



Alphitonia.

Biodiversity Development Assessment Report - Revision A

Proposed development (SSD 8792) for Mainsbridge School for
Specific Purposes (SSP), Lawrence Hargrave Road, Warwick
Farm

19 December 2018

Environmental Planning
Ecological Assessments
Bushfire Hazard Management
Project Management

ABN. 98 611 057 768

PROJECT NAME	Biodiversity Development Assessment Report (BDAR) – Revision A – Mainsbridge School for Specific Purposes (SSP), SSD (8792)
PROJECT ADDRESS	Lot 22 // DP 715287, 95 Lawrence Hargraves Road, Warwick Farm, NSW 2170
PREPARED BY	Alphitonia Pty Ltd in collaboration with Ecoplanning Pty Ltd
AUTHOR/S	Brendan Pratt, Bruce Mullins, Thomas Hickman and Andrea Sabella
REVIEW	Bruce Mullins and Brendan Pratt
PROJECT MANAGAGER	Brendan Pratt

Brendan Pratt
BSc(Geosc), MEIANZ

Alphitonia.

Tel. 0431 896 846
Email. brendan.pratt@alphitonia.com.au
Web. www.alphitonia.com.au
ABN. 98 611 057 768

Ecoplanning Pty Ltd
74 Hutton Ave, Bulli NSW 2516
M. 0497 603 549
www.ecoplanning.com.au



This report should be cited as: *Alphitonia. (2018). Biodiversity Development Assessment Report – Revision A – Mainsbridge School for Specific Purposes, Warwick Farm. Prepared for Hayball.*

DISCLAIMER

This report has been prepared in accordance with the scope of services described in agreement between *Alphitonia Pty Ltd* and the Client.

The findings contained in this report are the result of discrete/specific methodologies used in accordance with normal practices and standards. To the best of our knowledge, they represent a reasonable interpretation of the general condition of the site in question. Under no circumstances, however, can it be considered that these findings represent the actual state of the site/sites at all points.

Any representation, statement, opinion or advice, expressed or implied in this publication is made in good faith but on the basis that *Alphitonia Pty Ltd*, its agents and employees are not liable (whether by reason of negligence, lack of care or otherwise) to any person for any damage or loss whatsoever, which has occurred or may occur in relation to that person taking or not taking (as the case may be) action in respect of any representation, statement, or advice referred to above. Any findings, conclusions or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by the Client.

Furthermore, this report has been prepared solely for use by the Client. *Alphitonia Pty Ltd* accepts no responsibility for its use by other parties. It is assumed that the Client has undertaken all necessary consultation with the relevant local Authorities.

Contents

1.	Introduction.....	1
1.1	Background.....	1
1.2	Location and site identification.....	1
1.3	Proposed development.....	1
2.	Landscape context.....	6
2.1	Identify landscape features.....	6
2.1.1	IBRA bioregions and IBRA subregions.....	6
2.1.2	NSW landscape regions (Mitchell Landscapes).....	6
2.1.3	Other features.....	6
2.2	Determining site context.....	7
2.2.1	Assessing native vegetation cover.....	7
2.2.2	Assessing patch size.....	7
3.	Native vegetation.....	12
3.1	Plant community types (PCTs) and threatened ecological communities.....	12
3.1.1	Previous vegetation mapping.....	12
3.1.2	Field assessment of vegetation communities.....	12
3.1.3	Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835; HN526).	18
3.2	Vegetation zones.....	22
3.2.1	Condition classes, subcategories and areas.....	22
3.2.2	Vegetation integrity survey plots.....	22
3.2.3	Current and future vegetation integrity scores.....	22
4.	Threatened species.....	25
4.1	Identifying threatened species for assessment.....	25
4.1.1	Geographic and habitat features.....	25
4.1.2	Ecosystem credit species.....	27
4.2	Identify candidate species.....	29
4.3	Determine presence or absence of a candidate species credit species.....	33
4.3.1	Targeted field surveys - flora.....	33
4.3.2	Targeted field surveys – fauna.....	33
4.4	Field survey and results.....	34
4.4.1	Field survey.....	34
4.4.2	Field survey results.....	34
5.	Avoiding and minimising impacts on biodiversity values.....	37
5.1	Avoiding and minimising impacts on native vegetation and habitat during project planning.....	37
5.1.1	Locating a project to avoid and minimise impacts on native vegetation and habitat.....	37
5.1.2	Designing a project to avoid and minimise impacts on native vegetation and habitat.....	37
5.2	Avoiding and minimising prescribed biodiversity impacts during project planning.....	37
5.2.1	Locating a project to avoid and minimise prescribed biodiversity impacts.....	38
5.2.2	Designing a project to avoid and minimise prescribed biodiversity impacts.....	38

6.	Assessing and offsetting impacts	39
6.1	Assessment of impacts	39
6.1.1	Assessing impacts to native vegetation and habitat.....	39
6.1.2	Assessing indirect impacts on native vegetation and habitat	39
6.2	Assessing prescribed biodiversity impacts.....	39
6.3	Mitigating and managing impacts on biodiversity values	40
6.3.1	Pre-clearance protocols.....	40
6.3.2	Construction Environmental Management Plan (CEMP)	40
6.3.3	Tree protection measures.....	40
6.4	Adaptive management for uncertain impacts.....	41
6.5	Thresholds for the assessment and offsetting of impacts of development	43
6.5.1	Serious and Irreversible impacts	43
6.5.2	Impacts which require an offset.....	43
6.5.3	Impacts that do not require further assessment	43
7.	Final credit calculations	44
7.1	Credit calculations and classes.....	44
7.1.1	Ecosystem credits	44
7.1.2	Species credits	44
8.	References	46
	Appendix A: Plot data collected.....	48
	Appendix B: Likelihood Table.....	49
	Appendix C: Flora and fauna species inventories	51
	Appendix D: Credit summary report, biodiversity payment summary report and biodiversity credit report (like for like).....	53

Figures

Figure 1.1:	Subject land location.	3
Figure 1.2:	Proposed development and construction footprint.....	4
Figure 1.3:	Environmentally Significant Land in the subject land (LLEP 2008).....	5
Figure 2.1:	Site map.	9
Figure 2.2:	Location map.....	10
Figure 3.1:	Vegetation types (OEH, 2016b).	14
Figure 3.2:	Vegetation types (NPWS, 2002).	15
Figure 3.3:	Vegetation types (Tozer et al., 2006).	16
Figure 3.4:	Field results and validated vegetation (Ecoplanning, 2018).....	17
Figure 3.5:	Forest Red Gum – Rough-barked Apple grassy woodland ‘underscrubbed’.	19
Figure 3.6:	Cleared land ‘exotic grassland’ in the subject land.	21
Figure 3.7:	An example of a planted <i>Corymbia citriodora</i> adjacent to the construction fence.	21
Figure 3.8:	Vegetation zones and vegetation integrity survey plot locations.....	24
Figure 4.1:	Survey effort.	35
Figure 6.1:	Field validated vegetation (Ecoplanning, 2018) and proposed footprint.	42

Tables

Table 3.1: Corresponding vegetation communities, PCTs and TECs.	12
Table 3.2: Details of PCTs within the subject land including area of vegetation zones and candidate SAI entities.	13
Table 3.3: VIS plant community type profile (OEH, 2018b) – Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835; HN526).	19
Table 3.4: Vegetation integrity survey plots.	22
Table 3.5: Vegetation integrity scores.	23
Table 4.1: Assessment of habitat constraints and geographic limitations of ecosystem credit species.	26
Table 4.2: Assessment of habitat constraints and geographic limitations of species credit species.	26
Table 4.3: Ecosystem credit species predicted on site.	28
Table 4.4: Candidate species for which the subject land is not considered suitable habitat.	29
Table 4.5: Survey periods for confirmed candidate threatened floral species.	33
Table 4.6: Survey periods for candidate threatened faunal species.	33
Table 4.7: Daily weather observation at Bankstown Airport (6 km to the east of the subject land).	34
Table 4.8: Key faunal habitat features present across the subject land.	36
Table 6.1: Vegetation zones assessed that require an offset.	43
Table 6.2: Vegetation which does not require offsets.	43
Table 7.1: Ecosystem credits summary and credit profile.	44
Table 7.2: Ecosystem credit costs.	44
Table 7.3: Species credits summary and profile.	45
Table 7.4: Species credits costs.	45

Glossary and abbreviations

Acronym	Description
BAM	Biodiversity Assessment Methodology
BC Act	NSW <i>Biodiversity Conservation Act 2016</i>
BC Reg	<i>Biodiversity Conservation Regulation 2017</i>
BCT	Biodiversity Conservation Trust
BDAR	Biodiversity Development Assessment Report
CEMP	Construction Environmental Management Plan
COLA	Covered Outdoor Learning Area
DoEE	Commonwealth Department of the Environment and Energy
DPE	NSW Department of Planning and Environment
EEC	Endangered Ecological Community
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
ha	hectare(s)
HTE	High Threat Exotic
IBRA	Interim Bioregionalisation of Australia
km	kilometre
LGA	Local Government Area
LLEP	Liverpool Local Environmental Plan 2008
LLS Act	<i>Local Land Services Act 2013</i>
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)
SAIL	Serious and Irreversible Impacts
SEARs	Secretary's Environmental Assessment Requirements
SSD	State Significant Development
SSP	School for Specific Purposes
TEC	Threatened Ecological Community, listed as vulnerable, endangered or critically endangered under either the BC Act and/or EPBC Act

1. Introduction

1.1 Background

This Biodiversity Development Assessment Report (BDAR) has been undertaken to accompany the construction of additional facilities for the Mainsbridge School for Specific Purposes (SSP). The proposed development (the 'subject land') would be constructed within the existing Warwick Farm Public School site located at Lot 22 // DP 715287, 95 Lawrence Hargraves Road, Warwick Farm, NSW 2170 (the 'school boundary'). The new Mainsbridge SSP facilities would be constructed on the north side of the existing Warwick Farm Public School site, on and around the grassed recreation area.

The project is a State Significant Development (SSD). As such, Secretary's Environmental Assessment Requirements (SEARs; SSD 8792 dated 22 November 2017) have been issued for the Project and require that *"biodiversity impacts related to the proposal and the preparation of a Biodiversity Assessment are to be addressed in accordance with the requirements of the Biodiversity Conservation Act 2016 (BC Act)"*. Section 7.9 of the BC Act is relevant to this SSD project. Section 7.9(2) states:

Any such application is to be accompanied by a biodiversity development assessment report unless the planning Agency Head and the Environment Agency Head determine that the proposed development is not likely to have any significant impact on biodiversity values.

As such, this report has been prepared to address the SEARs issued by the Department of Planning and Environment (DPE) 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 Bruce Mullins, an Accredited Assessor (BAAS17024) under the BC Reg, and is consistent with the BAM (OEH, 2017a).

Sources of information for this report included:

- NSW Planning Portal (NSW Dept. of Planning and Environment 2018)
- BioNet Atlas of NSW Wildlife (NSW Office of Environment and Heritage 2018a)
- Western Sydney native vegetation mapping (NPWS 2002)
- Native Vegetation of the Sydney Metropolitan Area (OEH 2016b)
- Southeast NSW Native Vegetation Classification and Mapping (Tozer et al. 2006)
- SIX Maps (LPI 2018)

1.2 Location and site identification

The subject land for this BDAR covers a total area of approximately 1.70 ha and is within Lot 22 // DP 715287. Refer to **Figure 1.1**. The subject land is situated in the Liverpool Local Government Area (LGA) and is currently zoned R2 – Rural Landscape under the Liverpool Local Environmental Plan 2008 (LLEP). The subject land is comprised of cleared land 'exotic grasses' and planted vegetation.

The subject land is in an urban residential setting which is adjacent to the floodplain of Brickmakers Creek and Cabramatta Creek (**Figure 1.1**). It is bounded by Lawrence Hargrave Road to the south, Williamson Crescent to the west, Brickmakers Creek and Durrant Oval to the east and Hargrave Park Long Daycare to the north. The subject land currently contains buildings, play equipment, playing courts, fields and recreation areas, and car parking that are part of Warwick Farm Public School.

1.3 Proposed development

The proposal involves construction of school facilities for the new Mainsbridge SSP. The proposed development will comprise the following works:

- A single-storey school building (home bases) with an attached 2 storey administration and staff area,
- A double-storey school building (home bases),

- A single-storey library building and multipurpose space,
- Hydrotherapy pool,
- Car, minibus and coaster bus parking with access along Williamson Crescent,
- A Covered Outdoor Learning Area (COLA),
- A sport field and associated toilet block,
- Significant excavation works to rehabilitate the contaminated soils found on the subject site,
- Landscaping to create essential play spaces for the school population,
- Demolition of existing sheds associated with Warwick Farm Public School, and
- Re-purposing and refurbishment of some existing facilities in Warwick Farm Public School.

The proposed development is shown in **Figure 1.2**. The land along the eastern perimeter of Lot 22 // DP 715287 is mapped as “Environmentally Significant Land” on the Terrestrial Biodiversity Map (LLEP, 2008) (see **Figure 1.3**), of which 0.53 ha is situated in the subject land. Ground truthing of the subject land has found no significant ecology, no riparian vegetation, and negligible habitat for threatened faunal species.

The proposal includes extensive landscaping. This landscaping creates essential play spaces that caters to the special needs of the proposed school population and is therefore an essential component of the proposal.

The site is also in a degraded state with no areas of unmanaged bushland. Because of this, there are no obvious areas of the subject site that should be excluded from construction activities on the grounds of conservation or biodiversity preservation. As such the entire development site can be considered to be the construction footprint of the Proposal.

Due to the need to remediate the contaminated soil on the subject site, the vast majority of the subject site (if not the entire site) will be impacted by construction activities.

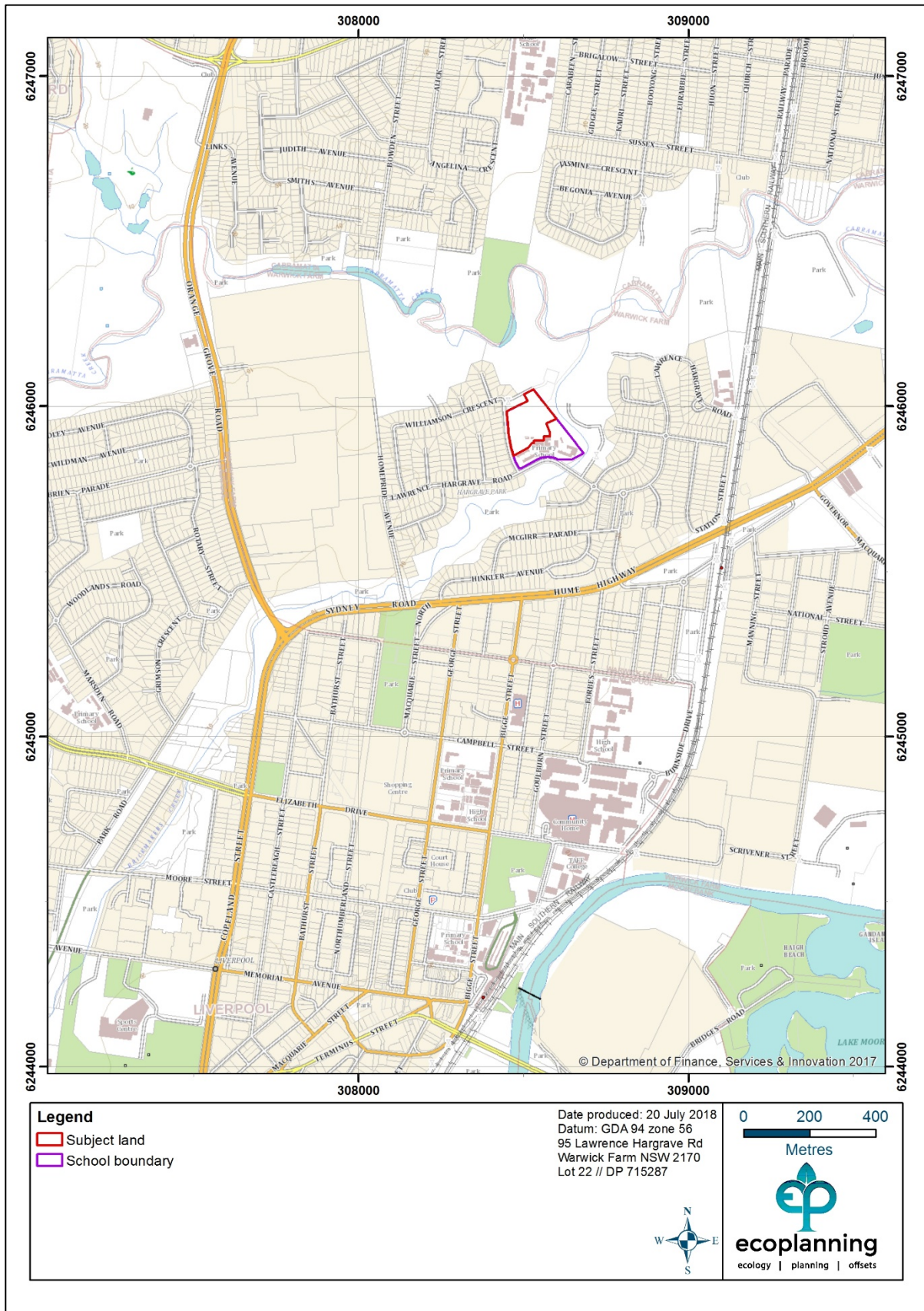


Figure 1.1: Subject land location.

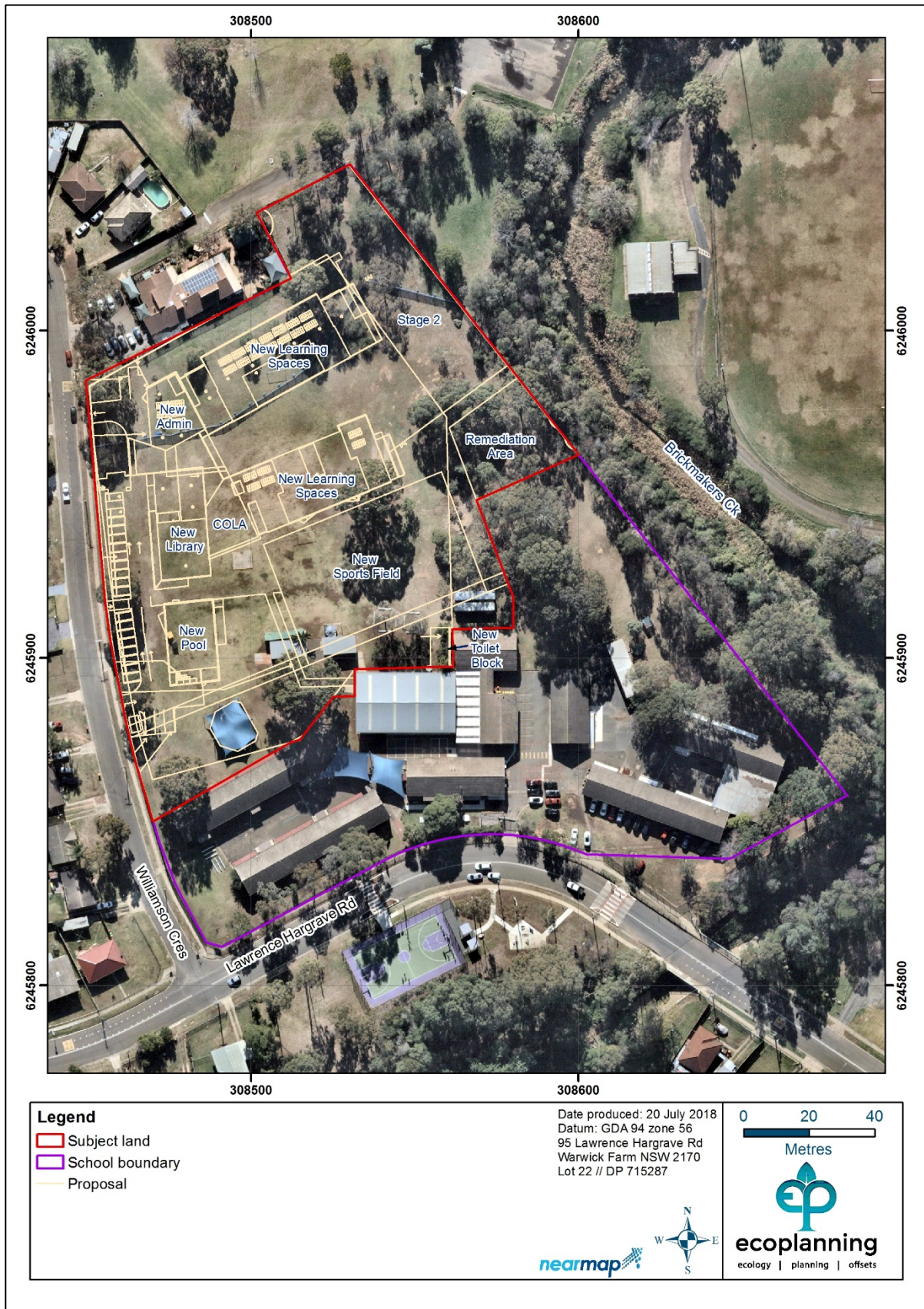


Figure 1.2: Proposed development and construction footprint.

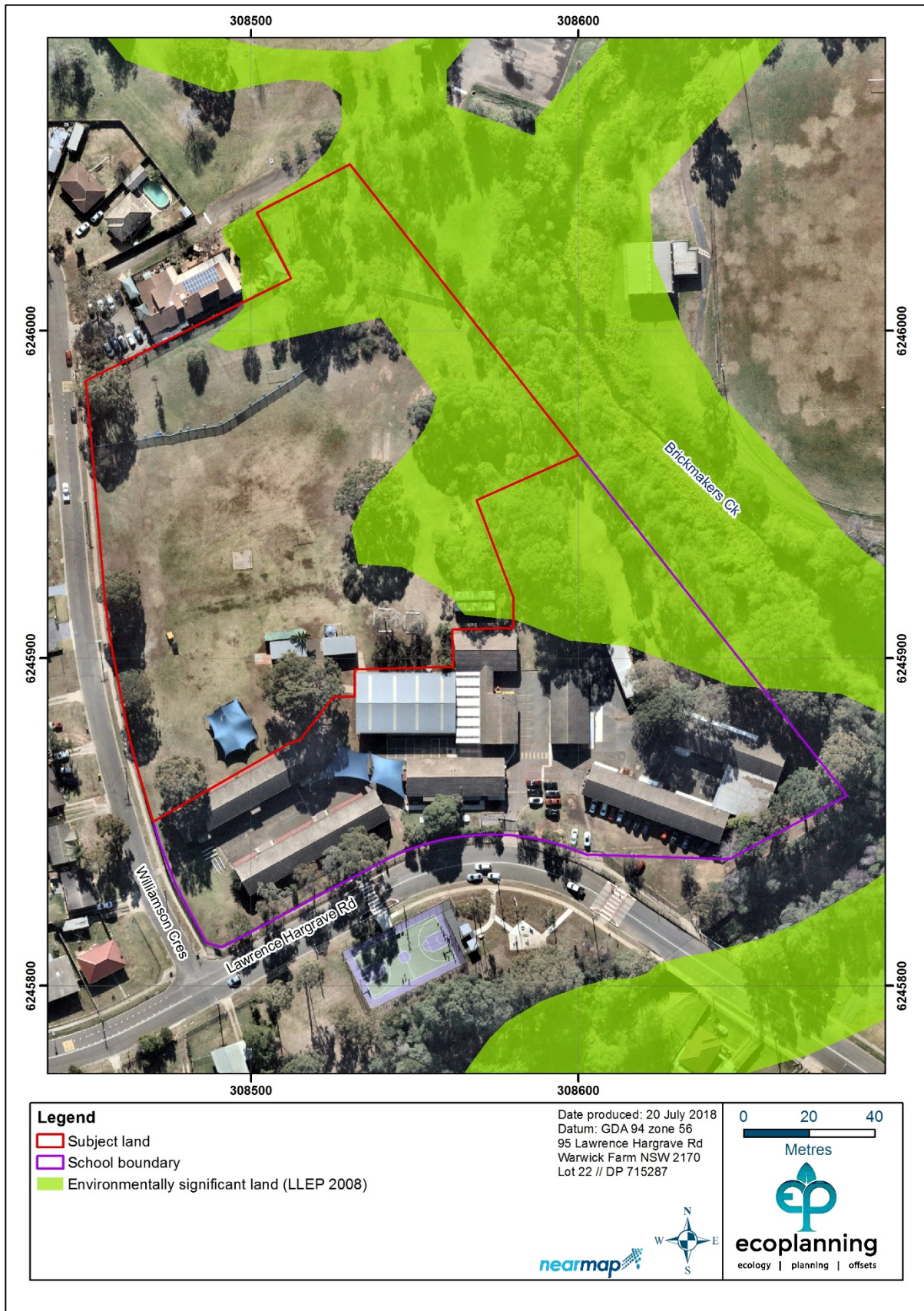


Figure 1.3: Environmentally Significant Land in the subject land (LLEP 2008).

2. Landscape context

2.1 Identify landscape features

In accordance with the BAM, a number of features are assessed within and surrounding the subject land. Provided below are details related to IBRA bioregion 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 addressed, where appropriate. The landscape features are presented in both the Site Map (**Figure 2.1**) and Location Map (**Figure 2.2**) as per section 4.2 of the BAM.

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 the 'Georges River Alluvial Plain' NSW Mitchell Landscape (Mitchell Landscapes V3.1). The 'Cumberland Plain' landscape also occurs within the 1,500 m buffer. Refer to **Figure 2.2**.

The 'Georges River Alluvial 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 Brickmakers Creek flows south to north just east of the school boundary. Brickmakers Creek (a second order stream) flows into Cabramatta Creek (a fourth order stream), which then flows east to Chipping Norton Lake and the Georges River (a seventh order stream). Both Cabramatta Creek and Georges River are within the 1,500 m assessment circle (see **Figure 2.2**). While there are no mapped watercourses within the subject land, runoff from the subject land would flow into Brickmakers Creek.

The riparian buffer associated with Brickmakers Creek intersects with the school boundary along the eastern boundary and south-eastern corner. The buffer covers a portion of the south-eastern corner of the subject land. This portion is 3 m wide at the widest section, and 23 m long along the subject land boundary (**Figure 2.1**). This riparian feature has been marked as 'part of the development footprint' in the 'Site Context' tab of the BAM calculator.

Local and important wetlands

No important wetlands, as defined by the BAM, are within the subject land or buffer area.

Brickmakers Creek flows into the lower section of Cabramatta Creek Wetland, which is approximately 300 m downstream from the subject land (see **Figure 2.2**). Cabramatta Creek Wetland is a local wetland, as defined by the BAM, and is managed by a Plan of Management prepared by Fairfield City Council and Liverpool City Council with support from Sydney Metropolitan Catchment Management Authority (FCC & LCC 2011).

Habitat connectivity

The vegetation within the subject land is connected to the riparian corridor along Brickmakers Creek, east of the subject land (see **Figure 2.1**: Site map.). The vegetation along this riparian corridor connects Brickmakers Creek corridor to Cabramatta Creek corridor. As less than 15% of the buffer area is vegetated, these riparian corridors form significant habitat connectivity in the buffer area. There are small terrestrial corridors that link from the riparian corridors into urban areas.

Areas of geological significance and soil hazard features

The subject land does not incorporate areas of geological significance.

Contaminated fill, including asbestos fibres and lead, has been identified on the subject site. **Figure 2.3** shows the areas of the subject site that are affected by this contaminated fill.

Areas of outstanding biodiversity value

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

Human made structures

Human made structures were found to be present on the subject land in the form of two toilet blocks, currently in use by Warwick Farm Public School, and two shipping containers. Both structures are along the southern boundary of the subject land. The shipping containers are adjacent each other in the southeast portion and the two toilet blocks are in the south-central portion. Refer to **Figure 1.2**.

Non-native vegetation

Non-native vegetation is present on the subject land in the form of planted trees and shrubs and exotic grass cover.

2.2 Determining site context

2.2.1 Assessing native vegetation cover

A layer of native vegetation cover is required for a 1,500 m 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 Native Vegetation of the Sydney Metropolitan Area updated vegetation layer (OEH, 2016b) as a base, with edits made to the layer where obvious changes to vegetation extent had occurred. Refer to **Figure 2.2**.

The total area of the 1,500 m buffer around the subject land is 773.88 ha, with the area of vegetation mapped within the buffer being 106.82 ha. This is a native vegetation cover of 13.80% (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 is 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 100 m from the next area of moderate to good condition native vegetation (or ≤30 m 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 of each other (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, 2016b). 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 woody patches of vegetation in the subject land are less than 100 m apart and hence are considered one patch of vegetation (see **Figure 2.2**). This patch connects to woody vegetation along Brickmakers Creek and Cabramatta Creek. The patch along Cabramatta Creek is intersected by major, dual carriageway roads in the east (Hume Highway) and west (Cumberland Highway) of the buffer area. These roads are considered to be barriers that separate the patch and hence the vegetation patch was severed at these roads. This patch comprises approximately 38 ha and has been assigned second largest patch class of 25-100 ha.

The exotic grassland in the subject site forms a patch of grassland that connects with the playing fields and sporting grounds along Brickmakers Creek and Cabramatta Creek. This patch is approximately 20 ha and has been assigned 5-24 ha class.

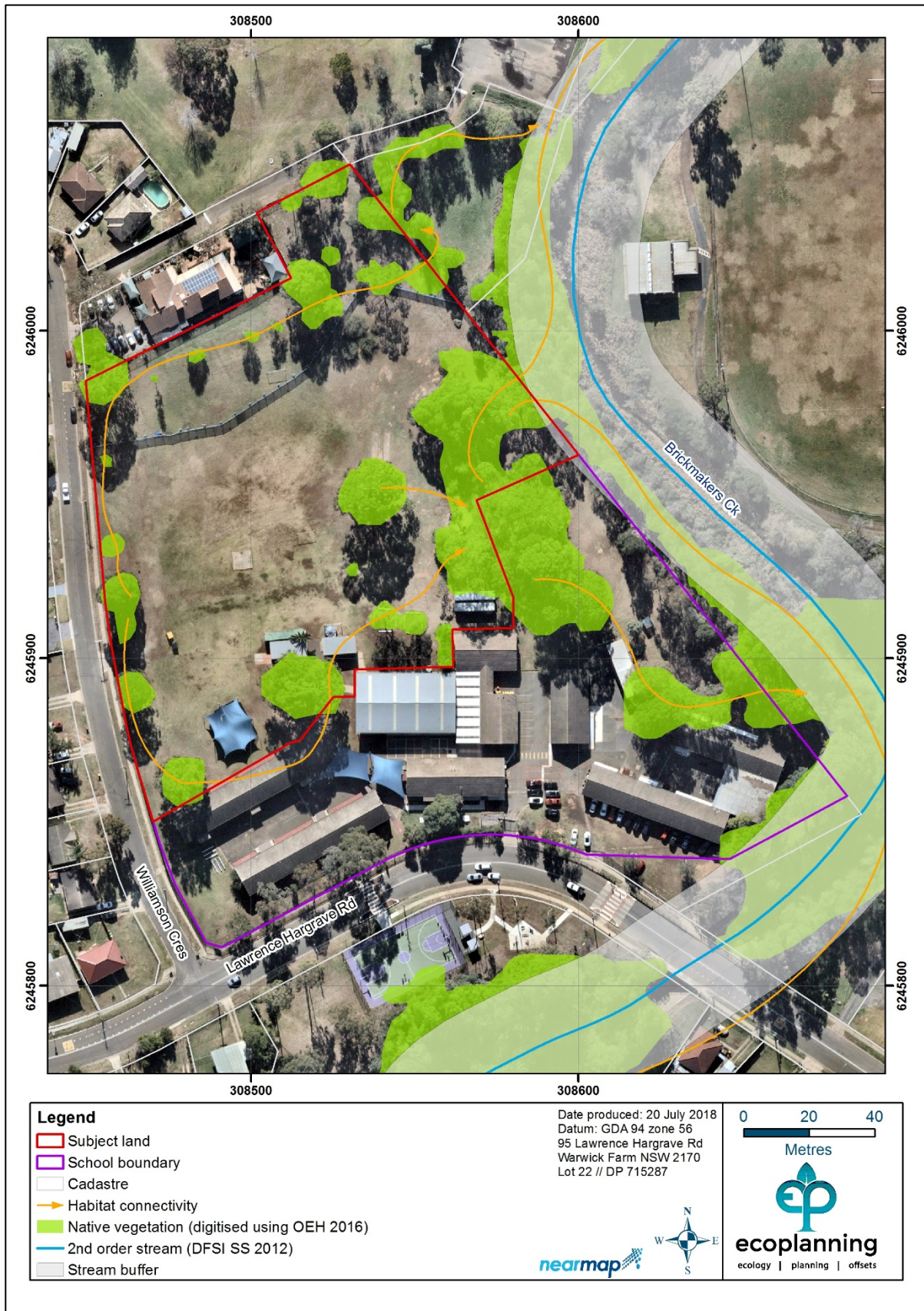


Figure 2.1: Site map.

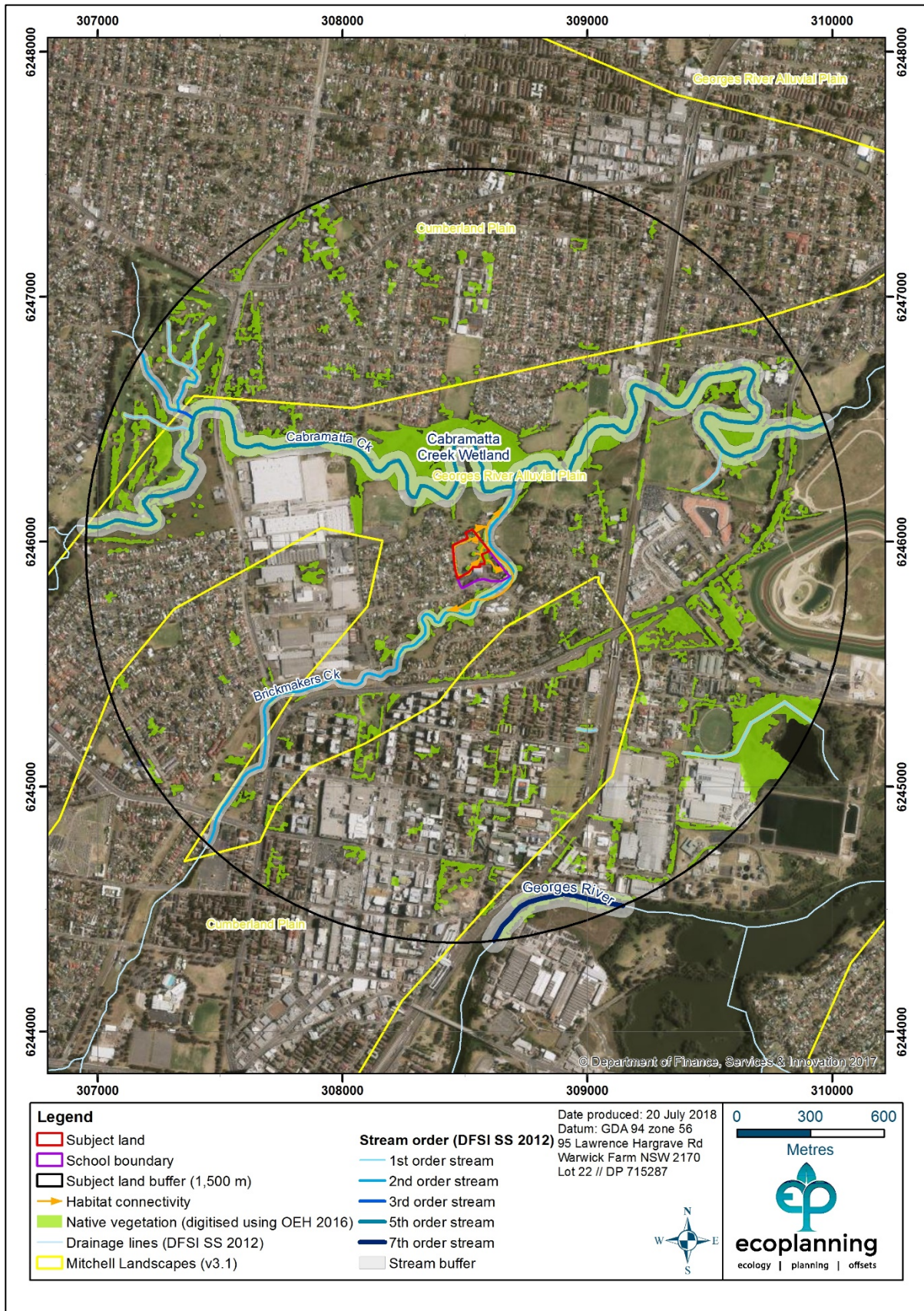
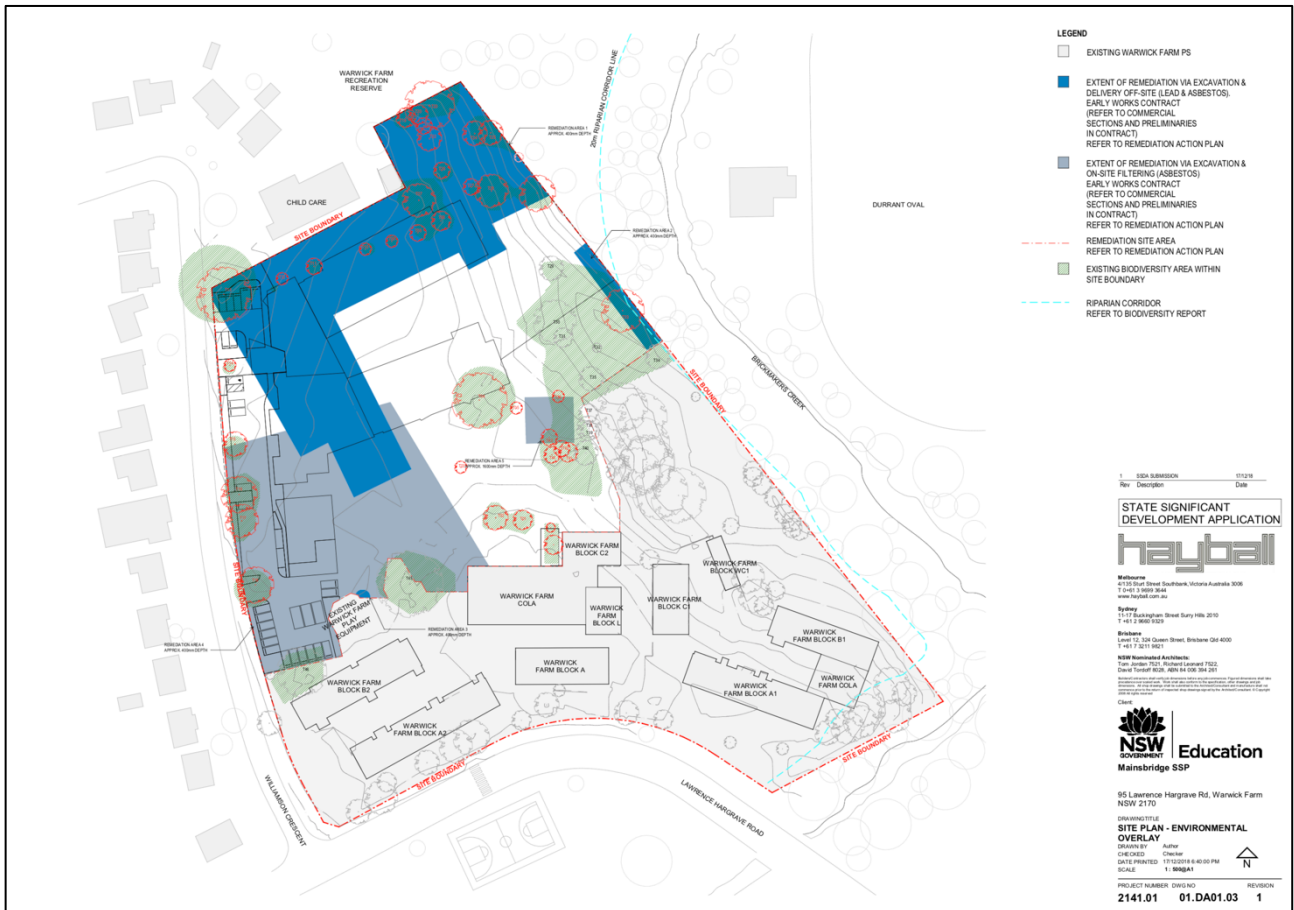


Figure 2.2: Location map.



3. Native vegetation

3.1 Plant community types (PCTs) and threatened ecological communities

3.1.1 Previous vegetation mapping

Desktop assessment indicates the subject land does not contain remnant native vegetation communities (NPWS, 2002; OEH, 2016b; Tozer et al., 2006). Refer to **Figure 3.1**, **Figure 3.2** and **Figure 3.3**. However, a strip of vegetation to the east of the subject land along Brickmakers Creek has been identified as Alluvial Woodland (MU11) (NPWS, 2002) while OEH (2016b) mapping shows three different communities:

- Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT835);
- Cumberland Swamp Oak Riparian Forest (PCT 1800); and
- Urban/exotic vegetation without a PCT assigned to it.

Regional vegetation mapping by Tozer et al. (2006) does not include vegetation mapping of the subject land or the immediate surrounds. The closest mapped patch of vegetation occurs to the north of the site along Cabramatta Creek and has been identified as Cumberland River Flat Forest (p.33).

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, one native vegetation community in an 'underscrubbed' condition class was identified and two exotic vegetation communities (see **Figure 3.4**) and are listed below:

- Alluvial Woodland (MU11)
- Exotic grassland/infrastructure
- Exotic planted vegetation

Alluvial Woodland forms part of the Endangered Ecological Community (EEC), '*River-flat Eucalypt Forest on Coastal Floodplains of the in the Sydney Basin Bioregion*' under the BC Act. The relationship between the Alluvial Woodland, its corresponding Plant Community Types (PCTs) and Threatened Ecological Community (TEC) 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 (OEH 2013)	Plant Community Types (PCTs)	Threatened Ecological Communities (TECs)	BC Act	EPBC Act
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	-

E = Endangered

3.1.2 Field assessment of vegetation communities

Assessment and mapping of Plant Community Types (PCTs) was undertaken on 3 July 2018 by Thomas Hickman (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, vegetation communities present were identified, and their boundaries were mapped. The floristics of each of these vegetation communities were then sampled within 20 x 20 m 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.

It is noted that the identification of vegetation communities and PCTs was complicated by the fact that field observations were of disturbed, fragmented and previously cleared stands of vegetation. Furthermore, the canopy and midstorey stratum in the subject land consisted of planted vegetation, some of which is not indigenous to the Sydney Basin Bioregion. Nevertheless, a majority of the planted vegetation meets the definition of 'native vegetation' in accordance with *Local Land Services Act 2013* (LLS Act), as they consist of trees and understorey plants that are native to New South Wales (NSW). Planted 'native vegetation' is required to be treated in the same way as native vegetation, and where the vegetation is a mix of local and non-local planted species, the best matching PCT should be considered. Based on this, the following PCT was assigned to the 'native vegetation' in the subject land (**Figure 3.4**):

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

A summary of the PCT within the subject land including areas of vegetation zones, the percent cleared for the PCT and Serious and Irreversible Impacts (SII) 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 SII entities.

Plant Community Types (PCTs)	Vegetation Formation & class	Vegetation zones	Area (ha)	Threatened Ecological Communities (TECs)	SII 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	0.37	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	No
Exotic planted vegetation	N/A	N/A	0.03	N/A	N/A
Exotic grassland/infrastructure	N/A	N/A	1.30	N/A	N/A
Total vegetation			1.70*		

* Rounding errors may occur as calculations were done to 6 decimal places and reported to 2 decimal places

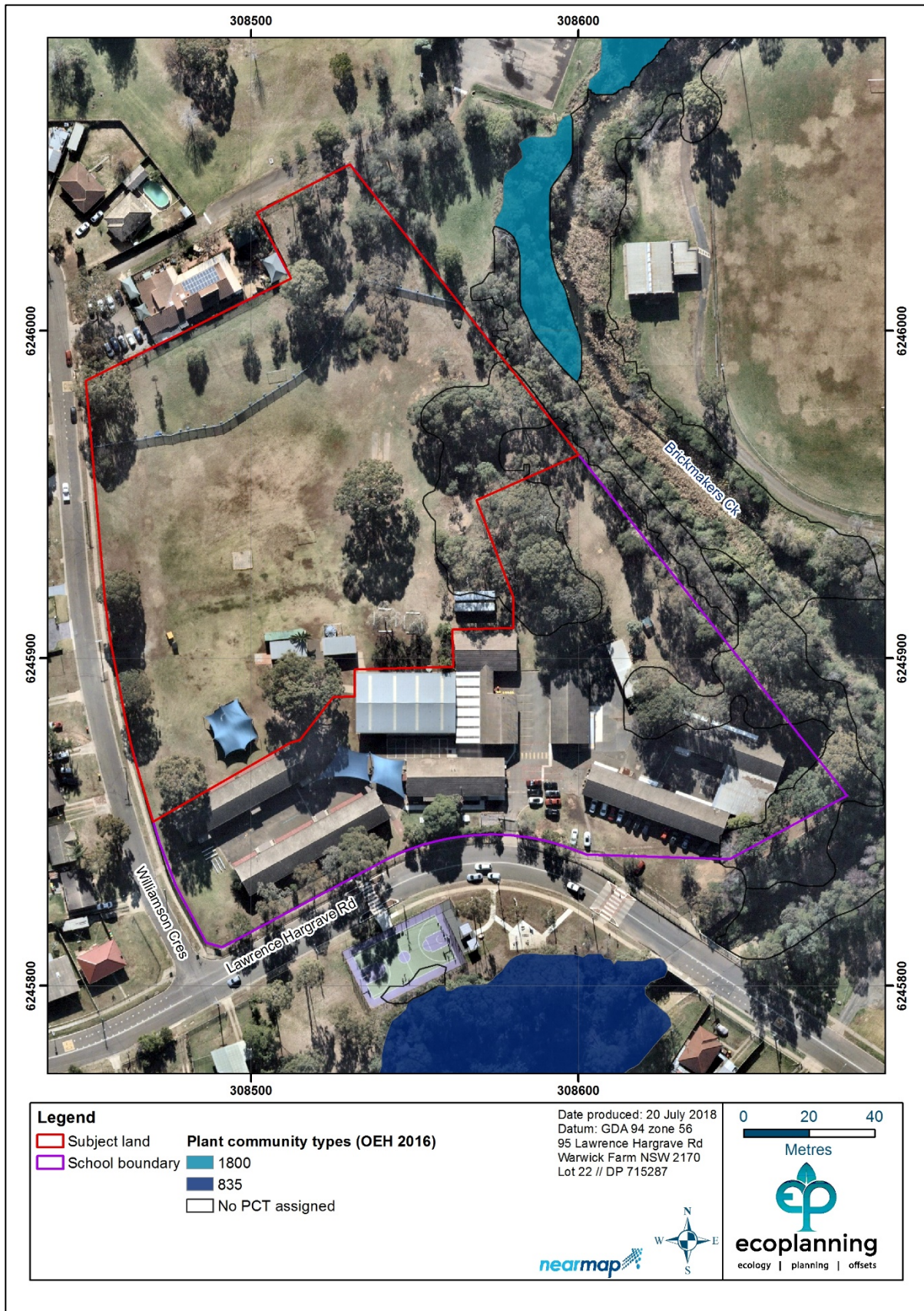


Figure 3.1: Vegetation types (OEH, 2016b).



Figure 3.2: Vegetation types (NPWS, 2002).

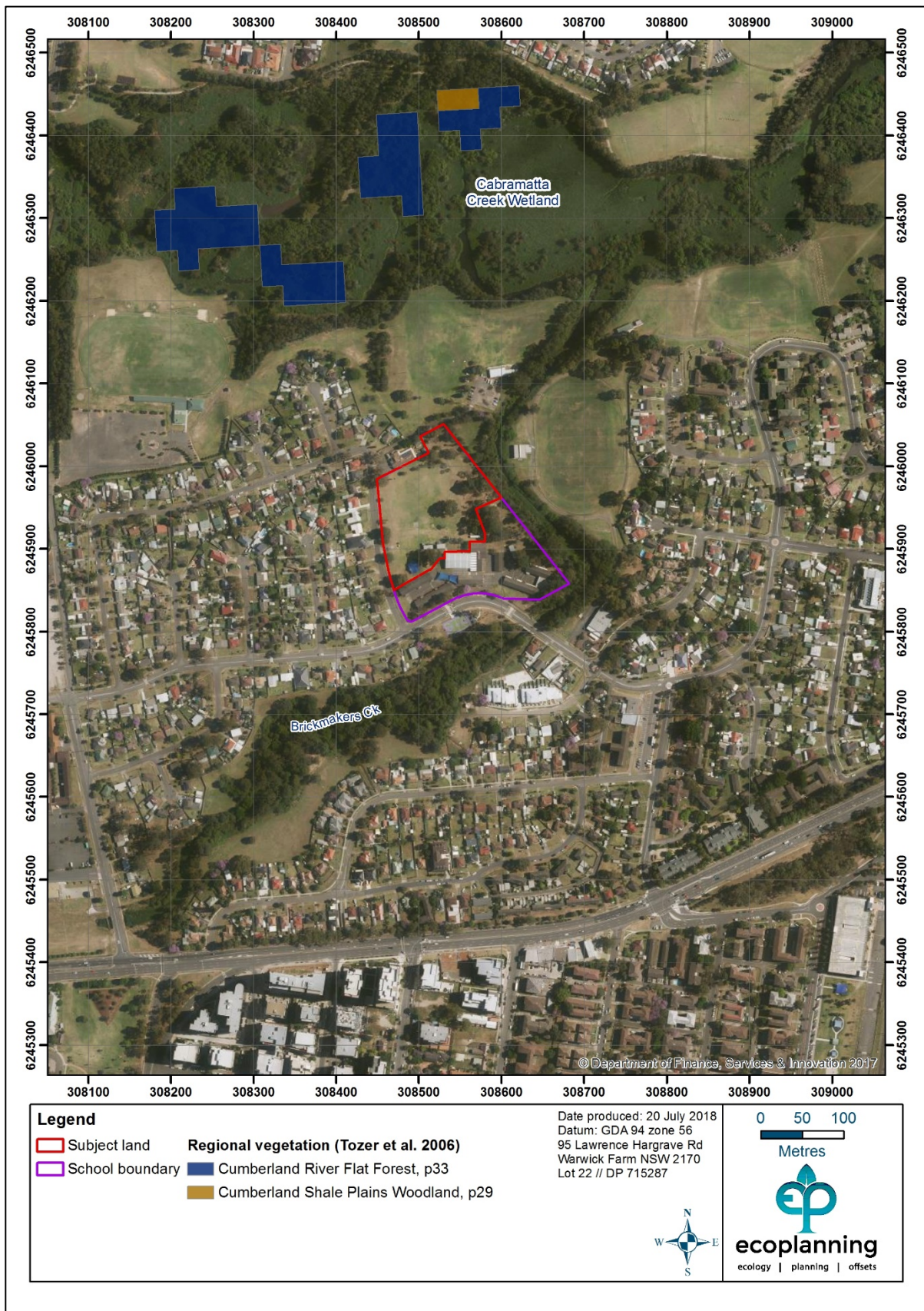


Figure 3.3: Vegetation types (Tozer et al., 2006).



Figure 3.4: 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 the vegetation in the subject land to be most appropriately allocated to Alluvial Woodland (MU11) (**Figure 3.4**). This allocation was based on the likely presence of this community in the landscape prior to the removal of indigenous canopy and midstorey species and subsequent disturbances which have altered the native groundlayer. Alluvial Woodland corresponds with the PCT 'Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835)'. PCT 835 is situated on the riverflats of the Cumberland Plain in western Sydney in the Hunter Valley 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. One condition class of Forest Red Gum – Rough-barked Apple grassy woodland was identified onsite; 'underscrubbed' (see **Figure 3.5**).

This vegetation community is comprised of midstorey and canopy species that are 'native vegetation' in accordance with the LLS Act, including *Eucalyptus microcorys* (Tallowwood), *Lophostemon confertus* (Brushbox), and *Callistemon viminalis* (Weeping Bottlebrush). However, these species are non-indigenous to the Liverpool LGA and do not naturally occur within any of the PCTs within the Sydney Basin Bioregion. Additional native canopy species identified in the study area included *E. robusta* (Swamp Mahogany), which is planted and is not commonly associated with vegetation communities in the area. Several *Casuarina cunninghamiana* (River Oak) were identified in the subject site and are likely planted. However, it is possible that some *C. cunninghamiana* have naturally recruited, as they occur within the vegetation along Brickmakers Creek and it is listed as a diagnostic species for Alluvial Woodland (MU11) (NPWS, 2002).

A grassy understorey was present throughout this vegetation community and contained native grasses and forbs, such as *Tricoryne elatior* (Yellow Autumn-lily), *Desmodium varians* (Slender Tick-trefoil), *Eragrostis brownii* (Brown's Lovegrass), *Dichondra repens* (Kidney Weed) and *Microlaena stipoides* var. *stipoides* (Weeping Grass). Exotic species constituted a reasonable proportion of the groundlayer (ranging between 50% and up to 95% in some areas), with a higher proportion of exotic species recorded in the south of the subject land. Dominant exotic grasses and herbaceous weeds included, *Axonopus fissifolius** (Narrow-leaved Carpet Grass), *Bidens pilosa** (Cobblers Pegs), *Cenchrus clandestinus** (Kikuyu Grass), *Cynodon dactylon*† (Couch), *Eragrostis curvula** (African Lovegrass) and *Sporobolus africanus** (Parramatta 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. However, as the native canopy and midstorey in the study area are non-indigenous to the Liverpool LGA, the PCT allocation for the vegetation could not be based on the dominant canopy and midstorey species onsite. As such, assessments were made to determine which the most likely PCT occurred in the subject land prior to vegetation clearing and ongoing management of the site. Based upon the landscape position of the subject being identified as stream banks and alluvial flats on the Cumberland Plain, PCT 835 was identified as the most appropriate PCT. Furthermore, the vegetation to the east of the subject land along Brickmakers Creek appeared to be consistent with PCT 835.

'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 SAI 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 SAI 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**. Species recorded onsite within this patch are highlighted in **bold text** in this table.



Figure 3.5: Forest Red Gum – Rough-barked Apple grassy woodland ‘underscrubbed’.

Table 3.3: VIS plant community type profile (OEH, 2018b) – 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	<i>Eucalyptus tereticornis</i> (Forest Red Gum), <i>Angophora floribunda</i> (Rough-barked Apple), and <i>E. amplifolia</i> subsp. <i>amplifolia</i> (Cabbage Gum)
Middle stratum	<i>Acacia parramattensis</i> (Parramatta Wattle), <i>Bursaria spinosa</i> subsp. <i>spinosa</i> (Blackthorn), and <i>Sigesbeckia orientalis</i> (Indian Weed)
Ground stratum	<i>Microlaena stipoides</i> var. <i>stipoides</i> , <i>Oplismenus aemulus</i> , <i>Dichondra repens</i> (Kidney Weed), <i>Entolasia marginata</i> (Bordered Panic), <i>Solanum prinophyllum</i> (Forest Nightshade), <i>Pratia purpurascens</i> (Whiteroot), <i>Desmodium gunnii</i> , <i>Echinopogon ovatus</i> (Forest Hedgehog Grass), <i>Commelina cyanea</i> (Native Wandering Jew), and <i>Veronica plebeia</i> (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)	BC 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

Exotic 'grassland/infrastructure'

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 (see **Figure 3.6**), including *Cenchrus clandestinus**, *Cynodon dactylon*†, *Eragrostis tenuifolia** (Elastic Grass), *Gamochaeta* sp.*, *Hypochaeris radicata** (Catsear), *Paspalum dilatatum** (Paspalum) and *Sporobolus africanus**. This grassland vegetation was noted to be predominantly exotic (approximately 99% cover), with the most abundant native species recorded as, *Cenchrus clandestinus** and *Cynodon dactylon*†.

Cynodon dactylon† is a cosmopolitan species that is likely 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 R. Brown (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 *Cynodon dactylon*† commonly occurred with an array of other introduced pasture grasses within the school oval, 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.

Exotic 'planted vegetation'

Planted vegetation that does not constitute the definition of 'native vegetation' in accordance with s5a of the LLS Act. For the purposes of this assessment this includes all planted *Corymbia citriodora* (Lemon-scented Gum) within the subject land (see **Figure 3.7**).



Figure 3.6: Cleared land 'exotic grassland' in the subject land.



Figure 3.7: An example of a planted *Corymbia citriodora* adjacent to the construction fence.

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 3.4**. **Figure 3.8** shows the spatial arrangement of the vegetation zones within the development site and associated vegetation integrity survey plots. Only one vegetation zone was identified for the Forest Red Gum - Rough-barked Apple grassy woodland in the subject land, in an 'underscrubbed' condition.

3.2.2 Vegetation integrity survey plots

Two vegetation integrity survey plots were completed on the subject land, 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 (**Table 3.4**), 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.

Table 3.4: Vegetation integrity survey plots.

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	0.37	1	1
NA	Exotic 'planted vegetation'	Exotic vegetation	0.03	NA	0
NA	Exotic 'grassland/infrastructure'	Exotic grasslands	1.30	NA	1*

Note: A vegetation integrity plot was undertaken in the exotic grassland to provide quantitative evidence to conclude if the grassland was native or exotic. The vegetation was found to not constitute native vegetation due to its dominance of exotic species and low vegetation integrity score and hence not incorporated into the BAM calculator beyond Section 5.4 of the BAM.

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 less than 2ha, only one vegetation integrity plot was required for a vegetation zone of this size.

The vegetation integrity scores for the vegetation zone and exotic grassland are provided in **Table 3.5**. The vegetation Zone 1 (PCT 835 'underscrubbed' condition class) recorded a vegetation integrity score of 24/100. It is noted that the cosmopolitan species, *Cynodon dactylon*†, was not included as a native species within the Alluvial Woodland (PCT 835) vegetation zones for the purposes of calculating the vegetation integrity score.

The vegetation integrity score for the exotic grassland is 2.3/100. This constitutes a highly degraded community and is below the threshold for requiring offset as per Section 3.1.1.3 of the BAM.

A future vegetation integrity score was allocated to the vegetation zone. The project would involve complete clearing of all vegetation in the subject land and the default future vegetation integrity score of 0 was applied.

Table 3.5: 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	Underscrubbed	0.37	24	0
NA	Exotic 'planted vegetation'	Exotic vegetation	0.03	NA	NA
NA	Exotic grassland	Exotic grasslands	1.30	2.3	NA

Note: A vegetation integrity plot was undertaken in the exotic grassland to provide quantitative evidence to conclude if the grassland was native or exotic. The vegetation was found to not constitute native vegetation due to its dominance of exotic species and low vegetation integrity score and hence not incorporated into the BAM calculator beyond Section 5.4 of the BAM.



Figure 3.8: Vegetation zones and vegetation integrity survey plot locations.

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 1500 m 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 Geographic and habitat features

Selected ecosystem credit species and 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 an ecosystem credit species or candidate species for assessment. **Table 4.3** and **Table 4.2** outlines the questions asked for these species, and whether the species is confirmed as a candidate species.

Table 4.1: Assessment of habitat constraints and geographic limitations of ecosystem credit species.

Scientific Name / Common Name	Habitat constraints	Geographic limitations	Maintained as an ecosystem credit species
<i>Botaurus poiciloptilus</i> Australasian Bittern	1. Waterbodies 2. Brackish or freshwater wetlands	-	No
<i>Grantiella picta</i> Painted Honeyeater	1. Other 2. Mistletoes present at a density of greater than five mistletoes per hectare	-	No
<i>Ixobrychus flavicollis</i> Black Bittern	1. Waterbodies 2. Land within 40 m of freshwater and estuarine wetlands, in areas of permanent water and dense vegetation	-	No

Table 4.2: Assessment of habitat constraints and geographic limitations of species credit species.

Scientific Name / Common Name	Habitat constraints	Geographic limitations	Maintained as candidate species
<i>Burhinus grallarius</i> Bush Stone-curlew	1. Fallen/standing dead timber including logs	-	No
<i>Chalinolobus dwyeri</i> Large-eared Pied Bat	1. Cliffs 2. Within 2 km of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels	-	No. There are no caves in the subject land. It is unlikely that there are any habitat constraints within 2 km of the subject land.
<i>Litoria aurea</i> Green and Golden Bell Frog	1. Semi-permanent/ephemeral wet areas 2. Within 1 km of wet areas Swamps 3. Within 1 km of swamp Waterbodies 4. Within 1 km of waterbody	-	Yes

Scientific Name / Common Name	Habitat constraints	Geographic limitations	Maintained as candidate species
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> - endangered population <i>Marsdenia viridiflora</i> R. Br. subsp. <i>viridiflora</i> population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	-	Those LGAs named in the population's listing	Yes
<i>Myotis macropus</i> Southern Myotis	1. Hollow bearing trees 2. Within 200 m of riparian zone 3. Bridges, caves or artificial structures within 200 m of riparian zone	-	Yes
<i>Pilularia novae-hollandiae</i> Austral Pillwort	1. Semi-permanent/ephemeral wet areas 2. Periodically waterlogged sites (including drains and farm dams)	-	No
<i>Wahlenbergia multicaulis</i> - endangered population Tadgell's Bluebell in the local government areas of Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield	1. Other 2. Land situated in damp, disturbed sites	-	No. Although the habitat constraint is present in the subject land, this population has geographic constraints identified in the name (although not identified as a geographic limitation in the credit calculator). This assessment has taken the geographic constraint in the name to be a geographic limitation as per s6.4.1.3 of the BAM.

4.1.2 Ecosystem credit species

The ecosystem credit species predicted on site are provided in **Table 4.3**. The habitat and geographic constraints were initially assessed for the ecosystem credit species. Three species, Australasian Bittern (*Botaurus poiciloptilus*), Painted Honeyeater (*Grantiella picta*) and Black Bittern (*Ixobrychus flavicollis*) were removed from the list due to the habitat constraints assigned to these species not occurring in the subject land. Additionally, areas of exotic grassland were not considered as habitat for any ecosystem credit species.

Table 4.3: Ecosystem credit species predicted on site.

Scientific Name / Common Name	NSW listing status*	National listing status*
<i>Anthochaera phrygia</i> Regent Honeyeater (Foraging)	CE	CE
<i>Artamus cyanopterus cyanopterus</i> Dusky Woodswallow	V	-
<i>Callocephalon fimbriatum</i> Gang-gang Cockatoo (Foraging)	V	-
<i>Chthonicola sagittata</i> Speckled Warbler	V	-
<i>Climacteris picumnus victoriae</i> Brown Treecreeper (eastern subspecies)	V	-
<i>Daphoenositta chrysoptera</i> Varied Sittella	V	-
<i>Dasyurus maculatus</i> Spotted-tailed Quoll	V	E
<i>Glossopsitta pusilla</i> Little Lorikeet	V	-
<i>Haliaeetus leucogaster</i> White-bellied Sea-Eagle (Foraging)	V	-
<i>Hieraaetus morphnoides</i> Little Eagle (Foraging)	V	-
<i>Lathamus discolor</i> Swift Parrot (Foraging)	E	CE
<i>Lophoictinia isura</i> Square-tailed Kite (Foraging)	V	-
<i>Melanodryas cucullata cucullata</i> Hooded Robin (south-eastern form)	V	-
<i>Melithreptus gularis gularis</i> Black-chinned Honeyeater (eastern subspecies)	V	-
<i>Miniopterus australis</i> Little Bentwing-bat (Foraging)	V	-
<i>Miniopterus schreibersii oceanensis</i> Eastern Bentwing-bat (Foraging)	V	-
<i>Mormopterus norfolkensis</i> Eastern Freetail-bat	V	-
<i>Neophema pulchella</i> Turquoise Parrot	V	-
<i>Ninox connivens</i> Barking Owl (Foraging)	V	-
<i>Ninox strenua</i> Powerful Owl (Foraging)	V	-
<i>Pandion cristatus</i> Eastern Osprey (Foraging)	V	-
<i>Petroica boodang</i> Scarlet Robin	V	-
<i>Petroica phoenicea</i> Flame Robin	V	-

Scientific Name / Common Name	NSW listing status*	National listing status*
<i>Phascolarctos cinereus</i> Koala (Foraging)	V	V
<i>Pteropus poliocephalus</i> Grey-headed Flying-fox (Foraging)	V	V
<i>Saccolaimus flaviventris</i> Yellow-bellied Sheath-tail-bat	V	-
<i>Stagonopleura guttata</i> Diamond Firetail	V	-
<i>Tyto novaehollandiae</i> Masked Owl (Foraging)	V	-

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

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 use the 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 and consists of planted 'native' and exotic vegetation. To inform an assessment of how habitat degradation has impacted candidate threatened species a search of the Atlas of NSW Wildlife (OEH, 2018a) was undertaken (see **Appendix B**). 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, and
- 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 4.4** outlines the predicted candidate species which were deemed to not have suitable habitat within the subject land, including justification for this decision.

Table 4.4: Candidate species for which the subject land is not considered suitable habitat.

Species	Justification*
FLORA	
<i>Eucalyptus benthamii</i> (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.

Species	Justification*
<i>Callistemon linearifolius</i> (Netted Bottle Brush)	Unsuitable habitat within the subject land, the species grows in dry sclerophyll forest on the coast and adjacent ranges. Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. Recorded in 2000 at Coalcliff in the northern Illawarra. For the Sydney area, recent records are limited to the Hornsby Plateau area near the Hawkesbury River. Not recorded during the last 20 years within 5 km of the subject land.
<i>Hibbertia</i> sp. Bankstown (syn. <i>H. puberula</i> subsp. <i>glabrescens</i>)	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 4 km of the subject land.
<i>Persicaria elatior</i> (Tall Knotweed)	Unsuitable habitat within the subject land, the species has been recorded in south-eastern NSW (Mt Dromedary (an old record), Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. The species normally grows in damp places, especially besides streams. This habitat does not occur within the subject land. Not recorded during the last 20 years within 5 km of the subject land.
<i>Persoonia hirsuta</i> (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.
<i>Pilularia novae-hollandiae</i> (Austral Pillwort)	Unsuitable habitat for this species in the subject land, this species 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.
<i>Pomaderris brunnea</i> (Brown Pomaderris)	Unsuitable habitat for this species in the subject land, the species is found in a very limited area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. Not recorded during the last 20 years within 5 km of the subject land.
<i>Thesium australe</i> (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.
FAUNA	
<i>Anthochaera phrygia</i> (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.
<i>Callocephalon fimbriatum</i> (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 located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts. No hollow bearing trees were identified in the subject land.

Species	Justification*
	Not recorded during the last 20 years within 5 km of the subject land.
<i>Cercartetus nanus</i> (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.
<i>Haliaeetus leucogaster</i> (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.
<i>Hieraaetus morphnoides</i> (Little Eagle) (Breeding)	No suitable breeding habitat within the subject land. Breeding habitat for this species is tall living trees within a remnant patch, where pairs build a large stick nest in winter. The vegetation in the subject site does not form part of a remnant patch of vegetation and consists exclusively of planted native vegetation.
<i>Lathamus discolor</i> (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.
<i>Litoria aurea</i> (Green and Golden Bell Frog)	The subject land is within 1 km of a waterbody and wet areas, including Cabramatta Creek Wetlands, which is situated approximately 300 m to the north (Figure 2.2). As such, the subject land contains the habitat constraint for the species (see Table 4.1). However, the subject land is substantially degraded and does not provide suitable habitat for the species. No marshes, dams, or watercourses with vegetation such as bulrushes (<i>Typha</i> spp.) or spike-rushes (<i>Eleocharis</i> spp.) were identified in the subject land. Furthermore, the vegetation in the subject land is heavily managed and regularly mown and contained no habitat, such as coarse woody debris or dense vegetation cover.
<i>Lophoictinia isura</i> (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).
<i>Meridolum corneovirens</i> (Cumberland Plain Land Snail)	Unsuitable and degraded habitat within the subject land. This species lives under litter or bark, leaves and logs, or shelters in loose soil around grass clumps. The groundlayer in the subject land is heavily managed by regular mowing and is devoid of coarse woody debris and litter accumulation. Not recorded during the last 20 years within 3.75 km of the subject land
<i>Miniopterus australis</i> (Little Bentwing-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-bat (<i>Miniopterus schreibersii</i>) and appears to depend on the large colony to provide the high temperatures needed to rear its young.
<i>Miniopterus schreibersii oceanensis</i>	No suitable breeding habitat within the subject land. The species forms discrete populations centred on a maternity cave that is used

Species	Justification*
(Eastern Bentwing-bat) (Breeding)	annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes.
<i>Ninox connivens</i> (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 extend 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 6,000 ha, with 2,000 ha being more typical in NSW habitats. No hollow bearing trees were identified in the subject land. Not recorded during the last 20 years within 5 km of the subject land.
<i>Ninox strenua</i> (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 that harass him. No hollow bearing trees of suitable diameter for Powerful Owl to nest in were identified in the subject land.
<i>Pandion cristatus</i> (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 1 km of the sea.
<i>Petaurus norfolcensis</i> (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.
<i>Phascolarctos cinereus</i> (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 4 km of the subject land.
<i>Tyto novaehollandiae</i> (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. No hollow bearing trees or caves were recorded within 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 **four** predicted candidate species were confirmed for the subject land:

- *Cynanchum elegans* (White-flowered Wax Plant)
- *Marsdenia viridiflora* subsp. *viridiflora* (endangered population including occurrences in the Blacktown LGA)
- *Myotis macropus* (Southern Myotis)
- *Pteropus poliocephalus* (Grey-headed Flying-fox) (Breeding)

4.3 Determine presence or absence of a candidate species credit species

Confirmed candidate species were assessed consistent with Steps 4 – 6 of Section 6.4 of the BAM. Targeted surveys for species credit species was undertaken in accordance within Section 6.5 of the BAM, including undertaking surveys during the nominated survey period specified for each candidate species and in accordance with OEH threatened species survey guidelines. The survey effort, timing and locations for threatened flora and fauna are outlined in the following sections.

4.3.1 Targeted field surveys - flora

Targeted surveys for candidate threatened flora species were conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH, 2016a). Targeted surveys were undertaken on 3 July 2018 by Thomas Hickman (Ecologist) during the nominated survey periods for *Cynanchum elegans* (White-flowered Wax Plant) and *Marsdenia viridiflora* subsp. *viridiflora* (see **Table 4.5**). Targeted surveys initially involved identification of areas of potential habitat for candidate threatened flora species within the subject land. Areas of suitable habitat were then surveyed along parallel field-traverses with approximately 10 m separation, consistent with the requirements of OEH (2016a) for the smallest lifeforms (herbs ferns, forbs and climbers) on the list of candidate threatened flora species. Survey effort for threatened flora is shown on **Figure 4.1** and was focussed in potential habitat for the species in the north of the subject land, where the groundlayer was less disturbed and contained a higher proportion of native groundlayer species.

No candidate threatened flora species were recorded within the subject land.

Table 4.5: Survey periods for confirmed candidate threatened floral species.

Candidate species	Survey period (BAM Calculator)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<i>Cynanchum elegans</i> (White-flowered Wax Plant)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> (endangered population including occurrences in the Blacktown LGA)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Blue column indicates the primary survey month.

4.3.2 Targeted field surveys – fauna

Targeted surveys for the candidate threatened fauna species Grey-headed Flying-fox are outlined in **Table 4.6**. A survey was not undertaken for Southern Myotis as the timing is not suitable for reliable detection of this species. Given the records for this species in habitat surrounding the subject land, and presence of habitat constraints, this species was assumed present for the purposes of species credit calculations for this proposal.

Table 4.6: Survey periods for candidate threatened faunal species.

Candidate species	Survey period (BAM Calculator)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<i>Myotis macropus</i> (Southern Myotis)	Y	Y	Y								Y	Y
<i>Pteropus poliocephalus</i> (Grey-headed Flying-fox) (Breeding)										Y	Y	Y

Blue column indicates the survey months

Grey-headed Flying-fox (Pteropus poliocephalus) – Breeding habitat

Grey-headed Flying-fox roosts within communal 'camps', which are large congregations of many individuals of this species, where individuals hang from branches with limited protection. Many of these camps act as maternity camps where annual breeding and rearing of young takes place (DEC, 2004). Camps are typically located near water, such as lakes, rivers or the coast and commonly include rainforest patches, stands of

Melaleuca, mangroves and riparian vegetation, but colonies also use highly modified vegetation in urban and suburban areas (van der Ree et al., 2005).

As part of the 'National Flying-fox Monitoring Program' maps of known camps of this species have been prepared, with no known camp mapped within the subject land (DoEE, 2018). The nearest known camp of this species is located approximately 2 km south-east of the subject land at Cabramatta, with between 2,5000-10,000 individuals of this species recorded from this camp in May 2017 (DoEE, 2018).

The method for surveying for the presence of unrecorded day roosts included diurnal observations across the subject land. Flying-fox camps are easily recognised from a distance due to the distinctive audible calls that are heard most frequently in the early morning or under sunny conditions. Other signs include their distinctive odour and droppings.

No camps for this species were observed within the subject land. While, the survey timing (3 July 2018) does not coincide with the allowable survey period for Grey-headed Flying-fox under the BAM (October to December; **Table 4.6**), the surveys completed are considered sufficient to determine the presence of breeding habitat for the species within the subject land.

4.4 Field survey and results

4.4.1 Field survey

A field survey was undertaken on 3 July 2018 by Thomas Hickman (Ecologist). **Figure 4.1** shows the survey effort. The field survey included a general flora and fauna habitat and vegetation community assessment and the completion of two vegetation integrity plots in accordance with the BAM (OEH, 2017a). Weather conditions on the day were cold with 4.2 mm of rain recorded within 24 hours prior to the survey (see **Table 4.7**).

Table 4.7: Daily weather observation at Bankstown Airport (6 km to the east of the subject land).

Date	Temp (°C)		Rainfall (mm)	Max wind	
	Min	Max		Direction	Speed (km/h)
2/07/18	7.9	16.9	0.2	SE	28
3/07/18	6.4	18.9	4.0	WSW	17

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, decorticated 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 41 floral species were identified in the subject land during the field survey, of which 20 were native and 21 were exotic. Refer to **Appendix C**. A total of four high threat exotic (HTE) species were recorded in the subject land. Nomenclature follows the Flora of NSW (Harden 1990-2002) and updates provided in PlantNET (RBGDT 2018). No threatened floral species were identified in the subject land.



Figure 4.1: Survey effort.

Fauna habitat

The subject land contains minimal faunal habitat (see **Table 4.8**). The mature trees and a built environment within the study area could provide foraging, roosting, breeding and nesting resources for native fauna. The

subject land provides habitat for species common the urban environments, including the bird species recorded in the subject land during field survey (see **Appendix C**). No hollow-bearing trees, or substantial faunal habitat in the form of coarse woody debris were identified in the subject land.

Table 4.8: Key faunal habitat features present across the subject land.

Habitat features	Faunal species	Importance of habitat on site to life cycle of faunal species
Underscrubbed vegetation	Birds	Minimal as habitat available in adjacent land.
	Arboreal mammals	Minimal as habitat available in adjacent land.
	Microchiropteran bats	Minimal as habitat available in adjacent land.
	Reptiles	Minimal as habitat available in adjacent land.
Built infrastructure	Birds	Minimal. Only minor amount of built infrastructure present on subject site.
	Microchiropteran bats	Minimal. Only minor amount of built infrastructure present on subject site.
Open pasture	Birds	Minimal as habitat available in adjacent land.
	Microchiropteran bats	
	Reptiles	Minimal as habitat available in adjacent land.

Fauna species

The field survey undertaken for this report recorded a total of 16 faunal species, of which two were introduced (see **Appendix C**). No threatened faunal species were identified in the subject land.

5. Avoiding and minimising impacts on biodiversity values

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

The ability to avoid impacts to the native vegetation within the subject land was, difficult due to the scale of the project, and the fact that the site requires extensive soil remediation due to asbestos and lead contamination.

The proposed development will require the construction of new school facilities within the existing Warwick Farm Public School and will mostly impact on cleared land identified as exotic 'grassland/infrastructure' (1.30 ha, or approximately 76% of the subject land). Several planted small trees and shrubs must be removed for the required carparking of the development. The vegetation that will be impacted in the subject land consists of a mixture of both exotic and native planted vegetation. This vegetation was found to occur in a degraded condition and has been subject to past vegetation clearing and ongoing disturbances.

A large part of the area of the subject land outside the building envelope will be impacted by the soil remediation works that are required as part of the Proposal. Areas found to contain contaminated soil are shown in **Figure 2.3**. The actual construction footprint required to remediate the contaminated soils is much greater than the total area of contamination due to the need for machine and truck movement on site, as well as the stockpiling of materials for these construction activities. The need for extensive soil remediation leaves little scope to design the project in such a way that would minimise or avoid impacts on native vegetation and habitat.

5.1.1 Locating a project to avoid and minimise impacts on native vegetation and habitat

The proposal does not feasibly have the ability to select an alternative location to avoid or minimise impacts on native vegetation and habitat. The project is being constructed on land that is currently in use by the Department of Education for educational purposes. There are no alternative sites for the proposed development. Of note, there is a minimal amount of native vegetation and habitat on the subject site to avoid in the first instance.

5.1.2 Designing a project to avoid and minimise impacts on native vegetation and habitat

As mentioned above, the Proposal on the subject site does not have the ability to extensively avoid or minimise impacts on native vegetation and habitat as the areas outside the building footprints of the development are required to be disturbed to address the soil contamination issues.

Four additional mature trees are to be retained on the subject site as part of the current Proposal. To preserve these trees, all soil contamination is to be excavated by hand within the tree protection zones around the trees in order to preserve the integrity of the root systems.

There are no intact areas of bushland on the subject site. As such, there are limited options to design the Proposal to avoid impacts on native vegetation and habitat, design the proposal to enable species and genetic material to move across barriers or hostile gaps, or to make provisions in the Proposal to restore or rehabilitate biodiversity on the subject site.

The habitat values on the subject site are considered to be minimal, and as such, provide little opportunity to design the Proposal to avoid or minimise impacts on habitat features of the subject site.

5.2 Avoiding and minimising prescribed biodiversity impacts during project planning

Two prescribed biodiversity impacts were found to have the potential to be applicable to the Proposal: 1) impacts to habitat of threatened species associated with human made structures, and 2) impacts to habitat of threatened species associated with non-native vegetation.

The proposal will remove two small toilet blocks and two shipping containers from the subject site. The shipping containers are designed to not allow fauna to enter them and therefore are not considered to have any habitat value to threatened faunal species. The toilet blocks to be removed from the site have been considered to be of minimal habitat value to threatened faunal species.

The proposal will remove planted native and non-native trees that could potentially be used as marginal habitat (occasional foraging, roosting, breeding or nesting resources) for threatened faunal species. However, the riparian corridor of Brickmakers Creek, adjacent to and east of the subject site, was found to contain the same habitat resources. Considering the Proposal in the context of the habitat values of threatened species in the surrounding areas, the impact is considered to not be significant. Additionally, trees will be planted on the subject site as part of the Proposal, further improving the ecological values of the area as these mature, and effectively offsetting any impacts from the necessary clearing works.

There is present a minor connection within the subject site itself and Brickmakers Creek riparian corridor however, the mature trees on the subject site do not form a connecting corridor between any areas of significant biodiversity. Refer to **Figure 2.1**.

5.2.1 Locating a project to avoid and minimise prescribed biodiversity impacts

The project is being constructed on land that is already currently in use by the Department of Education for educational purposes. There are no alternative sites for the proposed development that would enable the project to avoid or minimise prescribed biodiversity impacts on the subject land.

There is also minimal scope to relocate the Proposal on the subject land to avoid or minimise prescribed biodiversity impacts due to the need for soil remediation works to address the extensive soil contamination issue on site. This consideration limits the options available to the proposal to minimise any prescribed biodiversity impacts.

5.2.2 Designing a project to avoid and minimise prescribed biodiversity impacts

As per the most current version of the Proposal, four additional mature trees are to be retained on the subject site after the Proposal has been adjusted and re-designed. However, given the constraints and considerations of the Proposal, there is minimal scope to design the project to further avoid or minimise disturbance to the non-native vegetation on the subject site while meeting the Proposal requirements.

The removal of the two toilet blocks has been deemed appropriate given their age and condition. A new toilet block will be built as part of the Proposal to replace the existing toilet blocks. Given these new facilities will improve the site amenity for the school population, the retention of the current toilet blocks has not been considered as part of the Proposal. The project cannot be designed in a way that avoids or minimises the removal of this feature from the subject land.

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 clearing 0.37 ha of native vegetation within the subject land. This native vegetation comprises one vegetation zone; PCT 835 Forest Red Gum – Rough-barked Apple grassy woodlands on Alluvial Flats in an ‘underscrubbed’ condition. The native vegetation is synonymous with the TEC River-flat Eucalypt Forest. The clearing and subsequent development of the subject land would represent a permanent impact, or loss, of this native vegetation and habitat.

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 residential development and supporting highly modified native vegetation is 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 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 unlikely to cause any increase in disturbances, such as trampling of flora, rubbish dumping, or introduce any pests, weeds or pathogens to the adjacent areas of native vegetation and habitat.

The boundary of the subject site (and therefore the construction site) is defined by a security fence, a 2.4m ‘diplomat’ steel fence. The accidental disturbance (e.g., trampling of native flora, litter, chemical storage or vehicle parking) of the riparian corridor from construction activities will be mitigated by this fencing.

All areas within the fence line are currently ‘disturbed’ so no indirect impacts are anticipated within the subject site itself.

Additionally, the subject site is a school with regular noise from the school population and regular disturbance by grounds maintenance (i.e., regular mowing with a ride-on lawn mower). The indirect impacts from the Proposal are considered to be minimal.

Indirect impacts associated with the construction phase of the project are to be mitigated through appropriate management practices and the implementation of a Construction Environmental Management Plan (CEMP).

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

6.2 Assessing prescribed biodiversity impacts

The subject site contains minimal habitat for faunal species. What is present is habitat in the form of under-scrubbed vegetation, built infrastructure and open pasture. None of these features are extensive in size or situated in connective corridors essential to the movement of threatened species. Post construction, all of these habitat features will return to the subject site, albeit in a modified version to the current state.

The impact of the Proposal on the habitat of threatened species or ecological communities associated with human made structures will be minimal. The human made structures that are to be removed for the Proposal include two toilet blocks (both small buildings that are used by the current school population) and two shipping containers. The suitability of these human made structures for threatened species or ecological communities is considered low.

The toilet blocks are in constant use by the current school population of Warwick Farm Public School. The activity and noise associated with their use would make them undesirable for bat species to roost in for prolonged periods of time and would therefore not form a vital habitat component for bat species. No other threatened faunal species in the surrounding area are considered likely to utilize these human made structures.

The shipping containers by design are considered to have little to no available habitat for bat species, or for other threatened species in the surrounding area.

No ecological communities are reliant on any of the man-made features found on the subject site.

The impact of the Proposal on the habitat provided by non-native vegetation for threatened species or ecological communities is considered minimal. The occasional use of the non-native vegetation on the subject site by threatened species is not seen as vital to the survival of each individual species as these habitat components are degraded in nature and more suitable habitat is situated in the adjacent Brickmakers Creek.

No ecological communities are reliant on any of the non-native vegetation found on the subject site.

6.3 Mitigating and managing impacts on biodiversity values

As described above, a majority of the impact will be incurred to exotic 'grassland/infrastructure'. Several measures will be implemented to reduce impacts where possible, such as appropriate pre-clearance protocols and a Construction Environmental Management Plan (CEMP). Details are provided below.

6.3.1 Pre-clearance protocols

A number of non-threatened fauna species, particularly birds are likely to be present at the development site. Appropriate pre-clearance protocols will 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 CEMP.

On-site supervision of tree felling and relocation of fauna

An ecologist will be required to be present onsite when felling trees. Trees should be inspected visually prior to felling operations. Any fauna occupying a tree during felling operations are to be relocated (where feasible) to bushland immediately adjacent to the site.

The ecologist will need to work closely with the plant operators to identify fauna and to stop work if an animal is observed and requires rescue. The ecologist will encourage any faunal species that may be present to move from site, or if considered necessary, capture, store and actively relocate them to another area. Any variation to this protocol must be approved by the 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 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 tree to vacate the tree prior to it 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 are to 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 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 Tree protection measures

It is recommended that all trees identified for retention on the subject site are to be managed in accordance with AS 4970 -2009 protection of trees on development sites. As per this standard, appropriate Tree

Protection Zones are to be installed around retained trees to mitigate the impact of construction activities on these trees.

6.4 Adaptive management for uncertain impacts

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

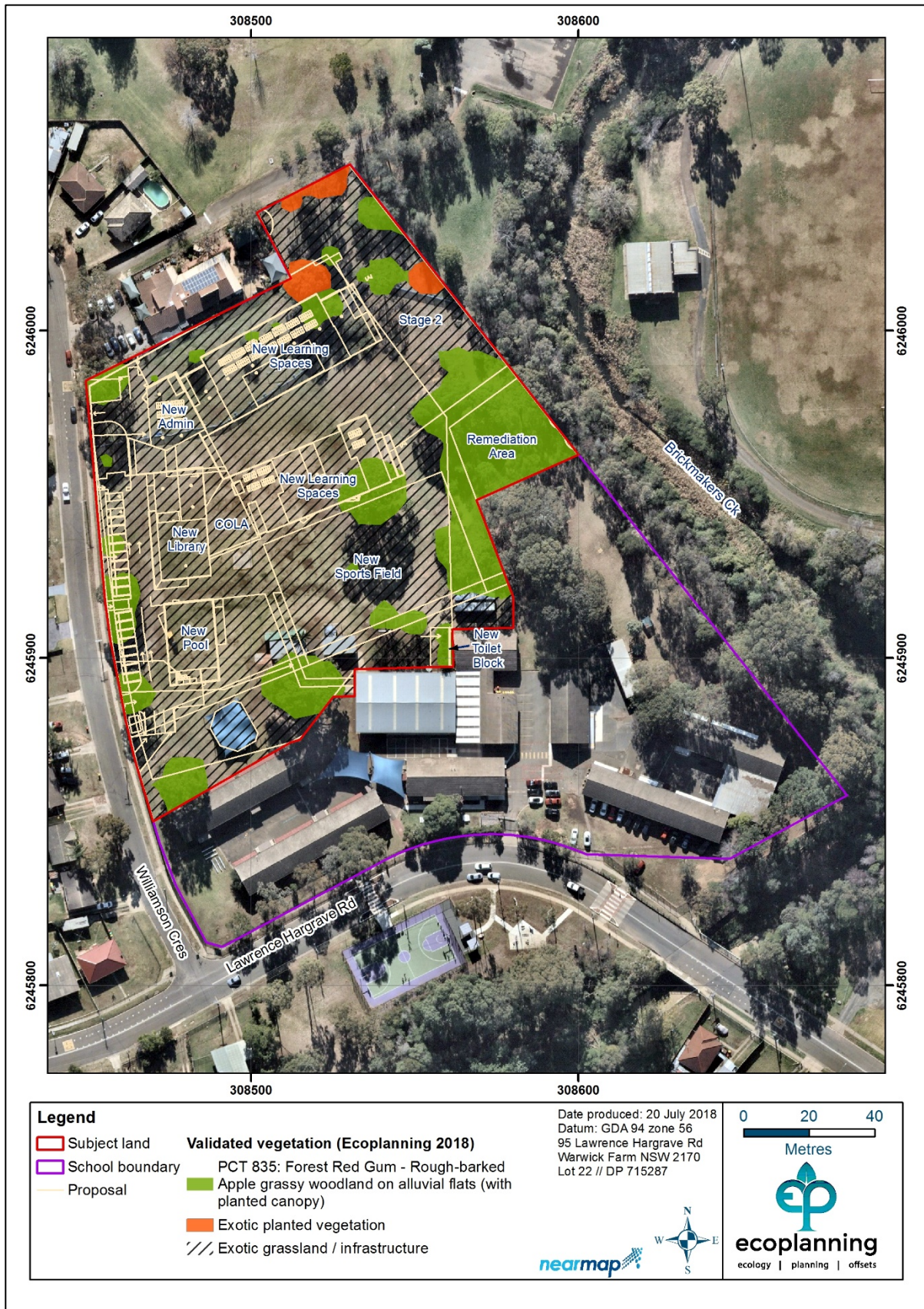


Figure 6.1: Field validated vegetation (Ecoplanning, 2018) and proposed footprint.

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 or not an impact on biodiversity values is likely to be a SAIL. The guide (OEH 2017b) lists in Appendix 3 the ecological communities that have potential to meet the SAIL principles and criteria. The *River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin* EEC identified in the subject land has not been identified as a potential SAIL entity in accordance with Appendix 3.

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 incurred to the PCT 835 (Alluvial Woodland) in an 'underscrubbed' condition will require offsets under the BAM (**Table 6.1**).

Table 6.1: Vegetation zones assessed that require an offset.

Veg zone number	Plant community type	Condition class	Biodiversity risk rating of PCT	Total impact (ha)
1	PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Underscrubbed	2	0.37
Total native vegetation impact				0.37

6.5.3 Impacts that do not require further assessment

As described in Section 10.3.1 of the BAM, impacts to non-native vegetation communities, including exotic 'planted vegetation and exotic 'grassland/infrastructure' were not considered beyond Section 5.4 or for Section 6.2 (including 6.2.1.4) of the BAM and did not require an offset (**Table 6.2**). Hence, they have not been assessed here.

Table 6.2: Vegetation which does not require offsets.

Vegetation	Condition class	Area impacted (ha)	Vegetation integrity score
Exotic 'planted vegetation'	Exotic vegetation	0.03	NA
Exotic grassland	Exotic grasslands	1.30	2.3

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 5 ecosystem credits are required to offset the development

Table 7.1: Ecosystem credits summary and credit profile.

Veg zone number	Plant community type	Condition class	Total impact (ha)	Credits required
1	PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Underscrubbed	0.4	5
Total native vegetation impact			0.4*	5

* Only one decimal place can be entered into the BAM calculator

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 km of the outer edge of the impacted site
- Containing hollow bearing trees - no

The total cost of ecosystem credits, should the Biodiversity Conservation Trust (BCT) be used to offset the impacts, are currently (20 July 2018) estimated to be **\$88,087.98** (excluding GST). Details are provided in **Table 7.2**. 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 7.2: Ecosystem credit costs.

Plant community type	Baseline price per credit	Price per credit	No. of ecosystem credits	Final credits price (ex GST)
PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	\$13,796.23	\$17,617.60	5	\$88,087.98

7.1.2 Species credits

Species credits are required for *Myotis macropus* (Southern Myotis). The species has been assumed present in the subject land. No surveys were conducted for this species due to the timing of the survey not being suitable for reliable detection of this species. Given the records for this species in habitat surrounding the subject land, and presence of habitat constraints, this species was assumed present for the purposes of species credit calculations for this proposal.

The species was assumed present in the native canopy vegetation in the subject land as it is within 200 m of a waterway. A total of 0.4 ha of ‘underscrubbed’ potential habitat is present in the subject land. All of this habitat would be directly impacted (i.e. removed). A total of 5 species credits are required for the removal of this habitat (**Table 7.3**).

The following offset rules apply for like-for-like options for Southern Myotis:

- *Myotis macropus* / Southern Myotis in any IBRA subregion in NSW

Table 7.3: Species credits summary and profile.

Veg zone number	Species credit species	Habitat	Total impact (ha)	Credits required
1	<i>Myotis macropus</i> (Southern Myotis)	PCT 835 - underscrubbed	0.4	5
Total habitat impact			0.4*	5

* Only one decimal place can be entered into the BAM calculator

The total cost of Southern Myotis species credits, should the Biodiversity Conservation Trust (BCT) be used to offset the impacts, are currently (9 July 2018) estimated to be **\$5,033.49** (excluding GST) (**Table 7.4** and **Appendix D**). The final credit price includes administrative cost and a risk premium.

Table 7.4: Species credits costs.

Species credit species	Price per credit	No. of ecosystem credits	Final credits price (ex GST)
<i>Myotis macropus</i> (Southern Myotis)	\$816.33	5	\$5,033.49

8. References

- Birdlife (2018). *Australia's Birds*. Online database available at: <http://birdlife.org.au/all-about-birds/australias-birds>, accessed 28 March 2018.
- Commonwealth Department of the Environment and Energy (DoEE 2015). *National Flying-fox Monitoring Viewer*. Accessed at <http://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf>.
- Department of Environment and Conservation (DEC) (NSW) (2004). *Natural Resource Management Advisory Series: Note 8: Flying Fox Camps*. Available online: <http://www.environment.nsw.gov.au/resources/nature/landholderNotes08FlyingFoxCamps.pdf>, accessed 28 March 2018.
- Groves, R.H. (2002). *Robert Brown and the naturalised flora of Australia*. *Cunninghamia* 7(4): 623-629.
- Harden, G. J. (ed.) (1990-2002). *Flora of New South Wales Volume 1-4, and including revisions and supplements*. New South Wales University Press, Sydney.
- Jessop, J., Dashorst, G.R.M. & James, F.M. (2006) *Grasses of South Australia: An Illustrated Guide to the Native and Naturalised Species*. Wakefield Press, Kent Town, South Australia.
- Langdon, R.F.N. (1954). *The origin and distribution of Cynodon Dactylon (L.) Pers.* Department of Botany, University of Queensland Press, Queensland.
- Liverpool City Council and Fairfield City Council (LCC & FCC) (2011). *Cabramatta Creek Wetland Plan of Management*, July 2011. Accessed at: www.fairfieldcity.nsw.gov.au/
- New South Wales National Parks and Wildlife Service (NPWS) (2002). *Interpretation Guidelines for the Native Vegetation Maps of the Cumberland Plain, Western Sydney, Final Edition*. NSW NPWS, Hurstville.
- NSW Dept. of Planning and Environment (DPE) (2018). *NSW Planning Portal*. NSW Government. Accessed at: <https://www.planningportal.nsw.gov.au/>.
- NSW Land and Property Information (LPI) (2018). *SIX Maps*. Accessed at: <https://maps.six.nsw.gov.au/>.
- NSW Office of Environment and Heritage (NSW OEH) (2016a). *NSW Guide to Surveying Threatened Plants*. Office of Environment and Heritage, Sydney.
- NSW Office of Environment and Heritage (OEH) (2016b). *The Native Vegetation of the Sydney Metropolitan Area - Version 3 VIS_ID 4489*
- NSW Office of Environment and Heritage (NSW OEH) (2017a). *Biodiversity Assessment Method*. Office of Environment and Heritage for the NSW Government, Sydney.
- NSW Office of Environment and Heritage (NSW OEH) (2017b). *Guidance to assist a decision-maker to determine a serious and irreversible impact*. Office of Environment and Heritage for the NSW Government, Sydney.
- NSW Office of Environment and Heritage (NSW OEH) (2018a). *BioNet Atlas of NSW Wildlife*. Accessed at: http://www.environment.nsw.gov.au/atlaspublicapp/UI_Modules/ATLAS_/AtlasSearch.aspx.
- NSW Office of Environment and Heritage (NSW OEH) (2018b). *NSW Vegetation Information Sydney (VIS) Classification Database VIS 2.1, logged in as public user at:* <http://www.environment.nsw.gov.au/NSWVCA20PRapp/LoginPR.aspx?ReturnUrl=%2fNSWVCA20PRapp%2fdefault.aspx>.
- PlantNET (RBGDT 2018). *NSW Flora Online*. Accessed at: <http://plantnet.rbgsyd.nsw.gov.au/>
- Simpson, K. and Day, N. (eds) (1993). *Field Guide to the Birds of Australia*. Viking O'Neil, Victoria.

Tindall, D., Pennay, C., Tozer, M.G., Turner, K., Keith, D.A. (2004). *Native vegetation map report series. No. 4. Araluen, Batemans Bay, Braidwood, Burragorang, Goulburn, Jervis Bay, Katoomba, Kiama, Moss Vale, Penrith, Port Hacking, Sydney, Taralga, Ulladulla, Wollongong.* NSW Department of Environment and Conservation and NSW Department of Infrastructure, Planning and Natural Resources, Sydney.

Tozer, M.G., Turner, K., Simpson, C.C., Keith, D.A., Beukers, P., Mackenzie, B., Tindall, D. & Pennay, C. (2006). *Native Vegetation of Southeast NSW: A Revised Classification and Map for the Coast and Eastern Tablelands. Version 1.0.* Department of Environment & Conservation and Department of Natural Resources, Sydney.

van der Ree, R., McDonnell, J., Temby, I., Nelson, J. and Whittingham, E. (2005). *The establishment and dynamics of a recently established urban camp of flying foxes (Pteropus poliocephalus) outside their geographic range.* *Journal of Zoology.* 268:177-185. The Zoological Society of London.

Appendix A: Plot data collected

Plot No.	PCT	Area (ha)	Patch size (ha)	Condition class	Zone	Easting	Northing	Bearing
1	835	0.4	38	Underscrubbed	56	308525	6246009	235
2	835	1.3	20	Exotic_Grassland	56	308488	6245891	350

Plot No.	Composition					
	Tree	Shrub	Grass	Forb	Fern	Other
1	2	0	3	3	0	2
2	0	0	0	0	0	0

Plot No.	Structure					
	Tree	Shrub	Grass	Forb	Fern	Other
1	15.0	0.0	31.1	2.2	0.0	1.1
2	0.0	0.0	0.0	0.0	0.0	0.0

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	0	0	20.0	0.0	0	0	0	0	0	0	24.1
2	0	0	27.0	0.0	0	0	0	0	0	0	66.0

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						
<i>Artamus cyanopterus cyanopterus</i> Dusky Woodswallow	BC Act: V	16	2/06/2014 (2.71 km)	1.49 km (2/10/1997)	Moderate	Low
<i>Circus assimilis</i> Spotted Harrier	BC Act: V	3	11/09/2013 (4.3 km)	4.3 km (11/09/2013)	Low	Low
<i>Daphoenositta chrysoptera</i> Varied Sittella	BC Act: V	8	3/06/2013 (1.61 km)	1.61 km (3/06/2013)	Moderate	Low
<i>Falco subniger</i> Black Falcon	BC Act: V	1	13/03/2000 (4.36 km)	4.36 km (13/03/2000)	Low	Low
<i>Glossopsitta pusilla</i> Little Lorikeet	BC Act: V	13	8/07/2014 (4.23 km)	1.98 km (28/05/2014)	Moderate	Moderate
<i>Haliaeetus leucogaster</i> White-bellied Sea-Eagle	BC Act: V EPBC Act: C	11	5/08/2014 (4.85 km)	1.44 km (10/06/2008)	Low	Low
<i>Hieraaetus morphnoides</i> Little Eagle	BC Act: V	4	28/05/2014 (1.98 km)	1.98 km (28/05/2014)	Low	Low
<i>Lathamus discolor</i> Swift Parrot	BC Act: E1 EPBC Act: CE	1	27/04/2006 (3.85 km)	3.85 km (27/04/2006)	Low	Low
<i>Melithreptus gularis gularis</i> Black-chinned Honeyeater (eastern subspecies)	BC Act: V	2	30/07/2007 (2.23 km)	2.23 km (30/07/2007)	Low	Low
<i>Ninox strenua</i> Powerful Owl	BC Act: V	2	1/11/2014 (2.27 km)	1.32 km (30/07/2007)	Not present	Not present
<i>Plegadis falcinellus</i> Glossy Ibis	EPBC Act: C	1	21/02/2013 (4.87 km)	4.87 km (21/02/2013)	Not present	Not present
KINGDOM: Animalia; CLASS: Gastropoda						
<i>Meridolum corneovirens</i> Cumberland Plain Land Snail	BC Act: E1	17	30/04/2016 (4.59 km)	3.75 km (10/11/1998)	Low	Not present
KINGDOM: Animalia; CLASS: Mammalia						
<i>Falsistrellus tasmaniensis</i> Eastern False Pipistrelle	BC Act: V	2	22/11/2010 (1.93 km)	1.93 km (22/11/2010)	Low	Low
<i>Miniopterus schreibersii oceanensis</i> Eastern Bentwing-bat	BC Act: V	6	6/04/2016 (4.85 km)	1.49 km (2/10/1997)	Low	Low
<i>Mormopterus norfolkensis</i> Eastern Freetail-bat	BC Act: V	3	22/11/2010 (1.93 km)	1.93 km (22/11/2010)	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
<i>Myotis macropus</i> Southern Myotis	BC Act: V	5	6/04/2016 (4.86 km)	1.93 km (22/11/2010)	Moderate	Assumed present
<i>Phascolarctos cinereus</i> Koala	BC Act: V EPBC Act: V	1	28/10/2015 (4.95 km)	4.95 km (28/10/2015)	Not present	Not present
<i>Pteropus poliocephalus</i> Grey-headed Flying-fox	BC Act: V EPBC Act: V	35	21/02/2016 (4.85 km)	1.2 km (17/06/2009)	Moderate	Moderate
<i>Saccolaimus flaviventris</i> Yellow-bellied Sheath-tail-bat	BC Act: V	1	6/06/2003 (3.87 km)	3.87 km (6/06/2003)	Low	Low
<i>Scoteanax rueppellii</i> Greater Broad-nosed Bat	BC Act: V	3	22/11/2010 (1.93 km)	1.93 km (22/11/2010)	Low	Low
KINGDOM: Plantae						
<i>Acacia pubescens</i> Downy Wattle	BC Act: V EPBC Act: V	2,144	22/01/2015 (4.74 km)	1.15 km (19/05/2011)	Low	Not present
<i>Hibbertia</i> sp. Bankstown	BC Act: E4A EPBC Act: CE	3	22/10/2014 (4.7 km)	4.7 km (22/10/2014)	Low	Not present
<i>Leucopogon exolasius</i> Woronora Beard-heath	BC Act: V EPBC Act: V	1	30/11/2000 (4.75 km)	4.75 km (30/11/2000)	Low	Not present
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> Marsdenia viridiflora R. Br. subsp. <i>viridiflora</i> population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	EPBC Act: E2	326	6/11/2014 (4.64 km)	2.58 km (29/10/2007)	Low	Not present
<i>Persoonia nutans</i> Nodding Geebung	BC Act: E EPBC Act: E1	1	26/05/2014 (4.95 km)	4.95 km (26/05/2014)	Low	Not present
<i>Pimelea spicata</i> Spiked Rice-flower	BC Act: E EPBC Act: E1	55	2/05/2014 (3.4 km)	2.23 km (22/10/2003)	Low	Not present

Unless otherwise stated, text is taken from the OEH 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 or HTE	BAM Growth Form	WFS01		WFS02	
					C	A	C	A
Anthericaceae	<i>Tricoryne elatior</i>	Yellow Autumn-lily	Native	Forb	0.1	2		
Asteraceae	<i>Bidens pilosa</i>	Cobblers Peg	Exotic	N/A	0.1	2		
Asteraceae	<i>Cardamine hirsuta</i>	Common Bittercress	Exotic	N/A			0.2	200
Asteraceae	<i>Conyza</i> sp.		Exotic	N/A	0.1	1	0.1	5
Asteraceae	<i>Gamochaeta</i> sp.		Exotic	N/A			0.1	20
Asteraceae	<i>Hypochaeris radicata</i>	Catsear	Exotic	N/A	0.1	50	0.2	20
Asteraceae	<i>Soliva sessilis</i>	Bindii	Exotic	N/A	0.5	100	0.5	200
Asteraceae	<i>Sonchus oleraceus</i>	Common Sowthistle	Exotic	N/A	0.1	2		
Asteraceae	<i>Taraxacum officinale</i>	Dandelion	Exotic	N/A	0.1	10	0.1	10
Campanulaceae	<i>Wahlenbergia</i> sp.		Native	Forb	0.1	1		
Caryophyllaceae	<i>Paronychia brasiliiana</i>	Chilean Whitlow Wort	Exotic	N/A	0.1	50	0.1	50
Casuarinaceae	<i>Casuarina cunninghamiana</i>	River Oak	Native	Tree	5	1		
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed	Native	Forb	2	200		
Cyperaceae	<i>Carex inversa</i>		Native	Grass & grasslike	0.1	5		
Fabaceae - Faboideae	<i>Desmodium varians</i>	Slender Tick-trefoil	Native	Other	0.1	10		
Fabaceae - Faboideae	<i>Glycine tabacina</i>		Native	Other	1	100		
Iridaceae	<i>Romulea</i> sp.		Exotic	N/A	0.1	20	0.1	50
Lomandraceae	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	Native#	Grass & grasslike				
Malvaceae	<i>Modiola caroliniana</i>	Red-flowered Mallow	Exotic	N/A	0.1	10		
Myrtaceae	<i>Callistemon viminalis</i>	Weeping Bottlebrush	Native#	Tree	10	2		
Myrtaceae	<i>Corymbia citriodora</i>	Lemon-scented Gum	Exotic#	N/A	12	1		
Myrtaceae	<i>Eucalyptus microcorys</i>	Tallowwood	Native#	Tree				
Myrtaceae	<i>Eucalyptus robusta</i>	Swamp Mahogany	Native#	Tree				
Myrtaceae	<i>Eucalyptus tereticornis</i>	Forest Red Gum	Native#	Tree				
Myrtaceae	<i>Kunzea ambigua</i>	Tick Bush	Native#	Shrub				
Myrtaceae	<i>Lophostemon confertus</i>	Brush Box	Native#	Tree				
Myrtaceae	<i>Melaleuca quinquenervia</i>	Broad-laved Paperbark	Native#	Tree				
Onagraceae	<i>Epilobium</i> sp.		Native	Forb	0.2	50		
Oxalidaceae	<i>Oxalis perennans</i>		Native	Forb	0.1	20		
Plantaginaceae	<i>Plantago lanceolata</i>	Lamb's Tongue	Exotic	N/A	0.2	50	0.1	10
Poaceae	<i>Axonopus fissifolius</i>	Narrow-leaved Carpet Grass	HTE	N/A	15	1000		
Poaceae	<i>Cenchrus clandestinus</i>	Kikuyu Grass	HTE	N/A	8	100	65	1000
Poaceae	<i>Cynodon dactylon</i>	Couch	Exotic	N/A	20	1000	15	500

Family	Scientific Name	Common name	Native, Exotic or HTE	BAM Growth Form	WFS01		WFS02	
					C	A	C	A
Poaceae	<i>Eragrostis brownii</i>	Brown's Lovegrass	Native	Grass & grasslike	1	100		
Poaceae	<i>Eragrostis curvula</i>	African Lovegrass	HTE	N/A	0.1	1		
Poaceae	<i>Eragrostis tenuifolia</i>	Elastic Grass	Exotic	N/A			0.5	50
Poaceae	<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass	Native	Grass & grasslike	30	2000		
Poaceae	<i>Paspalum dilatatum</i>	Paspalum	HTE	N/A	1	50	1	50
Poaceae	<i>Sporobolus africanus</i>	Parramatta Grass	Exotic	N/A	2	100	0.5	20
Proteaceae	<i>Banksia integrifolia</i>	Coast Banksia	Native#	Tree				
Rubiaceae	<i>Richardia</i> sp.		Exotic	N/A	0.1	50		

Fauna

Class	Family	Scientific name	Common name	Native/ Exotic	Ecoplanning (27/06/17)	Ecoplanning (03/07/18)
Aves	Anatidae	<i>Chenonetta jubata</i>	Australian Wood Duck	Native	U	-
Aves	Artamidae	<i>Cracticus tibicen</i>	Australian Magpie	Native	-	W
Aves	Artamidae	<i>Cracticus torquatus</i>	Grey Butcherbird	Native	U	-
Aves	Artamidae	<i>Strepera graculina</i>	Pied Currawong	Native	-	OW
Aves	Columbidae	<i>Columba livia</i> *	Rock Dove*	Exotic	U	O
Aves	Columbidae	<i>Ocyphaps lophotes</i>	Crested Pigeon	Native	U	W
Aves	Corvidae	<i>Corvus coronoides</i>	Australian Raven	Native	-	W
Aves	Meliphagidae	<i>Anthochaera carunculata</i>	Red Wattlebird	Native	U	W
Aves	Meliphagidae	<i>Manorina melanocephala</i>	Noisy Miner	Native	U	OW
Aves	Meliphagidae	<i>Manorina melanophrys</i>	Bell Miner	Native	-	W
Aves	Meliphagidae	<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	Native	-	OW
Aves	Oriolidae	<i>Sphecotheres vieilloti</i>	Australasian Figbird	Native	-	W
Aves	Pardalotidae	<i>Pardalotus punctatus</i>	Spotted Pardalote	Native	-	W
Aves	Psittacidae	<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	Native	U	OW
Aves	Sturnidae	<i>Sturnus tristis</i> *	Common Myna*	Exotic	U	W
Aves	Sturnidae	<i>Sturnus vulgaris</i>	Common Starling	Native	U	-

Observation type = O (seen), W (heard call), OW (seen and heard), U (unrecorded observation type)

Appendix D: Credit summary report, biodiversity payment summary report and biodiversity credit report (like for like)



Biodiversity payment summary report

Assessment Id	Payment data version	Revision number	Report created
00011419/BAAS17012/18/00011420	29	0	20/07/2018

PCT list

Include	PCT common name	Credits
Yes	835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	5

Species list

Include	Species	Credits
Yes	<i>Myotis macropus</i> (Southern Myotis)	5

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

IBRA sub region	PCT common name	Baseline price	Dynamic coefficient	Market coefficient	Risk premium	Administrative cost	Methodology adjustment factor	Price per credit	No. of ecosystem credits	Final credits price
Cumberland	835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion Note: This PCT has trades recorded	\$13,796.23	0.55443410	4.26249900	25.50%	\$36.42	1.0000	\$17,617.60	5	\$88,087.98
Subtotal (excl. GST)										\$88,087.98



Biodiversity payment summary report

						GST	\$8,808.80
						Total ecosystem credits (incl. GST)	\$96,896.78
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
10549	<i>Myotis macropus</i> (Southern Myotis)	Vulnerable	\$816.33	20.8700%	\$20.00	5	\$5,033.49
						Subtotal (excl. GST)	\$5,033.49
						GST	\$503.35
						Total species credits (incl. GST)	\$5,536.84
						Grand total	\$102,433.62



BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00011419/BAAS17012/18/00011420	Mainsbridge SSP BDAR - SSD 8792	24/02/2018
Assessor Name	Report Created	BAM Data version *
Lucas McKinnon	20/07/2018	3
Assessor Number	* 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.	
BAAS17012		

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	Candidate SAI	Ecosystem credits
Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion								
1	835_Underscrubbed	24.0	0.4	0.25	High Sensitivity to Potential Gain	2.00	TRUE	5
							Subtotal	5
							Total	5



BAM Credit Summary Report

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Candidate SAIL	Species credits
<i>Myotis macropus</i> / Southern Myotis (Fauna)						
835_Underscrubbed	24.0	0.4	0.25	2	False	5
					Subtotal	5



BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00011419/BAAS17012/18/00011420	Mainsbridge SSP BDAR - SSD 8792	24/02/2018
Assessor Name	Assessor Number	BAM Data version *
Lucas McKinnon	BAAS17012	3
Proponent Names	Report Created	* 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.
	20/07/2018	

Candidate Serious and Irreversible Impacts

Nil

Nil

Additional Information for Approval

PCTs With Customized Benchmarks
No Changes

Predicted Threatened Species Not On Site



BAM Biodiversity Credit Report (Like for like)

Name
Grantiella picta / Painted Honeyeater
Ixobrychus flavicollis / Black Bittern
Botaurus poiciloptilus / Australasian Bittern

Ecosystem Credit Summary

PCT	TEC	Area	Credits
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	0.4	5.00

Credit classes for 835	Like-for-like options		
	Any PCT with the below TEC	Containing HBT	In the below IBRA subregions
	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)	No	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.



BAM Biodiversity Credit Report (Like for like)

Credit classes for
835

Species Credit Summary

Species	Area	Credits
Myotis macropus / Southern Myotis	0.4	5.00

Myotis macropus / Southern Myotis	835_Underscrubbed	Like-for-like options	
		Only the below Spp	In the below IBRA subregions
		Myotis macropus /Southern Myotis	Any in NSW