey Box - Forest Red Gum grassy woodland on flats of the southern Cumberland Plain, Sydney Basin Bioregion' and 'Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin' that supported a canopy. The species polygon for Koala, zoomed in to the Noorumba-Mt Gilead Biobank Site and adjacent Noorumba Reserve, is reproduced in **Figure 9**. A regional-scale map of Koala habitat (current and to be restored) is provided in the expert report in **Appendix E**.

A description of Koala and the habitat features associated with the species in the Noorumba-Mt Gilead Biobank Site is provided in the expert report in **Appendix E**.

2.6.3 Geographic and habitat features

The responses in **Table 9** were provided to the geographic and habitat features questions (Step 2) in the Biobank calculator.

Table 9: Geographic and habitat questions and answers

Common name	Scientific name	Feature	Answer
<i>Wahlenbergia multicaulis</i> (Tadgells Bluebell) population, Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield LGAs	<i>Wahlenbergia multicaulis</i> - endangered population	Land situated in damp, disturbed sites	Not relevant
Cumberland Plain	<i>Meridolum corneovirens</i>	Land containing bark or leaf litter accumulation	Yes

Common name	Scientific name	Feature	Answer
Land Snail			
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	Land containing escarpments, cliffs, caves, deep crevices, old mine shafts or tunnels	No
Black Bittern	<i>Ixobrychus flavicollis</i>	Land within 40 m of freshwater and estuarine wetlands, in areas of permanent water and dense vegetation or emergent aquatic vegetation	No
Eastern Osprey	<i>Pandion cristatus</i>	Land within 40 m of fresh/brackish/saline waters of larger rivers or creeks; estuaries, coastal lagoons, lakes and/or inshore marine waters	No
Austral Pillwort	<i>Pilularia novae-hollandiae</i>	Periodically waterlogged sites (including table drains and farm dams)	Yes
Camden White Gum	<i>Eucalyptus benthamii</i>	Alluvial soils	Yes
Green and Golden Bell Frog	<i>Litoria aurea</i>	Land within 100 m of emergent aquatic or riparian vegetation	Yes
<i>Hypsela sessiliflora</i>	<i>Hypsela sessiliflora</i>	Wet and damp areas only	Yes
Matted Bush-pea	<i>Pultenaea pedunculata</i>	Land within 5 km of coast in South East Coastal Plains CMA subregion	Not relevant*

* while not relevant due to not being within the South East Coastal Plains CMA subregion, this species was targeted due to nearby records during previous survey (ELA 2014). The species was not found.

2.7 Changes to benchmark data

It is noted that the credit calculator did not include any benchmark values for the total length of fallen logs or trees with hollows for 'Grey Box - Forest Red Gum grassy woodland on flats of the southern Cumberland Plain, Sydney Basin Bioregion' (PCT849).

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 'Grey Box - Forest Red Gum grassy woodland on flats of the southern Cumberland Plain, Sydney Basin Bioregion', with one (1) 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 OEH on the Cumberland Plain. 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 be submitted to the OEH for approval.

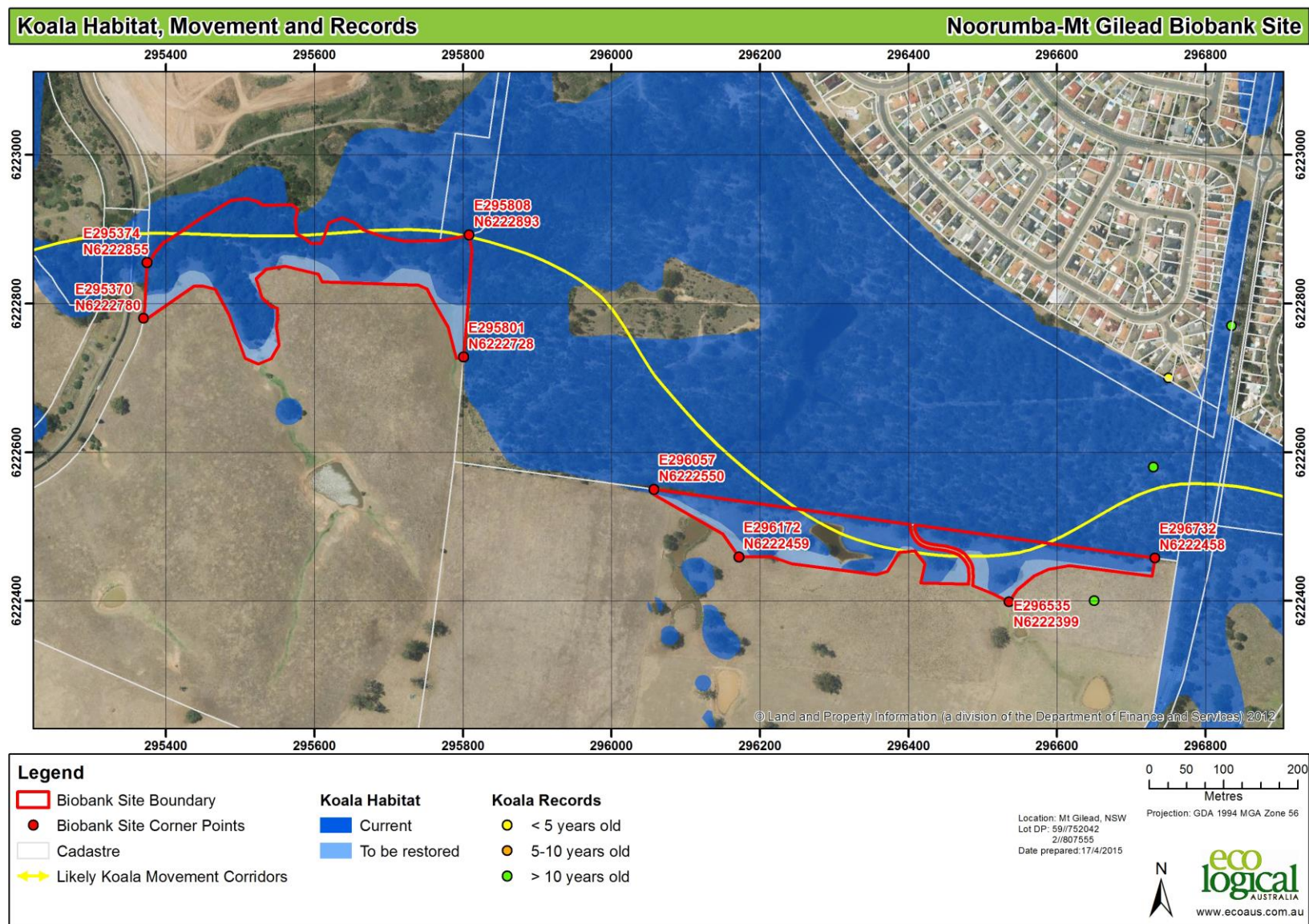


Figure 9: Species polygon of potential habitat for Koala in relation to the Noorumba-Mt Gilead Biobank Site

3 Credits generated

3.1 Ecosystem credits

Table 10 shows the results of the credit calculations. A copy of the credit report produced by the BioBanking calculator tool is provided in **Appendix D**. In total, 88 ecosystem credits are generated by the Noorumba-Mt Gilead Biobank Site.

Table 10: Ecosystem credits generated and credit profile

Vegetation zone ID	Plant community type	Condition and ancillary code	Area (ha)	Credits generated	Credits/ha
1	<i>Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion</i>	Moderate to Good (Sparse)	1.16	11	9.48
2	<i>Grey-Box – Forest Red Gum grassy woodlands on flats of the southern Cumberland Plain, Sydney Basin Bioregion</i>	Moderate to Good (Olive)	2.30	28	12.17
3		Moderate to Good (Native)	2.58	33	12.79
4		Low (Cleared/exotic to be regenerated)	1.58	16	10.13
Total			7.62	88	11.55 (average)

3.2 Species credits

Table 11 shows the results of the credit calculations. A copy of the credit report produced by the BioBanking calculator tool is provided in **Appendix D**. The Noorumba-Mt Gilead Biobank Site currently generates 43 species credits for Koala, and restored habitat would generate an additional 11 species credits.

Table 11: Species credits generated and credit profile

Koala habitat	Area (ha)	Credits generated
Current	6.04	43
Restored	1.58	11
Total	7.62	54

4 Existing management obligations

There are no covenants or conservation funding arrangements for the Noorumba-Mt Gilead Biobank Site, and the entire Biobank site is to be managed for ecosystem credits. The proposed Biobank site has no existing management obligations.

Based on the above, ELA is of the opinion that there is no requirement to 'discount' the number of credits generated.

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Appendix A Flora species recorded

Scientific Name	Common Name	Origin	Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Grey-Box – Forest Red Gum grassy woodlands on flats of the southern Cumberland Plain, Sydney Basin Bioregion				
			A01	B01	B02	C01	D01	D02
<i>Amaranthus</i> sp.		Exotic		x	x			
<i>Araujia sericifera</i>		Exotic	x	x				
<i>Aristida ramosa</i>	Purple Wiregrass	Native					x	x
<i>Asparagus asparagoides</i>	Bridal Creeper	Exotic		x	x			
<i>Asteraceae</i> sp.		Native		x				
<i>Asteraceae</i> weed 1		Exotic		x	x			
<i>Asteraceae</i> weed 2		Exotic		x				
<i>Austrostipa elegantissima</i>	Feather Speargrass	Native		x				
<i>Bidens pilosa</i>	Cobbler's Pegs	Exotic		x	x			x
<i>Bothriochloa macra</i>	Red Leg Grass	Native			x	x	x	
<i>Bromus</i> sp.	Brome	Exotic			x			
<i>Brunoniella australis</i>	Blue Trumpet	Native		x	x			
<i>Brunoniella pumilio</i>	Dwarf Blue Trumpet	Native					x	
<i>Bursaria spinosa</i>	Blackthorn	Native		x	x		x	x
<i>Carthamus</i> sp.		Exotic				x		

Scientific Name	Common Name	Origin	Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Grey-Box – Forest Red Gum grassy woodlands on flats of the southern Cumberland Plain, Sydney Basin Bioregion				
			A01	B01	B02	C01	D01	D02
<i>Cayratia clematidea</i>	Native Grape	Native			x			
<i>Chenopodium cristatum</i>	Crested Goosefoot	Native						x
<i>Chenopodium murale</i>	Nettle-leaf Goosefoot	Exotic		x				
<i>Chloris</i> sp.		Native			x			
<i>Chloris truncata</i>	Windmill Grass	Native					x	x
<i>Cirsium vulgare</i>	Spear Thistle	Exotic	x	x	x			x
<i>Clematis aristata</i>	Old Man's Beard	Native		x				
<i>Conyza bonariensis</i>	Fleabane	Exotic	x	x	x			x
<i>Cynodon dactylon</i>	Couch	Native				x	x	
<i>Cyperus gracilis</i>	Slender Flat-sedge	Native		x	x			x
<i>Cyperus</i> sp.		Native						x
<i>Desmodium varians</i>	Slender Tick-trefoil	Native			x			
<i>Dichondra repens</i>	Kidney Weed	Native		x	x		x	x
<i>Ehrharta erecta</i>	Panic Veldtgrass	Exotic	x	x	x			x
<i>Einadia hastata</i>	Berry Saltbush	Native	x	x				
<i>Einadia nutans</i>	Climbing Saltbush	Native		x				
<i>Einadia trigonos</i>	Fishweed	Native		x	x			x
<i>Eragrostis brownii</i>	Brown's Lovegrass	Native			x	x	x	x

Scientific Name	Common Name	Origin	Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Grey-Box – Forest Red Gum grassy woodlands on flats of the southern Cumberland Plain, Sydney Basin Bioregion				
			A01	B01	B02	C01	D01	D02
<i>Eucalyptus creber</i>	Narrow-leaved Ironbark	Native						x
<i>Eucalyptus tereticornis</i>	Forest Red Gum	Native		x	x		x	
<i>Euchiton/Gnaphalium</i> sp.		Native				x		
<i>Glycine clandestina</i>		Native		x	x		x	
<i>Goodenia hederacea</i>		Native					x	x
<i>Hypochaeris radicata</i>	Catsear	Exotic						x
<i>Lepidium</i> sp.		Exotic		x		x		x
<i>Ligustrum lucidum</i>	Large-leaved Privet	Exotic	x	x	x			
<i>Ligustrum sinense</i>	Small-leaved Privet	Exotic	x					
<i>Lycium ferocissimum</i>	African Boxthorn	Exotic		x	x			x
<i>Microlaena stipoides</i>	Weeping Grass	Native		x	x		x	
<i>Modiola caroliniana</i>	Red-flowered Mallow	Exotic		x	x	x		
<i>Olea europaea</i> subsp. <i>cuspidata</i>	African Olive	Exotic	x	x	x			
<i>Opercularia diphylla</i>		Native		x	x		x	
<i>Oplismenus aemulus</i>	Basket Grass	Native	x					
<i>Oxalis perennans</i>		Native		x			x	x
<i>Oxalis</i> sp.		Exotic			x			
<i>Panicum</i> sp.		Native				x		

Scientific Name	Common Name	Origin	Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Grey-Box – Forest Red Gum grassy woodlands on flats of the southern Cumberland Plain, Sydney Basin Bioregion				
			A01	B01	B02	C01	D01	D02
<i>Paspalum dilatatum</i>	Paspalum	Exotic			x	x	x	x
<i>Pennisetum clandestinum</i>	Kikuyu	Exotic		x	x			x
<i>Phyllanthus</i> sp.		Native					x	
<i>Plantago lanceolata</i>	Plantain	Exotic		x	x	x	x	x
<i>Portulaca oleracea</i>	Pigweed	Native		x		x		
<i>Richardia</i> sp.		Exotic					x	
<i>Rubus fruticosus</i> sp. aggregate		Exotic	x					
<i>Rytidosperma</i> sp.	Wallaby Grass	Native			x	x	x	x
<i>Senecio madagascariensis</i>	Fireweed	Exotic			x	x	x	x
<i>Setaria parviflora</i>		Exotic			x	x		x
<i>Sida rhombifolia</i>	Paddy's Lucerne	Exotic		x	x	x	x	x
<i>Sigesbeckia orientalis</i>		Native	x	x	x			x
<i>Solanum nigrum</i>	Blackberry Nightshade	Exotic	x					
<i>Solanum prinophyllum</i>	Forest Nightshade	Native	x	x				
<i>Solanum</i> sp.		Exotic		x		x		
<i>Sonchus</i> sp.		Exotic			x			
<i>Sporobolus creber</i>	Western Rat-tail Grass	Native			x	x	x	
<i>Stellaria</i> sp.	Chickweed	Exotic				x		x

Scientific Name	Common Name	Origin	Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Grey-Box – Forest Red Gum grassy woodlands on flats of the southern Cumberland Plain, Sydney Basin Bioregion				
			A01	B01	B02	C01	D01	D02
<i>Tylophora barbata</i>	Bearded Tylophora	Native	x					
Unidentified exotic grass		Exotic				x		
<i>Urochloa</i> sp.		Native				x		
<i>Verbena bonariensis</i>	Purpletop	Exotic		x		x		
<i>Veronica plebeia</i>	Trailing Speedwell	Native					x	x
<i>Wahlenbergia</i> sp.		Native				x		

Appendix B Biometric plot and transect data

Plot number	Native Plant Species	Native over-storey (%)	Native mid-storey cover (%)	Native ground cover – grasses (%)	Native ground cover – shrubs (%)	Native ground cover – other (%)	Exotic plant cover (%)	# Tree hollows	Over-storey regeneration	Fallen logs	Easting	Northing
<i>Zone 1: Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Sparse</i>												
A01	4	2	0	2	0	0	60	0	0	61	295459	6222898
<i>Zone 2: Grey-Box – Forest Red Gum grassy woodlands on flats of the southern Cumberland Plain, Sydney Basin Bioregion - Olive</i>												
B01	18	9.5	0	16	0	14	55.5	1	0	25	295526	6222778
B02	17	5.5	0	26	0	12	62.5	1	0	35	295646	6222853
<i>Zone 3: Grey-Box – Forest Red Gum grassy woodlands on flats of the southern Cumberland Plain, Sydney Basin Bioregion - Native</i>												
D01	18	8	0	74	0	2	4	0	0.67	4	296243	6222510
D02	15	7	0	50	0	12	8	0	0.67	0	296373	6222494
<i>Zone 4: Grey-Box – Forest Red Gum grassy woodlands on flats of the southern Cumberland Plain, Sydney Basin Bioregion –Cleared/exotic (to be regenerated)</i>												
C01	9	0	0	6	0	4	46	0	0	0	295378	6222795

Appendix C Predicted threatened species and species requiring survey

Predicted species (ecosystem credits) – survey not required

Common name	Scientific name	TS offset multiplier
Barking Owl	<i>Ninox connivens</i>	3
Black-chinned Honeyeater (eastern subspecies)	<i>Melithreptus gularis subsp. gularis</i>	1.3
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus subsp. victoriae</i>	2
Bush Stone-curlew	<i>Burhinus grallarius</i>	2.6
Diamond Firetail	<i>Stagonopleura guttata</i>	1.3
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	2.2
Eastern Freetail-bat	<i>Mormopterus norfolkensis</i>	2.2
Flame Robin	<i>Petroica phoenicea</i>	1.3
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	2
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	2.2
Hooded Robin (south-eastern form)	<i>Melanodryas cucullata subsp. cucullata</i>	1.7
Little Eagle	<i>Hieraaetus morphnoides</i>	1.4
Little Lorikeet	<i>Glossopsitta pusilla</i>	1.8
Masked Owl	<i>Tyto novaehollandiae</i>	3
Painted Honeyeater	<i>Grantiella picta</i>	1.3
Powerful Owl	<i>Ninox strenua</i>	3
Scarlet Robin	<i>Petroica boodang</i>	1.3
Speckled Warbler	<i>Chthonicola sagittata</i>	2.6
Spotted Harrier	<i>Circus assimilis</i>	1.4
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>	2.6
Square-tailed Kite	<i>Lophoictinia isura</i>	1.4
Swift Parrot	<i>Lathamus discolor</i>	1.3
Turquoise Parrot	<i>Neophema pulchella</i>	1.8
Varied Sittella	<i>Daphoenositta chrysoptera</i>	1.3
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	2.2

Species requiring survey (species credits) – if application to generated species credits is submitted

Common name	Scientific name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Austral Pillwort	<i>Pilularia novae-hollandiae</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bargo Geebung	<i>Persoonia bargoensis</i>	Yes	Yes	Yes	Yes	Yes							Yes
Brown Pomaderris	<i>Pomaderris brunnea</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bynoe's Wattle	<i>Acacia bynoeana</i>	Yes	Yes	Yes						Yes	Yes	Yes	Yes
Camden White Gum	<i>Eucalyptus benthamii</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cumberland Plain Land Snail	<i>Meridolum corneovirens</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Dillwynia tenuifolia</i>	<i>Dillwynia tenuifolia</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Downy Wattle	<i>Acacia pubescens</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Eastern Pygmy-possum	<i>Cercartetus nanus</i>												
Green and Golden Bell Frog	<i>Litoria aurea</i>	Yes	Yes	Yes					Yes	Yes	Yes	Yes	Yes
<i>Hibbertia</i> sp. Bankstown	<i>Hibbertia</i> sp. Bankstown									Yes	Yes	Yes	Yes
<i>Hypsela sessiliflora</i>	<i>Hypsela sessiliflora</i>									Yes	Yes	Yes	
Juniper-leaved Grevillea	<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Koala	<i>Phascolarctos cinereus</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> - endangered population	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Pimelea curviflora</i> subsp. <i>curviflora</i>	<i>Pimelea curviflora</i> subsp. <i>curviflora</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regent Honeyeater	<i>Anthochaera phrygia</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Common name	Scientific name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Spiked Rice-flower	<i>Pimelea spicata</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Squirrel Glider	<i>Petaurus norfolcensis</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sydney Plains Greenhood	<i>Pterostylis saxicola</i>									Yes	Yes	Yes	
Tall Knotweed	<i>Persicaria elatior</i>	Yes	Yes	Yes	Yes	Yes							Yes
White-flowered Wax Plant	<i>Cynanchum elegans</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Appendix D Biobanking credit report

Provided as a separate report

Appendix E Expert report

Provided as separate report.



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