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Biodiversity Development Assessment Report (BDAR)

657-769 Mamre Rd, Kemps Creek

Proposed Warehouse, Logistics and Industrial Facilities Hub

Prepared for: ALTIS Property Partners Pty Ltd and Frasers Property Australia

24 July 2020

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Glossary and abbreviations

Acronym	Description
BAM	Biodiversity Assessment Methodology
BC Act	NSW *Biodiversity Conservation Act 2016*
BC Reg	*Biodiversity Conservation Regulation 2017*
BCT	Biodiversity Conservation Trust
BDAR	Biodiversity Development Assessment Report
CEEC	Critically Endangered Ecological Community
DA	Development Application
DoEE	Commonwealth Department of the Environment and Energy
DNG	Derived Native Grassland
DPE	NSW Department of Planning and Environment
EEC	Endangered Ecological Community
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
GGBF	Green and Golden Bell Frog
ha	hectare(s)
HBT	Hollow Bearing Tree
IBRA	Interim Bioregionalisation of Australia
km	kilometre
LGA	Local Government Area
masl	Metres above sea level
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
PCT	Plant community type, as defined by OEH (2018)
PLEP	Penrith Local Environmental Plan 2010
SAII	Serious and Irreversible Impacts
SEARs	Secretary's Environmental Assessment Requirements
SSD	State Significant Development
TEC	Threatened Ecological Community, listed as vulnerable, endangered or critically endangered under either the BC Act and/or EPBC Act
WSEA	Western Sydney Employment Area

Executive Summary

ALTIS Property Partners Pty Ltd and Frasers Property Australia are proposing to subdivide across five lots located at 657 – 769 Mamre Road (Lot 34 // DP 1118173, Lot 1 // DP 1018318, Lot X // DP 421633, Lot Y // DP 421633 and Lot 22 // 258414), Kemps Creek, NSW. The proposed works would include subdivision of the land, bulk earthworks, services, roads and the construction of warehouses.

The requirement for this Biodiversity Development Assessment Report (BDAR) to accompany the Development Action for the proposed works is to address the Secretary's Environmental Assessment Requirements issued by the Department of Planning and Environment.

This BDAR has been prepared in accordance with the Biodiversity Assessment Methodology (BAM) to document impacts to biodiversity and has been prepared by an Accredited Assessor in accordance with the NSW *Biodiversity Conservation Act 2016* (BC Act) and the NSW *Biodiversity Conservation Regulation 2017* (BC Reg). The format for this BDAR follows that of the different 'stages' outlined within the BAM (OEH 2017a) including:

- Stage 1 – Biodiversity assessment. Includes sections 1 to 4 of this report including the introduction, site context including landscape features, native vegetation and threatened species.
- Stage 2 – Impact assessment. Includes sections 5 to 7 of this report which identify measures to avoid and minimise impacts, assessment of residual impacts to biodiversity, mitigation measures, offset requirements and credit calculations.

Native vegetation was identified and mapped across 9.28 ha of the approximately 86.77 ha of the subject land. Areas which did not support native vegetation included areas identified as supporting 'exotic grassland'. Two Plant Community Types (PCT) were identified within the subject land, namely:

- PCT 835 'Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion'
- PCT 849 'Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion'.

Both of the PCTs identified within the subject land comprise threatened ecological communities (TEC) under the BC Act, namely Cumberland Plain Woodland in the Sydney Basin Bioregion ('Cumberland Plain Woodland') and 'River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions' ('River-flat Eucalypt Forest'). Cumberland Plain Woodland is listed as a Critically Endangered Ecological Community (CEEC) under the BC Act and the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). River-flat Eucalypt Forest is listed as an Endangered Ecological Community (EEC) under the BC Act.

Targeted flora and fauna survey was conducted in accordance with the BAM. *Grevillea juniperina* subsp. *juniperina* was located within the study area, but will not be impacted by the proposal and, thus, no species credits are required. Survey for Green and Golden Bell Frog did not find any individuals within the subject site or study area (see **Section 4.3**). Likewise, Southern Myotis was considered unlikely to occur within the subject site or study area.

Cumberland Plain Woodland is a candidate community at risk for Serious and Irreversible Impacts (SAII) as defined under the BC Reg. Neither the 'River-flat Eucalypt Forest' or *Grevillea juniperina* subsp. *juniperina* are identified as candidate SAII entities. All SAII assessments for ecological communities and threatened species or populations have been assessed against Section 10.2.2 and 10.2.3 of the BAM following completion of the targeted surveys for candidate species.

In accordance with Section 8 of the BAM, this report outlines actions taken to avoid and minimise impacts. Mitigation measures to avoid impacts to biodiversity are recommended within this report and include pre-clearance protocols, dam dewatering plans and a construction environmental management plan for the proposed development.

All residual impacts to biodiversity, after measures to avoid, minimise and mitigate impacts have been assessed in accordance with the BAM. A total of 230 ecosystem credits are required to offset the impacts of the proposal. No species credits are required to offset the development following completion of targeted surveys for candidate species. The measures proposed to address the offset obligation outlined above will be determined as the proposal approvals progress.

1. Introduction

1.1 Background

This Biodiversity Development Assessment Report (BDAR) has been undertaken to address the Secretary's Environmental Assessment Requirements (SEARs), for the proposed State Significant Development application (SSD9522), located at Lot 34 // DP 1118173, Lot 1 // DP 1018318, Lot X // DP 421633, Lot Y // DP 421633 and Lot 22 // 258414, Mamre Road, Kemps Creek, NSW (the '**subject land**').

The subject land covers an area of approximately 86.77 ha, which is zoned RU2 – Rural Landscape under the *Penrith Local Environmental Plan* (PLEP 2010). The subject land is identified under the State Environmental Planning Policy - Western Sydney Employment Area (WSEA) 2009 application area (WSEA SEPP) and permits warehouse, logistics and industrial facilities. Land to the north of the subject site (Altis First Estate) and the adjacent Erskine Business Park, east of Mamre Road, have already been developed for warehouse, logistics and industrial facilities.

The SEARs issued by the Department of Planning and Environment (DPE), request a detailed assessment of the biodiversity impacts, in accordance with the Biodiversity Assessment Methodology (BAM) and documented in a BDAR in the form required by Section 6.12 of the *Biodiversity Conservation Act 2016* (BC Act) and Section 6.8 of the *Biodiversity Conservation Regulation 2017* (BC Reg).

This BDAR has been prepared by Lucas McKinnon, an Accredited Assessor (BAAS17012) under the BC Reg, and is consistent with the BAM (OEH 2017a).

Sources of information for this report included:

- NSW Planning Portal (DPIE 2020e)
- BioNet Atlas of NSW Wildlife (DPIE 2020b)
- Biodiversity Values map (DPIE 2020a)
- Cumberland Plain native vegetation mapping (OEH 2015)
- Native vegetation of southeast NSW (Tozer et al. 2006)
- SIX Maps (LPI 2018)
- Threatened Biodiversity Data Collection (OEH 2018c)

1.2 Location and site identification

The '**study area**' incorporates the entirety of Lot 34 // DP 1118173, Lot 1 // DP 1018318, Lot X // DP 421633, Lot Y // DP 421633 and Lot 22 // 258414 (Mamre Road, Kemps Creek, NSW, **Figure 1.1**). The study area is situated in the Penrith Local Government Area (LGA) and is zoned RU2 – Rural Landscape with E2 – Environmental Conservation zoning of the land directly adjacent to South Creek, pursuant to Penrith Local Environment Plan 2010. The total area, including the redevelopment of Bakers Lane, comprises 118 ha. Within the study area, the land proposed for development is referred to as the '**subject land**' and covers an area of 86.77 ha. The subject land is within the eastern portion of the study area, and is predominately comprised of exotic pasture, degraded riparian vegetation, scattered paddock trees and farms dams.

The subject land is bounded by Mamre Road in the east, the Upper Canal System in the north and the 1 in 100 year flood line in the west (**Figure 1.2**). Bakers Lane runs off Mamre Road in a westerly direction and extends along the southern perimeter of Lot 34 // DP 1118173. The site currently contains residential dwellings in Lot 34 // DP 1118173, Lot 1 // DP 1018318, Lot Y // DP 421633 and Lot 22 // 258414 and a small business (Mamre Produce) along Bakers Lane in Lot X // DP 421633. The subject land does not include the proposed freight rail corridor in the north of the study area or the proposed South Creek riparian area in the west of the study area.

1.3 Proposed development

Development Consent is sought for the construction, fit-out and operational use of ten (10) Warehouse / Industrial buildings, including ancillary offices and bulk earthworks. A two-stage Torrens Title subdivision of the land is proposed and consists of Stage 1, comprising five (5) residue allotments; and Stage 2, comprising 17 allotments, including eight (8) development allotments for built form. Proposed Lots 1 to 8 will be designated for Warehouse / Industrial development; Lots 9 & 10 will remain as a residue allotments for future Warehousing / Industrial development (as part of separate Development Applications); Lots 11-13 for bio-retention basins; Lots 14-16 for RE1 Public Open Space; Lot 17 for RE2 Private Recreation; and Lots 3-5 (Stage 1 Subdivision), adjacent to South Creek, are to remain undeveloped. The Proposal includes a total of 166,225 m^2 GFA proposed across Lots 1-8.

The proposed development is shown in **Figure 1.3**.

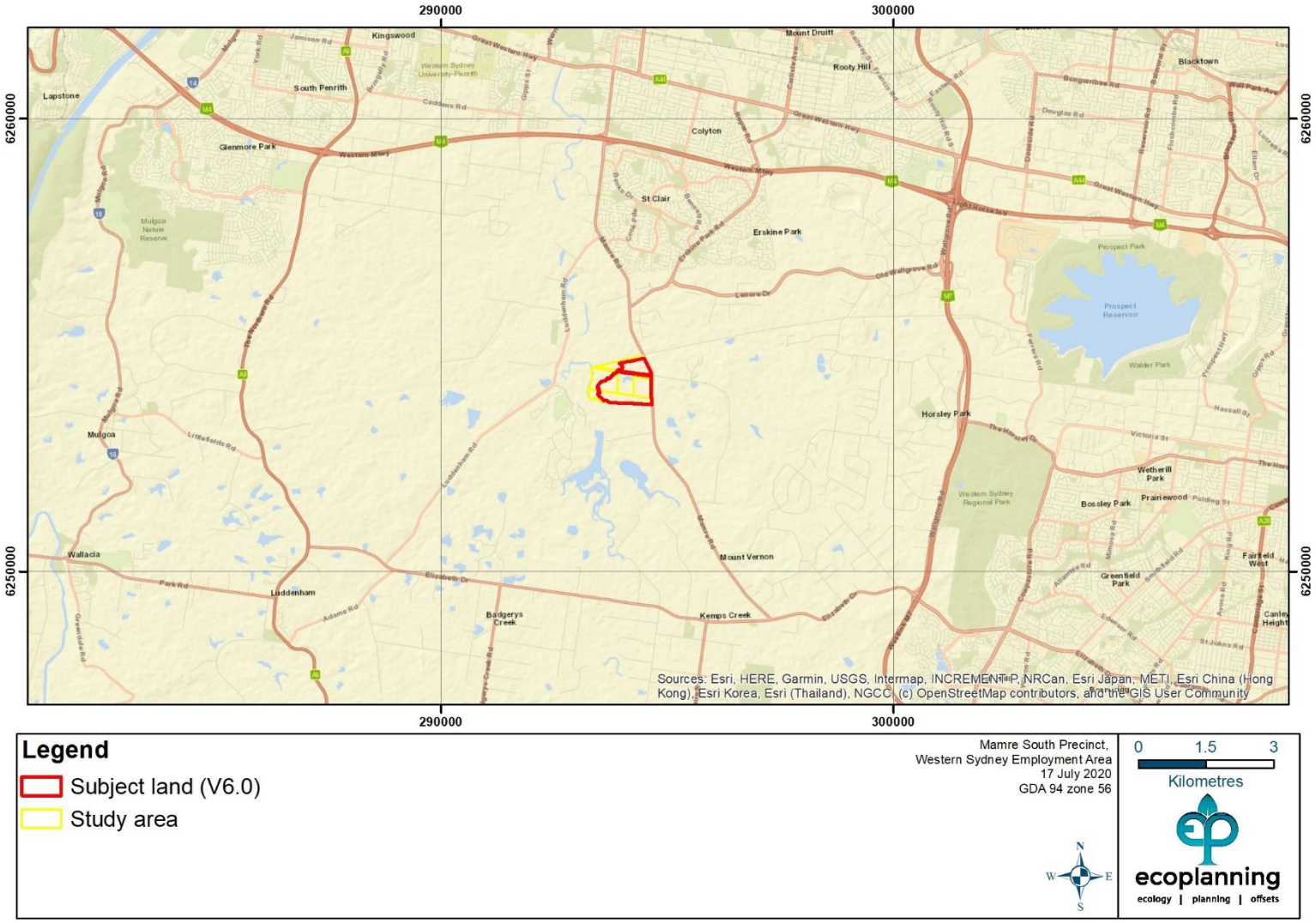

Figure 1.1: Subject land location.

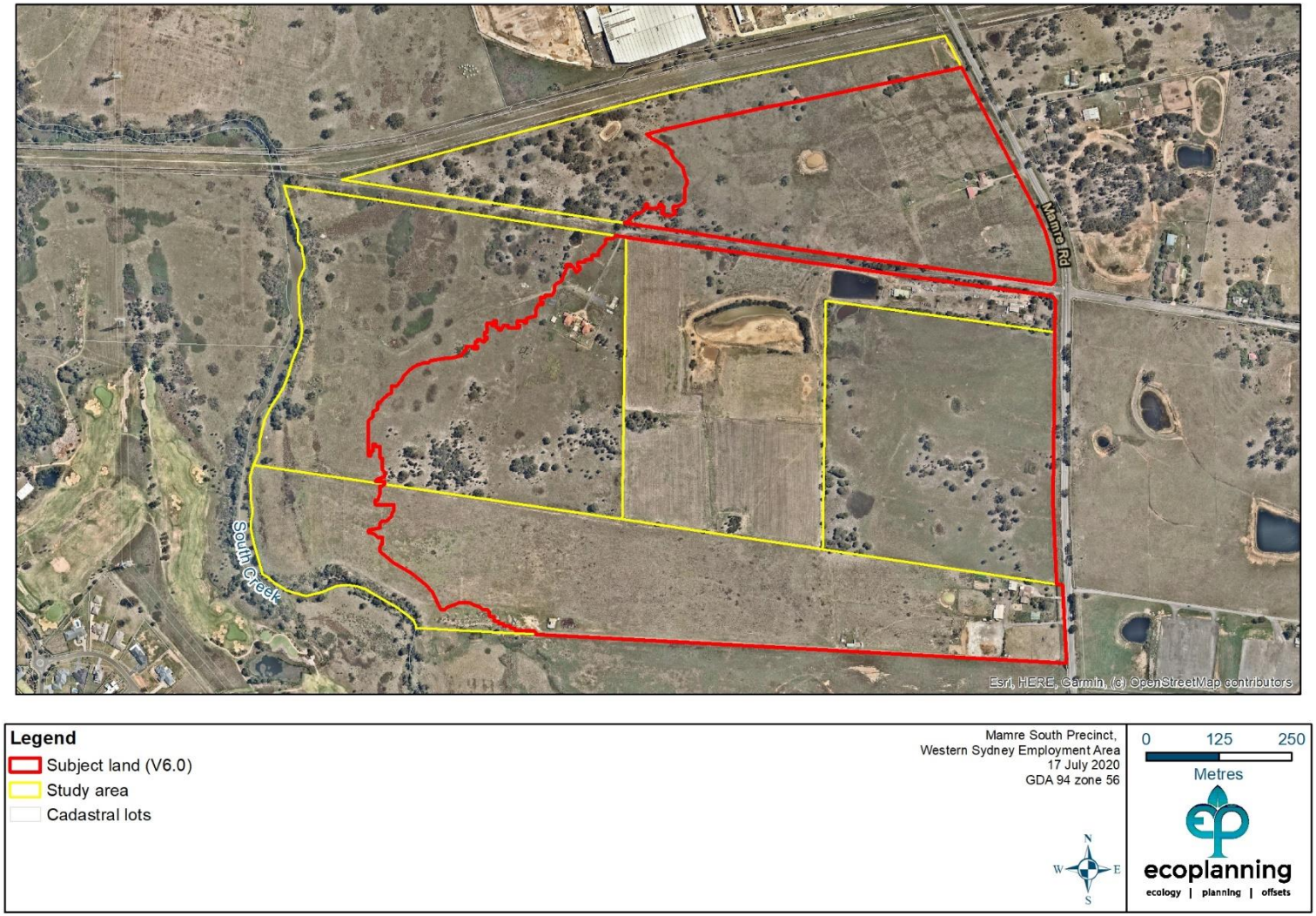

Figure 1.2: Site map.

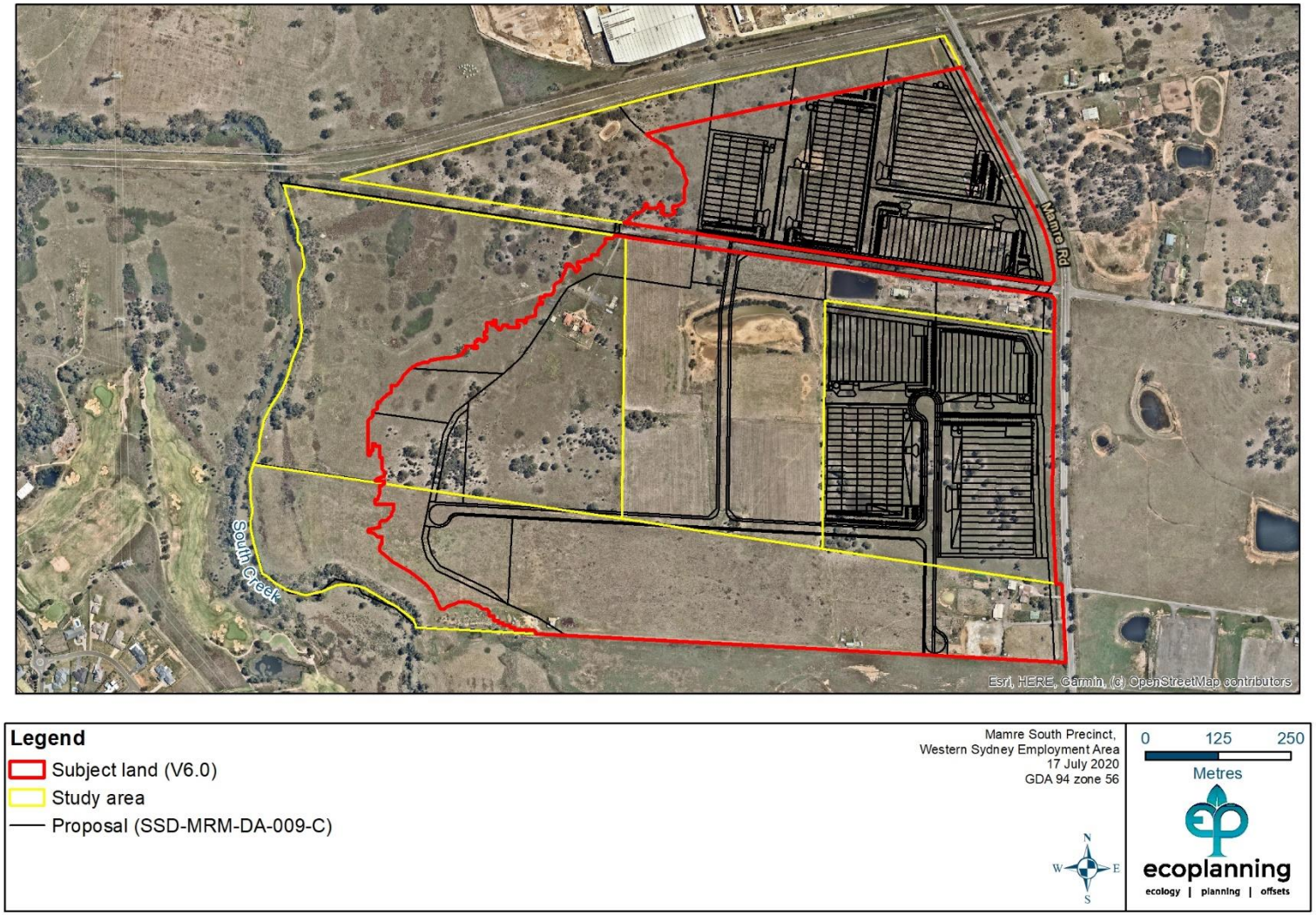

Figure 1.3: Proposed development footprint.

2. Landscape context

2.1 Identify landscape features

In accordance with the BAM, several features are assessed within and surrounding the subject land. Provided below are details related to IBRA region and subregion and NSW landscape regions (Mitchell Landscapes). Other features, such as rivers, streams, estuaries and wetlands, habitat connectivity, karst areas or areas of outstanding biodiversity value are considered where appropriate.

2.1.1 IBRA bioregions and IBRA subregions

Interim Biogeographic Regionalisation of Australia (IBRA) regions represent a landscape-based approach to classifying the land surface, including attributes of climate, geomorphology, landform, lithology, and characteristic flora and fauna species present. The subject land is located entirely within the Cumberland subregion (version 7) and within the NSW Sydney Basin IBRA region (version 7).

2.1.2 NSW landscape regions (Mitchell Landscapes)

The subject land occurs in two NSW Mitchell Landscapes, being the '*Cumberland Plain*' and *'Hawkesbury – Nepean Channels and Floodplains'* landscapes (Mitchell Landscapes V3.1). The '*Cumberland Plain'* landscape dominates the subject land and 1,500 m buffer (**Figure 2.1**).

The '*Cumberland Plain'* Mitchell Landscape was entered into the BAM calculator due to it being the dominant Mitchell Landscape within the subject land.

2.1.3 Other features

Rivers, streams and estuaries

No drainage lines are mapped within the subject land, although South Creek and Cosgroves Creek are mapped within the 1,500 m assessment circle (**Figure 2.1**). While there are no mapped watercourses within the subject land, there are low-lying areas, which may have once been part of informal drainage networks through the site.

South Creek, a fifth order stream flows north through the western portion of the 1,500 m buffer, along the western edge of the study area (**Figure 2.1**). An unnamed tributary of South Creek flows west, just south of the study area. The riparian buffers associated with South Creek and its tributaries, calculated in accordance with Appendix 3 of the BAM, are shown in **Figure 2.1**. The buffer of South Creek intersects the study area in the south-western corner of the subject land.

Local and important wetlands

No important wetlands, as defined by the BAM, are within the subject land or 1,500 m buffer area. There are several constructed farm dams within the subject land which have been mapped as part of this assessment (see **Section 3**).

Habitat connectivity

The vegetation within the subject land is connected to the riparian corridor along South Creek, west of the subject land (**Figure 2.1**). The vegetation along this riparian corridor is connected

along South Creek and Cosgroves Creek to vegetated patches along Blaxland Creek (north-west of the 1,500 m buffer). The landscape is highly modified and these riparian corridors, albeit thin, provide the only vegetated corridors through the landscape. As such, the native vegetation in the subject land is poorly connected to vegetation in reserves north, west and east of the subject land.

Areas of geological significance and soil hazard features

The subject land does not incorporate areas of geological significance or any soil hazard features.

Areas of outstanding biodiversity value

The subject land does not include any areas of outstanding biodiversity value as defined under the BC Act.

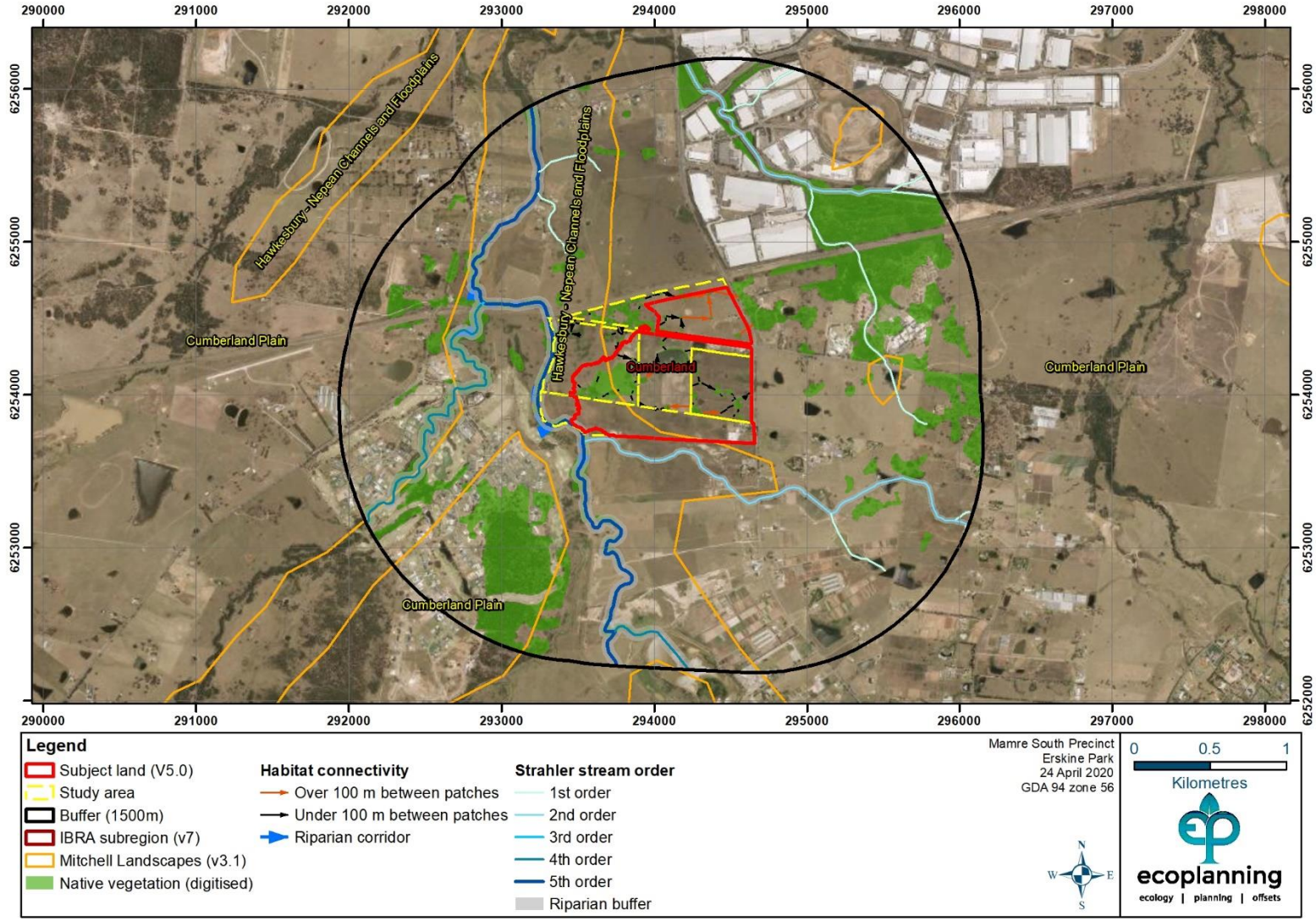

Figure 2.1: Location map.

2.2 Determining site context

2.2.1 Assessing native vegetation cover

A layer of native vegetation cover is required for a 1,500m buffer around the subject land to determine the context of the site. The extent of native vegetation on the subject land and immediate surrounds was mapped using the Western Sydney updated vegetation layer (OEH 2015) as a base, with edits made to the layer where obvious changes to vegetation extent had occurred **Figure 2.1**.

The total area of the 1,500m buffer around the subject land is 1368.88 ha, with the area of vegetation mapped within the buffer being 216.18 ha. This is a native vegetation cover of 15.79 % (10-30% class as defined in s4.3.2 of the BAM) and this value was entered into the BAM calculator.

2.2.2 Assessing patch size

Patch size as defined by the BAM as:

> *'an area of native vegetation that:*
>
> *a) occurs on the development site or biodiversity stewardship site, and*
>
> *b) includes native vegetation that has a gap of less than 100m from the next area of moderate to good condition native vegetation (or ≤30m for non-woody ecosystems).*
>
> *Patch size may extend onto adjoining land that is not part of the development site or biodiversity stewardship site.'*

In assessing patch size, stands of native vegetation within 100 m (where in a moderate to good condition) but which are separated by hard barriers including permanent artificial structures, wide roads or other barriers have been treated as separate patches. These highly modified breaks in vegetation connectivity would significantly alter ecological function of these areas of native vegetation such that these areas warrant recognition as separate patches.

Patch size was calculated for the vegetation on the development site using the field validated map of vegetation types identified and the updated native vegetation extent data layer prepared for the 1,500 m buffer (based on OEH 2015). Patch size is required to be assessed as one of four classes per vegetation zone mapped, being <5 ha, 5-24 ha, 25-100 ha or >100 ha.

The majority of woody patches of vegetation in the subject land are less than 100 m apart and hence are considered one patch of vegetation (**Figure 2.1**). This patch connects to woody vegetation along South Creek and to a patch of vegetation south of the subject land. This patch comprises over 100 ha and has been assigned the largest patch class of >100 ha. This patch includes one of the three patches of Shale Plains Woodland.

The two small stands of Shale Plains Woodland (Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain) in the north-east of the subject land are not connected to each other, other patches in the subject land or to vegetation east of the subject land. Hence, they are both considered individual patches of <5 ha.

Where vegetation zones included multiple patch sizes (where the Shale Plains Woodland vegetation zone occurs in three different patches), the larger patch size was entered into the BAM Calculator.

3. Native vegetation

3.1 Plant community types (PCTs) and threatened ecological communities

3.1.1 Previous vegetation mapping

Desktop assessment identified two native vegetation communities within the subject land (OEH 2015 after NPWS 2002). These communities are Shale Plains Woodland (MU10) and Alluvial Woodland (MU11). The patch of Alluvial Woodland is mapped in the north east of the subject land within a rectangular shaped area between Bakers Lane and the Upper Canal System. Shale Plains Woodland was mapped adjacent to the Alluvial Woodland in the north of the site and encompasses several small patches of vegetation in the centre of the subject land. For most of the subject land, no native vegetation community was identified as being present by OEH (2015).

Identification of vegetation communities within the subject land and community nomenclature follows the vegetation classification of NPWS (2002). Based on the floristic composition of the vegetation in the subject land, two native vegetation communities and two exotic communities, with varying condition classes, were identified (**Figure 3.1**) and are listed below:

- Alluvial woodland
- Shale Plains Woodland
- Cleared land 'exotic grasslands'
- Planted 'exotics, native indigenous and non-indigenous'

Regional vegetation mapping by Tozer et al. (2006) identified one small patch of vegetation in the centre of the subject land as Cumberland Shale Plain Woodland (GW p. 29) (**Figure 3.2**). For remainder of the subject land, no native vegetation was identified as being present by Tozer et al. (2006). Vegetation mapped in proximity to the subject land includes a large patch of Cumberland Shale Plain Woodland to the north east of the site on the eastern side of Mamre Road and Cumberland River Flat Forest (FoW p. 33) along South Creek to the west of the subject land (Tozer et al. 2006).

Shale Plains Woodland forms part of the Critically Endangered Ecological Community (CEEC), '*Cumberland Plain Woodland in the Sydney Basin Bioregion*' under the BC Act and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Whereas Alluvial Woodland forms part of the Endangered Ecological Community (EEC), '*River-flat Eucalypt Forest on Coastal Floodplains of the in the Sydney Basin Bioregion'.* The relationship between these native vegetation communities, Threatened Ecological Communities (TECs) and the corresponding Plant Community Types (PCTs) are summarised in **Table 3.1**. A description of each of the vegetation communities, including justification for the assigned vegetation community and PCTs is provided for each vegetation community in the following sections.

Table 3.1: Corresponding vegetation communities, PCTs and TECs.

Vegetation communities (NPWS 2002)	Plant Community Types (PCTs)	Threatened Ecological Communities (TECs)	BC Act	EPBC Act
Shale Plains Woodland (MU10)	PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Cumberland Plain Woodland in the Sydney Basin Bioregion ('Cumberland Plain Woodland')	CE	CE
Alluvial Woodland (MU11)	PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions ('River-flat Eucalypt Forest)'	E	-

CE = Critically Endangered; E = Endangered

3.1.2 Field assessment of vegetation communities

Assessment and mapping of Plant Community Types (PCTs) was undertaken on 30 April 2018 by Lucas Mckinnon (Principal Ecologist, Director), Thomas Hickman (Ecologist) and Kieren Northam (Ecologist). The subject land was traversed to identify the vegetation structure and dominant species within patches of native vegetation. The entire distribution of each patch of vegetation was traversed to sample any spatial variation within each polygon, identify boundaries between vegetation communities and to identify and map vegetation zones (variation in the broad condition state of vegetation polygons) in accordance with the BAM.

Based upon traverses of the subject land and study area, vegetation communities present were identified, and their boundaries were mapped. The floristics of each of these vegetation communities were then sampled within 20x20m plot-based floristic vegetation surveys, consistent with Section 5.2.1.9 of the BAM. These are also the location of vegetation integrity plots in accordance with Section 5.3 of the BAM. The location of floristic vegetation plots were based upon randomly sampled areas of each vegetation community, whilst ensuring that the plot-based surveys included representative areas within each community and avoided, where possible, edge effects (i.e. located close to edges of vegetation extent) or ecotones with adjacent vegetation zones.

The identification of PCTs was in accordance with the NSW PCT classification as described in the BioNet Vegetation Classification. Determination of the most appropriate PCTs for vegetation communities within the subject land used the BioNet Vegetation Classification database to identify PCT types which matched the geographic distribution (based upon IBRA subregions), vegetation formation and floristics of vegetation within the subject land. The data for each potential PCT including vegetation formation, descriptive attributes and distribution information were then reviewed to determine the most appropriate PCT for each of the vegetation communities sampled within the subject land. Observations of vegetation structure and composition made during traverses of the subject land as well as adjacent areas also informed the determination of most appropriate PCTs for the vegetation communities within the subject land. It is noted that identification of vegetation communities and PCTs was complicated by the fact that field observations were of disturbed, fragmented and previously

cleared stands of vegetation. Consequently, the identification of vegetation communities was based upon observations of the communities in a highly modified state with some elements of native vegetation communities absent or highly modified including where non-local native plantings has occurred.

The field survey identified two PCTs in the subject land (**Figure 3.3**):

- Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835; HN526).
- Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849; HN528).

A summary of two PCTs within the subject land including areas of vegetation zones, the percent cleared for each PCT and Serious and Irreversible Impacts (SAII) candidate entities is included in **Table 3.2**.

Table 3.2: Details of PCTs within the subject land including area of vegetation zones and candidate SAII entities.

Plant Community Types (PCTs)	Vegetation Formation & class	Vegetation zones	Area (ha)*	Threatened Ecological Communities (TECs)	SAII candidate entity
PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Forested Wetlands - Coastal Floodplain Wetlands	Underscrubbed	4.99	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	No
		DNG	4.04		No
PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Grassy Woodlands - Coastal Valley Grassy Woodlands	Underscrubbed	0.25	Cumberland Plain Woodland in the Sydney Basin Bioregion	Yes
Total native vegetation			**9.28**		
Planted exotic, indigenous and non-indigenous trees	N/A	N/A	0.72	N/A	N/A
Exotic grassland / Infrastructure	N/A	N/A	74.36	N/A	N/A
Dams	N/A	N/A	2.41	N/A	N/A
Total vegetation			**86.77**		

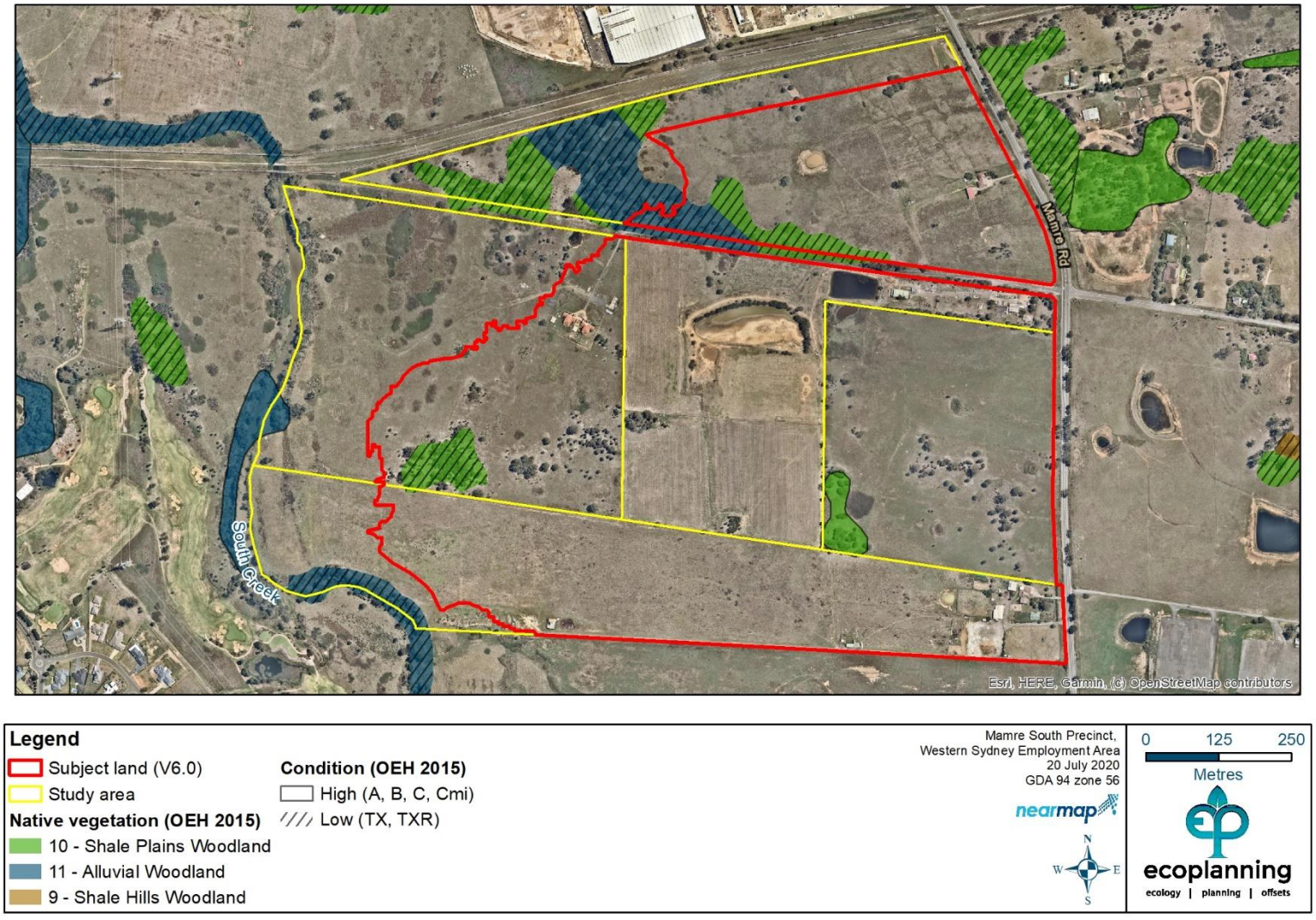

Figure 3.1: Vegetation types (OEH 2015).

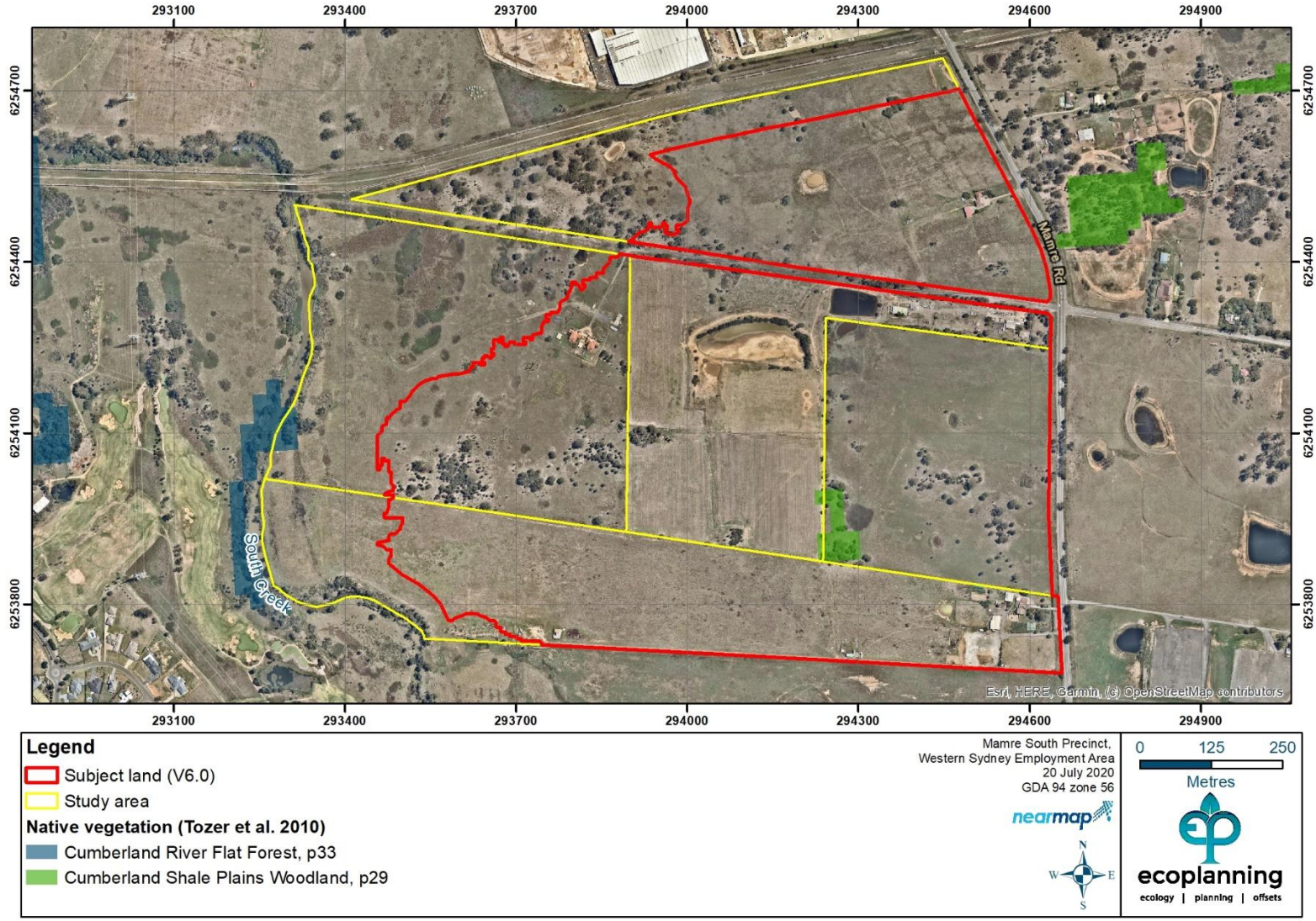

Figure 3.2: Vegetation types (Tozer et al. 2006).

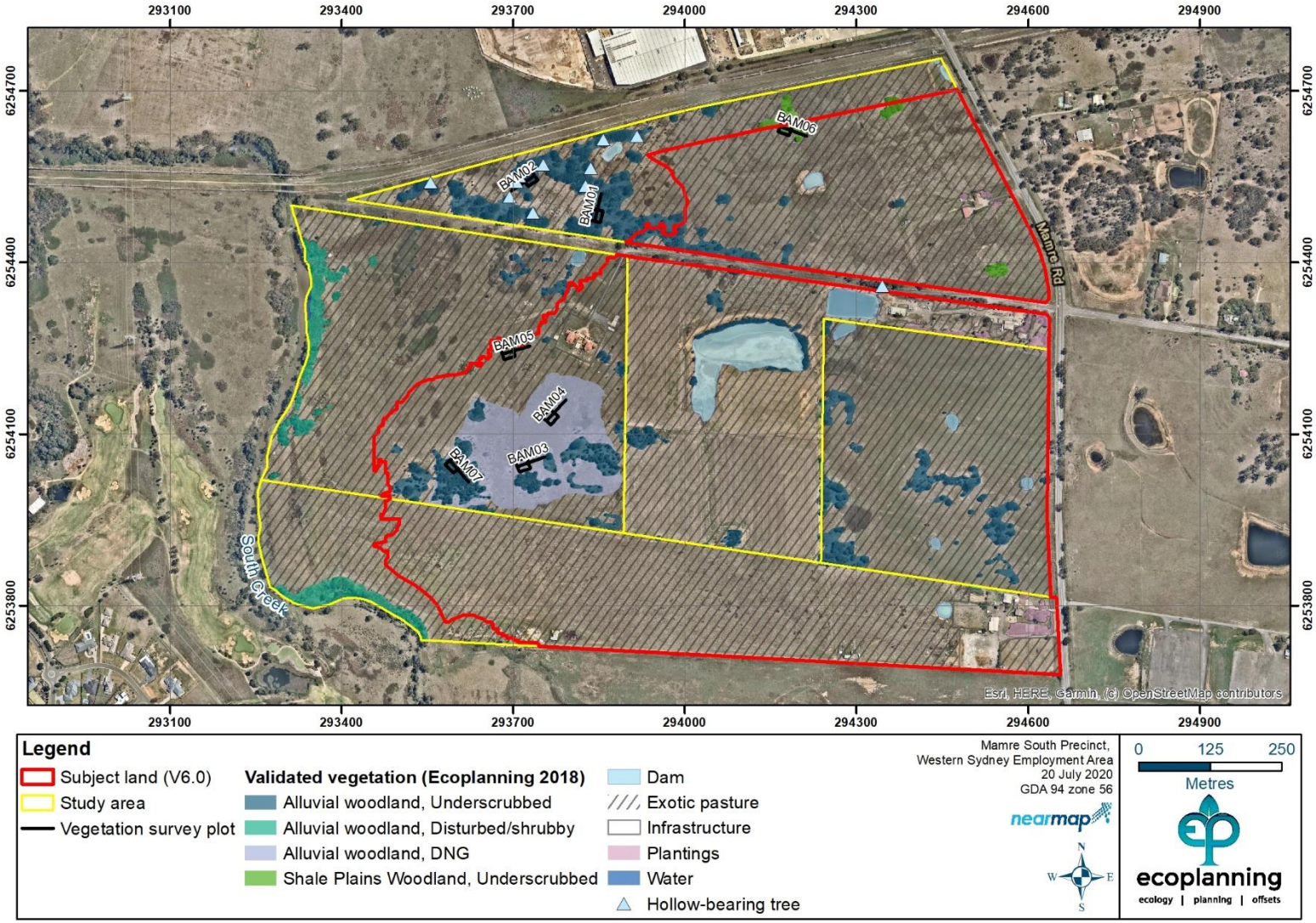

Figure 3.3: Field results and validated vegetation (Ecoplanning 2018).

3.1.3 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835; HN526).

Field assessment confirmed a majority of the vegetation in the north west of the subject land to be consistent with Alluvial Woodland (MU11) (**Figure 3.3**). Alluvial Woodland corresponds with the PCT 'Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion' (PCTID: 835). PCT 835 is situated on broad alluvial flats of the Hawkesbury and Nepean River systems at altitudes between one and 160 metres above sea level (masl) and with a mean annual rainfall of 750-1000 mm. Three distinct condition classes of Rough-barked Apple grassy woodland on alluvial flats were identified onsite, comprising 'underscrubbed' (**Figure 3.4**), 'Disturbed/shrubby' and 'Derived Native Grassland' (DNG) (**Figure 3.5**).

This vegetation community consisted of a grassy woodland dominated by *Eucalyptus amplifolia* (Cabbage Gum) and *Angophora floribunda* (Rough-barked Apple), with *Casuarina glauca* (Swamp Oak) also present around the perimeter of the large dam in the centre of the subject land. A sparse shrub layer was present within this vegetation community including *Bursaria spinosa* subsp. *spinosa* (Blackthorn), *Grevillea juniperina* subsp. *juniperina* and *Melaleuca decora*. Several patches of vegetation almost exclusively dominated by *Melaleuca decora* were identified within the subject land, including several patches of vegetation with substantial distance from Kemps Creek. These patches were often dominated by *Carex appressa* (Tall Sedge) in the groundlayer, which suggests some level of floodplain influence.

A grassy understorey was present throughout this vegetation community including grasses, forbs and sedges such as *Carex appressa*, *Centella asiatica* (Indian Pennywort), *Commelina cyanea, Cynodon dactylon* (Couch), *Juncus usitatus, Lomandra filiformis* (Wattle Mat-rush), *Microlaena stipoides* subsp. *stipoides* (Weeping Grass), *Themeda triandra* (Kangaroo Grass) and *Paspalidium distans* Exotic species occurred sporadically through the vegetation community; with a higher proportion observed between the interface of the community and the cleared land 'exotic grassland'. Dominant exotic grasses and herbaceous weeds included, *Axonopus fissifolius** (Narrow-leafed Carpet Grass), *Eragrostis curvula** (African Lovegrass), *Hypochaeris radicata** (Flatweed), *Paspalum dilatatum** (Paspalum), *Senecio madagascariensis** (Fireweed) and *Setaria parviflora** (Pigeon Grass).

Identification of the corresponding PCT was based on a review of the BioNet Vegetation Classification and specifically PCTs which occur within the 'Sydney Basin – Cumberland Plain' IBRA subregion and included *Eucalyptus amplifolia* as a dominant species. Based upon this search PCT 835 was identified as the most appropriate PCT based upon the floristic description and the landscape position identified as stream banks and alluvial flats on the Cumberland Plain. Additionally, the reference for PCT 835 '*Cumberland River Flat Forest*' (Tindall et al 2004) was considered a good description of the vegetation community within the subject land.

'Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion' (PCT 835) within the subject lands forms part of the '*River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*' EEC listed under the BC Act. This vegetation community is not identified as a potential SAII entity within Appendix 3 of the *Guidance to assist a decision-maker to determine a serious and irreversible impact* (OEH 2017b) and is therefore unlikely to meet the relevant SAII principles.

A summary of the PCT profile for the native vegetation type in the Vegetation Information System (VIS) (OEH (2018b) is provided in **Table 3.3**.

Figure 3.4: Forest Red Gum – Rough-barked Apple grassy woodland 'underscrubbed'.

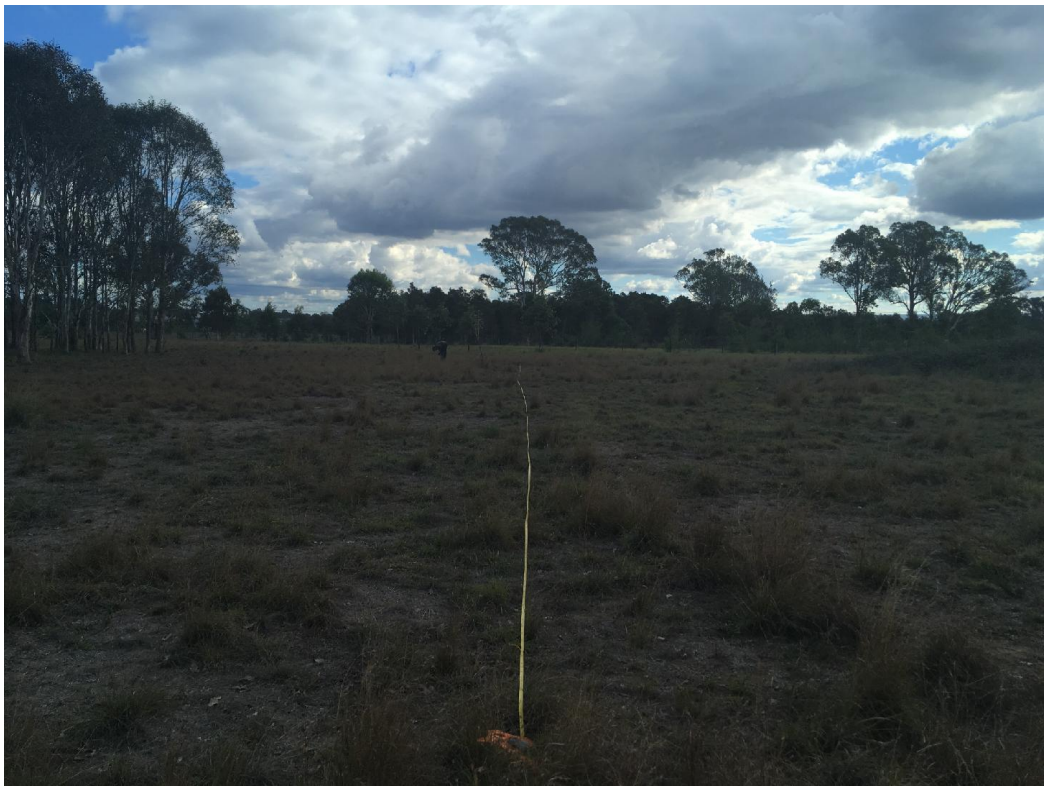

Figure 3.5: Forest Red Gum – Rough-barked Apple grassy woodland 'DNG'.

Table 3.3: VIS plant community type profile (OEH 2018a) – Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835; HN526).

Plant community type (PCT)	Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
PCT and BioMetric veg type (BVT) ID	PCT 835 / HN526 / ME018
Vegetation formation	KF_CH9 Forested Wetlands
Vegetation class	Coastal Floodplain Wetlands
Upper stratum	*Eucalyptus tereticornis* (Forest Red Gum), *Angophora floribunda* (Rough-barked Apple) and *Eucalyptus amplifolia* subsp. *amplifolia* (Cabbage Gum)
Middle stratum	*Acacia parramattensis* (Parramatta Wattle) *Bursaria spinosa* subsp. *spinosa* (Blackthorn) and *Sigesbeckia orientalis* (Indian Weed)
Ground stratum	*Microlaena stipoides* var. *stipoides*, *Oplismenus aemulus*, *Dichondra repens* (Kidney Weed), *Entolasia marginata* (Bordered Panic), *Solanum prinophyllum* (Forest Knightshade), *Pratia purpurascens* (Whiteroot), *Desmodium gunnii*, *Echinopogon ovatus* (Forest Hedgehog Grass), *Commelina cyanea* (Native Wandering Jew) and *Veronica plebeia* (Trailing Speedwell)
Landscape position	Occurs on stream banks and alluvial flats on the Cumberland Plain.
Profile source	FoW p33 (Tindall et al. 2004)
Full reference details	Tindall, D., Pennay, C., Tozer, M., Turner, K. and Keith, D., 2004. Native vegetation map report series No. 4. The Araluen, Batemans Bay, Braidwood, Burragorang, Goulburn, Jervis Bay, Katoomba, Kiama, Moss Vale, Penrith, Port Hacking, Sydney, Taralga;Tozer, M.G., Turner, K., Simpson, C., Keith, D.A., Beukers, P., MacKenzie, B., Tindall, D. & Pennay, C., 2010 Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. Version 1.0; OEH (2013) The Native Vegetation of the Sydney Metropolitan Area Version 2.0 NSW Office of Environment and Heritage Sydney
Estimate remaining pre-European extent rounded to nearest 5%	5%
EEC Name (Listing status)	TSC Act: River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions – Endangered EPBC Act: Not listed

3.1.4 Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849; HN528).

Field assessment identified Shale Plains Woodland (MU10) in the higher elevation areas of the site nearer to Mamre Road (**Figure 3.3**). Shale Plains Woodland corresponds with the PCT Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCTID: 849). PCT 849 occurs on clay/loam soils derived from Wianamatta Shales on the Cumberland Plain at low altitudes, typically below 150m. The three small patches of Grey Box – Forest Red Gum grassy woodland in the subject land where identified in an 'underscrubbed' condition class (**Figure 3.6**).

The vegetation community is represented by three small patches of vegetation; one exclusively dominated by *Eucalyptus moluccana* (Grey Box) and the other two by *Melaleuca decora*. The midstorey is devoid of a shrub layer a result of past underscrubbing and ongoing grazing of the vegetation community. The groundlayer was dominated by exotic grasses, including *Cenchrus clandestinus** (Kikuyu Grass), *Eragrostis curvula** and *Paspalum dilatatum**. Native grasses, forbs and sedges occurred within the vegetation community in low abundance and cover, including *Carex inversa, Commelina cyanea, Microlaena stipoides* var. *stipoides* and *Sporobolus creber* (Western Rat-tail Grass).

Identification of the corresponding PCT was based review of the BioNet Vegetation Classification database and specifically PCTs within the 'Grassy Woodland' vegetation formation which occur within the 'Sydney Basin – Cumberland Plain' IBRA subregion. Based upon this search PCT 849 identified as the most appropriate PCT based upon the floristic description and the landscape position which is identified as gently inclined areas on the Cumberland Plain. Additionally, the reference for PCT 849, *'Cumberland Shale Plains Woodland*' (Tozer et. al. 2006) was considered a good description of the vegetation community within the subject land.

The Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain (Shale Plains Woodland) vegetation community within the subject landforms part of the '*Cumberland Plain Woodland in the Sydney Basin Bioregion*' CEEC listed under the BC Act. This vegetation community is identified as a potential SAII entity within Appendix 3 of the 'Guidance to assist a decision-maker to determine a serious and irreversible impact' (OEH 2017b).

A summary of the PCT profile for the native vegetation type in the Vegetation Information System (VIS) (OEH (2018b) is provided in **Table 3.4**.

Figure 3.6: Grey Box - Forest Red Gum grassy woodland 'underscrubbed'.

Table 3.4: VIS plant community type profile (OEH 2015) – Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849; HN528).

Plant community type (PCT)	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
PCT and BioMetric veg type (BVT) ID	PCT 849 / BVT: HN528 and ME020
Vegetation formation	KF_CH3 Grassy Woodlands
Vegetation class	Coastal Valley Grassy Woodlands
Upper stratum	*Eucalyptus moluccana* (Grey Box) and *Eucalyptus tereticornis* (Forest Red Gum)
Middle stratum	*Bursaria spinosa* subsp. *spinosa* (Native Blackthorn)
Ground stratum	*Dichondra repens* (Kidney Weed), *Cheilanthes sieberi* subsp. *sieberi* (Rock Fern), *Aristida vagans* (Threeawn Speargrass), *Microlaena stipoides* var. *stipoides* (Weeping Grass), *Themeda australis* (Kangaroo Grass), *Brunoniella australis* (Blue Trumpet), *Desmodium gunnii* (Slender Tick-trefoil), *Opercularia diphylla* (Stinkweed), *Wahlenbergia gracilis* (Sprawling Bluebell), *Dichelachne micrantha* (Shorthair Plumegrass), *Paspalidium distans, Eragrostis leptostachya* (Paddock Lovegrass), *Lomandra filiformis* (Wattle Matt-rush), *Lomandra multiflora* (Many-flowered Mat-rush), *Dianella longifolia* (Blueberry Lily), *Oxalis perennans, Euchiton sphaericus* (Star Cudweed), *Goodenia hederacea* (Ivy Goodenia), *Aristida ramosa* (Purple Wiregrass), *Arthropodium milleflorum* (Pale Vanilla-lily), *Austrodanthonia tenuior* (A Wallaby Grass), *Cymbopogon refractus* (Barbed Wire Grass) and *Echinopogon caespitosus* (Bushy Hedgehog-grass)
Landscape position	Occurs on clay/loam soils derived from Wianamatta Shales on the Cumberland Plain at low altitudes (mainly below 150m).
Profile source	GW p29 (Tozer et al. 2006)
Full reference details	Tozer, M.G., Turner, K., Simpson, C., Keith, D.A., Beukers, P., MacKenzie, B., Tindall, D. & Pennay, C., 2010. Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. Version 1.0
Estimate remaining pre-European extent rounded to nearest 5%	5%
EEC Name (Listing status)	TSC Act: Cumberland Plain Woodland in the Sydney Basin Bioregion (Critically Endangered) EPBC Act: Cumberland Shale Plains and Shale Gravel Transition Forest (Critically Endangered)

3.1.5 Other vegetation

Planted 'exotic, indigenous and non-indigenous trees'

This vegetation type consists of planted exotics, native indigenous and non-indigenous trees surrounding the dwellings in the north east of the site and to the south of Bakers Lane. Planting included species such as, *Eucalyptus maculata* (Spotted Gum) and *Photinia serratifolia** (Chinese Photinia).

Cleared land 'exotic grassland'

Cleared land 'exotic grassland' within the subject land which was not assigned to a native vegetation community or an equivalent PCT. This included large areas throughout the subject land which have been subject to previous clearing and now support grasslands dominated by exotic grasses and herbaceous weeds (**Figure 3.7**) including *Axonopus fissifolius**, *Briza subaristata*, Eragrostis curvula**, *Hypochaeris radicata** and *Paspalum dilatatum**. Native species were generally absent or rare within this vegetation community although several species were infrequently present and at low abundance including *Bothriochloa macra* (Red-leg Grass), *Eragrostis leptostachya* (Paddock Lovegrass), *Tricoryne elatior* (Yellow Autumn-lily), *Themeda australis* (Kangaroo Grass).

This grassland vegetation was noted to be predominantly exotic (approximately 90-95 % cover), with the most abundant native species recorded as, *Cynodon dactylon*†, which is a cosmopolitan species that is quite possibly introduced given the overall site context and propensity of other introduced exotic pasture grasses. There is debate, and doubt, over the status of *C. dactylon*† within Australia (Langdon 1954), with the species having been recorded as an introduced species as early as 1802-1804 by Brown, R. (Groves 2002), although some authors recognise both indigenous and introduced populations within Sydney (Harden 1993 in Groves 2002) and Australia (Jessop et al. 2006). Within the subject land *C. dactylon*† commonly occurred with an array of other introduced pasture grasses suggesting that it is an introduced species. For this reason, these grassland areas have been mapped as 'exotic grassland' and no PCT has been assigned for this vegetation zone.

Figure 3.7: Cleared land 'exotic grassland' in the foreground.

3.2 Vegetation zones

3.2.1 Condition classes, subcategories and areas

The PCTs identified within the development site were classified into vegetation zones for credit calculation purposes. The vegetation zones are based on the condition descriptions above with the area of each vegetation zones shown in **Table 3.2**. **Figure 3.8** shows the spatial arrangement of the vegetation zones within the development site and associated vegetation integrity survey plots.

3.2.2 Vegetation integrity survey plots

Seven vegetation integrity survey plots were completed on the study area, with all being used to meet the requirements of the BAM (see **Appendix A** for data captured) (**Figure 3.8**). The number of plots surveyed within each vegetation zone is consistent with the requirements as outlined within Table 4 of the BAM, with the exception of the cleared land 'exotic grassland' vegetation zone, although this was not identified as a native vegetation community or assigned a PCT. No vegetation integrity survey plot was completed within the PCT 835 'Disturbed/shrubby' condition class. This was because the area of impact was considered too small to adequately fit a survey plot. To account for the impacts to this area, the 0.10 ha was subsumed into the 'Underscrubbed' condition class for PCT 835.

Table 3.5: Vegetation integrity scores.

Veg zone number	Plant community type	Condition class	Area impacted (ha)	Veg integrity plots required	Veg integrity plots undertaken
1	PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Underscrubbed	4.99	2	3 (BAM01, BAM02, BAM07)
2		DNG	4.04	2	2 (BAM03, BAM04)
3	PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Underscrubbed	0.25	1	1 (BAM06)
NA	Exotic grassland	Exotic grasslands	74.36	NA	1 (BAM05)

3.2.3 Current and future vegetation integrity scores

Vegetation integrity scores were calculated based on the vegetation integrity survey plots collected for each vegetation zone assigned to a native PCT. While the cleared land 'exotic grassland' vegetation zone was not assigned to a native PCT, the data collected from the single plot surveyed within this vegetation zone was entered into the BAM Calculator as a zone of PCT 835 (the most likely PCT prior to previous vegetation clearing across this vegetation zone) in order to calculate a vegetation integrity score for this vegetation zone. As the area of cleared land 'exotic grassland' within the subject land is between 50 ha and 100 ha, five vegetation integrity plots would be required for a vegetation zone of this size which was assigned to a native PCT. As this vegetation zone was not identified as forming part of any native PCT, only a single plot was collected and data from this plot was entered into the BAM calculator in order to allow for a vegetation integrity score to be calculated for this vegetation zone.

The vegetation integrity scores for each vegetation zone are provided in **Table 3.6**. Vegetation integrity scores ranges from 1.4/100 for the exotic grassland to 63.7/100 for the PCT 835 'underscrubbed' condition class. It is noted that the cosmopolitan species, *Cynodon dactylon*†, was not included as a native species within the Shale Plains Woodland (PCT 849) vegetation zones for the purposes of calculating the vegetation integrity score (see **Section 3.1.5**). A conservative approach has been taken for occurrences of this species within the Alluvial Wetland (PCT 835) vegetation zones where this species was treated as native grass when calculating vegetation integrity scores, as *C. dactylon*† is listed as being a component of some native vegetation communities on floodplains within the Sydney Basin (NSW Scientific Committee 2004b).

Future vegetation integrity scores were allocated for each vegetation zone. For all vegetation zones the project would involve complete clearing of all vegetation and the default future vegetation integrity score of 0 was retained.

Table 3.6: Vegetation integrity scores.

Veg zone number	Plant community type	Condition class	Area impacted (ha)	Veg integrity score – before development	Veg integrity score – after development
1	PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (Alluvial Woodland)	Underscrubbed	4.99	63.7	0
2		DNG	4.04	35	0
3	PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (Shale Planes Woodland)	Underscrubbed	0.25	8.7	0
NA	Exotic grassland	Exotic grasslands	74.36	1.4	NA

Note: The exotic grassland is not considered native vegetation due to its dominance of exotic species. A vegetation integrity plot was undertaken to assess the vegetation integrity score to ensure it was lower than the threshold.

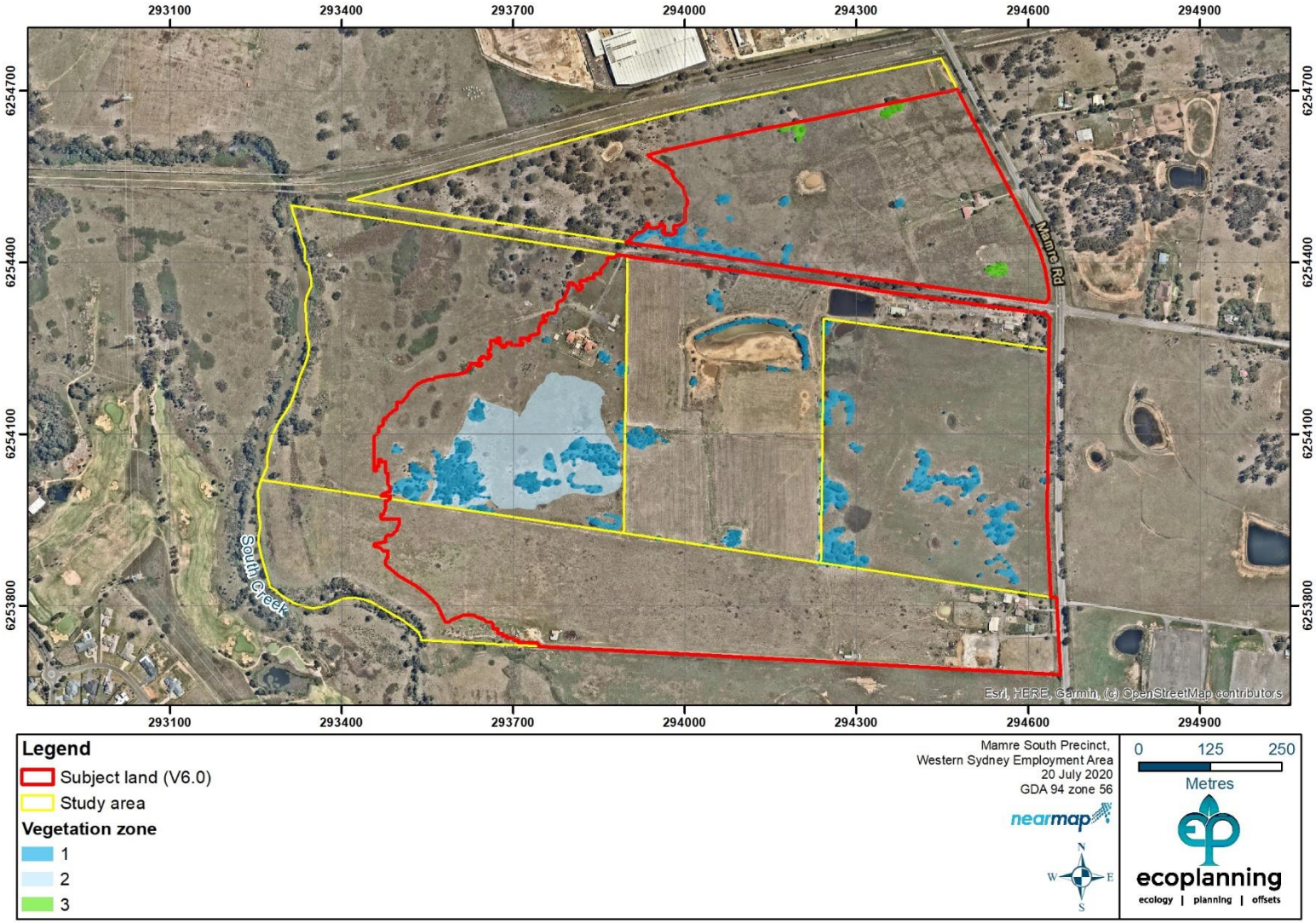

Figure 3.8: Vegetation zones.

4. Threatened species

Section 6 of the BAM details the process for determining the habitat suitability for threatened species.

Under the BAM, threatened species are separated into two classes, 'ecosystem' and 'species' credit species. Those threatened species where the likelihood of occurrence of a species or elements of the species' habitat can be predicted by vegetation surrogates and landscape features, or for which a targeted survey has a low probability of detection, are identified as 'ecosystem' credit species. Targeted surveys are not required for ecosystem species and potential impacts to these species are assessed in conjunction with impacts to PCTs.

Threatened species where the likelihood of occurrence of a species or elements of suitable habitat for the species cannot be confidently predicted by vegetation surrogates and landscape features and can be reliably detected by survey are identified as 'species' credit species. A targeted survey or an expert report is required to confirm the presence or absence of these species on the subject land.

For some threatened species, they are identified as both ecosystem and species credit species, with different aspects of the habitat and life cycle representing different credit types. Commonly, threatened fauna species may have foraging habitat as an ecosystem credit, while their breeding habitat represents a species credit.

The following sections outline the process for determining the habitat suitability for threatened species within the subject lands, and the results of targeted surveys for candidate threatened species.

4.1 Identifying threatened species for assessment

Threatened species that require assessment are initially identified based upon the following criteria:

- the distribution of the species includes the IBRA subregion in which the subject land (Cumberland IBRA subregion).
- the subject land is within any geographic constraints of the distribution of the species within the IBRA subregion.
- the species is associated with any of the PCTs identified within the subject land
- the native vegetation cover within an assessment area including a 1500m buffer around the subject land is equal to or greater than the minimum required for the species.
- the patch size that each vegetation zone is part of is equal to or greater than the minimum required for that species.
- the species is identified as an ecosystem or species credit species in the Threatened Biodiversity Data Collection.

The process for identifying threatened species which meet the above criteria is completed through the BAM Calculator. The PCTs identified within the subject land, patch sizes and

native vegetation cover, as outlined in **Section 3**, were entered into the BAM Calculator and a preliminary list of threatened species were identified.

4.1.1 Ecosystem credit species

The ecosystem credit species predicted on site are provided in **Table 4.1**. All ecosystem credit species were maintained in the assessment, as at least one species with the highest sensitivity to potential gain is likely to occur in each vegetation zone. Additionally, areas of exotic grassland were not considered as habitat for any ecosystem credit species.

Table 4.1: Ecosystem credit species predicted on site.

Scientific Name / Common Name	NSW listing status*	National listing status*
Anthochaera phrygia Regent Honeyeater (Foraging)	CE	CE
Artamus cyanopterus Dusky Woodswallow	V	-
Botaurus poiciloptilus Australasian Bittern	E	E
Callocephalon fimbriatum Gang-gang Cockatoo (Foraging)	V	-
Chthonicola sagittata Speckled Warbler	V	-
Circus assimilis Spotted Harrier	V	-
Climacteris picumnus victoriae Brown Treecreeper (eastern subspecies)	V	-
Daphoenositta chrysoptera Varied Sittella	V	-
Dasyurus maculatus Spotted-tailed Quoll	V	E
Glossopsitta pusilla Little Lorikeet	V	-
Grantiella picta Painted Honeyeater	V	V
Haliaeetus leucogaster White-bellied Sea-Eagle (Foraging)	V	-

Scientific Name / Common Name	NSW listing status*	National listing status*
Hieraaetus morphnoides Little Eagle (Foraging)	V	-
Ixobrychus flavicollis Black Bittern	V	-
Lathamus discolor Swift Parrot (Foraging)	E	CE
Lophoictinia isura Square-tailed Kite (Foraging)	V	-
Melanodryas cucullata Hooded Robin (south-eastern form)	V	-
Melithreptus gularis Black-chinned Honeyeater (eastern subspecies)	V	-
Miniopterus australis Little Bentwing-bat (Foraging)	V	-
Miniopterus schreibersii oceanensis Eastern Bentwing-bat (Foraging)	V	-
Mormopterus norfolkensis Eastern Freetail-bat	V	-
Neophema pulchella Turquoise Parrot	V	-
Ninox connivens Barking Owl (Foraging)	V	-
Ninox strenua Powerful Owl (Foraging)	V	-
Pandion cristatus Eastern Osprey (Foraging)	V	-
Petroica boodang Scarlet Robin	V	-
Petroica phoenicea Flame Robin	V	-
Phascolarctos cinereus Koala (Foraging)	V	V

Scientific Name / Common Name	NSW listing status*	National listing status*
Pteropus poliocephalus Grey-headed Flying-fox (Foraging)	V	V
Saccolaimus flaviventris Yellow-bellied Sheathtail-bat	V	-
Stagonopleura guttata Diamond Firetail	V	-
Tyto novaehollandiae Masked Owl (Foraging)	V	-

* CE- Critically Endangered; E- Endangered, V- Vulnerable

4.1.2 Species credit species

Geographic and habitat features

Species credit species are predicted following assessment of geographic and habitat features in the credit calculator, such as site location (IBRA subregion), PCTs and condition, patch size and the area of surrounding vegetation within the buffer. Some species require further assessment of habitat constraints and/or geographic limitations before being confirmed as candidate species for assessment. **Table 4.2** outlines the questions asked for these species, and whether the species is confirmed as a candidate species.

Table 4.2: Assessment of habitat constraints and geographic limitations.

Scientific Name / Common Name	Habitat constraints	Geographic limitations	Maintained as candidate species
Burhinus grallarius Bush Stone-curlew	Fallen/standing dead timber including logs	-	Yes
Dillwynia tenuifolia - endangered population Dillwynia tenuifolia, Kemps Creek	-	1. The area bounded by western Road, Elizabeth Drive, Devonshire Road and Cross Street, Kemps Creek in the Liverpool Local Government Area	No. The subject land is not within the Liverpool LGA.

Scientific Name / Common Name	Habitat constraints	Geographic limitations	Maintained as candidate species
Litoria aurea Green and Golden Bell Frog	1. Semi-permanent/ephemeral wet areas 2. Within 1km of wet areas | Swamps 3. Within 1km of swamp | Waterbodies Within 1km of waterbody	-	Yes
Marsdenia viridiflora subsp. *viridiflora* - endangered population Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	-	Those LGAs named in the population's listing	Yes
Pommerhelix duralensis Dural Woodland Snail	1. Other 2. Leaf litter and shed bark or within 50m of litter or bark | Rocky areas 3. Rocks or within 50m of rocks | Fallen/standing dead timber including logs 1. Including logs and bark or within 50m of logs or bark	-	Yes

4.2 Identify candidate species

In accordance with Section 6.4.1.17 of the BAM, a predicted candidate species can be considered unlikely to occur within the subject land (or specific vegetation zones) where habitat is substantially degraded such that the species is unlikely to utilise area, or where an expert report identifies that the species is unlikely to be present within the subject land (or a vegetation zone within the subject land). A predicted candidate species credit species that is not considered to have suitable habitat on the subject land (or specific vegetation zones) in accordance with Section 6.4.1.17 of the BAM does not require further assessment on the subject land (or specific vegetation zones). The reasons for determining that a predicted species credit species is unlikely to have suitable habitat on the subject land (or specific vegetation zones) must be documented.

As discussed in **Section 3**, much of the vegetation within the subject land has been previously cleared and fragmented which would represent substantial degradation for selected species credit species. To inform an assessment of how habitat degradation has impacted candidate threatened species a search of the Atlas of NSW Wildlife (DPIE 2020b) was undertaken. The search identified all records from the last 20 years within a 5 km radius around the subject land. The likelihood of occurrence of candidate threatened species was assessed by:

- review of location and date of recent (<5 years) and historical (>5-20 years) records
- review of available habitat within the subject land and surrounding areas
- review of the scientific literature pertaining to each species and population
- applying expert knowledge of each species

The potential for each threatened species, population and/or migratory species to occur was then considered following review of location and date of records of threatened species, available habitat within the subject land, and the condition of such habitat. **Table 4.3** outlines the predicted candidate species which were deemed to not have suitable habitat within the subject land, including justification for this decision.

Table 4.3: Candidate species for which the subject land is not considered suitable habitat.

Species	Justification*
Flora	
Acacia bynoeana (Bynoe's Wattle)	Unsuitable habitat within the subject lands, this species occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Not recorded during the last 20 years within 5 km of the subject land.
Caladenia tessellata (Thick Lip Spider Orchid)	Unsuitable habitat within the subject land, this species is known from the Sydney area (old records), Wyong, Ulladulla and Braidwood in NSW becoming more common to the south in coastal parts of Victoria. Generally found in coastal heaths, heathy woodland and open forest on well drained sand to clay loam soils (Backhouse 2018). Not recorded during the last 20 years within 5 km of the subject land.

Species	Justification*
Eucalyptus benthamii (Camden White Gum)	Unsuitable habitat within the subject land, the species requires a combination of deep alluvial sands and a flooding regime that permits seedling establishment. There are two major subpopulations: in the Kedumba Valley of the Blue Mountains National Park and at Bents Basin State Recreation Area. Several trees are scattered along the Nepean River around Camden and Cobbitty, with a further stand at Werriberri (Monkey) Creek in The Oaks. At least five trees occur on the Nattai River in Nattai National Park Not recorded during the last 20 years within 5 km of the subject land.
Hibbertia sp. Bankstown (syn. *H. puberula subsp. glabrescens*)	Unsuitable habitat within the subject land, the species is currently known to occur in only one population on tertiary alluvial soil along Airport Creek at Bankstown Airport. Habitat is in Castlereagh Ironbark Forest although some remnant vegetation at and near the site suggests Castlereagh Scribbly Gum Woodland is equally valid. Not recorded during the last 20 years within 5 km of the subject land.
Persoonia bargoensis (Bargo Geebung)	Unsuitable habitat within the subject land, the species occurs in woodland or dry sclerophyll forest on sandstone and on heavier well drained, loamy, gravelly soils of the Wianamatta Shale and Hawkesbury Sandstone. Much of the vegetation the species occurs within would be recognised as the Shale/Sandstone Transition Forest. Not recorded during the last 20 years within 5 km of the subject land.
Persoonia hirsuta (Hairy Geebung)	Unsuitable habitat within the subject land, this species is found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone. Not recorded during the last 20 years within 5 km of the subject land.
Pomaderris brunnea (Brown Pomaderris)	Unsuitable habitat within the subject land, this species is found in a very limited area around the Colo, Nepean and Hawkesbury Rivers. Not recorded during the last 20 years within 5 km of the subject land.
Pterostylis saxicola (Sydney Plains Greenhood)	Unsuitable and degraded habitat within the subject land, the species is restricted to western Sydney between Freemans Reach in the north and Picton in the south. 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. Not recorded during the last 20 years within 5 km of the subject land.
Thesium australe (Austral Toadflax)	No suitable habitat for this species. Although originally described from material collected in the SW Sydney area, populations have not been seen in a long time. Records from the Sydney basin are from 1803. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Not recorded during the last 20 years within 5 km of the subject land.

Species	Justification*
Wahlenbergia multicaulis - endangered population (Tadgell's Bluebell in the local government areas of Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield)	Not within the local government areas identified in the name.
Fauna	
Anthochaera phrygia (Regent Honeyeater) (Breeding)	No suitable breeding habitat within the subject land. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands.
Burhinus grallarius (Bush Stone-curlew)	Unsuitable and degraded habitat within the subject land. This species is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and, in the south-east, it is either rare or extinct throughout its former range. Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Fallen timber was largely absent from the subject land due to previous vegetation clearing. Not recorded during the last 20 years within 5 km of the subject land.
Callocephalon fimbriatum (Gang-gang Cockatoo) (Breeding)	No suitable breeding habitat within the subject land. In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. Favours old growth forest and woodland attributes for nesting and roosting. Nests are in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts. No hollow bearing trees of suitable diameter for Gang-gang Cockatoo to nest in were identified in the subject land. Not recorded during the last 20 years within 5 km of the subject land.
Cercartetus nanus (Eastern Pygmy-possum)	Unsuitable and degraded habitat within the subject land. This species is found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred. Not recorded during the last 20 years within 5 km of the subject land.

Species	Justification*
Chalinolobus dwyeri (Large-eared Pied Bat)	This species is found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features. Not recorded during the last 20 years within 5 km of the subject land.
Haliaeetus leucogaster (White-bellied Sea-Eagle) (Breeding)	No suitable breeding habitat within the subject land. Breeding habitat for this species consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat (characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea). Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as 'guard roosts'. Nests are large structures built from sticks and lined with leaves or grass.
Lathamus discolor (Swift Parrot) (Breeding)	No suitable breeding habitat within the subject land. This species breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland.
Litoria aurea (Green and Golden Bell Frog)	There are no Key Populations identified in the South Creek catchment. There are no records of this species within 5 km of the subject land. The last known records of this species west the M7 are from 1966 and 1973.
Lophoictinia isura (Square-tailed Kite) (Breeding)	Habitat within the subject land is unsuitable and degraded for breeding. This species nests on horizontal branches in mature living trees, especially eucalypts, often near water, and they need extensive areas of forest or woodland surrounding or nearby (Birdlife 2018).
Miniopterus australis (Little Bent-winged Bat) (Breeding)	No suitable breeding habitat within the subject land. Only five nursery sites /maternity colonies are known in Australia. In NSW the largest maternity colony is in close association with a large maternity colony of Eastern Bentwing-bats (*Miniopterus schreibersii*) and appears to depend on the large colony to provide the high temperatures needed to rear its young.
Miniopterus orianae oceanensis (Large Bent-winged bat) (Breeding)	No suitable breeding habitat within the subject land. The species forms discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes.

Species	Justification*
Ninox connivens (Barking Owl) (Breeding)	This species nests in living or dead trees with hollows >20 cm diameter and >4 m above the ground. Habitat includes woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extent into close forest and more open areas. Requires very large permanent territories in most habitats due to sparse prey densities. Monogamous pairs hunt over as much as 6000 hectares, with 2000 hectares being more typical in NSW habitats. No hollow bearing trees of suitable diameter for Barking Owl to nest in were identified in the subject land. Not recorded during the last 20 years within 5 km of the subject land.
Ninox strenua (Powerful Owl) (Breeding)	This species nests in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. While the female and young are in the nest hollow the male Powerful Owl roosts nearby (10-200 m) guarding them, often choosing a dense "grove" of trees that provide concealment from other birds. No hollow bearing trees of suitable diameter for Powerful Owl to nest in were identified in the subject land.
Pandion cristatus (Eastern Osprey) (Breeding)	No suitable breeding habitat within the subject land. This species nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.
Petaurus norfolcensis (Squirrel Glider)	No suitable habitat within the subject land. Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Require abundant tree hollows for refuge and nest sites. Not recorded during the last 20 years within 5 km of the subject land.
Phascolarctos cinereus (Koala) (Breeding)	Habitat within the subject land is unsuitable and degraded for Koala breeding habitat. The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. Inhabit eucalypt woodlands and forests. The subject land has been fragmented and isolated from any nearby records by previous vegetation clearing and urban and industrial development. Not recorded during the last 20 years within 5 km of the subject land.
Pommerhelix duralensis (Dural Woodland Snail)	No suitable habitat within the subject land. The species is a shale-influenced-habitat specialist, which occurs in low densities along the western and northwest fringes of the Cumberland IBRA subregion on shale-sandstone transitional landscapes. Found in an area of north-western Sydney between Rouse Hill - Cattai and Wiseman's Ferry, west from Berowra Creek. Not recorded during the last 20 years within 5 km of the subject land.

Species	Justification*
Tyto novaehollandiae (Masked Owl) (Breeding)	No suitable breeding habitat within the subject land. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. The Masked Owl utilises hollows greater than 20cm diameter in living or dead trees. No hollow bearing trees of suitable diameter for Masked Owl to nest in were identified in the subject land.

* Unless otherwise stated, habitat information is sourced from OEH (2018b)

Based upon the assessment of available habitat for predicted candidate species within the subject land, the following predicted candidate species were confirmed for the subject land:

- *Acacia pubescens* (Downy Wattle)
- *Callistemon linearifolius* (Netted Bottle Brush)
- *Cynanchum elegans* (White-flowered Wax Plant)
- *Dillwynia tenuifolia*
- *Grevillea juniperina* subsp. *juniperina* (Juniper-leaved Grevillea)
- *Litoria aurea* (Green and Golden Bell Frog)
- *Marsdenia viridiflora* subsp. *viridiflora* (endangered population including occurrences in the Blacktown LGA)
- *Myotis macrocarpus* (Southern Myotis)
- *Persicaria elatior* (Tall Knotweed)
- *Pilularia novae-hollandiae* (Austral Pillwort)
- *Pimelea curviflora* var. *curviflora*
- *Pimelea spicata* (Spiked Rice-flower)
- *Pultenaea pedunculata* (Matted Bush-pea)
- *Hieraaetus morphnoides* (Little Eagle) (Breeding)
- *Meridolum corneovirens* (Cumberland Plain Land Snail)
- *Pteropus poliocephalus* (Grey-headed Flying-fox) (Breeding)

4.3 Determine presence or absence of a candidate species credit species

Survey has been conducted for the sixteen predicted candidate species confirmed for the subject land. The field survey was conducted in accordance with OEH threatened species survey guidelines (DPIE 2019b). Predicted candidate species were assessed consistent with Steps 4 – 6 of Section 6.4 of the BAM and targeted surveys for species credit species were undertaken in accordance within section 6.5 of the BAM. The level of survey conducted is suitable for this BDAR.

4.3.1 Targeted field surveys - flora

Targeted surveys for candidate threatened flora species was conducted on 30 April 2018, 28 November 2019 and 7 April 2020 in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016). The survey period was within the nominated survey period for all the predicted candidate species (**Table 4.4**).

Grevillea juniperina subsp. *juniperina* (listed as Vulnerable under the BC Act **Figure 4.2**) was recorded within the study area, but not the subject land. A total of 29 individuals of this species were observed within a well-defined cluster in the north of the study area (**Figure 4.1**). No further threatened flora species were recorded within the study area. It is noted that *Dillwynia tenuifolia* falls outside of the survey period specified within the BAM Calculator. However, the NSW Threatened Species Profile for *D. tenuifolia* (DPIE 2020d), describes flowering as occurring sporadically throughout the year, peaking from August to March. No records of this species were found during targeted survey

Table 4.4: Survey periods for predicted candidate threatened flora species.

Candidate species	Survey period (BAM Calculator)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Acacia pubescens (Downy Wattle)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Callistemon linearifolius (Netted Bottle Brush)	Y									Y	Y	Y
Cynanchum elegans (White-flowered Wax Plant)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Dillwynia tenuifolia	*	*	*					Y	Y	Y	*	*
Grevillea juniperina subsp. *juniperina* (Juniper-leaved Grevillea)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Marsdenia viridiflora subsp. *viridiflora* (endangered population including occurrences in the Blacktown LGA)	Y	Y									Y	Y
Persicaria elatior (Tall Knotweed)	Y	Y	Y	Y	Y							Y
Pilularia novae-hollandiae (Austral Pillwort)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Pimelea curviflora var. *curviflora*	Y	Y	Y							Y	Y	Y
Pimelea spicata (Spiked Rice-flower)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Candidate species	Survey period (BAM Calculator)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pultenaea pedunculata (Matted Bush-pea)									Y	Y	Y	

Blue column indicates the primary survey month.

* Peak flowering period from NSW DPIE Threatened Species Profile (DPIE 2020d).

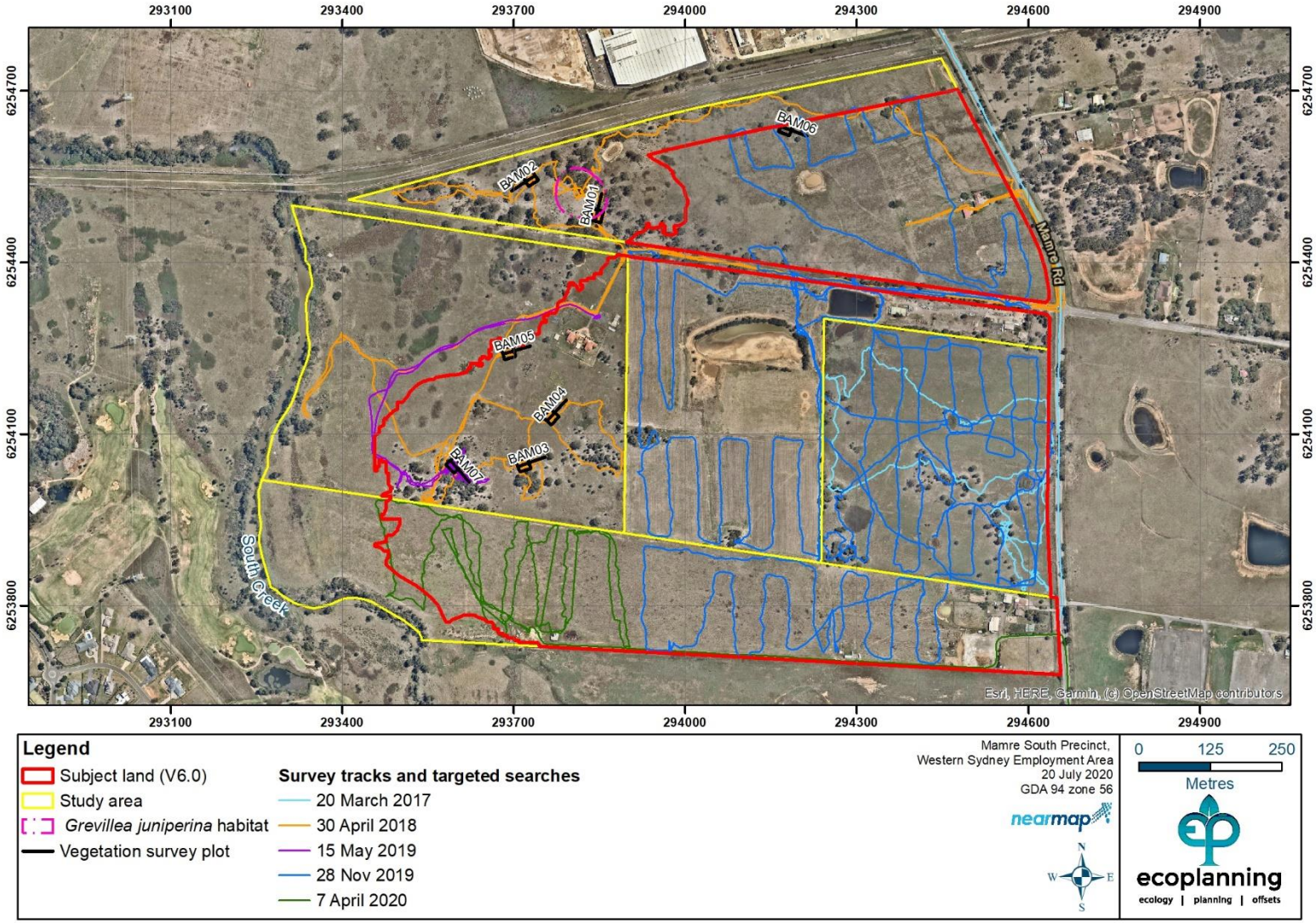

Figure 4.1: Targeted flora surveys and *Grevillea juniperina* subsp. *juniperina* habitat.

Figure 4.2: *Grevillea juniperina* subsp. *juniperina* within the study area.

4.3.2 Targeted field surveys – fauna

Targeted surveys for candidate species credit fauna and their associated survey periods are outlined below (**Table 4.5**). Additional incidental fauna species within the study area were also recorded. It is noted that the survey period did not fall within that specified for Little Eagle. However, no stick nests were observed within the study area during field survey.

Table 4.5: Survey periods for candidate threatened fauna species.

Candidate species	Survey period (BAM Calculator)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Meridolum corneovirens (Cumberland Plain Land Snail)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Pteropus poliocephalus (Grey-headed Flying-fox) (Breeding)										Y	Y	Y
Hieraaetus morphnoides (Little Eagle) (Breeding)								Y	Y	Y		
Litoria aurea (Green and Golden Bell Frog)	Y	Y	Y								Y	Y
Myotis macropus (Southern Myotis)	Y	Y	Y							Y	Y	Y

Blue: indicates the survey months

Green and Golden Bell Frog (*Litoria aurea*) *– Targeted Field Survey*

Targeted field survey for Green and Golden Bell Frog (GGBF) was undertaken over four nights. This was in accordance with the Commonwealth *Significant impact guidelines for the vulnerable green and golden bell frog* (DEWHA 2009) and the NSW *'Threatened species survey and assessment guidelines: field survey methods for fauna – amphibians'* (DECC 2009). Survey involved nocturnal searches, call playback and frog chorus census, with survey effort shown in **Figure 4.3**.

An initial survey was undertaken on 28 November 2019 by Angela Bibby (Ecologist) and Ross Wellington (Principal Ecologist – Australian Environmental Surveys). Ross Wellington is an approved biodiversity expert for GGBF in the Greater Sydney Region (DPIE 2019a). Potential GGBF habitat was identified by Ross Wellington during the field survey and is shown in **Figure** 4.3. This consisted of large dams with vegetation around their margins, areas of long grass, poorly drained areas, three small dams overgrown with *Typha* spp., ill-defined drainage lines and gardens within the main house. Weather conditions on 28 November 2019 were hot with a total of 5 mm of rainfall in the preceding five days, based on Erskine Park Reservoir, 2.8 km to the north east of the subject land (BOM 2020). Green and Golden Bell Frog were known to be active at the nearby Sydney Olympic Park Brickpit from 30 August 2019 (Dr Enhua Lee, Conservation Assessment Officer, Dept. of Planning, Industry and Environment, Biodiversity Conservation Division; email comm. with Lucas McKinnon, 8 November 2019).

Additional targeted surveys were undertaken on 21 and 22 January 2020. The potential habitat identified by Ross Wellington was targeted in these field surveys. Survey was completed following a total of 42 mm of rainfall for January leading up the survey, and 35 mm in the preceding five days. Weather conditions during the field survey were warm to hot. Targeted survey was undertaken by Angela Bibby (Ecologist) and Bruce Mullins (Principal Ecologist).

A final targeted survey was undertaken on the 11 February 2020. As with the January surveys, potential habitat was targeted. This survey was completed following a total of 415.8 mm for February leading up to the survey and 376.4 mm of rainfall in the preceding five days. Targeted survey was undertaken by Angela Bibby (Ecologist) and Bret Stewart (Senior Ecologist).

Following the survey effort and expert assessment, GGBF was considered unlikely to occur within the subject land.

Southern Myotis (*Myotis macropus*) *– Microbat Survey*

Microbat survey was undertaken for Southern Myotis within the study area. Survey was undertaken using acoustic detection in accordance with the *'Species credit' threatened bats and their habitats NSW survey guide* (OEH 2018a). Two Anabat devices were placed within the study area in proximity to the large dams (**Figure 4.3**). The devices were deployed over a period of 16 nights from 28 November to 13 December 2019. Bat call analysis, undertaken by Amy Rowles (see **Appendix E** for the full results), identified only one possible Southern Myotis pass over the 16 nights. This assessment concluded that the call was more likely to be a *Nyctophilus* sp. Typically, passes are common where there is significant Southern Myotis activity. While the occurrence of Myotis cannot be completely discounted, it is considered unlikely to occur within the study area.

Several other bat species were identified in the bat call analysis and have been included in the fauna species inventory (**Appendix C**). Of these species, three are listed as threatened under the BC Act. These were *Micronomus norfolkensis* (Eastern Coastal Free-tailed Bat), *Miniopterus australis* (Little Bent-winged Bat) and *Miniopterus orianae oceanensis* (Large Bent-winged Bat. Eastern Coastal Free-tailed Bat is only listed as an ecosystem credit species. Little Bent-winged Bat and Large Bent-winged Bat are only species credits for breeding habitat, and no suitable breeding habitat occurs within the subject land or study area.

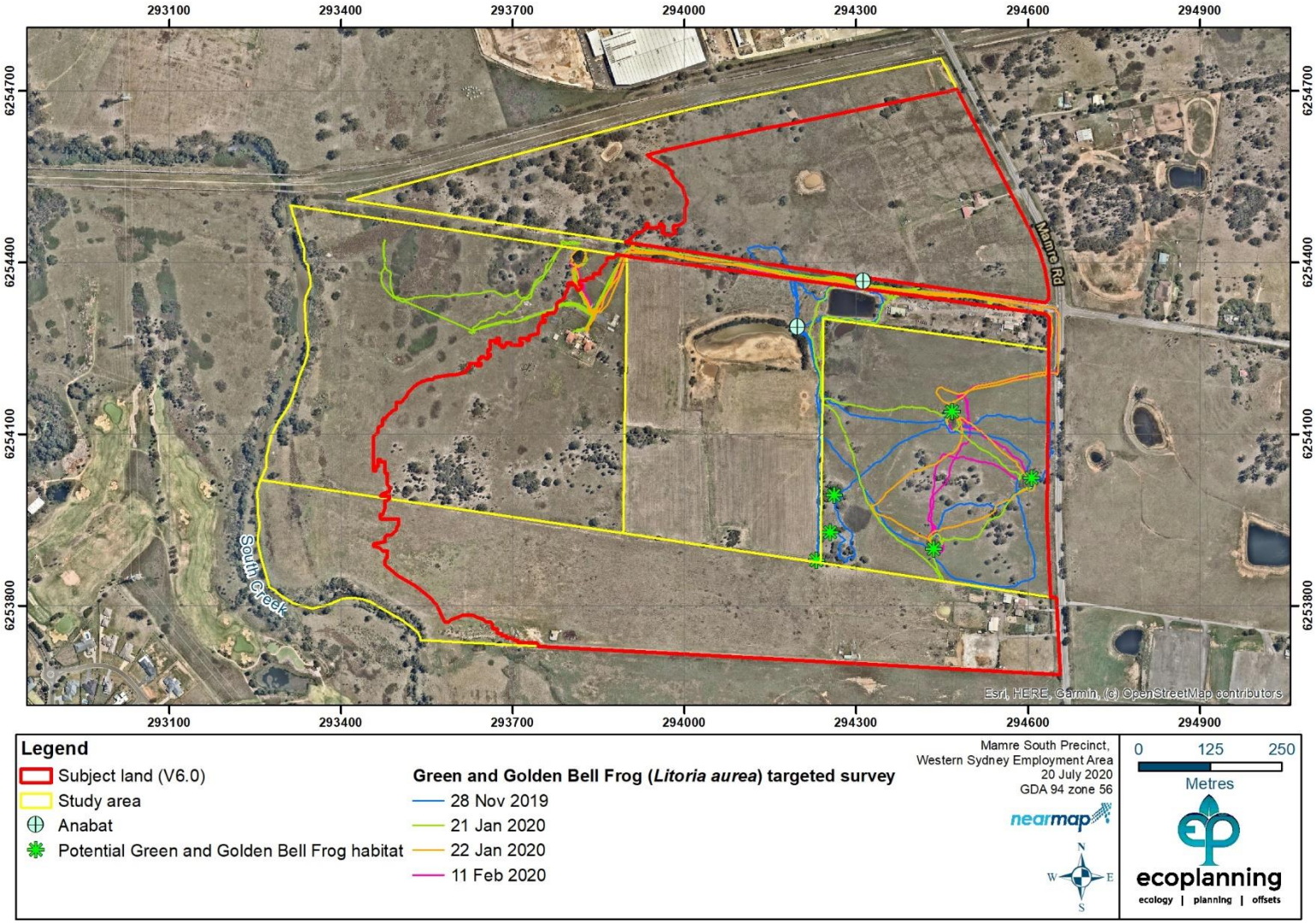

Figure 4.3: Green and Golden Bell Frog targeted survey effort.

4.4 Field survey and results

4.4.1 Field survey

A field survey was undertaken on 20 March 2017 by Thomas Hickman (Ecologist). Additional surveys were undertaken on 30 April 2018 by Lucas Mckinnon (Principal Ecologist, Director), Thomas Hickman (Ecologist) and Kieren Northman (Ecologist) and 16 May 2019 by Kieren Northam (Ecologist) and Angela Bibby (Ecologist) (**Figure 4.4**). Field survey included a general flora and fauna habitat and vegetation community assessment and the completion of 7 vegetation integrity plots in accordance with the BAM (OEH 2017a) over a total of 18 person hours. Weather conditions in 2018 were cool-warm with 1 mm of rain recorded within 24 hours prior to the survey and 8.0 mm on the day of survey (**Table 4.6**). Weather conditions in 2019 were cool-warm with no rainfall recorded within 24 hours prior to the survey. No weather data was available for 2017 at the time of reporting.

Targeted flora and fauna survey was undertaken on 28 November 2019, this included GGBF survey. An additional three nights of GGBF survey, following rainfall, were undertaken on 21, 22 January and 11 February 2020. Weather conditions over all targeted fauna survey periods were hot (**Table 4.6**). Following amendments to the masterplan, an additional targeted flora survey was undertaken on 7 April 2020. Weather conditions on 7 April 2020 were mild and dry, with no rainfall within 24 hours prior to the survey.

Table 4.6: Daily weather observation at Horsley Park Equestrian Centre (9 km south southeast of the subject land).

Date	Temp (ºC)		Rainfall (mm)*	Max wind	
	Min	Max		Direction	Speed (km/h)
30/04/18	11.0	21.8	8.0	SE	26
16/05/19	8.8	22.1	0.0	N	17
28/11/19	11.4	30.6	0.0	ESE	35
21/01/20	16.4	33.2	0.0	SE	37
22/01/20	17.5	35.5	0.0	ENE	39
11/02/20	19.0	32.2	0.0	ESE	30
7/04/20	14.4	20.6	0.0	SSE	20

*Rainfall based on Erskine Park Reservoir, 2.8 km north east of the subject land.

Fauna and fauna habitat

Opportunistic fauna survey was undertaken for birds, amphibians, reptiles and mammals, which included opportunistic observations along with signs of direct and indirect occupancy (i.e. scats, owl pellets, fur, bones, tracks, bark scratches, foliage chew marks and chewed cones of *Allocasuarina* spp. or *Pinus* spp. as well as some of the other cultivars known to be used by native fauna).

Fauna habitat searches were conducted for potential foraging, roosting, breeding or nesting habitat of nocturnal and diurnal species. This includes inspection for the presence of tree hollows, stags, bird nests, possum dreys, decorticating bark, rock shelters, rock outcrops/crevices, mature / old growth trees, food trees (*Banksia* spp., *Allocasuarina* spp., and

winter-flowering eucalypts), culverts, dens, dams, riparian areas and refuge habitats of man-made structures.

4.4.2 Field survey results

Flora species

A total of 85 flora species were identified in the study area during the field survey, of which 49 were native and 35 were exotic (**Appendix C**). Nomenclature follows the Flora of NSW (Harden 1990-2002) and updates provided in PlantNET (RBGDT 2018). One threatened flora species, *Grevillea juniperina* subsp. *juniperina* was identified in the study area and is listed as vulnerable under the BC Act. A total of 29 individuals were counted in a well-defined patch in the north of the study area.

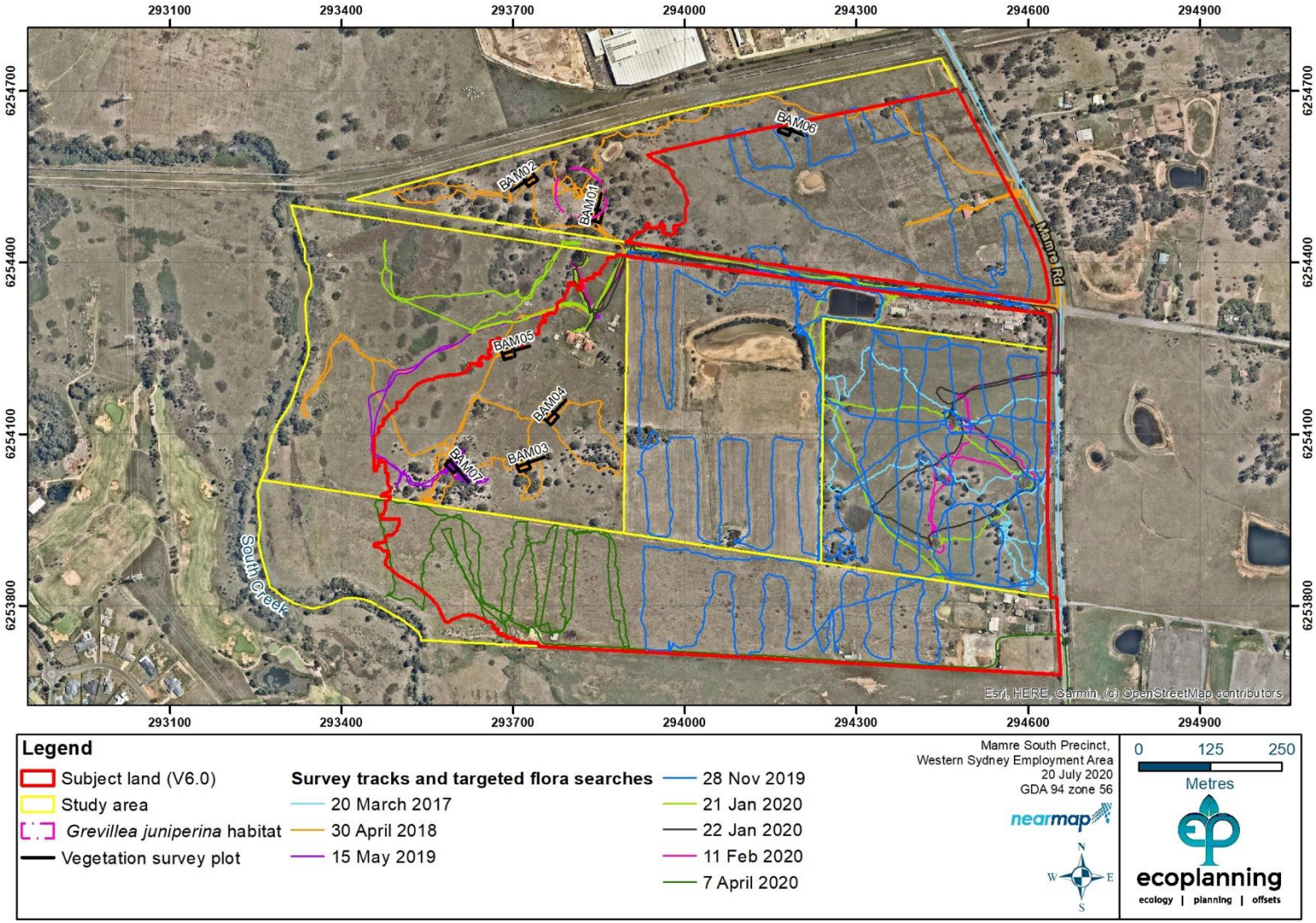

Figure 4.4: Survey effort.

Fauna habitat

The site contains habitat features, with the potential to provide refuge for a range of native fauna (**Table 4.7**). Habitat within the subject land provides potential foraging, roosting, breeding and nesting resources for native fauna. A total of 12 hollow bearing trees (HBTs) were identified, 11 which were confined to the northern portion of the study area, outside of the subject land. A large farm dam is situated in the centre of the subject land and several smaller dams are scattered across the northern and eastern portions of the site. The dam provides habitat for common frog and waterfowl species, including *Limnodynastes peronii* (Brown-striped Frog), *Porphyrio porphyrio* (Purple Swamphen), *Elseyornis melanops* (Black-fronted Dotterel), *Tachybaptus novaehollandiae* (Australasian Grebe) and *Poliocephalus poliocephalus* (Hoary-headed Grebe).

Table 4.7: Key fauna habitat features present across the subject land.

Habitat features	Fauna species
Underscrubbed vegetation	Diurnal and nocturnal birds, arboreal mammals, microchiropteran bats, reptiles and frogs
Hollow bearing trees	Arboreal mammals, birds, microchiropteran bats, reptiles and frogs
Dams	Frogs and birds
Open pasture	Birds, microchiropteran bats and reptiles
Coarse woody debris	Mammals, reptiles and frogs

Fauna species

The field survey undertaken for this report recorded a total of 68 fauna species, of which three were introduced. Of the 68 species, there were 34 birds, nine frog species, 19 mammals, five reptiles and one Eel (**Appendix C**). Targeted fauna survey was conducted in accordance with the BAM. Survey efforts have been highlighted in **Section 4.3.2**.

Four threatened microbat species were identified as part of the microbat analysis. These were:

- *Micronomus norfolkensis* (Eastern Coastal Free-tailed Bat) – Vulnerable – Probable ID
- *Miniopterus australis* (Little Bent-winged Bat) – Vulnerable – Possible ID.
- *Miniopterus orianae oceanensis* (Large Bent-winged Bat) – Vulnerable – Possible ID.
- *Myotis macropus* (Southern Myotis) – Vulnerable – Possible ID

Full bat call analysis has been provided in **Appendix E**.

5. Avoiding and minimising impacts on biodiversity values

5.1 Avoiding and minimising impacts on native vegetation and habitat during project planning

In accordance with Section 8.1.1.6 of the BAM, actions taken to avoid and minimise impacts through locating the project must be documented and justified in the BDAR.

Several options for avoiding impacts to native vegetation and habitat were considered during the project planning phase, a Biodiversity Stewardship (BS) site along the western edge of the property is still under consideration. The subject land has however, been revised (BDAR V3.0) to impact significantly less vegetation. The revised subject land largely avoids the area of highest conservation value on the site, where the native vegetation is mapped as River-flat Eucalypt Forest EEC with a vegetation integrity score of 63.7/100. It also avoids the majority of the hollow bearing trees and the 29 individuals of *G. juniperina* subsp. *juniperina*, a vulnerable species. The proposal layout overlaid over the validated vegetation is shown in **Figure 5.1**. As such, the proposal has largely avoided impacts to the native vegetation within the subject land.

A large portion of native vegetation has been retained within the west of the study area, which may still be considered as potential BS site. This would offset clearing of Rough-barked Apple – Forest Red Gum grassy woodland (Alluvial Woodland). There is also opportunity during future planning for a large part of the riparian corridor to be revegetated beyond the 40 m Vegetated Riparian Zone requirement of the NSW *Water Management Act 2000* (WM Act).

The remainder of the subject land consists of vegetation that is mostly isolated, in small patches and is in a poor condition, resulting in reduced viability, particularly when considering the current adjacent (and proposed future) adjacent industrial land uses. Furthermore, most of the impacts will be incurred to cleared land 'exotic grassland' (74.36 ha, or approximately 85.70 % of the subject land).

5.2 Avoiding and minimising prescribed biodiversity impacts during project planning

As described in **Section 2.1.3**, no prescribed biodiversity impacts are anticipated from the proposed development.

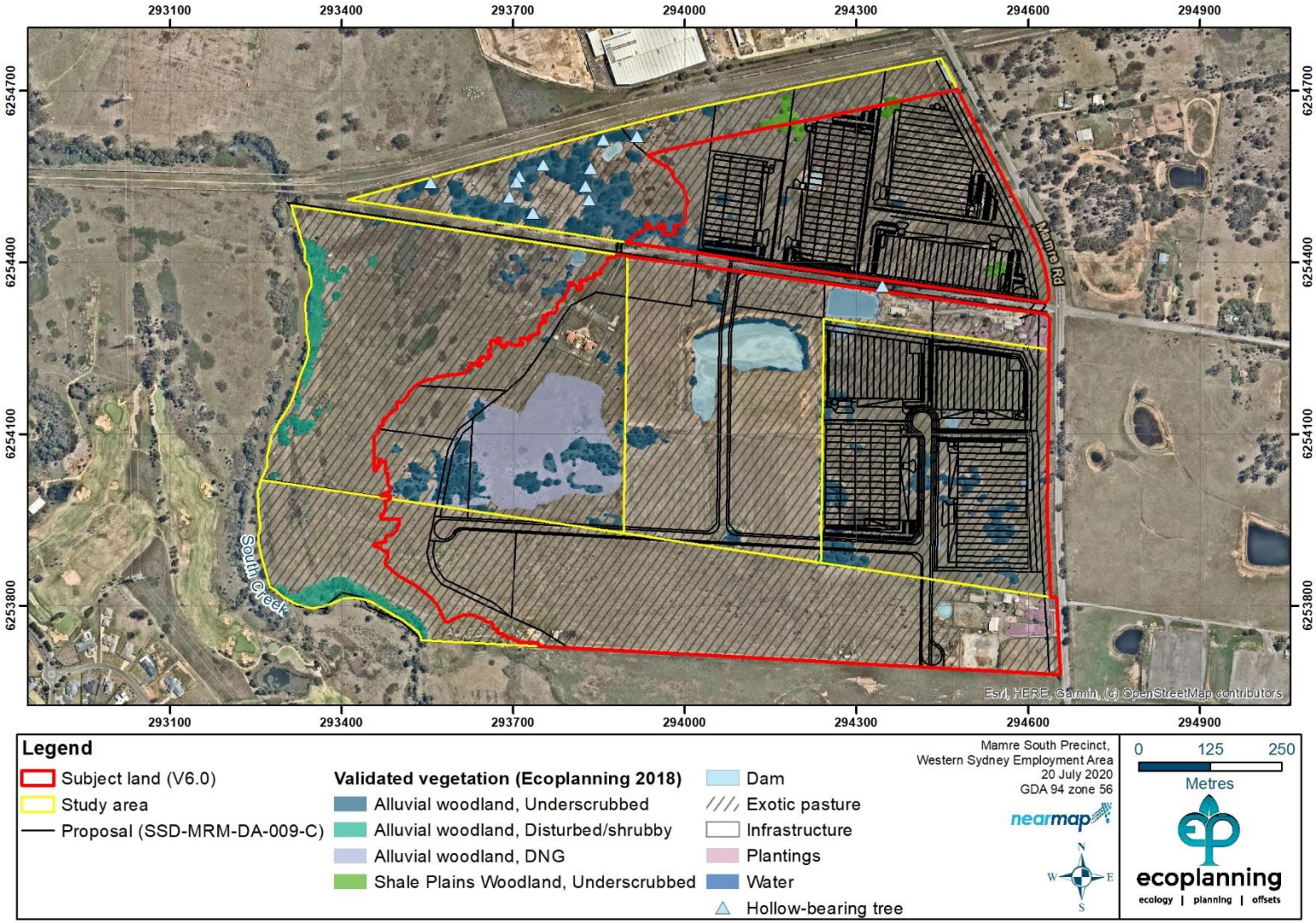

Figure 5.1: Field validated vegetation (Ecoplanning 2018) and proposed footprint.

6. Assessing and offsetting impacts

6.1 Assessment of impacts

6.1.1 Assessing impacts to native vegetation and habitat

Impacts to native vegetation are anticipated through the direct clearing of 9.15 ha of native vegetation within the subject land. This comprises 8.90 ha of Alluvial Woodland, with 4.86 ha in an 'underscrubbed' condition and 4.04 ha as DNG. An additional 0.25 ha of Shale Plains Woodland in an 'underscrubbed' condition will also be cleared. The Alluvial Woodland is synonymous with the TEC River-flat Eucalypt Forest and the Shale Plains Woodland is synonymous with the TEC Cumberland Plain Woodland. The direct clearing and subsequent development of the subject land would represent a permanent impact, or loss, of this native vegetation and habitat. A further 2.41 ha of farm dams, 0.72 ha of exotic plantings and 74.06 ha of cleared land 'exotic grassland' including only occasional native species would also be impacted by the project.

6.1.2 Assessing indirect impacts on native vegetation and habitat

It is difficult to quantify indirect impacts associated with the project, but these may include impacts such as noise and/or erosion associated with the construction phase of the project. The location of the subject lands adjacent to existing urban infrastructure and supporting highly modified native vegetation is considered unlikely to have inadvertent impacts on adjacent areas of native vegetation and habitat. Given the highly modified nature of the subject land and broader locality, and its proximity to industrial land use and large urban roads, the project is considered unlikely to reduce viability of any adjacent native vegetation or habitat due to edge effects, noise dust or light spill, or disturbance to breeding habitats. Further, within adjacent areas of native vegetation and habitat, the project is considered unlikely to cause any increase in trampling of flora, rubbish dumping, firewood or bush rock collection or introduce any pests, weeds or pathogens to the adjacent areas of native vegetation and habitat.

Measures to mitigate and manage indirect impacts are discussed in **Section 6.3**.

6.2 Assessing prescribed biodiversity impacts

As described in **Section 2.1.3**, no prescribed biodiversity impacts are anticipated from the proposed development.

6.3 Mitigating and managing impacts on biodiversity values

As described above, most of the impacts will be incurred to cleared land 'exotic grassland'. Several measures will be implemented to reduce impacts where possible, such as appropriate pre-clearance protocols and a CEMP. Details are provided below.

6.3.1 Pre-clearance protocols

Several non-threatened fauna species such as birds, arboreal mammals and amphibians are likely to be present at the development site. Appropriate pre-clearance protocols including dam dewatering protocols will need to be put in place at the time of construction to avoid and

mitigate any potential harm or injury to these individuals. These protocols are discussed below and should be included as a component of the Construction Environmental Management Plan (CEMP).

On-site supervision of habitat tree felling and relocation of fauna

An ecologist will be required to be present onsite when felling habitat trees (hollow bearing and/or stag trees). Hollows should be inspected from an elevated work platform or cameras mounted to telescopic poles, prior to felling operations. Any fauna occupying a hollow during felling operations will be relocated (where feasible) to bushland immediately adjacent to the site.

The ecologist will need to work closely with the plant operators to identify each hollow and to stop work if an animal is observed and requires rescue. The ecologist will encourage any fauna species that may be present to move from site or if considered necessary capture, store and actively relocate them to another area. All habitat trees should be left over night to give species that are not possible to handle, further opportunity to relocate. Advice on appropriate actions for individuals that continue to utilise habitat of trees should be provided by the onsite ecologist. Any variation to this protocol must be approved by onsite ecologist.

The ecologist will ensure that any injured animals receive the appropriate levels of care. The nearest veterinary clinics should be contacted prior to the works beginning to ensure that they have the capabilities to care for injured native animals. Qualified wildlife carer organisations (e.g. WIRES) should also be identified and contacted if required.

Soft felling operations

Soft felling of hollow bearing trees is encouraged to avoid unnecessary injuries to undetected fauna. This process involves an excavator or bulldozer softly 'nudging' trees before felling, in order to encourage any fauna that may be occupying a hollow or crevice to vacate the tree prior to being felled. Once the tree has been felled, the ecologist will undertake further searches of the tree for any animal that has not fled or is unable to flee. As above, fauna will be relocated to bushland adjacent to the site, or if required, veterinary clinics and/or qualified wildlife carers contacted.

6.3.2 Construction Environmental Management Plan (CEMP)

To avoid potential indirect offsite impact during construction, an appropriate erosion and sedimentation control plan should be in place following best practice protocols such as Landcom (2004). It is recommended that this is included in a site specific Construction Environmental Management Plan (CEMP), prior to any construction works taking place.

The CEMP will be required to span the pre, during and post-construction period, and will include the above pre-clearance and fauna management protocols.

6.3.3 Waterfront land

The subject land largely avoids waterfront land. However, the southern corner of the subject land will fall within 40m of south creek. The proposal includes a 40 m riparian zone reserve within this area with no proposed impacts. Any works on waterfront land should be carried out in accordance with the Guidelines for Controlled Activities (NRAR 2020).

6.4 Adaptive management for uncertain impacts

Excluding the need for a CEMP, no additional adaptive management measures are proposed.

6.5 Thresholds for the assessment and offsetting of impacts of development

6.5.1 Serious and Irreversible impacts

The Guidance to assist a decision-maker to determine a serious and irreversible impact (OEH 2017b) was used to determine whether an impact on biodiversity values is likely to be a Serious and Irreversible Impact. The guide (OEH 2017b) lists in Appendix 3 the ecological communities that have potential to meet the SAII principles and criteria. One potential entity that may trigger Serious and Irreversible Impacts (SAII) will be impacted by the proposal, being impacts to the Cumberland Plain Woodland CEEC (PCT 849). **Appendix B** is a list of potential species that meet the SAII principles and criteria. Targeted surveys for Green and Golden Bell Frog have been undertaken which determined that they are unlikely to occur within the study area.

All serious and irreversible impact assessments for ecological communities and threatened species or populations and the targeted surveys for candidate species have been assessed against Section 10.2.2 and 10.2.3 of the BAM. One of the ecological communities identified as being impacted by the project, Cumberland Plain Woodland is identified as a potential SAII entity due to a rapid rate of decline and a very small population size. The following section addresses Section 10.2.2 of the BAM and provides additional information about the impacts of the proposal on Cumberland Plain Woodland.

Cumberland Plain Woodland SAII Assessment

Section 10.2.2.1 requires, '*the assessor to provide the following further information in the BDAR or BCAR about potential ecological communities*:

(a) the action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII

The actions and measures taken to avoid direct and indirect impacts on Cumberland Plain Woodland, and native vegetation more broadly, are outlined in **Section 5** of this report. Specifically, the proposal has been located within an area which predominately supports previously cleared areas containing exotic grasslands and smaller areas of degraded vegetation including underscrubbed native vegetation. The impacts associated with the project, including the clearing of native vegetation, have been situated within specific areas in order to avoid impacts to better condition, largely intact and more connected areas of native vegetation.

(b) the area (ha) and condition of the TEC to be impacted directly and indirectly by the proposed development. The condition of the TEC is to be represented by the vegetation integrity score for each vegetation zone

The area of Cumberland Plain Woodland which would be impacted by the proposal is 0.25 ha which was in an underscrubbed condition. This vegetation zone was heavily degraded as represented in the VI Score calculated for this zone (8.7/100, **Table 6.1)**. In particular, the composition (number of native species present within each growth form) and structure (the

foliage cover of growth forms) of the Cumberland Plain Woodland within the subject land has been heavily modified by a long history of disturbance including previous clearing and grazing.

Table 6.1: Vegetation integrity scores for Cumberland Plain Woodland.

Plant Community Types (PCTs)	Vegetation zones	Area (ha)	Vegetation Integrity (VI) Score			
			Composition	Structure	function	Final VIS
PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats	Underscrub bed	0.25	15.7	2.8	15	8.7
	Total	**0.25**	**-**	**-**	**-**	**-**

(c) a description of the extent to which the impact exceeds the threshold for the potential entity that is specified in the Guidance to assist a decision-maker to determine a serious and irreversible impact

No assessment against impact thresholds for Cumberland Plain Woodland, in accordance with Section 10.2.2.1 (c) of the BAM, can be undertaken as no thresholds have been identified for this ecological community.

(d) the extent and overall condition of the potential TEC within an area of 1000ha, and then 10,000ha, surrounding the proposed development footprint

In accordance with Section 10.2.2.1 (d) of the BAM, the extent and overall condition of Cumberland Plain within an area of 1,000 ha and 10,000 ha, surrounding the subject land has been calculated. The extent of Cumberland Plain Woodland was calculated using polygons mapped as part of the native vegetation mapping of the Western Cumberland Plain (OEH 2015). A total of 957.34 ha of Cumberland Plain Woodland has been mapped within the 10,000 ha surrounding the subject land with 95.15 ha mapped within the 1,000 ha surrounding the subject land. This represents 53.81% and 68.58% of the total native vegetation mapped within the 10,000 ha and 1,000 ha assessment circles, respectively (**Figure 6.1; Table 6.2**). The proposal would result in a 0.26 % decrease in the area of Cumberland Plain Woodland within the 1,000 ha surrounding the subject land and a 0.03 % decrease within the 10,000 ha surrounding the subject land.

It is noted that for the vegetation mapping of the Western Cumberland Plain (OEH 2015), areas of native vegetation less than 0.5 ha were generally excluded. Further, this analysis (OEH 2015) did not included an assessment of Cumberland Plain Woodland found in a derived state, i.e., regrowth without a tree canopy. Consequently, the area of Cumberland Plain Woodland calculated for the 1,000 ha and 10,000 ha surrounding the subject land may represent an underestimation of the total area of the ecological community.

The overall condition of the Cumberland Plain woodland surrounding the subject land is summarised in **Table 6.2**. Generally, more intact areas of Cumberland Plain Woodland (areas with condition code of 'A' and 'B' [OEH 2015]) accounted for 52.29 % of the Cumberland Plain within the 10,000 ha assessment circle and 52.08 % of the Cumberland Plain Woodland within the 1,000 ha assessment circle.

(e) an estimate of the extant area and overall condition of the potential TEC remaining in the IBRA subregion before and after the impact of the proposed development has been taken into consideration

(f) an estimate of the area of the potential TEC that is in the reserve system within the IBRA region and the IBRA subregion

In accordance with sections 10.2.2.1(e) and (f) of the BAM, the extent of Cumberland Plain within the Cumberland IBRA subregion and within the reserve system is presented in **Table 6.3**. As part of the *Biodiversity Investment Opportunities Map* (OEH 2015b), the extent of Cumberland Plain Woodland within and outside NPWS estate was calculated for the 'Cumberland' IBRA subregion (extent of two PCTs which together comprise Cumberland Plain Woodland was calculated). A total of 22,503.28 ha of Cumberland Plain Woodland was identified within the Cumberland IBRA subregion with 1,228.13 ha (5.46 %) occurring within NPWS estate. The distribution of Cumberland Plain Woodland is generally confined to the Cumberland IBRA subregion with limited occurrences within adjoining subregions.

(g) the development, clearing or biodiversity certification proposal's impact on:

(i) abiotic factors critical to the long-term survival of the potential TEC; for example, how much the impact will lead to a reduction of groundwater levels or the substantial alteration of surface water patterns

(ii) characteristic and functionally important species through impacts such as, but not limited to, inappropriate fire/flooding regimes, removal of understorey species or harvesting of plants

(iii) the quality and integrity of an occurrence of the potential TEC through threats and indirect impacts including, but not limited to, assisting invasive flora and fauna species to become established or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants which may harm or inhibit growth of species in the potential TEC

The proposal would result in direct removal of 0.25 ha of Cumberland Plain Woodland comprising previously underscrubbed and grazed vegetation. The proposed works would not impact on abiotic factors (including groundwater, fire/flooding regimes, vegetation harvesting etc.) which would threaten any patches of the ecological community outside the subject land. Additionally, the proposal would not alter any functionally important species. The proposal would not result in any reduction in the quality or integrity of any patches of the ecological community outside the subject land through impacts such as assisting invasive flora and fauna species to become established or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants.

(h) direct or indirect fragmentation and isolation of an important area of the potential TEC

The proposal would impact upon relatively small and degraded stands of Cumberland Plain Woodland which have been fragmented and isolated by the adjoining roads and Sydney Water Pipeline. The proposal would result in a small increase in the fragmentation of the ecological community (through clearing of a small stand of the community) but would not isolate an important area of the ecological community.

(i) the measures proposed to contribute to the recovery of the potential TEC in the IBRA subregion.

Section 10.2.2.1 (i) of the BAM requires identification of measures proposed to contribute to the recovery of SAII candidate entity in the IBRA subregion. This proposal is located on the perimeter in areas of low conservation or recreation value and close to established

employment areas and the metropolitan road network. The Cumberland Plain Woodland impacted within the subject land was in very poor condition (8.7 VI score), with minimal habitat connectivity and does not require offsets under the BAM (see **Section 6.5.2**). Cumberland Plain Woodland more broadly in the IBRA subregion is managed under the Cumberland Plain Recovery Plan (ECCW 2010) and the Cumberland Plain Conservation Plan which is currently under development (DPIE 2020c).

Table 6.2: Area of Cumberland Plain Woodland surrounding the subject land.

Plant Community Type	Condition / disturbance code	Area (ha)	
		10,000 ha assessment circle	1,000 ha assessment circle
849: Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (OEH 2015)	A	426.61	49.40
	B	48.86	0.15
	Cmi	9.78	0.00
	TX	333.78	35.67
	TXR	15.77	0.00
850: Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (OEH 2015)	A	14.96	0.00
	B	10.12	0.00
	Cmi	3.72	0.00
	TX	50.30	9.93
	TXR	43.44	0.00
Total		**915.29***	**95.15***

* Rounding errors may apply

Table 6.3: Area of Cumberland Plain Woodland within the Cumberland IBRA subregion (OEH 2015, OEH 2016).

Plant Community Type	Area (ha)		Total
	Within NPWS estate	Outside NPWS estate	
849: Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	1,026.10	12,500.78	**13,541.49**
850: Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	177.27	8,774.37	**8,961.79**
Cumberland Plain Woodland -Total	**1,203.37**	**21,275.15**	**22,503.28**

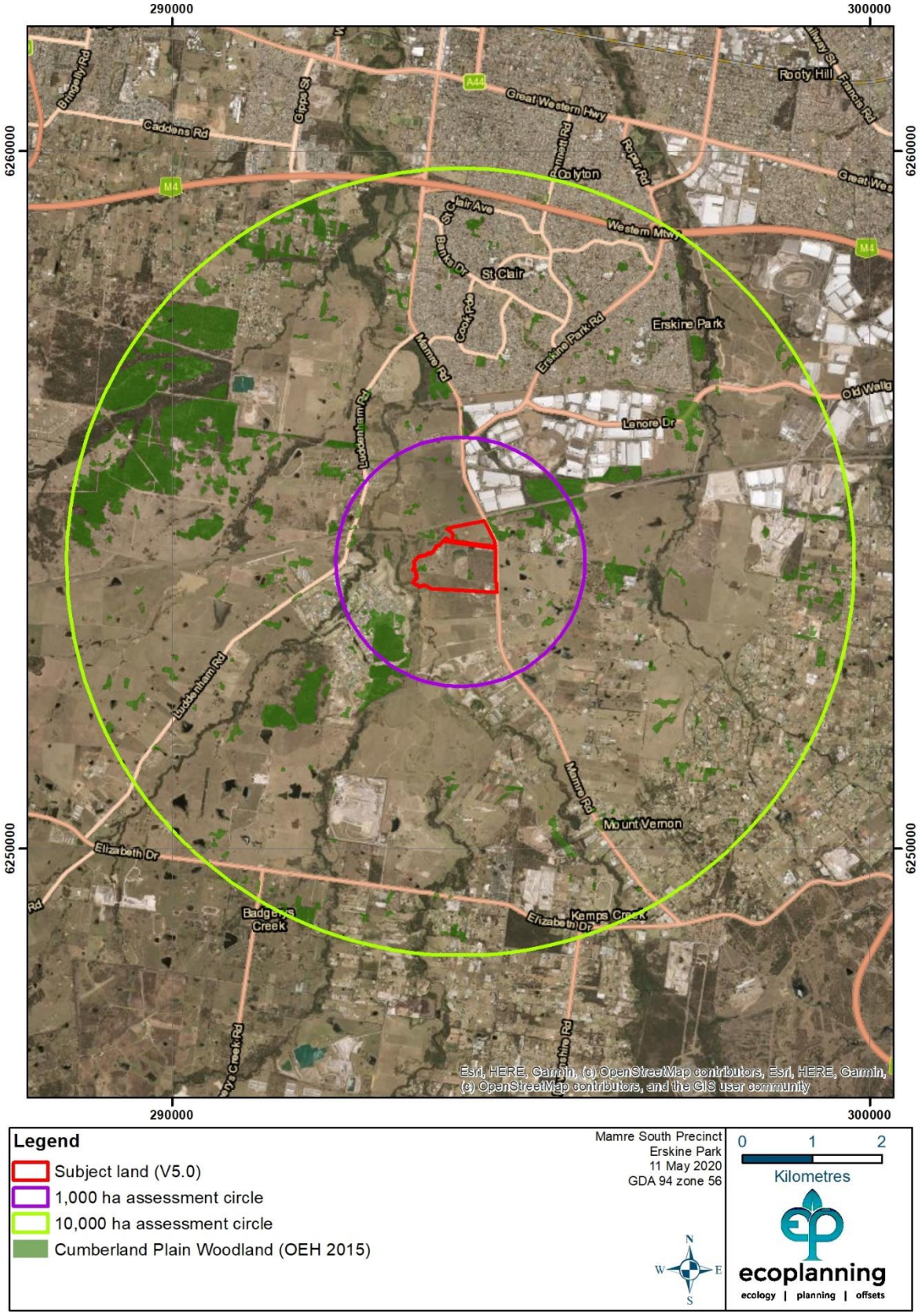

Figure 6.1: Mapped extent of Cumberland Plain Woodland surrounding the subject land (OEH 2015).

6.5.2 Impacts which require an offset

Section 10.3.1 of the BAM outlines that the following vegetation zones require offsets:

- vegetation zones that have a vegetation integrity score ≥15 where the PCT is representative of an endangered or critically endangered ecological community.
- a vegetation zone that has a vegetation integrity score of ≥17 where the PCT is associated with threatened species habitat or is a vulnerable ecological community.
- a vegetation zone that has a vegetation integrity score ≥20.

Impacts associated with one of the two vegetation zones for the project will require offset under the BAM. The areas of Vegetation Zone 2: PCT 849 (Shale Plains Woodland) mapped as 'underscrubbed' do not require an offset as the vegetation integrity score for this vegetation zone was 8.7.

6.5.3 Impacts that do not require further assessment

As described in s31.1.3 of the BAM, impacts to non-native vegetation (cleared land, exotic grassland and built structures, and planted non-indigenous trees) were not considered beyond s5.4 or for s6.2 (including 6.2.1.4) of the BAM and did not require an offset. Hence, they have not been assessed here.

As outlined above, impacts to those areas of PCT 849 (Shale Plains Woodland) mapped as 'underscrubbed' do not require offsetting (**Table 6.4**), due to the vegetation integrity score being less than 15.

Table 6.4: Vegetation zones which do not require offsets.

Veg zone number	Plant community type	Condition class	Area impacted (ha)	Veg integrity score
Vegetation zones which do not require impacts to be offset				
3	PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Underscrubbed	0.25	8.7

6.6 Response to submissions

6.6.1 SEPP WSEA - Clauses

Several additional clauses within SEPP WSEA are required to be addressed in this BDAR. The clauses to be addressed specifically relate to native vegetation and are summarised in **Table 6.5**.

Table 6.5: SEPP WSEA additional considerations

SEPP WSEA	Ecoplanning response
A person must not clear native vegetation on land in Zone E2 Environmental Conservation or Zone RE1 Public Recreation without development consent.	No impacts are proposed within the E2 zoned land in the study area. The impacts to the RE1 public recreation are addressed in this BDAR and will be offset under the BC Act.
Development consent under this clause is not to be granted unless the consent authority is satisfied of the following in relation to the disturbance of native vegetation caused by the clearing of the vegetation— a. that there is no reasonable alternative available to the disturbance of the native vegetation, b. that any impact of the proposed clearing on biodiversity values is avoided or minimised, c. that the disturbance of the native vegetation will not increase salinity, d. that native vegetation inadvertently disturbed for the purposes of construction will be re-instated where possible on completion of construction, e. that the loss of remnant native vegetation caused by the disturbance will be compensated by revegetation on or near the land to avoid a net loss of remnant native vegetation, f. that the clearing of the vegetation is unlikely to cause or increase soil erosion, salination, land slip, flooding, pollution or other adverse land or water impacts.	a. Avoidance and mitigation measures are addressed in **Section 5** of this BDAR. b. Avoidance and mitigation measures are addressed in **Section 5** of this BDAR. c. The impacts to native vegetation are addressed in this BDAR and will be offset under the BC Act. Increases in salinity are not assessed in this BDAR, however are considered unlikely. d. The native vegetation outside of the subject land will be protected through the implementation of a CEMP (See Ecoplanning 2020). e. Impacts to native vegetation will be offset under the BAM, addressed in the BDAR. Additionally, the riparian corridor of south creek with be restored (See Ecoplanning 2020). f. Soil erosion, salination, land slip, flooding, pollution or other adverse land or water impacts will be managed though a CEMP (See Ecoplanning 2020).
The consent authority must, when determining a development application in respect of the clearing of native vegetation on land zoned E2 Environmental Conservation have regard to the objectives for development in that zone.	Within the study area the E2 zone land is located on the western boundary, associated with South Creek. No impacts are proposed within this zone. Additionally, a 40 m vegetated riparian zone will be restored as part of the Flora and Fauna Management Plan (See Ecoplanning 2020).
This clause does not apply to or in respect of action required or authorised to be done by or under the *Electricity Supply Act 1995*, the *Roads Act 1993*, the *Surveying and Spatial Information Act 2002* or the *Sydney Water Act 1994*	Noted

6.6.2 Penrith City Council

Additional comments regarding biodiversity considerations have been provided by Penrith City Council in a letter dated 15 July 2020 (Penrith City Council 2020). The biodiversity considerations addressed by Penrith City Council have been summarised in **Table 6.6**.

Table 6.6: Response to Penrith City Council (2020)

Penrith City Council (2020)	Ecoplanning response
While greater efforts to avoid and minimise have been demonstrated, the proposal could further protect the biodiversity values of the subject site through integrated protection of existing native vegetation within the proposed lots where significant benching and earthworks is not required.	Ecoplanning has only assessed the impacts from the provided layout.
Justification for the removal of the Southern Myotis from the assessment also does not seem to be appropriate. It is suggested that this species be included in the assessment.	Myotis is considered unlikely to occur on site. Justification for this is provided in **Section 4.3.2**, of this BDAR with Microbat survey results have been provided in **Appendix D**.

7. Final Credit Calculations

7.1 Credit calculations and classes

7.1.1 Ecosystem credits

The ecosystem credits required to offset the proposal are provided in **Table 7.1** and **Appendix D**. A total of **230** ecosystem credits are required to offset the development.

The following offset rules apply:

- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (including PCT's 686, 828, 835, 839, 941, 971, 1064, 1108, 1109, 1212, 1228, 1232, 1293, 1318, 1326, 1386, 1522, 1556, 1594, 1618, 1646, 1648, 1720, 1794, 1800)
- In the following subregions - Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometres of the outer edge of the impacted site
- Containing hollow bearing trees – yes

The total cost of ecosystem credits, should the Biodiversity Conservation Trust (BCT) be used to offset the impacts, are currently (17 July 2020) estimated to be **$4,350,445.00** (excluding GST). Details are provided in **Table 7.2**. Note that the credit prices are revised quarterly. The proponent may also wish to purchase credits available on the market or may wish to pursue other offset sites as required. A final decision on how the credits will be secured will be made as the project progresses.

Table 7.1: Ecosystem credits summary.

Veg zone number	Plant community type	Condition class	Total impact (ha)	Total credits required
1	PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Underscrubbed	4.99	159
2		DNG	4.04	71
3	PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Underscrubbed	0.25	0
		Totals	***9.28***	***230***

Table 7.2: Ecosystem credits price for payment into the Biodiversity Conservation Fund.

Plant community type	Price per credit[1]	Total credits	Total credits price (ex GST)[2]
PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	$18,914.98	**230**	**$4,350,445.00**

[1] includes weighting and administration fees

[2] Baseline credit price and price per credit per BAM Public Calculator, 17July 2020

7.1.2 Species credits

No species credits are required for *Grevillea juniperina* subsp. *juniperina* which occurs within the study area and will not be impacted by the proposal. No threatened flora and fauna requiring species credits were found on site during targeted surveys.

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Appendix A: Plot data collected

Plot No.	PCT	Area (ha)	Patch size	Condition class	Zone	Easting	Northing	Bearing
1	835	4.99	101	Underscrubbed	56	293842	6254472	0
2	835	4.99	101	Underscrubbed	56	293737	6254552	223
3	835	4.04	4	DNG	56	293707	6254043	55
4	835	4.04	4	DNG	56	293758	6254123	30
5	Exotic grassland – 835	74.36	101	Exotic	56	293681	6254239	57
6	849	0.25	1	Underscrubbed	56	294166	6254638	90
7	835	4.99	101	Underscrubbed	56	293842	6254053	120

Plot No.	Composition					
	Tree	Shrub	Grass	Forb	Fern	Other
1	1	1	4	2	1	0
2	2	1	5	1	1	0
3	1	0	10	3	0	0
4	0	0	8	3	0	0
5	0	0	5	2	0	0
6	0	1	4	1	0	0
7	1	2	5	5	1	3

Plot No.	Structure					
	Tree	Shrub	Grass	Forb	Fern	Other
1	25.0	3.0	96.1	0.2	0.1	0.0
2	9.0	1.0	82.6	0.1	0.1	0.0
3	0.2	0.0	82.7	0.3	0.0	0.0
4	0.0	0.0	85.7	0.3	0.0	0.0
5	0.0	0.0	0.9	1.1	0.0	0.0
6	0.0	5.0	0.4	0.1	0.0	0.0
7	20.0	35.0	75.4	0.5	0.1	0.3

Plot No.	Function										
	Large trees	Hollow trees	Litter cover	Fallen logs	Tree stem 5-10	Tree stem 10-20	Tree stem 20-30	Tree stem 30-50	Tree stem 50-80	Tree regen	High threat exotic
1	1	0	31.0	0.0	1	1	1	1	1	1	3.7
2	1	1	27.0	2.0	0	0	1	0	1	1	3.2
3	0	0	20.0	0.0	0	0	0	0	0	1	10.5
4	0	0	9.0	0.0	0	0	0	0	0	1	14.1
5	0	0	31.0	0.0	0	0	0	0	0	0	88.1
6	0	0	47.0	0.0	0	0	0	0	0	0	35.3
7	2	0	39	0.0	1	0	1	0	2	1	1.4

Appendix B: Likelihood Table

Scientific Name Common Name	Legal status	Number of records	Closest record and date	Most recent and proximity	Likelihood of occurrence	
					Prior to field assessment	Post field assessment
KINGDOM: Animalia; CLASS: Aves						
Apus pacificus Fork-tailed Swift	EPBC Act: C, J, K	2	3.0 km (13/07/2005)	3.0 km (13/07/2005)	Low	Low
Artamus cyanopterus Dusky Woodswallow	BC Act: V	10	0.78 km (16/03/2018)	0.78 km (16/03/2018)	Moderate	Moderate
Callecephalon fimbriatum Gang-gang Cockatoo	BC Act: V	3	1.4 km (27/07/2018)	1.4 km (27/07/2018)		
Calyptorhynhus lathami Glossy Black-Cockatoo	BC Act: V	2	1.8 km (27/07/2018)	1.8 km (27/07/2018)		
Chthonicola sagittata Speckled Warbler	BC Act: V	5	4.4 km (20/04/2006)	3.4 km (20/04/2006)	Low	Low
Daphoenositta chrysoptera Varied Sittella	BC Act: V	5	4.3 km (2/08/2002)	4.9 km (21/04/2006)	Low	Low
Gallinago hardwickii Latham's Snipe	EPBC Act: C, J, K	4	1.5 km (22/02/2008)	3.5 km (25/10/2018)	Low	Low
Glossopsitta pusilla Little lorikeet	BC Act: V	2	3.6 km (27/07/2018)	3.9 km (26/02/2019)	Low	Low
Haliaeetus leucogaster White-bellied Sea-Eagle	BC Act: V EPBC Act: C	9	1.8 km (15/03/2019)	1.8 km (15/03/2019)	Low	Low
Hieraaetus morphnoides Little Eagle	BC Act: V	8	0.65 km (27/07/2018)	0.65 km (27/07/2018)	Low	Low

Scientific Name Common Name	Legal status	Number of records	Closest record and date	Most recent and proximity	Likelihood of occurrence	
					Prior to field assessment	Post field assessment
Ixobrychus flavicollis Black Bittern	BC Act: V	1	4.4 km (15/06/2016)	4.4 km (15/06/2016)	Low	Low
Lophoictinia isura Square-tailed Kite	BC Act: V	6	1.4 km (27/07/2018)	1.4 km (27/07/2018)		
Ninox strenua Powerful Owl	BC Act: V	2	3.8 km (25/05/2012)	4.2 km (17/07/2013)	Low	Low
Rostratula australis Australian Painted Snipe	BC Act: E1 EPBC Act: E	1	2.2 km (28/01/2015)	2.2 km (28/01/2015)	Low	Low
Stagonopleura guttata Diamond Firetail	BC Act: V	1	2.2 km (27/03/2012)	2.2 km (27/03/2012)	Low	Not present
Stictonetta naevosa Freckled Duck	BC Act: V	1	4.2 km (25/10/2018)	4.2 km (25/10/2018)	Low	Low
Tringa nebularia Common Greenshank	EPBC Act: C, J, K	1	2.9 km (21/04/2006)	2.9 km (21/04/2006)	Low	Low
Tyto novaehollandiae Masked Owl	BC Act: V	1	2.7 km (27/10/2016)	2.7 km (27/10/2016)	Low	Low
KINGDOM: Animalia; CLASS: Gastropoda						
Meridolum corneovirens Cumberland Plain Land Snail	BC Act: E1	139	0.62 km (28/05/2000)	4.9 km (15/03/2019)	High	Moderate
KINGDOM: Animalia; CLASS: Mammalia						
Falsistrellus tasmaniensis Eastern False Pipistrelle	BC Act: V	1	3.4 km (16/10/2001)	3.4 km (16/10/2001)	Moderate	Moderate
Micronomus norfolkensis *Eastern Coastal Free-tailed Bat*	BC Act: V	9	1.9 km (17/11/2009)	4.5 km (30/09/2018)	Moderate	Moderate

Scientific Name Common Name	Legal status	Number of records	Closest record and date	Most recent and proximity	Likelihood of occurrence	
					Prior to field assessment	Post field assessment
Miniopterus australis Little Bent-winged Bat	BC Act: V	2	2.7 km (27/10/2018)	3.4 km (27/10/2018)	Moderate	Moderate
Miniopterus orianae oceanensis Large Bent-winged Bat	BC Act: V	4	1.6 km (26/06/2016)	4.5 km (30/09/2018)	Low	Low
Myotis macropus Southern Myotis	BC Act: V	14	1.2 km (18/02/2014)	4.9 km (27/07/2018)	Moderate	Moderate
Petaurus australis Yellow-bellied Glider	BC Act: V	1	4.9 km (26/09/2018)	4.9 km (26/09/2018)		
Pteropus poliocephalus Grey-headed Flying-fox	BC Act: V, EPBC Act: V	35	2.4 km (8/01/2018)	4.5 km (30/09/2018)	Moderate	Moderate
Saccolaimus flaviventris Yellow-bellied Sheathtail-Bat	BC Act: V	1	4.5 km (30/09/2018)	4.5 km (30/09/2018)		
Scoteanax rueppellii Greater Broad-nosed Bat	BC Act: V	5	1.2 km (18/02/2014)	4.5 km (30/09/2018)	Low	Low
KINGDOM: Plantae						
Acacia pubescens Downy Wattle	BC Act: V EPBC Act: V	1	4.6 km (11/04/2013)	4.6 km (11/04/2013)	Low	Not present
Dillwynia tenuifolia	BC Act: V	630	0.99 km (22/02/2018)	3.7 km (29/08/2018)	Moderate	Low
Dillwynia tenuifolia Dillwynia tenuifolia, Kemps Creek	BC Act: E2, V	41	4.6 km (22/05/2018)	4.6 km (31/05/2018)	Moderate	Low
Grevillea juniperina subsp. juniperina Juniper-leaved Grevillea	EPBC Act: V	153	0.12 km (30/04/2018)	3.9 km (21/03/2019)	High	Recent Record

Scientific Name **Common Name**	**Legal status**	**Number of records**	**Closest record and date**	**Most recent and proximity**	**Likelihood of occurrence**	
					Prior to field assessment	**Post field assessment**
Grevillea parviflora subsp. parviflora Small-flower Grevillea	BC Act: V EPBC Act: V	7	4.7 km (3/05/2001)	4.9 km (6/12/2018)	Low	Not present
Isotoma fluviatilis subsp. *fluviatilis*	EPBC Act: X	7	0.41 km (18/07/2002)	0.41 km (18/07/2002)	Low	Not present
Marsdenia viridiflora subsp. viridiflora Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	EPBC Act: E2	18	3.7 km (29/10/2010)	4.2 km (7/05/2015)	Moderate	Low
Persoonia nutans Nodding Geebung	BC Act: E1 EPBC Act: E	3	3.8 km (9/11/2018)	3.8 km (9/11/2018)	Low	Not present
Pimelea spicata Spiked Rice-flower	BC Act: E1 EPBC Act: E	1	1.9 km (31/05/1999)	1.9 km (31/05/1999)	Low	Not present
Pultenaea parviflora	BC Act: V EPBC Act: E1	94	1.7 km (16/02/2016)	3.8 km (9/11/2018)	High	Low

Unless other stated, text is taken from the DPIE Threatened Species (http://www.environment.nsw.gov.au/threatenedspecies/); Legal Status codes from the Atlas of NSW Wildlife: V = Vulnerable, E = Endangered, E2 = Endangered Population, E4A = Critically Endangered, C = China and Australia Migratory Bird Agreement (CAMBA), J = Japan and Australia Migratory Bird Agreement (JAMBA); K = Republic of Korea Migratory Bird Agreement (ROKAMBA), BC Act = *Biodiversity Conservation Act 2016,* EPBC Act = Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

Appendix C: Flora and fauna species inventories

Flora

Family	Scientific Name	Common name	Native/Exotic	Form	BAM01		BAM02		BAM03		BAM04		BAM05		BAM06		BAM07	
					C	A	C	A	C	A	C	A	C	A	C	A	C	A
Alliaceae	*Nothoscordum gracile*	Onion Weed	Exotic	F														
Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed	Native	F														
Anthericaceae	*Tricoryne elatior*	Yellow Autumn-lily	Native	F					0.1	10	0.1	50	0.1	2				
Apiaceae	*Centella asiatica*	Indian Pennywort	Native	F			0.1	20			0.1	5	1	50				
Apiaceae	*Foeniculum vulgare*	Fennel	Exotic	F														
Apocynaceae	*Araujia sericifera*	Moth Vine	Exotic	L													0.1	5
Asteraceae	*Bidens subalternans*	Greater Beggar's Ticks	Exotic	F													5	100
Asteraceae	*Cirsium vulgare*	Spear Thistle	Exotic	F														
Asteraceae	*Conyza* sp.		Exotic	F	0.1	1			0.1	5			0.1	1				
Asteraceae	*Gamochaeta* sp.		Exotic	F					0.1	1								
Asteraceae	*Hypochaeris radicata*	Flatweed	Exotic	F	0.1	20			1	200	1.5	200	3	200				
Asteraceae	*Senecio madagascariensis*	Fireweed	Exotic	F	0.1	5	0.1	2			0.1	1	0.1	5	0.1	10	0.1	10
Asteraceae	*Senecio pterophorus*		Exotic	F	0.1	1												
Asteraceae	*Senecio quadridentatus*	Cotton Fireweed	Native	F														
Cactaceae	*Opuntia sp.*		Exotic	F														

Family	Scientific Name	Common name	Native/Exotic	Form	BAM01		BAM02		BAM03		BAM04		BAM05		BAM06		BAM07	
					C	A	C	A	C	A	C	A	C	A	C	A	C	A
Campanulaceae	*Wahlenbergia gracilis*	Tufted Bluebell	Native	F														
Casuarinaceae	*Casuarina glauca*	Swamp Oak	Native	T														
Chenopodiaceae	*Einadia nutans*	Climbing Saltbush	Native	F														
Chenopodiaceae	*Einadia trigonos*	Fishweed	Native	F													0.1	5
Commelinaceae	*Commelina cyanea*		Native	F	0.1	50									0.1	5	0.1	10
Convolvulaceae	*Convolvulus erubescens*	Blushing Bindweed	Native	L														
Convolvulaceae	*Dichondra repens*	Kidney Weed	Native	F													0.1	10
Cyperaceae	*Carex appressa*	Tall Sedge	Native	V	15	100	65	1000			0.1	1						
Cyperaceae	*Carex inversa*		Native	V											0.1	10		
Cyperaceae	*Cyperus spp.*		Exotic	F											0.1	1		
Fabaceae – Faboideae	*Desmodium varians*	Slender Tick-trefoil	Native	F													0.1	20
Fabaceae – Faboideae	*Glycine clandestine*		Native	F													0.1	10
Fabaceae – Faboideae	*Glycine tabacina*		Native	F													0.1	2
Fabaceae - Mimosoideae	*Acacia parramattensis*	Parramatta Wattle	Native	S/T														
Hypericaceae	*Hypericum gramineum*	Small St. John's Wort	Native	F							0.1	1						
Hypoxidaceae	*Hypoxis hygrometrica*	Golden Weather-grass	Native	F														
Juncaceae	*Juncus cognatus*		Exotic	R			1	20										
Juncaceae	*Juncus continuus*		Native	R			0.1	10										

Family	Scientific Name	Common name	Native/Exotic	Form	BAM01		BAM02		BAM03		BAM04		BAM05		BAM06		BAM07	
					C	A	C	A	C	A	C	A	C	A	C	A	C	A
Juncaceae	*Juncus* sp.		Exotic	R	0.1	20									0.1	10		
Juncaceae	*Juncus usitatus*		Native	R	0.1	10	0.5	50	0.1	10	0.1	10	0.1	2				
Lobeliaceae	*Pratia purpurascens*	Whiteroot	Native	F	0.1	50											0.1	1
Lomandraceae	*Lomandra filiformis*	Wattle Mat-rush	Native	F					3	200	0.5	10					0.1	10
Lomandraceae	*Lomandra multiflora*	Many-flowered Mat-rush	Native	F					2	50								
Malvaceae	*Modiola caroliniana*	Red-flowered Mallow	Exotic	F														
Malvaceae	*Sida rhombifolia*	Paddy's Lucerne	Exotic	F											0.1	1	0.1	20
Marsileaceae	*Marsilea* sp.		Native	E	0.1	10	0.1	5										
Myrtaceae	*Angophora floribunda*	Rough-barked Apple	Native	T			1	1										
Myrtaceae	*Eucalyptus amplifolia*	Cabbage Gum	Native	T	25	20	8	1	0.2	2							20	5
Myrtaceae	*Eucalyptus eugenioides*	Thin-leaved Stringybark	Native	T														
Myrtaceae	*Eucalyptus moluccana*	Grey Box	Native	T														
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum	Native	T														
Myrtaceae	*Melaleuca decora*		Native	S/T			1	1							5	1	30	13
Oleaceae	*Ligustrum sinense*	Small-leaved Privet	Exotic	S														
Oxalidaceae	*Oxalis perennans*		Native	F					0.1	1							0.1	5
Phyllanthaceae	*Phyllanthus virgatus*		Native	F					0.1	1								
Pittosporaceae	*Bursaria spinosa* subsp. *spinosa*	Blackthorn	Native	S	3	100											5	20

Family	Scientific Name	Common name	Native/Exotic	Form	BAM01		BAM02		BAM03		BAM04		BAM05		BAM06		BAM07	
					C	A	C	A	C	A	C	A	C	A	C	A	C	A
Plantaginaceae	*Plantago lanceolata*	Lamb's Tongue	Exotic	F														
Poaceae	*Axonopus fissifolius*	Narrow-leafed Carpet Grass	Exotic	G	0.5	50	1	50	4	200	10	500	5	300				
Poaceae	*Bothriochloa macra*	Red-leg Grass	Native	G					0.5	50			0.1	2				
Poaceae	*Briza subaristata*		Exotic	G					2	100	5	200	30	1000				
Poaceae	*Cenchrus clandestinus*	Kikuyu Grass	Exotic	G											0.2	50	0.1	5
Poaceae	*Chloris gayana*	Rhodes Grass	Exotic	G														
Poaceae	*Cynodon dactylon*	Couch	Native	G	500	80	15	500	2	50	3	200	10	200	5	100		
Poaceae	*Eragrostis brownii*	Brown's Lovegrass	Native	G					2	100	3	200					0.1	10
Poaceae	*Eragrostis curvula*	African Lovegrass	Exotic	G	0.1	1	0.1	5	0.5	2					25	50	1	50
Poaceae	*Eragrostis leptostachya*	Paddock Lovegrass	Native	G									0.1	5				
Poaceae	*Eriochloa sp.*		Native	G														
Poaceae	*Imperata cylindrica*	Blady Grass	Native	G														
Poaceae	*Microlaena stipoides*	Weeping Grass	Native	G	1	100	2	200	3	200	5	200			0.1	10	75	1000
Poaceae	*Paspalidium distans*		Native	G					5	200	1	50						
Poaceae	*Paspalum dilatatum*	Paspalum	Exotic	G	2	100	2	200	4	300	5	500	65	2000	10	50	0.1	2
Poaceae	*Setaria parviflora*	Pigeon Grass	Exotic	G	0.1	1	0.1	2	0.1	50	1	100	1	50			1	50
Poaceae	*Sporobolus creber*	Western Rat-tail Grass	Native	G					0.1	10			0.1	10	0.1	5	0.1	5
Poaceae	*Stenotaphrum secundatum*	Buffalo Grass	Exotic	G														
Poaceae	*Themeda australis*	Kangaroo Grass	Native	G					65	2000	80	2000	0.5	10			0.1	2
Poaceae	*Vulpia* sp.		Exotic	G			1	100										

Family	Scientific Name	Common name	Native/Exotic	Form	BAM01		BAM02		BAM03		BAM04		BAM05		BAM06		BAM07	
					C	A	C	A	C	A	C	A	C	A	C	A	C	A
Polygonaceae	*Persicaria* sp.		Native	F														
Proteaceae	*Grevillea juniperina* subsp. *juniperina*		Native	S														
Proteaceae	*Hakea sericea*	Needlebush	Native	S														
Pteridaceae	*Cheilanthes sieberi*		Native	F													0.1	1
Rosaceae	*Rubus fruticosus*		Exotic	L	1	10												
Rubiaceae	*Asperula conferta*	Common Woodruff	Native	F														
Solanaceae	*Cestrum parqui*	Green Cestrum	Exotic	S														
Solanaceae	*Lycium ferocissimum*	African Blackthorn	Exotic	S														
Solanaceae	*Solanum sisymbriifolium*		Exotic	F											0.1	3	0.1	5
Solanaceae	*Solanum nigrum*	Black-berry Nighshade	Exotic	F											0.1	2	0.1	1
Typhaceae	*Typha orientalis*	Broadleaf Cumbungi	Native	F														
Verbenaceae	*Verbena bonariensis*	Purpletop	Exotic	F														
Verbenaceae	*Verbena rigida*	Veined Verbena	Exotic	F														

Fauna

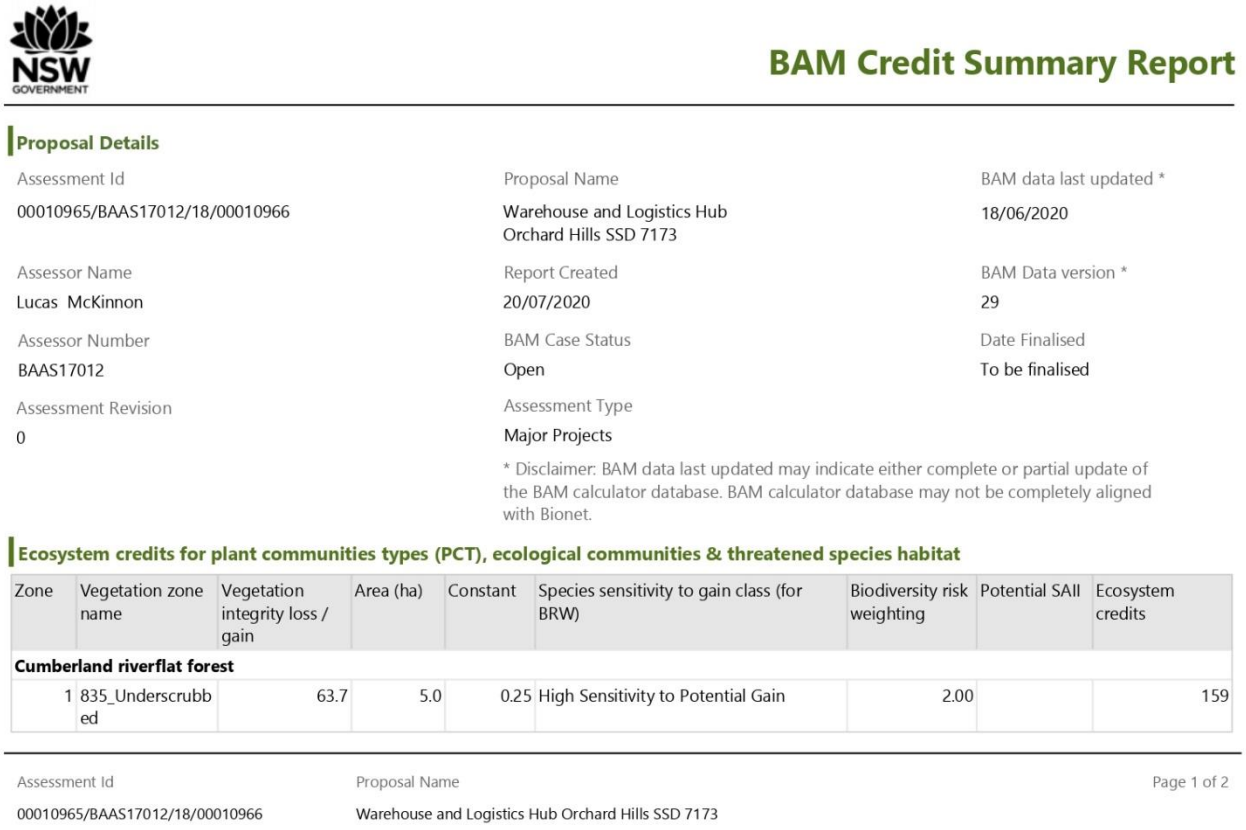
Class	Family	Scientific name	Common name	Native/ Exotic	Ecoplanning (30/04/18)	Ecoplanning (20/03/17)	Ecoplanning 2019/20
Actinopterygii	Anguillidae	*Anguilla reinhardtii*	Long-finned Eel	Native	-	-	O
Amphibia	Hylidae	*Litoria dentata*	Bleating Tree Frog	Native	-	-	W
Amphibia	Hylidae	*Litoria fallax*	Eastern Dwarf Tree Frog	Native	-	-	OW
Amphibia	Hylidae	*Litoria peronii*	Peron's Tree Frog	Native	-	-	W
Amphibia	Hylidae	*Litoria verreauxii*	Verreaux's Tree Frog	Native	-	-	W
Amphibia	Limnodynastidae	*Limnodynastes peronii*	Striped March Frog	Native	-	W	W
Amphibia	Limnodynastidae	*Limnodynastes tasmaniensis*	Spotted Grass Frog	Native	-	-	W
Amphibia	Myobatrachidae	*Crinia signifera*	Common Eastern Froglet	Native	W	W	W
Amphibia	Pelodryadidae	*Ranoidea caerulea*	Australian Green Tree Frog	Native	-	-	W
Amphibia	Myobatrachidae	Uperoleia laevigata	Smooth toadlet	Native	-	-	W
Aves	Anatidae	*Anas gracilis*	Grey Teal	Native	O	-	-
Aves	Anatidae	*Anas superciliosa*	Pacific Black Duck	Native	O	O	-
Aves	Anatidae	*Aythya australis*	Hardhead	Native	O	-	-
Aves	Ardeidae	*Ardea ibis*	Cattle Egret	Native	OW	-	-
Aves	Ardeidae	*Egretta novaehollandiae*	White-faced Heron	Native	O	-	-
Aves	Artamidae	*Cracticus tibicen*	Australian Magpie	Native	OW	OW	-
Aves	Artamidae	*Cracticus torquatus*	Grey Butcherbird	Native	W	W	-
Aves	Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo	Native	-	OW	-
Aves	Cacatuidae	*Cacatua sanguinea*	Little Corella	Native	-	-	-
Aves	Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	Native	-	OW	-
Aves	Charadriidae	*Elseyornis melanops*	Black-fronted Dotterel	Native	O	-	-
Aves	Charadriidae	*Vanellus miles*	Masked Lapwing	Native	W	W	-
Aves	Cisticolidae	*Cisticola exilis*	Golden-headed Cisticola	Native	W	OW	-

Class	Family	Scientific name	Common name	Native/ Exotic	Ecoplanning (30/04/18)	Ecoplanning (20/03/17)	Ecoplanning 2019/20
Aves	Columbidae	*Ocyphaps lophotes*	Crested Pigeon	Native	OW	O	-
Aves	Corvidae	*Corvus coronoides*	Australian Raven	Native	OW	OW	-
Aves	Estrildidae	*Neochmia temporalis*	Red-browed Finch	Native	O	-	-
Aves	Falconidae	*Falco cenchroides*	Nankeen Kestrel	Native	OW	-	-
Aves	Hirundinidae	*Hirundo neoxena*	Welcome Swallow	Native	OW	-	-
Aves	Maluridae	*Malurus cyaneus*	Superb Fairy-wren	Native	OW	W	-
Aves	Meliphagidae	*Manorina melanocephala*	Noisy Miner	Native	OW	W	-
Aves	Monarchidae	*Grallina cyanoleuca*	Magpie-lark	Native	OW	OW	-
Aves	Pelecanidae	*Pelecanus conspicillatus*	Australian Pelican	Native	OW	-	-
Aves	Phalacrocoracidae	*Microcarbo melanoleucos*	Little Pied Cormorant	Native	O	-	-
Aves	Podicipedidae	*Poliocephalus*	Hoary-headed Grebe	Native	O	-	-
Aves	Podicipedidae	*Tachybaptus novaehollandiae*	Australasian Grebe	Native	O	-	-
Aves	Psittacidae	*Platycercus elegans*	Crimson Rosella	Native	-	W	-
Aves	Psittacidae	*Platycercus eximius*	Eastern Rosella	Native	OW	-	-
Aves	Psittacidae	*Psephotus haematonotus*	Red-rumped Parrot	Native	OW	W	-
Aves	Psittacidae	*Trichoglossus haematodus*	Rainbow Lorikeet	Native	OW	W	-
Aves	Rallidae	*Fulica atra*	Eurasian Coot	Native	O	-	-
Aves	Rallidae	*Porphyrio*	Purple Swamphen	Native	OW	W	-
Aves	Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail	Native	OW	W	-
Aves	Sturnidae	*Sturnus tristis**	Common Myna*	Exotic	W	OW	-
Aves	Threskiornithidae	*Threskiornis spinicollis*	Straw-necked Ibis	Native	O	O	-
Mammalia	Bovidae	*Bos taurus*	Cattle	Exotic	O	O	O
Mammalia	Canidae	*Vulpes Vulpes**	European Red Fox*	Exotic	O	-	-
Mammalia	Leporidae	*Lepus europaeus**	European Hare*	Exotic	O	-	-

Class	Family	Scientific name	Common name	Native/ Exotic	Ecoplanning (30/04/18)	Ecoplanning (20/03/17)	Ecoplanning 2019/20
Mammalia	Macropodidae	*Macropus giganteus*	Eastern Grey Kangaroo	Native	O	O	-
Mammalia	Macropodidae	*Wallabia bicolor*	Swamp Wallaby	Native	O	-	-
Mammalia	Miniopteridae	*Miniopterus australis*	Little Bent-winged Bat	Native	-	-	U (Po)
Mammalia	Miniopteridae	*Miniopterus orianae oceanensis*	Large Bent-Winged Bat	Native	-	-	U (Po)
Mammalia	Molossidae	*Austronomus australis*	White-striped Free-tailed Bat	Native	-	-	WU (D)
Mammalia	Molossidae	*Mormopterus (micronomus) norfolkensis*	Eastern Coastal Free-tailed Bat	Native	-	-	U (Pr)
Mammalia	Molossidae	*Mormopterus (ozimops) ridei*	Ride's Free-tailed Bat	Native	-	-	U (D)
Mammalia	Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-Fox	Native	-	-	O
Mammalia	Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat	Native	-	-	U (D)
Mammalia	Vespertilionidae	*Chalinolobus morio*	Chocolate Wattled Bat	Native	-	-	U (D)
Mammalia	Vespertilionidae	*Myotis macropus*	Southern Myotis	Native	-	-	U (Po)
Mammalia	Vespertilionidae	*Nyctophilus sp.*		Native	-	-	U (D)
Mammalia	Vespertilionidae	*Scotorepens orion*	Eastern Broad-nosed Bat	Native	-	-	U (Po)
Mammalia	Vespertilionidae	*Vespadelus darlingtoni*	Large Forest Bat	Native	-	-	U (Pr)
Mammalia	Vespertilionidae	*Vespadelus vulturnus*	Little Forest Bat	Native	-	-	U (D)
Mammalia	Vombatidae	*Vombatus ursinus*	Wombat	Native	FB, P	-	-
Reptilia	Chelidae	*Chelodina longicollis*	Eastern Long-necked Turtle	Native	-	-	O
Reptilia	Elapidae	*Pseudechis porphyriacus*	Red-bellied Black Snake	Native	-	O	-
Reptilia	Elapidae	*Pseudechis textilis*	Eastern Brown Snake	Native	-	-	O
Reptilia	Scincidae	*Lampropholis delicata*	Dark-flecked Garden Skink	Native	-	-	O
Reptilia	Scincidae	*Ctenotus robustus*	Robust Ctenotus	Native	-	-	O

Observation type = O (seen), W (heard call), OW (seen and heard), FB (burrow), P (scat), U (Ultrasonic) where D – definite; Pr – probable & Po – possible. See **Appendix E** for full Ultrasonic results.

Appendix D: Biodiversity credit summary and payment summary report



NSW GOVERNMENT

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00010965/BAAS17012/18/00010966	Warehouse and Logistics Hub Orchard Hills SSD 7173	18/06/2020
Assessor Name	**Report Created**	**BAM Data version ***
Lucas McKinnon	20/07/2020	29
Assessor Number	**BAM Case Status**	**Date Finalised**
BAAS17012	Open	To be finalised
Assessment Revision	**Assessment Type**	
0	Major Projects	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Cumberland riverflat forest								
1	835_Underscrubbed	63.7	5.0	0.25	High Sensitivity to Potential Gain	2.00		159

NSW GOVERNMENT

BAM Credit Summary Report

2	835_ClearedLand	1.4	74.4	0.25	High Sensitivity to Potential Gain	2.00		0
4	835_DNG	35.0	4.0	0.25	High Sensitivity to Potential Gain	2.00		71
							Subtotal	**230**
Cumberland shale plains woodland								
3	849_Underscrubbed	8.7	0.3	0.25	High Sensitivity to Potential Gain	2.50	TRUE	0
							Subtotal	**0**
							Total	**230**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAII	Species credits

Assessment Id	Proposal Name	Page 2 of 2
00010965/BAAS17012/18/00010966	Warehouse and Logistics Hub Orchard Hills SSD 7173	

Biodiversity payment summary report

Assessment Id	Payment data version	Assessment Revision	Report created
00010965/BAAS17012/18/00010966	63	0	20/07/2020

Assessor Name	Assessor Number	Proposal Name	BAM Case Status
Lucas McKinnon	BAAS17012	Warehouse and Logistics Hub Orchard Hills SSD 7173	Open

Assessment Type	Date Finalised
Major Projects	To be finalised

PCT list

Price calculated	PCT common name	Credits
Yes	**835 -** Cumberland riverflat forest	230
Yes	**849 -** Cumberland shale plains woodland	0

Species list

Price calculated	Species	Credits

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

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Biodiversity payment summary report

IBRA sub region	PCT common name	Threat status	Offset trading group	Risk premium	Administrative cost	Methodology adjustment factor	Price per credit	No. of ecosystem credits	Final credits price
Cumberland	**835** - Cumberland riverflat forest	No	Coastal Floodplain Wetlands >90%	19.73%	$611.49	2.2036	$ 18,914.98	230	$ 4,350,445.00
Cumberland	**849** - Cumberland shale plains woodland	No	Coastal Valley Grassy Woodlands >90%	19.73%	$860.72	2.0896	$ 26,624.20	0	$0.00

Subtotal (excl. GST)	**$4,350,445.00**
GST	**$435,044.50**
Total ecosystem credits (incl. GST)	**$4,785,489.50**

Species credits for threatened species

Species profile ID	Species	Threat status	Price per credit	Risk premium	Administrative cost	No. of species credits	Final credits price

No species available

NSW GOVERNMENT

Biodiversity payment summary report

Grand total	**$4,785,489.50**

Note: Pages 2, 4 and 6 of the payment report were blank and therefore not included.

Appendix E: Microbat survey results

CORYMBIA ECOLOGY

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BAT CALL ANALYSIS RESULTS

Ecoplanning
Project Name: Mamre Road South, Erskine Park 2018-070
Date of survey: 28-11-2019 to 13/12/2019 (16 nights)

Note: calls were generally of low quality

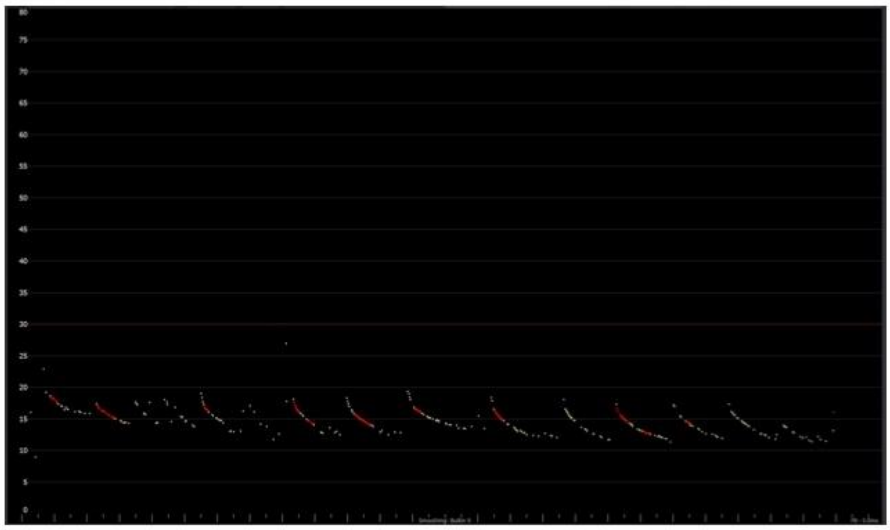
Species	ID Confidence	Detector 28-29/11/19 567 files	SM 28/11/19-13/12/19 14460 files 13220 noise files	Notes
Austronomus australis	D	D	D	
Chalinolobus morio	D	Pr	D	
Chalinolobus gouldii	D	D	Po	
Miniopterus australis	Po	Po	Po	A few calls in the correct frequency range. Could however be very high *Chalinolobus morio*.
Nyctophilus sp	D	D	-	Calls indistinguishable between the species
Myotis macropus	Po	-	Po	Only one possible pass. Usually when there is significant *Myotis* activity passes are common. Therefore, it is more likely that this short pass is a *Nyctophilus*, but the presence of Myotis can not be completely discounted.
Vespadelus vulturnus	D	D	D	
Mormopterus (ozimops) ridei	D	D		
Mormopterus norfolkensis	Pr	Po	Pr	Calls were not clear enough to be clearly distinguished from *Mormopterus (ozimops) ridei*.
Vespadelus darlingtoni	Pr	Pr	Pr	Could not be clearly distinguished from *Miniopterus schreibersii oceanensis* with these calls
Miniopterus schreibersii oceanensis	Po	Po	Po	Most likely *Vespadelus darlingtoni*
Scotorepens orion	Po	Po	Po	Most likely *Scotorepens orion*, however there is some potential to be *Falsistrellus tasmaniensis* or *Scoteanax rueppelleii* on call characteristics.

- D – definite; Pr – probable; Po – possible; E-either.
- Calls were analysed using Analook and Anabat Insight Software.
- Example calls presented below are displayed in this report at F8 – Anabat Insight.
- Analysis was completed on the 8th February 2020
- The following resources were consulted during analysis:
    - Pennay M., Law B., and Reinhold L. (2004) Bat Calls of NSW. DEC of NSW.
    - Corben C. (2009) Anabat Techniques Workshop, Titley Scientific.
    - Bat Call Identification Workshop (2019), Titley Scientific and Balance Environmental.
    - Personal experience analysing calls and collection of reference calls in NSW

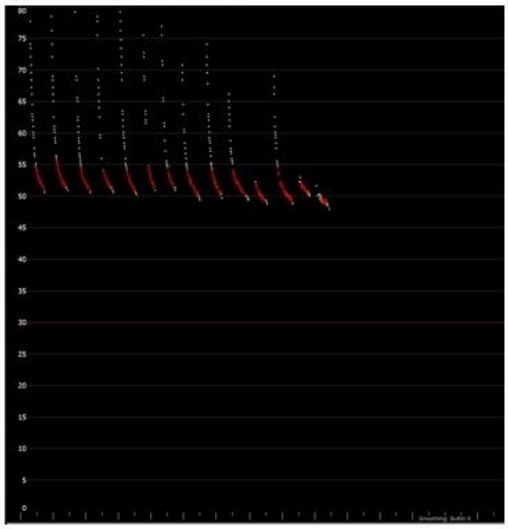
Please note: only calls with a definite confidence rating should be uploaded to Bionet.

Examples of calls for definite identified species

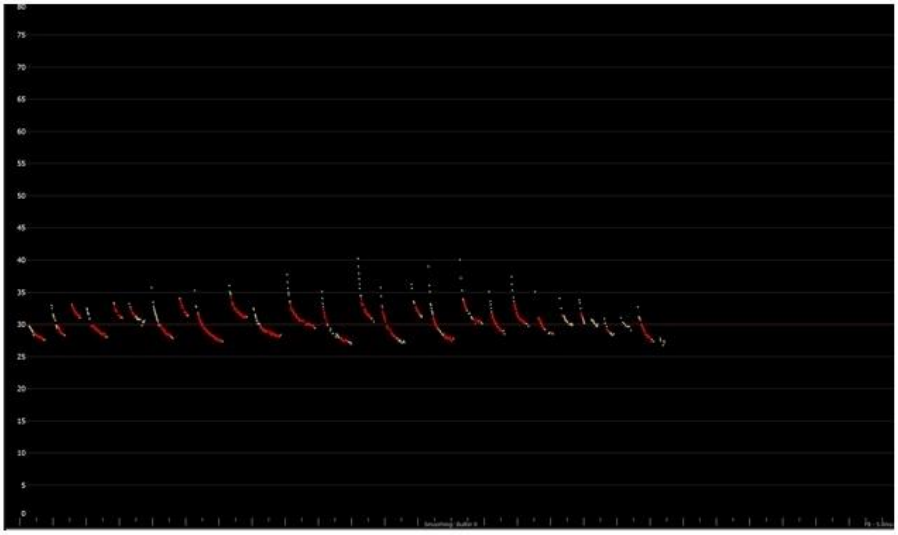
Austronomus australis



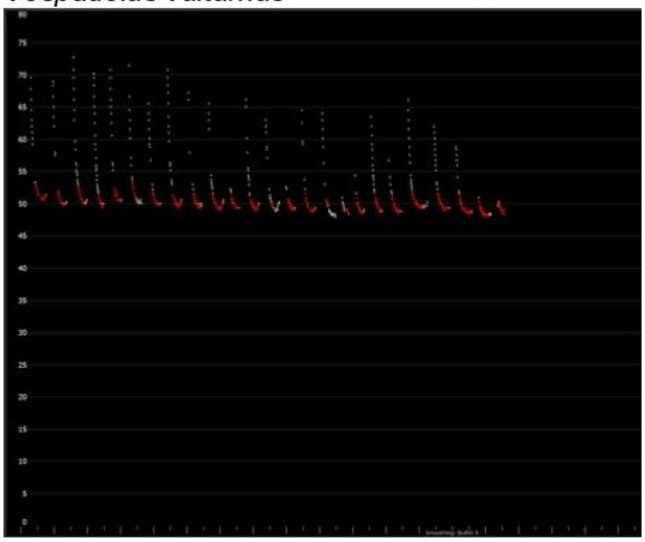
Chalinolobus morio



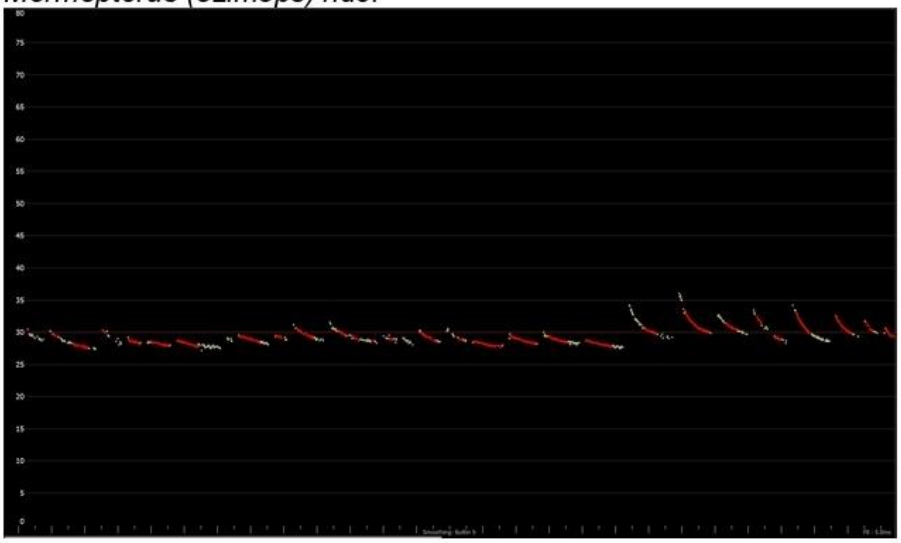
Chalinolobus gouldi



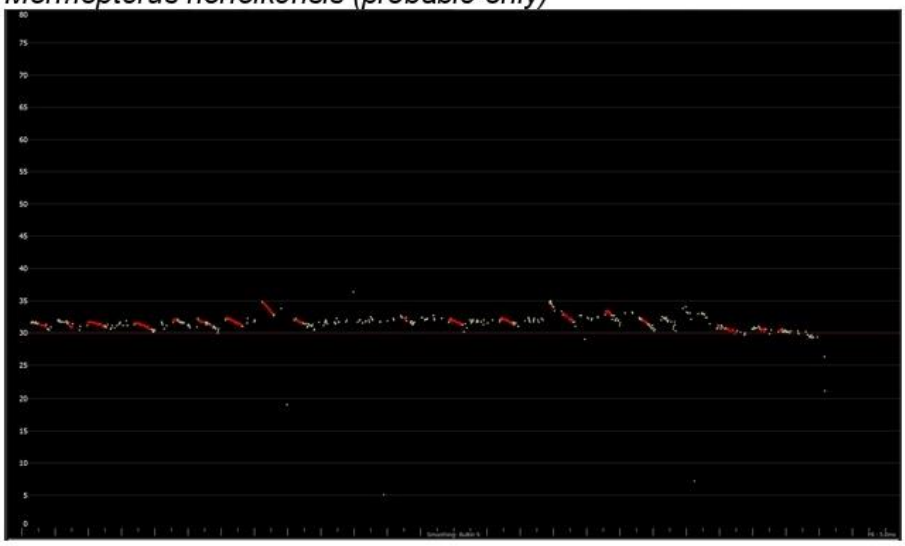
Vespadelus vulturnus



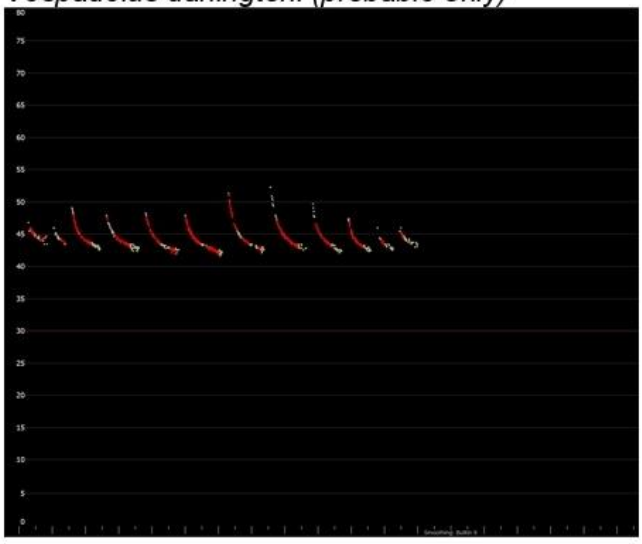
Mormopterus (ozimops) ridei



Mormopterus norfolkensis (probable only)



Vespadelus darlingtoni (probable only)



Scotorepens orion (probable only)