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*environmental*

## Biodiversity Development Assessment Report

Centre of Excellence in Agricultural Education at Richmond

Vines Drive, Richmond NSW 2753

NBRS Architecture c/o Schools Infrastructure NSW

14<sup>th</sup> of December 2021



# NARLA

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<b>Report:</b>	Biodiversity Development Assessment Report
<b>Prepared for:</b>	NBRS Architecture c/o Schools Infrastructure NSW
<b>Prepared by:</b>	Narla Environmental Pty Ltd
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# Glossary

Acronym/ Term	Definition
Accredited Biodiversity Assessor	Individuals accredited by the Department of Planning, Industry and Environment (DPIE) to apply the Biodiversity Assessment Method.
APZ	Asset Protection Zone
BAM	The NSW Biodiversity Assessment Method
BAMC	The NSW Biodiversity Assessment Method Calculator
BC Act	New South Wales Biodiversity Conservation Act 2016
BDAR	Biodiversity Development Assessment Report
Biodiversity credit report	The report produced by the Credit Calculator that sets out the number and class of biodiversity credits required to offset the remaining adverse impacts on biodiversity values at a development site, or on land to be biodiversity certified.
Biodiversity Offsets	Management actions that are undertaken to achieve a gain in biodiversity values on areas of land in order to compensate for losses to biodiversity from the impacts of development.
Biodiversity values	The composition, structure and function of ecosystems, including threatened species, populations and ecological communities, and their habitats.
BOS	NSW Biodiversity Offset Scheme
CEEC	Critically Endangered Ecological Community
DPIE	NSW Department of Planning, Industry and Environment (formerly OEH)
Ecosystem credit	The class of biodiversity credit that relates to a vegetation type and the threatened species that are reliably predicted by that vegetation type (as a habitat surrogate).
EEC	Endangered Ecological Community
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
ha	Hectares
HTE	High Threat Exotic
km	Kilometres
Lease Area	Location of the proposed works within on Vines Drive (Lot 2 DP 1051798)
LGA	Local Government Area
Locality	A 1500m buffer area surrounding the Subject Land
m	metres
Native Vegetation	Means any of the following types of plants native to New South Wales: (a) trees (including any sapling or shrub), (b) understorey plants, (c) groundcover (being any type of herbaceous vegetation), (d) plants occurring in a wetland.
NSW	The State of New South Wales
OEH	Office of Environment and Heritage (now DPIE)
PCT	NSW Plant Community Type
Proposal	The development, activity or action proposed.
SAII	Serious and Irreversible Impacts
SAII entity	Species and ecological communities that are likely to be the subject of serious and irreversible impacts (SAIIs)
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
Species credit	The class of biodiversity credit that relate to threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection.
SSDA	State Significant Development Application
Subject Land	The Operational Footprint, Construction Footprint and APZ.
Threatened species, populations and	Species, populations and ecological communities specified in Schedules 1 and 2 of the BC Act 2016.

Acronym/ Term	Definition
ecological communities	
TPZ	Tree Protection Zone: A specified area above and below ground and at a given distance from the trunk set aside for the protection of a tree's roots and crown to provide for the viability and stability of a tree to be retained where it is potentially subject to damage by development
VIS Plot	Vegetation Integrity Survey Plot

# Executive Summary

Narla Environmental Pty Ltd (Narla) was commissioned by NBRS Architecture c/o School's Infrastructure NSW ('the proponent') to prepare a Biodiversity Development Assessment Report (BDAR) to accompany a State Significant Development Application (SSDA) for the new Hawkesbury Centre of Excellence, located within the Western Sydney University Campus on Vines Drive, Richmond (Lot 2/DP1051798). The BDAR will assess the biodiversity impacts of the proposed development in accordance with the requirements of the Biodiversity Conservation Act 2016 and Biodiversity Conservation Regulation 2017. The assessment has been completed in accordance with Appendix K of the BAM (DPIE 2020a).

The proposed development will involve the construction of a secondary school known as the Centre of Excellence (CoE) in Agricultural Education at Richmond. The proposed works will involve the development of new administrative, learning, dining, temporary accommodation, farming and aboriginal enterprise buildings, as well as establishing several new dams, agricultural plots, an orchard as well as driveways, walkways and other hardstand areas. The works will also require creating access to Maintenance Lane to allow as well as the widening of Vines Drive and creation of a roundabout at the Clydesdale Road and Londonderry Road interface to allow for suitable bus access.

The proposed development has been divided into three components, which are collectively referred to as the 'Subject Land': the operational footprint (4.93ha); the construction footprint (5.09ha); and the retained vegetation to be managed as an APZ (1.96ha). Most vegetation within the Subject Land will require removal to accommodate the proposed development, with the exception of some trees only requiring trimming along Vines Drive and the vegetation which will be managed as an Asset Protection Zone.

The proposed development is expected to impact one (1) Plant Community Type (PCT) 835: Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion. The following ecosystem credits are required to be offset in order to mitigate the impacts upon biodiversity as a result of the proposed development:

- Three (3) ecosystem credits for PCT 835.

Plant Community Type 835 conforms to the Endangered Ecological Community (EEC) River-flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (RFEF). River-flat eucalypt forest is not listed as an 'SAIL entity' within the BioNet Threatened Biodiversity Data Collection (DPIE 2021b).

In order to avoid and minimise potential impacts of the proposal on local biodiversity values, a series of mitigation and management measures have been identified, which are to be implemented as part of any Construction Environmental Management Plan (CEMP) produced for the site. This includes assigning a Project Ecologist to undertake an extensive pre-clearing survey, and to supervise the clearing of all vegetation in relation to the proposed development.



# 1. Introduction

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## 1.1 Overview

Narla Environmental Pty Ltd (Narla) was commissioned by NBRS Architecture c/o School's Infrastructure NSW ('the proponent') to prepare a Biodiversity Development Assessment Report (BDAR) to accompany a State Significant Development Application (SSDA) for the new Hawkesbury Centre of Excellence, located within the Western Sydney University Campus on Vines Drive, Richmond (Lot 2/DP1051798).

The BDAR will assess the biodiversity impacts of the proposed development in accordance with the requirements of the Biodiversity Conservation Act 2016 and Biodiversity Conservation Regulation 2017. The assessment has been completed in accordance with Appendix K of the BAM (DPIE 2020a).

## 1.2 The Proposed Development

The Proposed Site Plan prepared by NBRS Architecture (**Figure 1**) and indicative Vines Drive widening plan (**Figure 2**), shows the development of nine (9) new buildings to be utilised for administration, learning, dining, temporary accommodation, farming and Aboriginal Enterprise. They also shows the establishment of three (3) new dams, as well as agricultural plots, an orchard, a village green and areas of hardstand including driveways, carparks, footpaths as well as the new proposed access to Maintenance Lane and the widening of Vines Drive, and creation of a roundabout at the Clydesdale Road interface. The Site Remediation Strategy prepared by NBRS Architecture also shows areas that require soil remediation.

The proposed development will encompass the majority of the Lease Area with the exception of a small section in the south-west. The proposed development also includes a new access way from Maintenance Land and road widening works to the north of the Lease Area along Vines Drive. The proposed development has been divided into three components, which are collectively referred to as the 'Subject Land' (**Figure 3**):

- Operational Footprint (4.93ha): the footprint of the proposed works, including buildings, dams' agricultural plots, orchard, village green, access roads and car parks, pedestrian access (footpaths), Maintenance Lane access, Vines Drive widening and roundabout creation for bus access.
- Construction Footprint (5.09ha): additional land that is required for proposed stockpiling, soil remediation and/or additional vegetation removal to facilitate works. This area can also be used for temporary/ancillary construction facilities.
- Retained vegetation to be managed as an APZ (1.96ha): Vegetation within 50m of the proposed new buildings which is to be retained and managed as an APZ (Bushfire Planning Australia 2021).

The Subject Land covers an area of approximately 11.98ha, which was mostly dominated by agricultural grassland. Scattered areas of trees exist within the Subject Land, including both native and exotic species. Vines Drive has also been included within the Subject Land to account for works associated with the widening of the road. Most vegetation within the Subject Land will require removal to accommodate the proposed development, with the exception of the select trees along Vines Drive that will only require trimming and vegetation to be managed as an APZ.

## 1.3 Site Location and Description

The Lease Area is situated within a vacant area of land within the Western Sydney University Hawkesbury Campus in the suburb of Richmond in the Hawkesbury Local Government Area (LGA; **Figure 4**). The Lease Area is also located within the boundaries of the Deerubbin Local Aboriginal Land Council (Deerubbin LALC). It has an area of approximately 11.37ha, has frontage to Vines Drive to the north, Maintenance Lane to the east, and is bounded by similar agricultural landscapes to the south and west. The Lease Area is comprised of grass pastures with some remnant native and exotic trees.





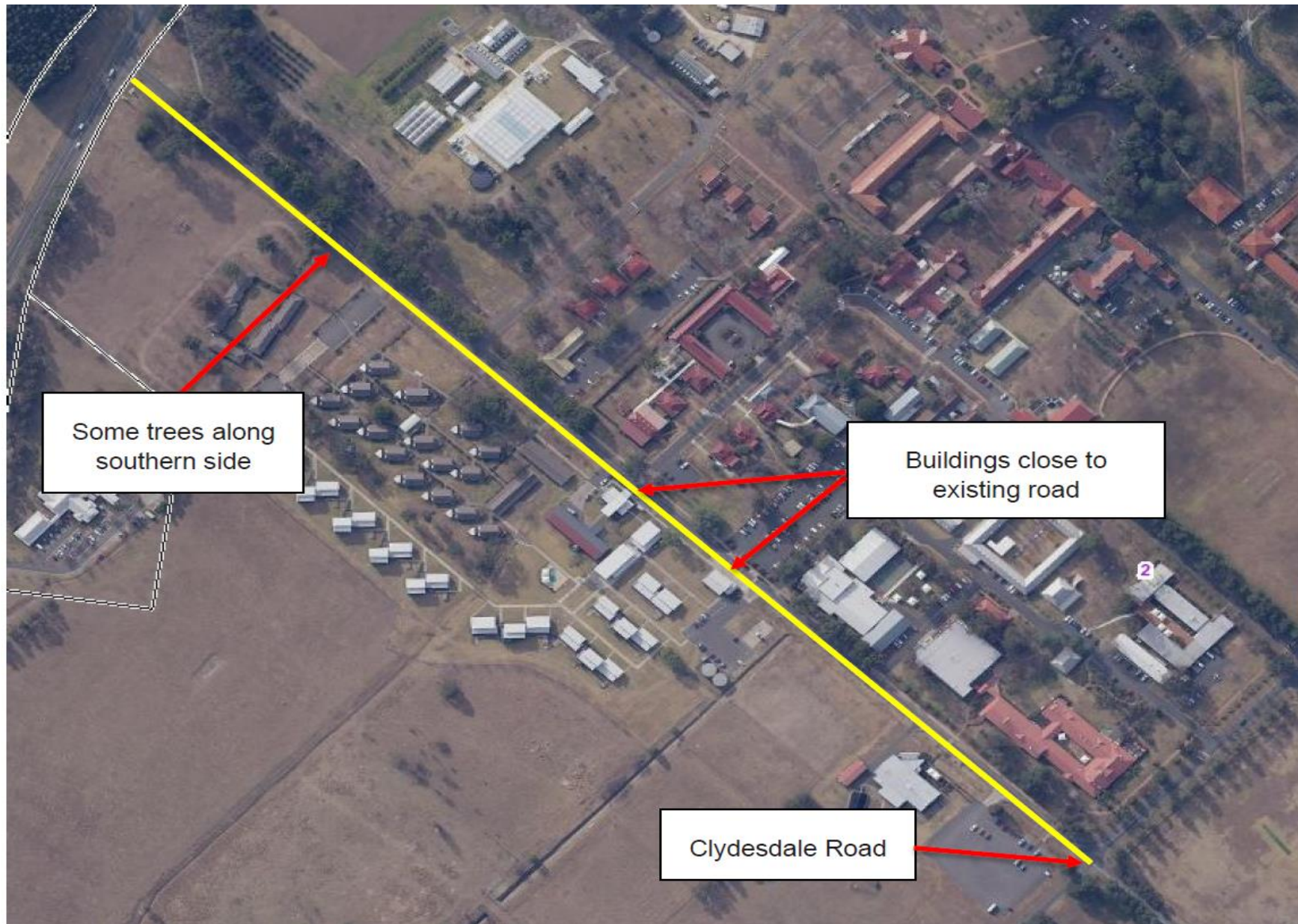


Figure 2. Indicative plan for the widening of Vines Drive to allow for appropriate bus access (RCC 2021)





Figure 3. The components of the Subject Land.



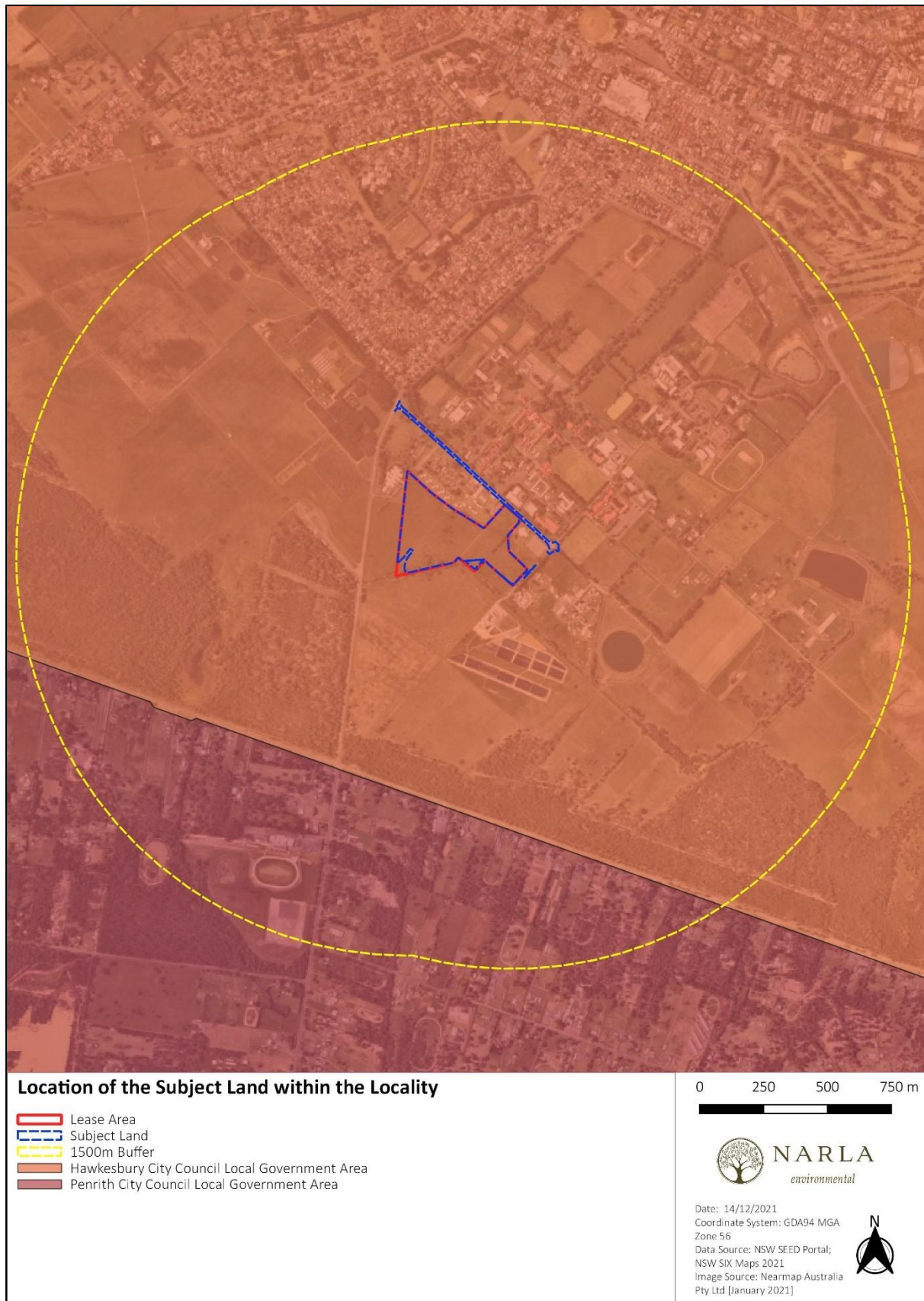


Figure 4. The location of the Subject Land within the locality.



## 1.4 Sources of Information Used

A thorough literature review was undertaken to gain an insight into the ecology and applicable legislation within the locality and the Hawkesbury City Council LGA, including:

- Relevant State and Commonwealth Databases & Datasets:
  - NSW BioNet. The website of the Atlas of NSW Wildlife (DPIE 2021b);
  - NSW BioNet. Threatened Biodiversity Data Collection (DPIE 2021c);
  - NSW BioNet. Vegetation Classification System (DPIE 2021d); and
  - NSW Government Spatial Services: Six Maps Clip & Ship.
- Vegetation and Soil Mapping:
  - 'The Remnant Vegetation of the western Cumberland subregion' 2013 Update. VIS\_ID 4207 (OEH 2013).
  - Soil Landscapes of the Penrith 1:100 000 Sheet (Bannerman & Hazelton 1990).
- NSW State Guidelines:
  - Biodiversity Assessment Method (DPIE 2020a);
  - Guidance to assist a decision-maker to determine a serious and irreversible impact (DPIE 2019a);
  - Biodiversity Assessment Method Calculator Version 1.3.0.00 (DPIE 2020b);
  - Biodiversity Offsets and Agreement Management System (BOAMS) ;
  - Surveying threatened plants and their habitats - NSW survey guide for the Biodiversity Assessment Method (DPIE 2020c); and
  - Threatened Species Survey and Assessment: Guidelines for developments and activities. Working Draft (DEC 2004)
- Council Documents:
  - Hawkesbury Development Control Plan (DCP) 2002; and
  - Hawkesbury Local Environment Plan (LEP) 2012.

Preparation of this BDAR also involved the review of the following accompanying project documents:

- NBRS Architecture (2021a) Proposed Site Plan Rev 3;
- NBRS Architecture (2021b) Demolition Plan Rev 3;
- NBRS Architecture (2021c) Site Remediation Strategy;
- Sturt Noble Arboriculture (2021a) Arboricultural Impact Assessment Report: Centre of Excellence Rev G
- Sturt Noble Arboriculture (2021a) Arboricultural Impact Assessment Report: Vines Drive Rev B
- Bushfire Planning Australia (2021) consultation; and
- Richard Crookes Construction (RCC; 2021) Indicative plan for the widening of Vines Drive to allow for appropriate bus access.

These sources were used to gain an understanding of the natural environment and ecology of the Subject Land and its surrounds. Searches using NSW Wildlife Atlas (BioNet) were conducted to identify current threatened flora and fauna records within and surrounding the Subject Land. These data were used to assist in establishing the presence or likelihood of any biodiversity values as occurring on, or adjacent to, the Subject Land, and helped inform our Ecologist on what to look for during the site assessment.

## 1.5 Aim and Approach

This report has been prepared in accordance with the BAM (DPIE 2020a) and aims to:

- Describe the biodiversity values present within the Subject Land, including the extent of native vegetation, vegetation integrity and the presence of Threatened Ecological Communities (TECs);
- Determine the habitat suitability within the Subject Land for candidate threatened species;
- Prepare an impact assessment in regard to potential impacts of the proposed development on biodiversity values, including potential prescribed impacts and SAIIs within the Subject Land;
- Discuss and recommend efforts to avoid and minimise impacts on biodiversity values; and
- Calculate the biodiversity credits (i.e., ecosystem credits and species credits) that measure potential impacts of the development on biodiversity values. This calculation will inform the decision maker as to the number and class of offset credits required to be purchased and retired as a result of the proposed development.

## 2. Landscape Context

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### 2.1 IBRA Bioregion and Subregion

The Subject Land occurs within the ‘Cumberland’ Interim Biogeographic Regionalisation for Australia 7 (IBRA7) Subregion, which is part of the ‘Sydney Basin’ IBRA7 Bioregion (**Figure 5**).

### 2.2 Mitchell Landscapes

‘NSW Landscapes Mapping: Background and Methodology’ (Mitchell 2002) groups ecosystems into meso-ecosystems representing larger natural entities based on topography and geology. The naming of ecosystems and meso-ecosystems was standardised so that each name provided location information and a meaningful descriptive landscape term.

The Subject Land occurs within the ‘Hawkesbury – Nepean Terrace Gravels’ Mitchell Landscape Ecosystem (**Figure 6**). This landscape is characterised by three levels of river terrace dating into the Tertiary. General elevation 20 to 45m, local relief 10m. Planar, poorly drained terraces with harsh texture-contrast soils and heavy clays in swamps and cut-off meanders. In places deep sands of crevasse splays support scribbly gum (*Eucalyptus sclerophylla*), narrow-leaved apple (*Angophora bakeri*) and old man banksia (*Banksia serrata*) on podsol with adjacent sedgeland. Most clay-based soils (harsh texture-contrast profiles) are very gravelly and carry broad-leaved ironbark (*Eucalyptus fibrosa* ssp. *fibrosa*) and narrow-leaved ironbark (*Eucalyptus crebra*), grey box (*Eucalyptus moluccana*), paperbarks (*Melaleuca* sp.) and drooping red gum (*Eucalyptus parramattensis*). Several vegetation communities are now rare especially that on the Pliocene/Pleistocene sand body with podsol soil profiles at Agnes Banks.

### 2.3 Topography, Geology and Soils

The Subject Land is generally flat with an elevation ranging between 23m and 25m above sea level (Google Earth 2021). The Subject Land is mapped as occurring on the Berkshire Park soil landscape, which is the result of three depositional phases of Tertiary alluvial/colluvial origin. The lowest deposit is the St Marys formation. This is overlain by the Rickerby’s Creek gravel formation, which is of varying thickness and in turn is topped by the Londonderry Clay formation. All of these formations are derived from sandstone and clay. Erosion of the surface has led to exposure of all three formations in different locations.

The Subject Land did not contain any areas of geological significance, such as karsts, caves, cliffs or crevices. The Subject Land and wider locality (1500m buffer) are not mapped as occurring on acid sulfate soils nor mapped as having risk/probability of exhibiting occurrence of acid sulfate soils.

### 2.4 Hydrology

No mapped watercourses were located within the Subject Land however three (3) unmapped artificial swales and one dam were identified either within the Subject Land or in the broader Lease Area. (**Figure 7**).

A number of mapped watercourses also occur within the 1500m buffer surrounding the Subject Land, ranging from 1<sup>st</sup> to 3<sup>rd</sup> order streams (**Figure 8**). These watercourses appear to have been historically altered due to the rural nature of the landscape and eventually drain into the Hawkesbury River.

The Subject Land does not contain any areas of native vegetation identified as ‘Coastal Wetlands’ or ‘Littoral Rainforest’. However, one area mapped as ‘Proximity to Coastal Wetlands and Coastal Wetland’ as per the State

Environmental Planning Policy (Coastal Management) 2018, was mapped within the 1500m buffer surrounding the Subject Land (**Figure 9**).

## 2.5 Native Vegetation Cover and Connectivity

Native vegetation cover and connectivity have been assessed in accordance with Section 3.2 of the BAM (DPIE 2020a). The native vegetation cover will be used to assess the habitat suitability of the Subject Land for threatened species. Areas of connectivity will determine the extent of habitat that may facilitate the movement of threatened species across their range. A 1500m buffer around the boundary of the Subject Land was calculated to determine the extent of native vegetation and habitat connectivity. Native vegetation covered approximately 737ha within the buffer circle (total area = 916ha) and was assigned to the >70% class.

Large areas of connectivity that may facilitate the movement of threatened species were evident within the 1500m surrounding the Subject Land (**Figure 10**). This included large areas to the east, west and south of the Subject Land, and smaller pockets to the north. Due to native species being found within the grassland areas within the Subject Land, all grassland areas were included as native species presence could not be ruled out.

## 2.6 Areas of Outstanding Biodiversity Value

No Areas of Outstanding Biodiversity Value occur on the Subject Land or surrounding area.

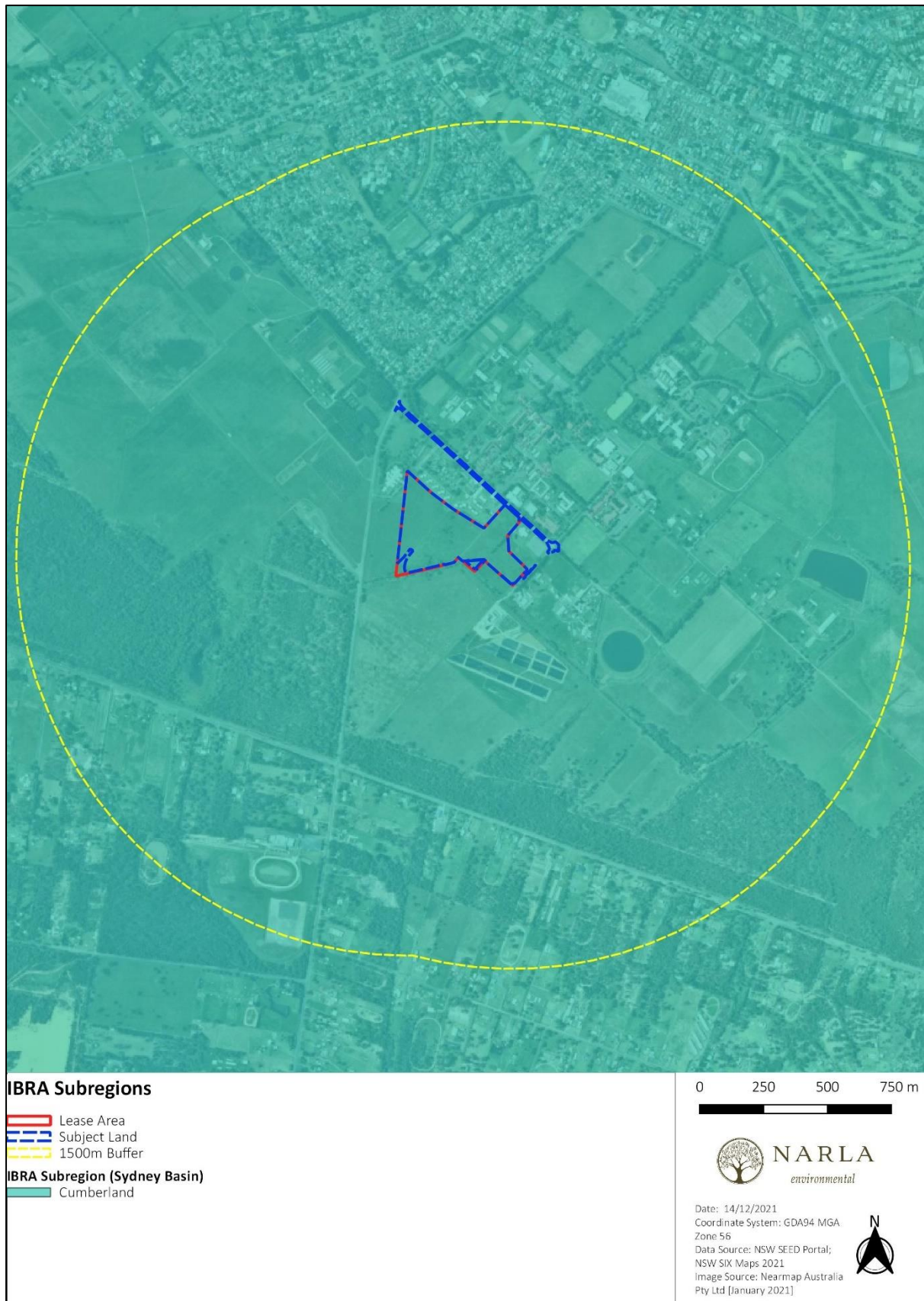


Figure 5. IBRA Bioregion and Subregion of the Subject Property and Subject Land, and within a 1500m buffer.





Figure 6. Mitchell Landscapes of the Subject Property and Subject Land, and within a 1500m buffer.





Figure 7. Water features occurring within the Lease Area.





Figure 8. Rivers and streams (with associated riparian buffers) occurring within the 1500m buffer.





Figure 9. Areas mapped under the Coastal Management SEPP in relation to the Subject Land and general locality.





Figure 10. The extent of native vegetation and habitat connectivity within the 1500m buffer.



## 3. Native Vegetation

### 3.1 Plant Community Types (PCTs) Identified within the Subject Land

#### 3.1.1 Historically Mapped Vegetation

The vegetation within the Subject Land has not been included in the 'Remnant Vegetation of the western Cumberland subregion, 2013 Update' (OEH 2013), and is mapped as containing cleared land by the 'Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands'.

#### 3.1.2 Plant Community Type Selection Process

Field surveys conducted by experienced Narla confirmed that one (1) native vegetation community occurred within the Subject Land. Plant Community Type selection for this vegetation community was undertaken using information and databases provided in the BioNet Vegetation Classification System (DPIE 2020c). The following selection criteria were used in the PCT Filter Tool to develop the PCT shortlist:

- IBRA Bioregion: Sydney Basin
- IBRA Subregion: Cumberland Plain
- Dominant Species: *Eucalyptus tereticornis* and *Angophora subvelutina*

This process delivered a selection of seven (7) PCT's that occur within the Cumberland IBRA Subregion (and Sydney Basin Bioregion) that had one or more (out of two) of the observed dominant species (i.e., the highest potential of occurring within the Subject Land). The geographical distribution and landscape position of each shortlisted PCT was then compared against the location and landscape of the Subject Land, resulting in three (3) candidate PCTs (**Table 1**). The steps taken to justify the presence/absence of the candidate PCTs within the Subject Land are detailed in **Table 2**.

**Table 1. Output from the PCT Filter Tool (DPIE 2021c) and subsequent shortlisting of candidate PCTs. Green shading indicates the PCTs from the output that occur within the distribution of the Subject Land.**

Plant Community Type (PCT)	Subject Land within known distribution/landscape position?	No. of Matches	<i>Eucalyptus tereticornis</i>	<i>Angophora subvelutina</i>
PCT 774: Coast Banksia scrub on sand in the Elderslie area, Sydney Basin Bioregion	No. The Subject Land is not located in the Elderslie area.	1	-	x
PCT 830: Forest Red Gum - Grey Box shrubby woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	No. The Subject Land is located on alluvial soils not shale. Furthermore, this PCT protected aspects on steeper shale hills and rises at higher elevations of the southern half of the Cumberland Plain.	1	x	-

Plant Community Type (PCT)	Subject Land within known distribution/landscape position?	No. of Matches	<i>Eucalyptus tereticornis</i>	<i>Angophora subvelutina</i>
PCT 835: Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Yes	2	x	x
PCT 849: Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Yes.	1	x	-
PCT 850: Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	No. PCT 850 occupies higher elevations associated with the hills and rises south from Prospect. The Subject Land is north of Prospect.	1	x	-
PCT 1800: Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley	Yes	1	x	-
PCT 1847: Smooth-barked Apple - Grey Gum - Forest Red Gum tall open forest on shale bands around the foreshores of the drowned river valleys of Sydney	No. PCT 1847 is found on localised patches of shale-enriched sandstone which occur on crests and slopes of minor sandstone scarps adjoining the coastal waterways of Sydney. The Subject Land is located on alluvial soils on a river flat landscape.	1	x	-

Table 2. PCT Selection Criteria. Green indicates the selected PCT.

Candidate PCT	Characteristics (DPIE 2021c)	Justification
PCT 835: Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	<b>Landscape position/ geology</b>	Narla have assigned this PCT to the vegetation within the Subject Land as it fits with the landscape profile and comprises a number of diagnostic species.  Furthermore, PCT 835 is described as having a canopy that includes one of either Rough-barked Apple ( <i>Angophora floribunda</i> ) or Broad-leaved Apple ( <i>Angophora subvelutina</i> ) and one or both of forest red gum ( <i>Eucalyptus tereticornis</i> ) and cabbage gum ( <i>Eucalyptus amplifolia</i> ). <i>Angophora subvelutina</i> and <i>Eucalyptus tereticornis</i> were both identified within the Subject Land.
	Occurs on stream banks and alluvial flats on the Cumberland Plain.	
	<b>Characteristic canopy</b>	
	<i>Eucalyptus tereticornis</i> , <i>Angophora floribunda</i> and <i>Eucalyptus amplifolia</i> subsp. <i>amplifolia</i> .	
	<b>Characteristic mid-storey/ shrub</b>	
	<i>Acacia parramattensis</i> , <i>Bursaria spinosa</i> subsp. <i>spinosa</i> and <i>Sigesbeckia orientalis</i> .	
PCT 1800: Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley	<b>Characteristic ground layer</b>	Narla have NOT assigned this PCT to the vegetation within the Subject Land. Whilst it did fit with the landscape profile and comprised a number of diagnostic species, this community's distinguishing feature is the prominent stands of <i>Casuarina glauca</i> . Whilst <i>Casuarina glauca</i> 's were identified within the Subject Land, they only existed as historically planted barriers between paddocks. Based on their nature within the Subject Land and the lack of accounting for <i>Angophora subvelutina</i> , it was determined that this PCT could not be assigned as the 'Best Fit' for the vegetation within the Subject Land.
	<i>Microlaena stipoides</i> , <i>Oplismenus aemulus</i> , <i>Dichondra repens</i> , <i>Entolasia marginata</i> , <i>Solanum prinophyllum</i> , <i>Pratia purpurascens</i> , <i>Desmodium gunnii</i> , <i>Echinopogon ovatus</i> , <i>Commelina cyanea</i> and <i>Veronica plebeia</i> .	
	<b>Landscape position/ geology</b>	
	Found on the riverflats of the Cumberland Plain in western Sydney and in the Hunter Valley	
	<b>Characteristic canopy</b>	
	<i>Casuarina glauca</i> , <i>Eucalyptus moluccana</i> , <i>Angophora floribunda</i> , <i>Eucalyptus baueriana</i> and <i>Eucalyptus tereticornis</i> .	
	<b>Characteristic mid-storey/ shrub</b>	
	<i>Casuarina glauca</i> , <i>Bursaria spinosa</i> , <i>Melaleuca decora</i> , <i>Melaleuca nodosa</i> , <i>Melaleuca styphelioides</i> , <i>Acacia decurrens</i> , <i>Brunoniella australis</i> , <i>Dianella longifolia</i> , <i>Maytenus silvestris</i> , <i>Ozothamnus diosmifolius</i> and <i>Polyscias sambucifolia</i>	
	<b>Characteristic ground layer</b>	

Candidate PCT	Characteristics (DPIE 2021c)	Justification
	<i>Entolasia marginata</i> , <i>Einadia hastata</i> , <i>Microlaena stipoides</i> , <i>Echinopogon ovatus</i> , <i>Pratia purpurascens</i> , <i>Commelina cyanea</i> , <i>Senecio hispidulus</i> , <i>Veronica plebeia</i> , <i>Wahlenbergia gracilis</i>	
PCT 849: Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	<b>Landscape position/ geology</b>	Narla have NOT assigned this PCT to the vegetation within the Subject Land. This PCT is known to occur on shale soils of the Cumberland Plain however the Subject Land is mapped as occurring on alluvial soils. Furthermore, this community is described as being dominated by <i>Eucalyptus moluccana</i> (Grey Box), <i>Eucalyptus tereticornis</i> (Forest Red Gum) and ironbarks such as <i>Eucalyptus crebra</i> or <i>Eucalyptus fibrosa</i> . Whilst <i>Eucalyptus tereticornis</i> was identified within the Subject Land it was codominant with <i>Angophora subvelutina</i> . As this PCT does not account for <i>Angophora subvelutina</i> and is listed as occurring shale soils, this PCT was not assigned as the best fit PCT.
	Occurs on clay/loam soils derived from Wianamatta Shales on the Cumberland Plain at low altitudes (mainly below 150m).	
	<b>Characteristic canopy</b>	
	<i>Eucalyptus moluccana</i> and <i>Eucalyptus tereticornis</i>	
	<b>Characteristic mid-storey/ shrub</b>	
	<i>Bursaria spinosa</i> subsp. <i>spinosa</i>	
	<b>Characteristic ground layer</b>	
	<i>Dichondra repens</i> , <i>Cheilanthes sieberi</i> subsp. <i>sieberi</i> , <i>Aristida vagans</i> , <i>Microlaena stipoides</i> var <i>stipoides</i> , <i>Themeda australis</i> , <i>Brunoniella australis</i> , <i>Desmodium gunnii</i> , <i>Opercularia diphylla</i> , <i>Wahlenbergia gracilis</i> , <i>Dichelachne micrantha</i> , <i>Paspalidium distans</i> , <i>Eragrostis leptostachya</i> , <i>Lomandra filiformis</i> , <i>Lomandra multiflora</i> , <i>Dianella longifolia</i> , <i>Oxalis perennans</i> , <i>Euchiton sphaericus</i> , <i>Goodenia hederacea</i> , <i>Aristida ramosa</i> , <i>Arthropodium milleflorum</i> , <i>Austrodanthonia tenuior</i> , <i>Cymbopogon refractus</i> and <i>Echinopogon caespitosus</i>	

### 3.1.3 Final PCT and Vegetation Zone Selection

Field surveys conducted by Narla confirmed that in addition to areas of hardstand (Vines Drive and Maintenance Lane), one (1) PCT was identified within the Subject Land:

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

Three (3) vegetation zones were identified within the Subject Land that consisted of differing condition classes or vegetation types:

- Zone 1: PCT 835 – Grassland with exotic trees;
- Zone 2: PCT 835 – Grassland with planted *Casuarina glauca*; and
- Zone 3: PCT 835 – Remnant Canopy.

These vegetation zones are detailed in **Table 3**, and displayed in **Figure 11**.

Table 3. Vegetation zones identified within the Subject Land.

PCT 835: Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion			
Vegetation class	Coastal Floodplain Wetlands		
Total area within Subject Land	11.31		
Description in the VIS			
<p>Cumberland Riverflat Forest (Benson and Howell 1990) is an open eucalypt forest situated on broad alluvial flats of the Hawkesbury and Nepean River systems. It also forms narrower ribbons alongside streams and creeks that drain the Cumberland Plain. Typically, the canopy includes one of either rough-barked apple (<i>Angophora floribunda</i>) or broad-leaved apple (<i>Angophora subvelutina</i>) and one or both of forest red gum (<i>Eucalyptus tereticornis</i>) and cabbage gum (<i>Eucalyptus amplifolia</i>). However, there are a wide variety of other interesting eucalypts that are highly localised. On the Georges River near Bankstown and on Cabramatta and Prospect creeks blue box (<i>Eucalyptus baueriana</i>) is commonly encountered, sometimes as a smaller tree beneath the canopy. Further north and east Sydney blue gum (<i>Eucalyptus saligna</i>) and blackbutt (<i>Eucalyptus pilularis</i>) occurs. Near Hoxton Park spotted gum (<i>Corymbia maculata</i>) forms a minor component of the canopy.</p> <p>The understorey within this Riverflat forest is characterised by an occasional sparse to open small tree stratum of paperbark (<i>Melaleuca</i> spp.) and wattles (<i>Acacia</i> spp.). A sparse lower shrub layer features blackthorn (<i>Bursaria spinosa</i>) at most sites. The ground layer is characterised by an abundant cover of grasses with small herbs and ferns. Cumberland Riverflat Forest occurs at altitudes between one and 160 metres above sea level and with a mean annual rainfall of 750-1000 millimetres. Within the study area the largest remaining areas are situated on the Georges River. Highly disturbed examples occur on Prospect and Orphan School creeks.</p>			
Condition Class	Vegetation Zone 1: Grassland with exotic trees	Vegetation Zone 2: Grassland with planted <i>Casuarina glauca</i>	Vegetation Zone 3: Remnant Canopy
Extent within Subject Land (approximate)	10.91	0.16	0.23
Field survey effort	Three (3) BAM plot was established.	One (1) BAM plot was established.	One (1) BAM plots were established.
Description of vegetation	The vegetation within this zone was considerably degraded; characterised by no native canopy species or shrubs, and a mixed covering of native and exotic groundcovers, particularly grasses ( <b>Plate 1</b> ). <i>Cynodon dactylon</i> was the only reoccurring native species within the BAM plots. Exotic species	The vegetation within this zone consisted of a stand of historically planted <i>Casuarina glauca</i> , utilised as a paddock barrier ( <b>Plate 2</b> ). There was a complete lack of shrub species. The ground layer consisted of sporadic natives such as <i>Cynodon dactylon</i> , <i>Sporobolus creber</i> and <i>Juncus usitatus</i> . The	The vegetation within this zone was characterised by a remnant native canopy species ( <b>Plate 3</b> ). Native canopy species consisted of <i>Angophora subvelutina</i> and <i>Eucalyptus tereticornis</i> with sporadic <i>Eucalyptus paniculata</i> and <i>Eucalyptus botryoides</i> planted along Vines Drive. No

**PCT 835: Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion**

	such as <i>Paspalum dilatatum</i> , <i>Eragrostis curvula</i> , <i>Setaria parviflora</i> and the priority weed <i>Senecio madagascariensis</i> were dominant. The zone also contained scattered exotic trees, including <i>Pinus radiata</i> , <i>Cinnamomum camphora</i> and <i>Pyrus ussuriensis</i> .	remained of the vegetation was dominated by exotics including <i>Eragrostis curvula</i> , <i>Cenchrus clandestinus</i> , <i>Paspalum dilatatum</i> and <i>Setaria parviflora</i> .	native shrub species were located however, the ground layer was comprised of select native species, including <i>Cynodon dactylon</i> , <i>Einadia hastata</i> <i>Microlaena stipoides</i> , <i>Commelina cyanea</i> and <i>Dysphania pumilio</i> . Exotic species were also prevalent in this zone and consisted of <i>Bidens subalternans</i> , <i>Sida rhombifolia</i> , <i>Cinnamomum camphora</i> , <i>Cenchrus clandestinus</i> and <i>Chloris gayana</i> .
<b>Structure of vegetation</b>	No native trees or shrubs were present within the vegetation zone. However, native ground covers were moderate, with native grasses accounting for an average of 54% groundcover across the zone. Other native features were mostly absent with only 0.1% forb and 0% other and ferns. The zone contained no tree stem sizes, leaf litter, hollow bearing trees or fallen logs.	A thin layer of canopy cover was evident within the BAM plot, with native trees totalling 15% cover. Shrub cover was absent. A native groundcover was present including 20.2% grass, 0% forbs, others and ferns. Leaf litter was low accounting for only 1% and no fallen logs were recorded. The BAM plot contained a low diversity of tree stem sizes, with tree stems recorded in just three (3) DBH classes. Regeneration stems were present however no large trees and no hollow bearing trees were present within the BAM plot.	A low- canopy cover was evident within the BAM plot, with native trees totalling 6% cover. Shrub cover was absent. A moderate native groundcover was present, including 10.3% grass, 9% forb and 0% other and fern. Leaf litter cover was low (7%) and no fallen logs were recorded.  The BAM plot contained a low diversity of tree stem sizes, with tree stems recorded in three (3) DBH classes, including one (1) large tree (>50cm DBH). No regenerating stems were recorded however, two (2) hollow bearing trees were identified within the BAM plot.
<b>Scientific Reference from VIS (DPIE 2021c)</b>	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;		



PCT 835: Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	
	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;
TEC Status (BC Act 2016 and EPBC Act 1999)	Conforms to the BC Act listed EEC River-flat Eucalypt Forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (see <b>Section 3.1.4</b> ).  Does not conform to the EPBC Act listed CEEC Coastal Floodplain Eucalypt Forest of Eastern Australia (see <b>Section 3.1.4</b> ).
TEC area (ha)	11.31ha
Estimate of percent cleared value of PCT in the major catchment area	93%



Plate 1. Representative photo of Vegetation Zone 1.





Plate 2. Representative photo of Vegetation Zone 2 within the Subject Land.





Plate 3. Representative photo of Vegetation Zone 3 within the Subject Land.



### 3.1.4 Threatened Ecological Communities

#### 3.1.4.1 Biodiversity Conservation Act 2016

The native vegetation within the Subject Land conforms to the BC Act listed EEC River-flat Eucalypt Forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (RFEF; **Figure 12**). This was determined by a comprehensive desktop assessment that identified the typical RFEF landscape attributes within the Subject Land, in conjunction with a site visit that found a suite of characteristic RFEF species that were in line with the 'Identification Guidelines for Endangered Ecological Communities: Riverflat Eucalypt Forest on Coastal Floodplains' (DECC 2007).

#### 3.1.4.2 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The native vegetation within the Subject Land does not conform to the EPBC Act 1999 listed Coastal Floodplain Eucalypt Forest of Eastern Australia Critically Endangered Community. Although the vegetation within Zone 3 meets most of the key diagnostic characteristics as outlined in Conservation Advice for this community, it does not meet the minimum condition threshold of:

- Category C2:  $\geq 30\%$  of its total understorey vegetation cover is comprised of native species (exotic annuals are excluded from this assessment) AND Ground cover richness  $\geq 4$  native species per 0.04 ha sample plot, within a large (greater than 2ha) or contiguous patch (greater than 0.5ha within a patch of native vegetation greater than 5ha).

The native vegetation cover within Zone 3 only accounted for 19.3%, and was not part of a large or contiguous patch. Therefore, the vegetation within Zone 3 does not meet the minimum requirements to be protected under the EPBC Act.

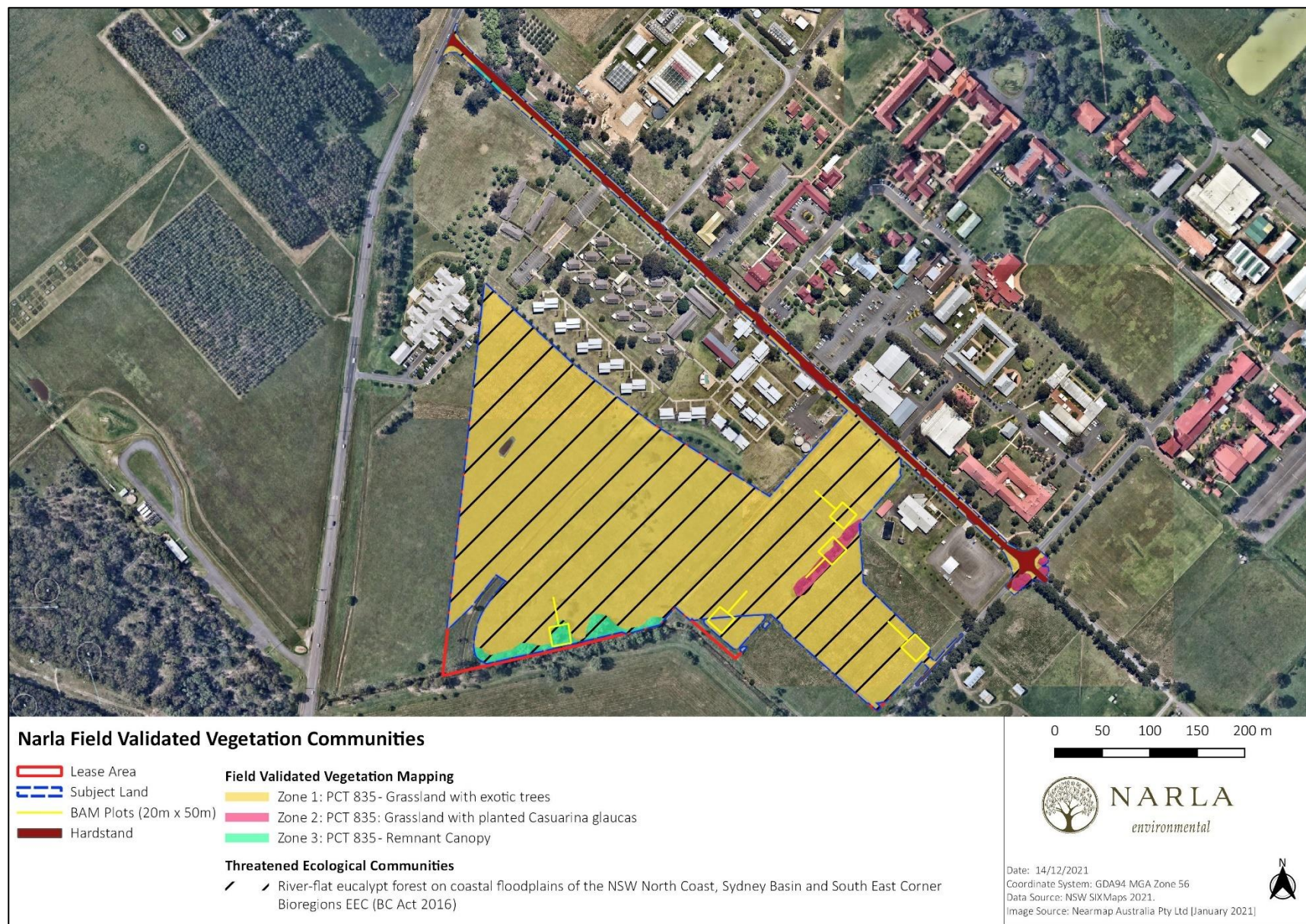


Figure 11. Narla field validated vegetation mapping and location of BAM plots within the Subject Land.



### 3.2 Assessing Patch Size

As defined by the BAM, a patch is an area of native vegetation that occurs on the Subject Land and includes native vegetation that has a gap of less than 100 m from the next area of native vegetation (or  $\leq 30$  m for non-woody ecosystems). A patch may extend onto adjoining land. For each vegetation zone, the assessor must determine the patch size in hectares and assign it to one of the following classes:

- <5 ha
- 5–<25 ha
- 25–<100 ha
- $\geq 100$  ha.

The patch size class is used to assess habitat suitability on the Subject Land for threatened species. The assessor may assign more than one patch size class to the vegetation zone if both of the following apply:

- A vegetation zone comprises two or more discontinuous areas of native vegetation, and
- The areas of discontinuous native vegetation have more than one patch size class.

As areas outside of the Subject Property were not assessed as part of the scope of this assessment, the vegetation zones identified within the Subject Land were separated into the following categories to allow for aerial mapping of patch size within the broader area (**Figure 12**):

- Non woody Ecosystems:
  - Zone 1: PCT 835 – Grassland with exotic trees.
- Woody Ecosystems:
  - Zone 2: PCT 835 – Grassland with planted *Casuarina glauca*; and
  - Zone 3: PCT835 – Remnant Canopy

**Table 4. Patch size classes of each PCT and associated vegetation zones.**

Plant Community Type	Category	Vegetation Zone	Patch Size Class
PCT 835	Non-woody Ecosystems	Zone 1	>100ha
PCT 835	Woody Ecosystems	Zone 2	<5ha
PCT 835	Woody Ecosystems	Zone 3	>100ha

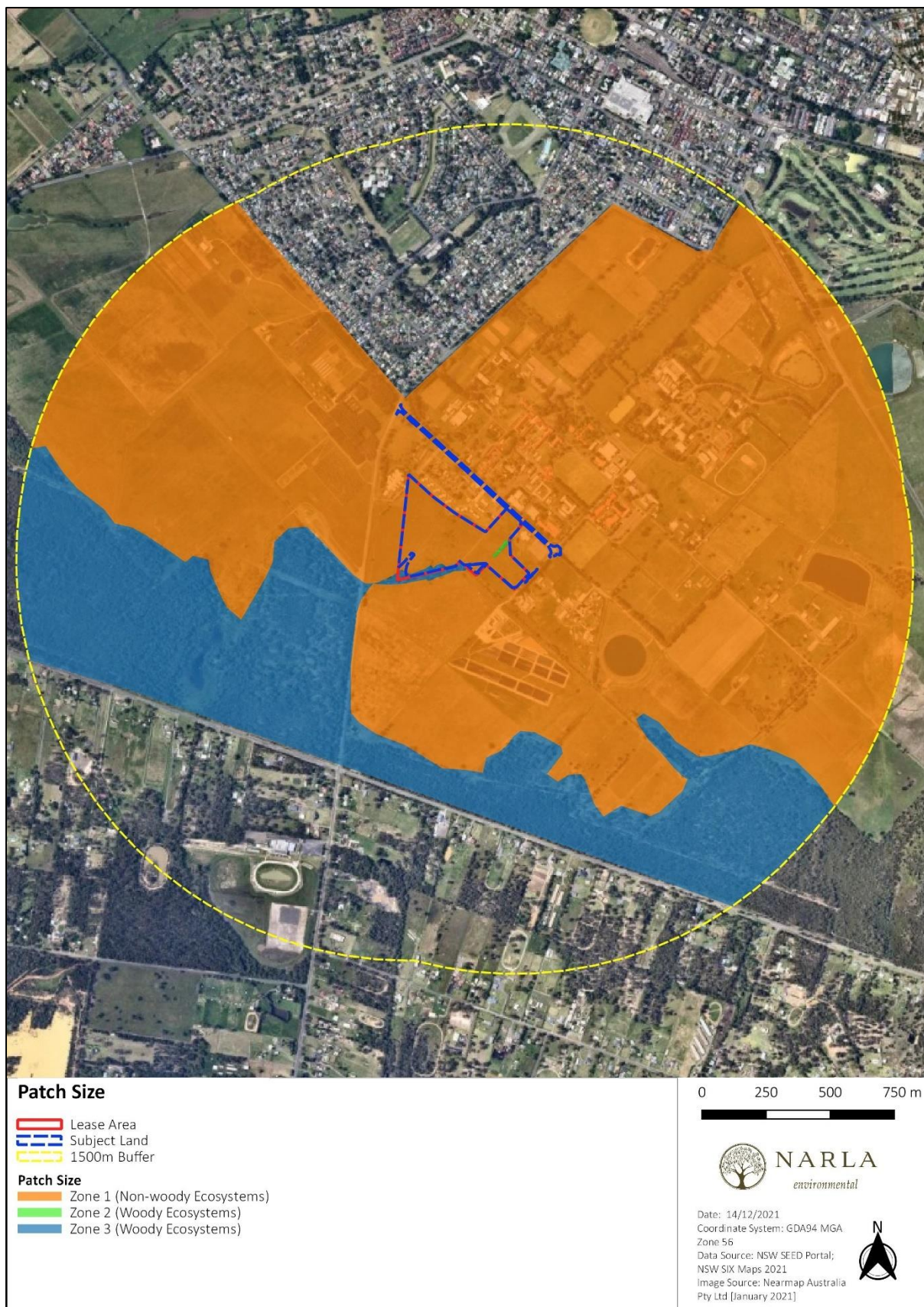


Figure 12. Patch size for each vegetation zone identified within the Subject Land.

### 3.3 Vegetation Integrity Survey (VIS) Plots

Five (5) BAM VIS Plots were established within the Subject Land. Plot data gathered for each attribute used to assess the function of the Subject Land vegetation is detailed in **Appendix A**. Vegetation Integrity (VI) Scores represented by existing vegetation within each vegetation zone is detailed in **Table 5**.

#### 3.3.1 Determining future vegetation integrity scores

Most projects will result in complete clearing of vegetation and threatened species habitat within the development footprint. In this scenario, the assessor must assess the proposed future value of each of the VI attributes as zero in the BAMC. However, in circumstances where partial clearing of vegetation is proposed and remaining vegetation will be maintained, the assessor may determine that the future value of the relevant VI attributes are greater than zero (DPIE 2020a).

The Subject Land will be exposed to varying degrees of clearing, including full clearing within the proposed development footprint, and partial clearing within the APZ. Subsequently, each vegetation zone has been divided into the following management zones to account for the varying clearing levels (**Figure 13**):

- Vegetation Zone 1: Grassland with exotic trees:
  - Management Zone 1.1: Total Impact – this area will require the removal of all vegetation to allow for the proposed development.
  - Management Zone 1.2: APZ – this area is defined by the APZ within the vegetation zone that requires management to achieve IPA specifications.
- Vegetation Zone 2: Grassland with planted *Casuarina glauca*'s:
  - Management Zone 2.1: Total Impact – this area will require the removal of all vegetation to allow for the proposed development.
  - Management Zone 2.2: APZ – this area is defined by the APZ within the vegetation zone that requires management to achieve IPA specifications.
- Vegetation Zone 3: Remnant Canopy:
  - Management Zone 3: Total Impact – this area will require the removal of all vegetation to allow for the proposed development.

The attributes influencing future vegetation scores within each of these management zones are detailed in **Table 6**.





Figure 13. Management zones within the Subject Land.



Table 5. Vegetation integrity scores for each identified zone.

PCT 835: Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion											
Vegetation Zone	Management Zone	Area (ha)	Survey Effort	Composition Condition Score	Structure Condition Score	Function Condition Score	VI Score	Future VI Score	Change in VI Score	Total VI Loss	Hollow bearing trees
Zone 1 -Grassland with exotic trees	1.1 Total Impact	9.04	3 x 1000m <sup>2</sup> (20m x 50m) VIS Plot	0.7	55.2	0	3.4	0	-3.4	-2.9	0
	1.2 APZ	1.87						3.4	0		
Zone 2 – Grassland with planted <i>Casuarina glauca's</i> .	2.1 Total Impact	0.07	1 x 1000m <sup>2</sup> (20m x 50m) VIS Plot	10.6	26.8	28.8	20.2	0	-20.2	-11.3	0
	2.2 APZ	0.09						15.8	-4.4		
Zone 3 – Remnant Canopy	3 Total Impact	0.23	1 x 1000m <sup>2</sup> (20m x 50m) VIS Plot	15.4	8.2	44.8	17.8	0	-17.8	-17.8	2

Table 6. Management Zones within the Subject Land, and relevant vegetation attributes (composition, structure and function) affecting future VI scores.

Vegetation Zone	Management Zone	Changes in current vegetation attributes	Vegetation attributes not changed	Future vegetation scores and justification
Zone 1 – PCT 835: Grassland with exotic trees	Zone 1.1 Total Impact	All vegetation will be removed	NA	<ul style="list-style-type: none"> <li>All vegetation within the development footprint is required for removal to allow for the proposed development.</li> <li>Future composition, structure and function score is 0.</li> </ul>
	Zone 1.2 APZ	<b>Vegetation Composition</b>		
		NA	<ul style="list-style-type: none"> <li>Canopy, shrub, grass, forb, fern and other composition.</li> </ul>	<ul style="list-style-type: none"> <li>Tree Composition = 0, Shrub composition = 0; Fern composition = 0, Other Composition = 0. <ul style="list-style-type: none"> <li>No trees, shrubs, ferns or other were present within the BAM plots.</li> </ul> </li> <li>Grass composition = 1; Forb composition = 0.3 <ul style="list-style-type: none"> <li>Grasses and some forbs have remained viable within the zone even though it is currently heavily degraded. It is therefore expected that there will be no change in this viability when the vegetation is kept to a height of &lt;100mm, and consequently no change in species composition.</li> </ul> </li> </ul>
		<b>Vegetation Structure</b>		
		NA	<ul style="list-style-type: none"> <li>Canopy, shrub, grass, forb, fern and other structure.</li> </ul>	<ul style="list-style-type: none"> <li>Tree structure = 0, Shrub structure = 0%; Fern structure = 0% and Other structure = 0% <ul style="list-style-type: none"> <li>No trees, shrubs, ferns or other were present within the BAM plots.</li> </ul> </li> <li>Grass cover = 53.7%; Forb cover = 0.1% <ul style="list-style-type: none"> <li>Grasses and forbs have remained viable within the zone even though it is currently heavily degraded. It is therefore expected that there will be no change in this viability when the vegetation is kept to a height of &lt;100mm, and consequently no change in species structure.</li> </ul> </li> </ul>
		<b>Vegetation Function</b>		
		NA	<ul style="list-style-type: none"> <li>Regenerating stems.</li> <li>Large trees and stem size classes;</li> </ul>	<ul style="list-style-type: none"> <li>No regenerating stems, trees of any size class, leaf litter or coarse wood debris were recorded within the BAM plots</li> <li>HTE cover = 31.6%:</li> </ul>

Vegetation Zone	Management Zone	Changes in current vegetation attributes	Vegetation attributes not changed	Future vegetation scores and justification
			<ul style="list-style-type: none"> <li>Leaf litter and coarse woody debris.</li> <li>HTE cover.</li> </ul>	<ul style="list-style-type: none"> <li>No reduction in HTE's is expected due to the degraded nature of the Subject Land and additional pressures from the proposed development.</li> </ul>
Zone 2 – Grassland with planted <i>Casuarina glauca's</i>	Zone 2.1 Total Impact	All vegetation will be removed	NA	<ul style="list-style-type: none"> <li>All vegetation within the development footprint is required for removal to allow for the proposed development.</li> <li>Future composition, structure and function score is 0.</li> </ul>
	Zone 2.2 APZ	<b>Vegetation Composition</b>		
		NA	<ul style="list-style-type: none"> <li>Canopy, shrub, grass, forb, fern and other composition.</li> </ul>	<ul style="list-style-type: none"> <li>Tree composition = 1. <ul style="list-style-type: none"> <li>It is assumed that the strategic removal/trimming of canopy trees will allow for the retention of all canopy species (i.e. retain current species diversity).</li> </ul> </li> <li>Shrub composition = 0; Forbs = 0, Fern composition = 0, Other = 0. <ul style="list-style-type: none"> <li>No shrubs, forbs, ferns or other were present within the BAM plot.</li> </ul> </li> <li>Grass composition = 3 <ul style="list-style-type: none"> <li>Grasses have remained viable within the zone even though it is currently heavily grazed. It is therefore expected that there will be no change in this viability when the vegetation is kept to a height of &lt;100mm, and consequently no change in species composition.</li> </ul> </li> </ul>
		<b>Vegetation Structure</b>		
		NA	<ul style="list-style-type: none"> <li>Canopy, shrub, grass, forb, fern and other structure.</li> </ul>	<ul style="list-style-type: none"> <li>Tree structure maintained at 15% cover <ul style="list-style-type: none"> <li>Tree canopy cover should be no more than 15% at maturity as per RFS (2019)</li> </ul> </li> <li>Shrub structure = 0%; forb structure = 0, fern structure = 0% and other structure = 0% <ul style="list-style-type: none"> <li>No shrubs, forbs, ferns or others were present within the BAM plot.</li> </ul> </li> <li>Grass cover = 20.2% <ul style="list-style-type: none"> <li>Grasses have remained viable within the zone even though it is currently heavily disturbed. It is therefore expected that there will</li> </ul> </li> </ul>

Vegetation Zone	Management Zone	Changes in current vegetation attributes	Vegetation attributes not changed	Future vegetation scores and justification
				be no change in this viability when the vegetation is kept to a height of <100mm, and consequently no change in species structure.
		<b>Vegetation Function</b>		
		<ul style="list-style-type: none"> <li>Removal of regenerating stems.</li> <li>Removal of all leaf litter.</li> </ul>	<ul style="list-style-type: none"> <li>Large trees and stem size classes;</li> <li>Coarse woody debris</li> <li>HTE cover.</li> </ul>	<ul style="list-style-type: none"> <li>Regenerating stems = Absent: <ul style="list-style-type: none"> <li>Regenerating stems will not remain viable as the groundcover is maintained to a height of &lt;100mm.</li> </ul> </li> <li>Litter cover = 0% <ul style="list-style-type: none"> <li>Leaves and vegetation debris require complete removal from the IPA.</li> </ul> </li> <li>No large trees or coarse woody debris were recorded within the BAM plots;</li> <li>Stem size classes = 3: <ul style="list-style-type: none"> <li>It is assumed that the strategic removal/trimming of canopy trees will allow for the retention of all stem size classes (including large trees) whilst maintaining canopy cover to &lt;15%.</li> </ul> </li> <li>HTE cover = 46.2%: <ul style="list-style-type: none"> <li>No reduction in HTE's is expected due to the degraded nature of the Subject Land and additional pressures from the proposed development.</li> </ul> </li> </ul>
Zone 3 – PCT 835: Remnant canopy	Zone 3 Total Impact	All vegetation will be removed	NA	<ul style="list-style-type: none"> <li>All vegetation within the development footprint is required for removal to allow for the proposed development.</li> <li>Future composition, structure and function score is 0.</li> </ul>

## 4. Threatened Species

### 4.1 Candidate Ecosystem Credit Species

Ecosystem credit species associated with the Subject Land are listed below in **Table 7**. No species predicted by the BAM calculator as potential ecosystem credits were excluded from the assessment due to habitat constraints.

**Table 7. Candidate ecosystem credits predicted to occur within the Subject Land.**

Scientific Name	BC Act Status	Excluded from Assessment	Reason for Exclusion from Assessment
<i>Anthochaera phrygia</i> Regent Honeyeater (Foraging)	Critically Endangered	No	-
<i>Artamus cyanopterus cyanopterus</i> Dusky Woodswallow	Vulnerable	No	-
<i>Botaurus poiciloptilus</i> Australasian Bittern	Endangered	No	-
<i>Callocephalon fimbriatum</i> Gang-gang Cockatoo (Foraging)	Vulnerable	No	-
<i>Chthonicola sagittata</i> Speckled Warbler	Vulnerable	No	-
<i>Climacteris picumnus victoriae</i> Brown Treecreeper (eastern subspecies)	Vulnerable	No	-
<i>Daphoenositta chrysoptera</i> Varied Sittella	Vulnerable	No	-
<i>Dasyurus maculatus</i> Spotted-tailed Quoll	Vulnerable	No	-
<i>Falsistrellus tasmaniensis</i> Eastern False Pipistrelle	Vulnerable	No	-
<i>Glossopsitta pusilla</i> Little Lorieet	Vulnerable	No	-
<i>Grantiella picta</i> Painted Honeyeater	Vulnerable	No	-
<i>Haliaeetus leucogaster</i> White-bellied Sea-Eagle (Foraging)	Vulnerable	No	-
<i>Hieraaetus morphnoides</i> Little Eagle (Foraging)	Vulnerable	No	-
<i>Ixobrychus flavicollis</i> Black Bittern	Vulnerable	No	-
<i>Lathamus discolor</i> Swift Parrot (Foraging)	Endangered	No	-
<i>Lophoictinia isura</i> Square-tailed Kite (Foraging)	Vulnerable	No	-
<i>Melanodryas cucullata cucullata</i> Hooded Robin (south-eastern form)	Vulnerable	No	-
<i>Melithreptus gularis gularis</i> Black-chinned Honeyeater (eastern subspecies)	Vulnerable	No	-



Scientific Name	BC Act Status	Excluded from Assessment	Reason for Exclusion from Assessment
<i>Micronomus norfolkensis</i> Eastern Coastal Free-tailed Bat	Vulnerable	No	-
<i>Miniopterus australis</i> Little Bent-winged Bat (Foraging)	Vulnerable	No	-
<i>Miniopterus orianae oceanensis</i> Large Bent-winged bat (Foraging)	Vulnerable	No	-
<i>Neophema pulchella</i> Turquoise Parrot	Vulnerable	No	-
<i>Ninox connivens</i> Barking Owl (Foraging)	Vulnerable	No	-
<i>Ninox strenua</i> Powerful Owl (Foraging)	Vulnerable	No	-
<i>Pandion cristatus</i> Eastern Osprey (Foraging)	Vulnerable	No	-
<i>Petroica boodang</i> Scarlet Robin	Vulnerable	No	-
<i>Petroica phoenicea</i> Flame Robin	Vulnerable	No	-
<i>Petroica boodang</i> Scarlet Robin	Vulnerable	No	-
<i>Petroica phoenicea</i> Flame Robin	Vulnerable	No	-
<i>Phascolarctos cinereus</i> Koala (Foraging)	Vulnerable	No	-
<i>Pteropus poliocephalus</i> Grey-headed Flying-fox (Foraging)	Vulnerable	No	-
<i>Saccolaimus flaviventris</i> Yellow-bellied Sheathtail-bat	Vulnerable	No	-
<i>Scoteanax rueppellii</i> Greater Broad-nosed Bat	Vulnerable	No	-
<i>Stagonopleura guttata</i> Diamond Firetail	Vulnerable	No	-
<i>Tyto novaehollandiae</i> Masked Owl (Foraging)	Vulnerable	No	-

## 4.2 Candidate Species Credit Species Summary

This section provides a summary of the candidate species credit fauna and flora species for the Subject Land derived from BAMC (DPIE 2020d). A summary of the targeted survey effort applied to each species is provided along with the results of the survey effort, specifically whether or not the species credit needs to be offset through retiring of Biodiversity Offset Credits (Table 8; Table 9).

**Table 8. Candidate Fauna Credit Species predicted to occur within the Subject Land.**

Scientific Name	Included in Assessment?	Targeted Survey conducted?	Present within Subject Land?	Biodiversity Risk Weighting	Biodiversity Offset Credits Required?
<i>Anthochaera phrygia</i> Regent Honeyeater (Breeding)	This Subject Land is not located within any mapped areas of important habitat for this species. Therefore, it has been excluded from the assessment.	NA	NA	Very High - 3	No
<i>Burhinus grallarius</i> Bush Stone-curlew	This species requires abundant fallen/standing dead timber including logs. As no such habitat was present within the Subject Land, this species was excluded from the assessment.	NA	NA	High - 2	No
<i>Callocephalon fimbriatum</i> Gang-gang Cockatoo (Breeding)	This species nests in hollows that are 10cm in diameter or larger and at least 9m above the ground in eucalypts. As such habitat constraints are present within the Subject Land, this species was included in the assessment.	Yes	No	High - 2	No
<i>Cercartetus nanus</i> Eastern Pygmy-possum	After carrying out a field assessment of the habitat constraints or microhabitats on the Subject Land, it was determined that the habitat is substantially degraded such that the species is unlikely to utilise the Subject Land. This species is found in a broad range of habitats including rainforest, sclerophyll forest, woodland and heath, feeding that banksias, eucalyptus and bottlebrushes. This species breeds in tree hollows and decorticated (shredded) bark. Due to the absence of a mid-stratum layer due to continued grazing, and the isolated nature of the paddock trees, it is highly unlikely this species will utilise the Subject Land. Therefore, this species was excluded from the assessment.	NA	NA	High - 2	No
<i>Chalinolobus dwyeri</i> Large-eared Pied Bat	This species is known to occur within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels.	NA	NA	Very High - 3	No

Scientific Name	Included in Assessment?	Targeted Survey conducted?	Present within Subject Land?	Biodiversity Risk Weighting	Biodiversity Offset Credits Required?
	Such geological features were not observed within or adjacent to the Subject Land. Furthermore, as the Subject Land and surrounds are located within a flat terrain with little topographical variation, it is highly unlikely such habitat features would occur within the area surrounding the Subject Land. As such, this species was excluded from the assessment.				
<i>Haliaeetus leucogaster</i> White-bellied Sea-Eagle (Breeding)	This species builds large stick nests in living or dead mature trees within suitable vegetation within 1km of rivers, lakes, large dams or creeks, wetlands and coastlines. As such habitat constraints are present, this species was included in the assessment	Yes	No	High - 2	No
<i>Hieraaetus morphnoides</i> Little Eagle (Breeding)	This species nests in tall living trees within a remnant patch of native vegetation. As large trees are present within the Subject Land, this species was included in the assessment.	Yes	No	Moderate - 1.5	No
<i>Lathamus discolor</i> Swift Parrot (Breeding)	No, the Subject Land is not included on the map of important areas for Swift Parrot.	NA	NA	Very High - 3	No
<i>Litoria aurea</i> Green and Golden Bell Frog	This species is known to occur within semi-permanent/ephemeral wet areas, and within 1km of wet areas (swamps and waterbodies). As a number of waterbodies are present within 1km of the Subject Land (including within the Subject Land), this species was included in the assessment.	Yes	No	High - 2	No
<i>Lophoictinia isura</i> Square-tailed Kite (Breeding)	This species requires live, large old trees within vegetation for nesting. As large trees are present within the Subject Land, this species was included in the assessment.	Yes	No	Moderate - 1.5	No



Scientific Name	Included in Assessment?	Targeted Survey conducted?	Present within Subject Land?	Biodiversity Risk Weighting	Biodiversity Offset Credits Required?
<i>Meridolum corneovirens</i> Cumberland Plain Land Snail	This species lives under the litter of bark, leaves and logs, or shelters in loose soil around grass clumps, often at the base of trees. As such habitat is present within the Subject Land this species was included in the assessment.	Yes	No	High - 2	No
<i>Miniopterus australis</i> Little Bent-winged Bat (Breeding)	This species is known to breed in caves, tunnels, mines and culverts. As such habitat constraints are not present within the Subject Land, this species was excluded from the assessment.	NA	NA	Very High - 3	No
<i>Miniopterus orianae oceanensis</i> Large Bent-winged Bat (Breeding)	This species is known to breed in caves, tunnels, mines and culverts. As such habitat constraints are not present within the Subject Land, this species was excluded from the assessment.	NA	NA	Very High - 3	No
<i>Myotis macropus</i> Southern Myotis	As the Subject Land occurs within 200m of a waterbody with pools/stretchers of 3m or wider, this species was included in the assessment.	Yes	No	High - 2	No
<i>Ninox connivens</i> Barking Owl (Breeding)	This species is known to breed in living or dead trees with hollows greater than 20cm diameter. A hollow bearing tree with a hollow greater than 20cm diameter was present within the Subject Land. This species was therefore included in the assessment.	Yes	No	High - 2	No
<i>Ninox strenua</i> Powerful Owl (Breeding)	This species is known to breed in living or dead trees with hollows greater than 20cm diameter. A hollow bearing tree with a hollow greater than 20cm diameter was present within the Subject Land. This species was therefore included in the assessment.	Yes	No	High - 2	No

Scientific Name	Included in Assessment?	Targeted Survey conducted?	Present within Subject Land?	Biodiversity Risk Weighting	Biodiversity Offset Credits Required?
<i>Pandion cristatus</i> Eastern Osprey (Breeding)	This species builds large stick nests in living or dead mature trees within suitable vegetation within 100m of a floodplain. As large trees are present and the Subject Land was located on a floodplain, this species was included in the assessment	Yes	No	Moderate – 1.5	No
<i>Petauroides volans</i> Greater Glider	Suitable habitat for this species was present within the Subject Land, therefore this species was included in the assessment.	Yes	No	High - 2	No
<i>Petaurus norfolcensis</i> Squirrel Glider	Suitable habitat for this species was present within the Subject Land, therefore this species was included in the assessment.	Yes	No	High - 2	No
<i>Phascolarctos cinereus</i> Koala (Breeding)	Potential feed trees were present within the Subject Land therefore this species was included in the assessment.	Yes	No	High - 2	No
<i>Pteropus poliocephalus</i> Grey-headed Flying-fox (Breeding)	This species is known to breed within breeding camps. As such habitat constraints are not present within the Subject Land, this species was excluded from the assessment.	NA	NA	High - 2	No
<i>Tyto novaehollandiae</i> Masked Owl (Breeding)	This species is known to breed in living or dead trees with hollows greater than 20cm diameter. A hollow bearing tree with a hollow greater than 20cm diameter was present within the Subject Land. This species was therefore included in the assessment.	Yes	No	High - 2	No

Table 9. Candidate Flora Credit Species predicted to occur within the Subject Land.

Scientific Name	Included in Assessment?	Targeted Survey conducted?	Present within Subject Land?	Biodiversity Risk Weighting	Biodiversity Offset Credits Required?
<i>Callistemon linearifolius</i> Netted Bottle Brush	This species is known to grow in dry sclerophyll forests on the coast and adjacent ranges. As no such habitat is located within the Subject Land this species was excluded from the assessment.	NA	NA	Moderate – 1.5	No
<i>Cynanchum elegans</i> White-flowered Wax Plant	This species usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree <i>Leptospermum laevigatum</i> – Coastal Banksia <i>Banksia integrifolia</i> subsp. <i>integrifolia</i> coastal scrub; Forest Red Gum <i>Eucalyptus tereticornis</i> aligned open forest and woodland; Spotted Gum <i>Corymbia maculata</i> aligned open forest and woodland; and Bracelet Honey myrtle <i>Melaleuca armillaris</i> scrub to open scrub. As potential habitat was located within the Subject Land this species was included in the assessment	Yes	No	High - 2	No
<i>Eucalyptus benthamii</i> Camden White Gum	This species is known to occur on alluvial flats. As such habitat was present within the Subject Land this species was included in the assessment.	Yes	No	High - 2	No
<i>Hibbertia</i> sp. Bankstown	This species is currently only known from one population at Bankstown Airport, in the Bankstown LGA. As the Subject Land is not located within this LGA it is deemed highly unlikely that this species would be present. It has therefore been excluded from the assessment.	NA	NA	Very High - 3	No
<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	This population has a geographic limitation of the Blacktown, Camden, Campbelltown, Canterbury-Bankstown, Cumberland, Fairfield, Liverpool and Penrith LGAs. As the Subject Land is located outside of these LGAs this species has been excluded from the assessment.	NA	NA	High - 2	No
<i>Persicaria elatior</i> Tall Knotweed	This species is known to occur in semi-permanent/ephemeral wet areas or within 50m of swamps, waterbodies or wetlands. As such habitat is	Yes	No	High - 2	No



Scientific Name	Included in Assessment?	Targeted Survey conducted?	Present within Subject Land?	Biodiversity Risk Weighting	Biodiversity Offset Credits Required?
	present within the Subject Land, this species was included in the assessment.				
<i>Persoonia hirsuta</i> Hairy Geebung	This species is known to occur on sandy soils in dry sclerophyll open forest, woodland and heath on sandstone. As no such habitat was present within this Subject Land this species excluded from the assessment.	NA	NA	Very High - 3	No
<i>Pilularia novae-hollandiae</i> Austral Pillwort	This species grows in shallow swamps and waterways often among sedges and grasses. As such habitat was present within the Subject Land this species has been included in the assessment.	Yes	No	Very High - 3	No
<i>Pomaderris brunnea</i> Brown Pomaderris	This species grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines. As such habitat was located within the Subject Land this species has been included in the assessment.	Yes	No	High - 2	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	This endangered population occurs in the local government areas of Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield. As the Subject Land is located outside of these LGAs, this population has been excluded from the assessment.	NA	NA	High - 2	No

### 4.3 Targeted Species Credit Surveys

Targeted surveys were undertaken for a number of species credit species considered likely to have suitable habitat within the Subject Land. These surveys were implemented in accordance with Section 5.3 of the BAM and all relevant OEH and DPIE threatened species survey guidelines. Targeted surveys were undertaken by Narla Ecologist Chris Moore on the 17<sup>th</sup> of March 2021, who has undertaken hundreds of targeted surveys all across NSW. Additional targeted surveys were then conducted by experienced Narla Ecologists Angus McClelland and Ellena Tsanidis from the 9<sup>th</sup> – 12<sup>th</sup> and 16<sup>th</sup> to 19<sup>th</sup> of Augusts 2021 and again from the 8<sup>th</sup> to the 11<sup>th</sup> of November 2021.

Weather conditions taken from the nearest weather station (Richmond Station 067105) in the lead up and during the field surveys are outlined in **Table 10**. Pre-survey weather conditions were generally conducive for identifying threatened species should they occur within the Subject Land. Rainfall in the weeks prior to the targeted flora surveys provided suitable conditions for the flowering and/or emergence of the targeted flora species. Such rainfall also allowed for optimal conditions for the emergence of shrubs and groundcovers within the Subject Land, which ensured maximum species diversity was observed during the site visit.

**Table 10. Weather conditions taken from the nearest weather stations (Station number 067105) in the lead up and during the field survey (BOM 2021). Survey date is in bold.**

Timing/activities	Date	Day	Temperature		Rainfall (mm)
			Min	Max	
Lead up to the survey	10/03/2021	Wednesday	19.2	27.7	1.6
	11/03/2021	Thursday	18.6	26.5	0
	12/03/2021	Friday	19.7	27.3	3.8
	13/03/2021	Saturday	17.4	33.4	0.2
	14/03/2021	Sunday	18.8	19.1	18.4
	15/03/2021	Monday	12.2	24.3	12.8
	16/03/2021	Tuesday	12.8	22.4	0
<b>Site Assessment &amp; Targeted Survey</b>	<b>17/03/2021</b>	<b>Wednesday</b>	<b>16.2</b>	<b>22.2</b>	<b>3.6</b>
Lead up to the surveys	02/08/2021	Monday	2.5	19.0	0
	03/08/2021	Tuesday	7.8	20.5	4.2
	04/08/2021	Wednesday	7.2	16.2	0
	05/08/2021	Thursday	1.8	20.6	0
	06/08/2021	Friday	0.1	20.7	0
	07/08/2021	Saturday	-0.2	19.4	0
	08/08/2021	Sunday	3.7	13.6	0
<b>Targeted Surveys</b>	<b>09/08/2021</b>	<b>Monday</b>	<b>7.0</b>	<b>19.2</b>	<b>0.4</b>
	<b>10/08/2021</b>	<b>Tuesday</b>	<b>2.8</b>	<b>22.7</b>	<b>0</b>
	<b>11/08/2021</b>	<b>Wednesday</b>	<b>5.0</b>	<b>25.0</b>	<b>0</b>
	<b>12/08/2021</b>	<b>Thursday</b>	<b>12.3</b>	<b>20.6</b>	<b>0</b>
Lead up to the surveys	13/08/2021	Friday	0.4	20.7	0
	14/08/2021	Saturday	0.2	19.6	0
	15/08/2021	Sunday	2.5	21.9	0
<b>Targeted Surveys</b>	<b>16/08/2021</b>	<b>Monday</b>	<b>4.5</b>	<b>23.5</b>	<b>0</b>
	<b>17/08/2021</b>	<b>Tuesday</b>	<b>1.3</b>	<b>19.5</b>	<b>0</b>
	<b>18/08/2021</b>	<b>Wednesday</b>	<b>0.3</b>	<b>19.3</b>	<b>0</b>
	<b>19/08/2021</b>	<b>Thursday</b>	<b>1.8</b>	<b>22.4</b>	<b>0</b>
Lead up to the surveys	01/11/2021	Monday	8.3	23.0	0
	02/11/2021	Tuesday	10.0	26.9	0
	03/11/2021	Wednesday	9.6	28.0	0

Timing/activities	Date	Day	Temperature		Rainfall (mm)
			Min	Max	
	04/11/2021	Thursday	16.3	19.5	0.6
	05/11/2021	Friday	15.8	22.4	19.0
	06/11/2021	Saturday	14.9	27.6	20.6
	07/11/2021	Sunday	15.7	22.4	0.6
Targeted Surveys	08/11/2021	Monday	16.6	27.2	37.2
	09/11/2021	Tuesday	16.5	27.0	23.2
	10/11/2021	Wednesday	16.2	20.5	0.2
	11/11/2021	Thursday	16.5	19.2	20.2

#### 4.3.1 Fauna Species Credit Survey

A total of twenty-two (22) threatened fauna species were identified within the BAMC (DPIE 2020d) as having the potential to occur within the Subject Land. Fourteen (14) species were identified as having the potential to occur within the Subject Land due to suitable habitat. To determine whether these species credit species are present, or are likely to use suitable habitat on the Subject Land, the following was undertaken:

- Targeted fauna surveys were conducted for fourteen (14) species within the DPIE endorsed survey period (**Table 11**). The targeted survey effort undertaken for these species is detailed in Section 4.3.2.

The remaining eight (8) species were not surveyed for in accordance with BAM Section 5.2.3 (DPIE 2020a), due to the following reasons:

- The assessor determines that microhabitats required by a species are absent from the subject land (or specific vegetation zone).
- The assessor determines that the habitat constraints or microhabitats are degraded to the point that the species is unlikely to use the subject land (or specific vegetation zones).

**Table 11. Threatened Fauna species identified in the BAM Calculator and BioNet Search Tool as having potential to occur within the Subject Land, and DPIE endorsed survey periods.**

Candidate Fauna Species	Survey Period (BAMC)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<i>Callocephalon fimbriatum</i> Gang-gang Cockatoo (Breeding)											✓	
<i>Haliaeetus leucogaster</i> White-bellied Sea-Eagle (Breeding)								✓				
<i>Hieraaetus morphnoides</i> Little Eagle (Breeding)								✓				
<i>Litoria aurea</i> Green and Golden Bell Frog											✓	
<i>Lophoictinia isura</i> Square-tailed Kite (Breeding)											✓	
<i>Meridolum corneovirens</i> Cumberland Plain Land Snail			✓					✓				
<i>Myotis macropus</i> Southern Myotis											✓	



Candidate Fauna Species	Survey Period (BAMC)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<i>Ninox connivens</i> Barking Owl (Breeding)								✓				
<i>Ninox strenua</i> Powerful Owl (Breeding)								✓				
<i>Pandion cristatus</i> Eastern Osprey (Breeding)								✓				
<i>Petauroides volans</i> Greater Glider								✓				
<i>Petaurus norfolcensis</i> Squirrel Glider								✓				
<i>Phascolarctos cinereus</i> Koala (Breeding)			✓					✓				
<i>Tyto novaehollandiae</i> Masked Owl (Breeding)								✓				
<b>Key</b>	✓ = Surveyed			= Optimum Survey Period								

#### 4.3.2 Targeted Fauna Survey Effort

##### 4.3.2.1 Threatened Snail Surveys

Targeted surveys were undertaken for the following threatened snail species that were identified by the BAMC as having the potential to utilise the habitat within the Subject Land:

- *Meridolum corneovirens* (Cumberland Plain Land Snail)

Targeted surveys for this species were required to determine their presence or absence. The targeted survey effort undertaken for these species is detailed in **Table 12**.

**Table 12. Threatened snail targeted fauna survey effort undertaken within the Subject Land.**

Target Species	Survey Technique	Survey Effort and Timing	Targeted Species Identified?
<i>Meridolum corneovirens</i> Cumberland Plain Land Snail	Habitat search	Thorough searches of potential habitat over the course of one (1) day. Habitat searches focused on areas of suitable habitat with ample leaf litter and debris.	No

##### 4.3.3 Threatened Mammal Species Credit Survey

Three (3) threatened mammal species were identified by the BAMC as being likely to occur within the Subject Land and therefore required targeted survey to determine their presence/absence.:

- *Petauroides volans* (Greater Glider);
- *Petaurus norfolcensis* (Squirrel Glider);
- *Phascolarctos cinereus* (Koala)

In order to determine the presence/absence of these species within the Subject Land, targeted surveys in accordance with the NSW '*Threatened Species Survey and Assessment: Guidelines for developments and activities*' were undertaken (DEC 2004). The targeted survey effort undertaken for these species is detailed in **Table 13**.

None of the BAMC predicted threatened mammal species were identified within the Subject Land or its surrounds.

**Table 13. Threatened Mammal targeted survey effort undertaken within the Subject Land.**

Target Species	Survey Technique	Survey Effort & Timing	Target Species Identified?
<i>Phascolarctos cinereus</i> Koala	Nocturnal Spotlighting Transect	One (1) session per night for eight (8) nights	No
	Diurnal Habitat Search	One day searching all trees within the Subject Land, for scratching's and scats	No
<i>Petauroides volans</i> Greater Glider	Baited Motion Sensor Cameras	Three (3) devices over eight (8) days and nights running continuously	No
<i>Petauroides norfolcensis</i> Squirrel Glider	Nocturnal Spotlighting Transects	One (1) session per night for eight (8) nights	

#### 4.3.4 Targeted Avian Species Credit Survey

Eight (8) threatened avian species were identified by the BAMC as being likely to occur within the Subject Land and therefore required targeted survey to determine their absence:

- *Callocephalon fimbriatum* (Gang-gang Cockatoo);
- *Haliaeetus leucogaster* (White-bellied Sea Eagle);
- *Hieraaetus morphnoides* (Little Eagle);
- *Lophoictinia isura* (Square-tailed Kite);
- *Ninox connivens* (Barking Owl);
- *Ninox strenua* (Powerful Owl);
- *Pandion cristatus* (Eastern Osprey); and
- *Tyto novaehollandiae* (Masked Owl).

Targeted surveys were carried-out in accordance with the NSW '*Threatened Species Survey and Assessment: Guidelines for developments and activities*' (DEC 2004) within the appropriate breeding season for each species. The targeted survey effort undertaken for these species is detailed in **Table 14**.

None of the surveyed for BAMC predicted avian species were identified within the Subject Land or its surrounds.

**Table 14. Threatened avian targeted survey effort within the Subject Land.**

Target Species	Survey Technique	Survey Effort & Timing	Target Species Identified?
<i>Callocephalon fimbriatum</i> (Gang-gang Cockatoo)  <i>Haliaeetus leucogaster</i> White-bellied Sea Eagle  <i>Hieraaetus morphnoides</i> Little Eagle  <i>Lophoictinia isura</i> Square-tailed Kite  <i>Pandion cristatus</i> Eastern Osprey	Diurnal Bird Surveys and Habitat Surveys (Area Search)	Habitat searches (large nests) traversing the entire site during the appropriate survey timetable	No
<i>Ninox connivens</i> Barking Owl  <i>Ninox strenua</i> Powerful Owl  <i>Tyto novaehollandiae</i> Masked Owl	Nocturnal Call Playback  SM4 acoustic recorder	Multiple call playback points were established and undertaken over 8 nights  Two (2) devices over eight (8) nights.	No

#### 4.3.5 Targeted Microbat Survey

One (1) threatened microbat species was identified by the BAMC as being likely to occur within the Subject Land and therefore required targeted survey to determine their absence:

- *Myotis macropus* (Southern Myotis)

Targeted surveys were undertaken in accordance with 'Species credit threatened bats and their habitats: NSW survey guide for the Biodiversity Assessment Method' (OEH 2018a). The targeted survey involved the use of acoustic recording devices. Four (4) passive acoustic recording devices (Wildlife Acoustics SongMeter SM4BAT) were randomly placed throughout the Subject Land. The data was then sent to Consultant Ecologist Peter Knock (Fauna Sonics) for analysis and species identification

**Table 15. Threatened microbat targeted survey effort within the Subject Land.**

Target Species	Survey Technique	Survey Effort and Timing	Targeted Species Identified?
<i>Myotis macropus</i> (Southern Myotis)	SM4BAT	Four (4) devices deployed for four (4) nights between approximately 8pm and 5am.	No

Whilst no Southern Myotis were identified utilising the Subject Land, incidental recordings were identified for Eastern Coastal Free-tailed Bat, Yellow-bellied Sheath-tail Bat and Greater Broad-nosed Bat. These three (3) species are all listed as Vulnerable under the BC Act. These species are all considered Ecosystem Credits Species



within the BAMC, therefore no additional credits are required to be offset other than the Ecosystem Credits already accumulated for this project. Measures to minimise potential impacts to these species are outlined in **Table 18**. It is considered unlikely that the proposed works would result in a significant impact to any of these species.

#### 4.3.6 Threatened Amphibian Targeted Survey

One (1) threatened amphibian species was identified by the BAMC as being likely to occur within the Subject Land and therefore required targeted survey to determine their absence:

- *Litoria aurea* (Green and Golden Bell Frog)

Targeted surveys were conducted in accordance with the 'NSW Survey Guide for Threatened Frogs: a guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method' (DPIE 2020d). The targeted survey effort undertaken for these species is detailed in

Target Species	Survey Technique	Survey Effort and Timing	Targeted Species Identified?
<i>Litoria aurea</i> Green and Golden Bell Frog	Nocturnal spotlighting and Call Playback	Multiple call playback points were established and undertaken over 4 nights	No
	SM4 acoustic recorder	One (1) device over four (4) nights.	

#### 4.3.7 Flora Species Credit Survey

A total of ten (10) threatened flora species were identified within the BAMC (DPIE 2020d) as having the potential to occur within the Subject Land. Of these species, following the site assessment only five (5) were identified as having the potential to occur within the Subject Land due to suitable habitat and correction geographic distribution. To determine whether these species credit species were present, or were likely to use suitable habitat on the Subject Land, the following was undertaken:

- Targeted fauna surveys were conducted for all five (5) species within the DPIE endorsed survey period (**Table 16**). The targeted surveys were undertaken for these species in accordance with the 'Surveying threatened plants and their habitats - NSW survey guide for the Biodiversity Assessment Method' (DPIE 2020e; **Figure 14**).

**Table 16. Species credit flora species requiring targeted surveys. Targeted surveys were conducted within DPIE endorsed survey periods.**

Candidate Fauna Species	Survey Period (BAMC)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<i>Cynanchum elegans</i> White-flowered Wax Plant			✓									
<i>Eucalyptus benthamii</i> Camden White Gum			✓									
<i>Persicaria elatior</i> Tall Knotweed			✓									
<i>Pilularia novae-hollandiae</i> Austral Pillwort											✓	

Candidate Fauna Species	Survey Period (BAMC)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<i>Pomaderris brunnea</i> Brown Pomaderris								✓				
Key	✓ = Surveyed						= Optimum Survey Period					

#### 4.4 Species Polygons

No species credits are required to be offset as a result of the proposed development.

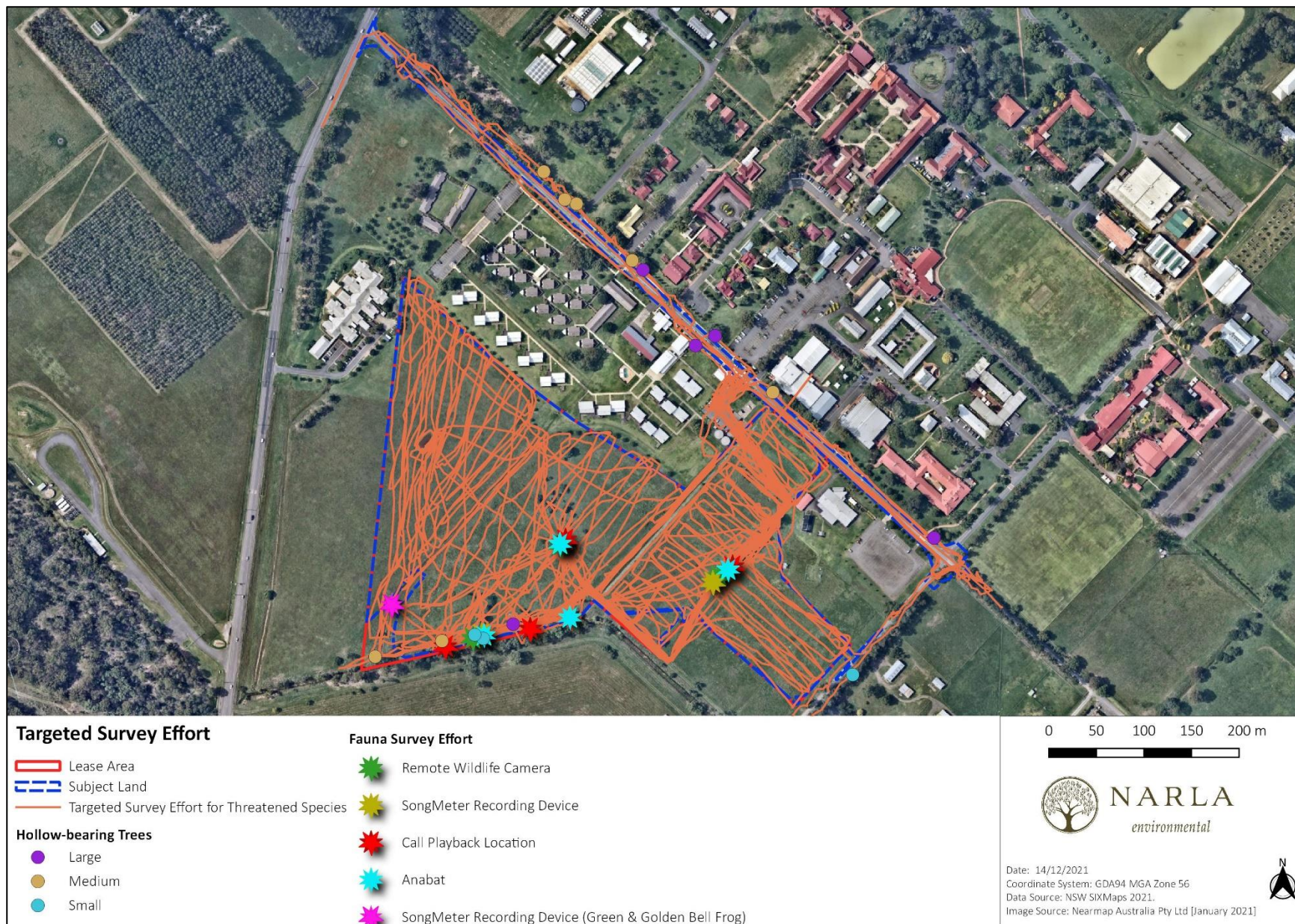


Figure 14. Targeted survey effort for species credit species within the Subject Land.



## 5. Prescribed Impacts

Certain projects may have impacts on biodiversity values in addition to, or instead of, impacts from clearing vegetation and/or loss of habitat. For many of these impacts, the biodiversity values may be difficult to quantify, replace or offset, making avoiding and minimising impacts critical. Prescribed biodiversity impacts require an assessment of the impacts of the subdivision on the habitat of threatened species or ecological communities. This is discussed in **Table 17**.

**Table 17. Prescribed and uncertain impacts associated with the proposed development.**

Will there be impacts on any of the following?	Yes/No	If Yes, Address all of the assessment questions from section 6 of the BAM
Habitat of threatened entities including: <ul style="list-style-type: none"> <li>karst, caves, crevices, cliffs, rocks and other geological features of significance, or</li> <li>human-made structures, or</li> <li>non-native vegetation</li> </ul>	No	There are no karsts, caves, crevices, cliffs and other features of geological significance on or near the Subject Land. No human-made structures are proposed to be impacted by the development, and the only non-native vegetation to be impacted will be exotic ground covers that provides little to no habitat for threatened species.
On areas connecting threatened species habitat, such as movement corridors	No	It is unlikely the proposed development will interrupt connectivity for any threatened species, due to the already heavily degraded nature of the Subject Land.
That affect water quality, water bodies and hydrological processes that sustain threatened entities (including from subsidence or upsidence from underground mining)	No	It is unlikely that the proposed development of above ground solar panels would impact upon the water quality within the Subject Land, such that the community on site suffered.
On threatened and protected animals from turbine strikes from a wind farm	No	No wind farms are associated with the proposed development.

Will there be impacts on any of the following?	Yes/No	If Yes, Address all of the assessment questions from section 6 of the BAM
On threatened species or fauna that are part of a TEC from vehicle strikes.	No	The Subject Land has the potential to support threatened species. However, due to the nature of the proposed development, it is highly unlikely that vehicle strikes will be an issue given the slow speed requirements of vehicles within the property.

## 6. Avoid and Minimise Impacts

### 6.1 Impact Mitigation and Minimisation Measures

This section details the measures to be implemented before, during and post construction to avoid and minimise the impacts of the project (**Table 18**).

**Table 18. Mitigation and minimisation of impacts associated with the proposed development.**

Action	Outcome	Timing	Responsibility
<b>Avoid and Minimise Impact - Project Location and Design</b>	<p>Owing to the contaminated nature of the site and the required remediation works involved, vegetation impacts cannot be avoided therefore, several mitigation measures have been proposed in this table to mitigate the impacts associated with the works.</p> <p>The majority of the Subject Land is located within an area that has been historically cleared and continues to be exposed to varying disturbances, including weed invasion.</p> <p>Any temporary structures required for construction works should be located within areas of grassland that have minimal biodiversity values. This will avoid unnecessary impacts on native vegetation and habitat elsewhere within the Subject Property.</p>	Pre-construction phase	Proponent
<b>Preparation of a Construction Environmental Management Plan (CEMP)</b>	<p>A CEMP will be required for the construction phase of the project, and will be prepared prior to issue of the Construction Certificate. The CEMP would include, as a minimum, industry-standard measures for the management of soil, surface water, weeds and pollutants, as well as site-specific measures, including the procedures outlined below. The proposed mitigation measures would include environmental safeguards for protection of neighbouring properties and nearby waterways in accordance with relevant policy documentation and Government guidelines. In order to address the potential impacts of the proposal on biodiversity, the mitigation and management measures outlined within this table would be implemented as part of the CEMP for the site.</p>	Pre-construction phase	Proponent Construction Contractor



Action	Outcome	Timing	Responsibility
<b>Tree Protections</b>	<p>Australian Standard 4970 (2009) Protection of Trees on Development Sites (AS-4970) outlines that a Tree Protection Zone (TPZ) is the principal means of protecting trees on construction sites. It is an area isolated from construction disturbance so that the tree remains viable. Ideally, works should be avoided within the TPZ.</p> <p>A Minor Encroachment is less than 10% of the TPZ and is outside the SRZ. A Minor Encroachment is considered acceptable by AS-4970 when it is compensated for elsewhere and contiguous within the TPZ.</p> <p>A Major Encroachment is greater than 10% of the TPZ or inside the SRZ. Major Encroachments generally require root investigations undertaken by non-destructive methods or the use of tree sensitive construction methods.</p>	Pre-construction phase	Proponent  Arborist
<b>Assigning a Project Ecologist for vegetation clearing</b>	<p>Prior to removing any vegetation and/or construction activities, the applicant should commission the services of a qualified and experienced Ecologist Consultant (minimum 3 years' experience) with a minimum tertiary degree in Science, Conservation, Biology, Ecology, Natural Resource Management, Environmental Science or Environmental Management. The Ecologist must be licensed with a current Department of Primary Industries Animal Research Authority permit and New South Wales Scientific License issued under the BC Act. The Ecologist will be commissioned to:</p> <ul style="list-style-type: none"> <li>▪ Undertake an extensive pre-clearing survey, to delineate, map, tag and mark habitat-bearing trees and shrubs to be retained/removed as well as other fauna habitat features and determine the presence of any resident native fauna using nests, dreys, hollows, logs etc.</li> <li>▪ Supervise the clearance of trees and shrubs (native and exotic) in order to capture, treat and/or relocate any displaced native fauna to an appropriate nearby location;</li> <li>▪ Supervise the removal of sections of trees containing hollows or habitat prior to clearing and felling of the tree.</li> </ul>	Prior to and during vegetation clearance works	Proponent  Project Ecologist
<b>Hollow Replacement</b>	If hollow dependent native fauna are found using existing hollows, compensatory tree hollows should be provided prior to removing the tree hollows and prior to the release of the hollow	Prior to and during vegetation	Proponent  Project Ecologist

Action	Outcome	Timing	Responsibility
	<p>dependent fauna unless the removed tree hollows can be relocated and installed on the same day they are removed.</p> <p>Several hollows were located along Vines Drive and Maintenance Lane. These habitat trees are only proposed for select trimming. No hollow-bearing limbs should be removed to accommodate trimming works.</p>	clearance works	
<b>Tree Replacement</b>	All trees proposed for removal should be replaced at a ratio of 2:1 elsewhere within the Subject Property, with mature, locally mature species representative of the River-flat Eucalypt Forest Endangered Ecological Community.	Construction phase; Post-construction phase	Proponent Project Ecologist
<b>Landscaping</b>	Landscaping works across the site should implement where possible, native vegetation representative of the River-flat Eucalypt Forest Endangered Ecological Community, to provide increased habitat features across the Subject Land.	Construction phase; Post-construction phase	Proponent Landscape Architect
<b>Seed Collection</b>	Seeds from native plants, including trees, shrubs and groundcover species proposed for removal should be collected and propagated and used in the plantings associated with this SSD. A seed collection program should be established by a suitably qualified person.	Prior to the removal of native vegetation.	Proponent Landscape Architect Project Ecologist
<b>Erosion and Sedimentation</b>	Appropriate erosion and sediment control must be erected and maintained at all times during construction in order to avoid the potential of incurring indirect impacts on biodiversity values. As a minimum, such measures should comply with the relevant industry guidelines such as 'the Blue Book' (Landcom 2004).	Construction phase	Proponent Construction Contractor
<b>Erection of temporary fencing</b>	Temporary fencing should be erected around retained native vegetation that may incur indirect impacts on biodiversity values due to the construction works.	Construction phase	Proponent Construction Contractor

Action	Outcome	Timing	Responsibility
<b>Storage and Stockpiling (Soil and Materials)</b>	All storage, stockpile and laydown sites should be located within the Construction Footprint ( <b>Figure 1</b> ). Avoid importing any soil from outside the site as this can introduce weeds and pathogens to the site in order to avoid the potential of incurring indirect impacts on biodiversity values.	Construction phase	Construction Contractors
<b>Stormwater</b>	Potential impacts relating to stormwater and runoff will be managed during construction and operation phases. The CEMP will guide stormwater management during the construction phase of development.	Post-construction phase	Proponent  Construction Contractors/ Architect
<b>Post work remediation</b>	All areas of vegetation to be impacted to facilitated construction works and soil remediation ('Construction Footprint'; <b>Figure 1</b> ) are to be restored to at least their current condition, once works have been completed	Post-construction phase	Proponent  Construction Contractors/ Architect



## 7. Assessment of Impacts

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### 7.1 Direct Impacts

#### 7.1.1 Full Clearing

The proposed development will require the removal of approximately 9.34ha of PCT 835 across the following condition zones:

- 9.04ha of PCT 835 – Grassland with exotic trees;
- 0.07ha of PCT 835 – Grassland with planted *Casuarina glauca's*; and
- 0.23ha of PCT 835 – Remnant Canopy.

The vegetation proposed for removal within the Subject Land is deemed of low quality, having been subject to extensive periods of clearing, as well as being overrun with exotic species. Mitigation measures have been proposed in **Table 18** to mitigate the impacts to this vegetation community.

#### 7.1.2 Direct Impacts – Partial Clearing

The proposed development will require the APZ maintenance of approximately 1.96ha of PCT 835 across the following condition zones:

- 1.87ha of PCT 835 – Grassland with exotic trees; and
- 0.09ha of PCT 835 – Grassland with planted *Casuarina glauca's*

The proposed development will require the APZ to be maintained to the standards of an IPA. It is anticipated that due to the lack of canopy cover across the zones, APZ requirements will be able to be achieved with tree removal being kept to a minimum.

### 7.2 Prescribed Impacts

There will be no prescribed impacts on threatened entities associated with the proposed development.

### 7.3 Indirect Impacts

Indirect impacts occur when the proposal or activities relating to the construction or operation of the proposal affect native vegetation, threatened ecological communities and threatened species habitat beyond the Subject Land. Impacts may also result from changes to land-use patterns, such as an increase in vehicular access and human activity on native vegetation, threatened ecological communities and threatened species habitat. The indirect impacts of this proposed development are outlined in **Table 19**.

**Table 19. Indirect impacts associated with the proposed development.**

Indirect Impact	Nature, extent and duration	TEC's/PCTs and/or Threatened Species and their habitat likely to be impacted	Consequences of the impacts for the bioregional persistence of the threatened species, threatened ecological communities and their habitats.
(a) inadvertent impacts on adjacent habitat or vegetation	Vegetation and habitat directly adjacent to the Subject Land has the potential to experience ongoing indirect impacts as a result of the proposed development. Although unlikely given the disturbed history of the Subject Land. The disturbance caused during construction may increase weed infestations within adjacent vegetation, which in turn may decrease its habitat value.	One TEC occurs adjacent to the Subject Land – River-flat Eucalypt Forest. There is also the potential that threatened species occur in areas adjacent to Subject Land that may be impacted by a decrease in habitat condition.	While changes to vegetation condition may have a localised impact to threatened species, threatened ecological communities and their habitats, this is not expected to impact on their bioregional persistence.
(b) reduced viability of adjacent habitat due to edge effects	The proposed construction and on-going operation may lead to an increase in weed infiltration into adjacent habitat due to enhanced edge effects. However, due to the disturbed nature of vegetation within and surrounding the Subject Land, it is unlikely that this will significantly impact on such areas. Any impacts are expected to be restricted to a couple of metres into adjacent vegetation.	One TEC occurs adjacent to the Subject Land – River-flat Eucalypt Forest. There is also the potential that threatened species occur in areas adjacent to Subject Land. The TEC and threatened species may be	While edge effects may have a localised impact to TECs and threatened species, this is not expected to impact on their bioregional persistence, considering the large habitat connectivity within the surrounding areas.

Indirect Impact	Nature, extent and duration	TEC's/PCTs and/or Threatened Species and their habitat likely to be impacted	Consequences of the impacts for the bioregional persistence of the threatened species, threatened ecological communities and their habitats.
		impacted by edge effects leading to a reduced viability in habitat.	
(c) reduced viability of adjacent habitat due to noise, dust or light spill	<p>An increase in noise is to be expected during construction. As the Subject Land is located in a rural area, this may have an impact on any species roosting adjacent to the site during the day that are not adapted to such noises. It is not expected that construction would occur throughout the night, and as such would not impact on nocturnal species that may utilise adjacent habitat, or diurnal species that roost in adjacent habitat.</p> <p>The construction may increase dust in adjacent habitat. Dust can impact on a plants ability to photosynthesise and may increase plant mortality in the adjacent vegetation. It is however not expected that this would have such an impact to decrease the viability of adjacent habitat.</p> <p>It is expected that the construction would occur during normal working hours, and as such light spill is not expected to affect adjacent habitat.</p>	<p>One TEC occurs adjacent to the Subject Land – River-flat Eucalypt Forest. This TEC may be impacted by increases in noise and dust spill.</p> <p>There is potential that threatened species use habitat adjacent to the Subject Land. Such species may be impacted by an increase in noise and dust spill into adjacent habitats.</p>	<p>While the construction may have a localised impact to the TEC and threatened species, this is not expected to impact on their bioregional persistence, considering large areas of habitat connectivity allowing their movement away from impacted areas.</p>



Indirect Impact	Nature, extent and duration	TEC's/PCTs and/or Threatened Species and their habitat likely to be impacted	Consequences of the impacts for the bioregional persistence of the threatened species, threatened ecological communities and their habitats.
(d) transport of weeds and pathogens from the site to adjacent vegetation	As previously discussed, the proposed construction may lead to an increase in weed infiltration into adjacent habitat due to enhanced edge effects. It is however not expected that weeds will be transported via human or vehicular traffic into surrounding areas during construction. Temporary fencing will be erected around retained native vegetation to avoid such indirect impacts occurring during construction.	One TEC occurs adjacent to the Subject Land – River-flat Eucalypt Forest. There is also potential that threatened species use habitat adjacent to the Subject Land. The TEC and threatened species may be impacted by weed and pathogen transportation leading to a reduced viability in habitat.	While weeds and pathogens may have a localised impact to TECs and threatened species, this is not expected to impact on their bioregional persistence, considering the large habitat connectivity within the surrounding areas.
(e) increased risk of starvation, exposure and loss of shade or shelter	It is highly unlikely that any threatened fauna would be exposed to increased risks from starvation, exposure, and loss of shade and shelter as a result of the proposed development given the majority of it is already completely cleared and unsuitable for habitation. No habitat is to be removed beyond the Subject Land, although disturbances from noise during construction and operation may deem such habitats unsuitable for certain species. However, due to the areas of habitat connectivity adjoining the Subject Land, it is unlikely that this impact will be significant as such habitats will continue to provide food resources and shelter for fauna species.	N/A	N/A

Indirect Impact	Nature, extent and duration	TEC's/PCTs and/or Threatened Species and their habitat likely to be impacted	Consequences of the impacts for the bioregional persistence of the threatened species, threatened ecological communities and their habitats.
(f) loss of breeding habitats	An increase in noise is to be expected during construction. As such, there is potential for disturbance to breeding habitats directly adjacent to the Subject Land. However, due to the large areas of habitat connectivity adjoining the Subject Land, it is not expected for this to significantly impact on species inhabiting such areas.	There is potential that threatened fauna species use habitat adjacent to the Subject Land for breeding. Such species may be impacted by an increase in noise into adjacent habitats, which may in turn impact on their breeding habitat.	This impact is expected to be localised and will not have an overall impact on the bioregional persistence of threatened species.
(g) trampling of threatened flora species	No threatened flora species were recorded within the Subject Land, however one (1) species has been "assumed present" due to potential habitat within the Subject Land.  Although no threatened flora species have been historically recorded in vegetated areas within the Subject Land, there is still the potential for such species to exist in these areas.	<i>Pilularia novae-hollandiae</i> (Austral Pillwort)	Where possible threatened species that are assumed to be present should be surveyed for within the appropriate DPIE survey period. If no appropriate surveys are able to be conducted then offsets are to be purchased for these species.
(h) inhibition of nitrogen fixation and increased soil salinity	It is unlikely that the inhibition of nitrogen fixation will affect vegetation adjacent to the Subject Land. Clearing will be limited to the Subject Land and as such is not expected to affect vegetation directly adjacent to the Subject Land.	N/A	N/A

Indirect Impact	Nature, extent and duration	TEC's/PCTs and/or Threatened Species and their habitat likely to be impacted	Consequences of the impacts for the bioregional persistence of the threatened species, threatened ecological communities and their habitats.
(i) fertiliser drift	This issue is not likely to affect the vegetation within or surrounding the Subject Land.	N/A	N/A
(j) rubbish dumping	There is the possibility that rubbish dumping (including littering) in adjacent vegetation increases during construction. The dumping/littering of food resources may provide a food source for fauna, including threatened species. However, this may also encourage invasive species into such habitats. This impact can be mitigated by the appropriate disposal of rubbish.	There is potential that threatened fauna species use habitat adjacent to the Subject Land. Such species may be impacted by the dumping of rubbish, particularly food resources. This may result in both positive (food source) and negative impacts (increase in predators) to such species.	This impact is expected to be localised and will not have an overall impact on the bioregional persistence of the TECs or threatened species.
(k) wood collection	This issue is not likely to affect the vegetation surrounding the Subject Land during and post-construction, particularly as the majority of vegetation surrounding the Subject Land cannot be accessed as it is private property.	NA	NA
(l) bush rock removal and disturbance	This issue is not likely to affect the vegetation surrounding the Subject Land. No bush rock was observed within or adjacent to the Subject Land.	N/A	N/A

Indirect Impact	Nature, extent and duration	TEC's/PCTs and/or Threatened Species and their habitat likely to be impacted	Consequences of the impacts for the bioregional persistence of the threatened species, threatened ecological communities and their habitats.
(m) increase in predatory species populations	There is potential that predatory species, such as foxes and cats, already inhabit areas within and surrounding the Subject Land. There is the possibility that other indirect impacts, such as an increase in rubbish dumping, may encourage predatory species into the area.	There is potential that threatened fauna species use habitat adjacent to the Subject Land. Such species may be impacted by an increase in predatory species populations.	An increase in predatory species adjacent to the Subject Land may have widespread ramifications for any locally occurring threatened species. In particular, the large areas of habitat connectivity adjacent to the Subject Land will allow for the movement of predatory species across the wider landscape.
(n) increase in pest animal populations	There is potential that pest animal populations already inhabit areas within and surrounding the Subject Land. There is the possibility that other indirect impacts, such as an increase in rubbish dumping, may encourage an increase in pest animal populations.	There is potential that threatened fauna species use habitat adjacent to the Subject Land. Such species may be impacted by an increase in pest animal populations.	An increase in pest animal species adjacent to the Subject Land may have widespread ramifications for any locally occurring threatened species. In particular, the large areas of habitat connectivity adjacent to the Subject Land will allow for the movement of pest animal species across the wider landscape.
(o) increased risk of fire	The Subject Land is identified as occurring within bushfire prone land. The proposed development has been positioned to comply with the RFS guidelines for bushfire protection	N/A	N/A



Indirect Impact	Nature, extent and duration	TEC's/PCTs and/or Threatened Species and their habitat likely to be impacted	Consequences of the impacts for the bioregional persistence of the threatened species, threatened ecological communities and their habitats.
	without any further land management. It is not expected that this will alter the bushfire risk of vegetation surrounding the Subject Land.		
(p) disturbance to specialist breeding and foraging habitat, e.g., beach nesting for shorebirds.	No specialist breeding and foraging habitat was identified within or adjacent to the Subject Land. It is therefore not expected that the proposed development will disturb any specialist breeding and foraging habitat.	N/A	N/A

## 8. Impact Summary

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### 8.1 Impacts on Native Vegetation

The following native vegetation within the Subject Land is proposed to be impacted as a result of the proposed development:

- 11.3ha representative of PCT 835: Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion

The purchase and retirement of Biodiversity Offset Credits will be required for the following native vegetation within the Subject Land (**Figure 15**):

- 0.16ha within Zone 2 (grassland with planted *Casuarina glauca*'s) representative of PCT 835; and
- 0.23ha within Zone 3 (remnant canopy), representative of PCT 835.

The purchase and retirement of Biodiversity Offset Credits will not be required for the vegetation within Zone 1 (grassland with exotic trees; **Figure 15**).

### 8.2 Impacts on Threatened Species

Incidental recordings were identified for Eastern Coastal Free-tailed Bat, Yellow-bellied Sheathtail Bat and Greater Broad-nosed Bat. These three (3) species are all listed as Vulnerable under the BC Act. These species are all considered Ecosystem Credits Species within the BAMC, therefore no additional credits are required to be offset other than the Ecosystem Credits already accumulated for this project. Measures to minimise potential impacts to these species are outlined in **Table 18**. It is considered unlikely that the proposed works would result in a significant impact to any of these species.

### 8.3 Serious and Irreversible Impacts (SAIL's)

No threatened species or communities within the Subject Land have been identified as an entity at risk of a SAIL in the Threatened Biodiversity Data Collection (DPIE 2021b).



Figure 15. Impacts on native vegetation and offset requirements.

## 9. Biodiversity Offset Credit Requirements

The preferred approach to offset the residual impacts of the proposal is to purchase and retire the appropriate species credits from registered Biodiversity Stewardship Sites that comply with the trading rules of the NSW BOS in accordance with the 'like for like' report generated by the BAM calculator. If such credits are unavailable, credits would be sourced in accordance with the 'variation report' generated by the BAMC.

A payment to the Biodiversity Conservation Trust (BCT) would be considered as a contingency option if a suitable number and type of biodiversity credits cannot be secured.

Estimated costs to purchase these credits, or alternatively, to allocate offset funds directly into the NSW BCT are available in the NSW Biodiversity Offsets Payment Calculator (DPIE 2020g).

### 9.1 Offset Requirement for Ecosystem Credits

A total of three (3) ecosystem credits are required to offset the biodiversity impacts of the proposed development (Table 20).

Table 20. Ecosystem credits required to offset the proposed development.

PCT	BC Act Status	Zone	Total Area (ha)	Ecosystem Credits Required
PCT 835: Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Endangered Ecological Community	Zone 1 (grassland with exotic trees)	10.9	0
		Zone 2 (Grassland with planted <i>Casuarina glauca's</i> )	0.16	1
		Zone 3 (Remnant Canopy)	0.23	2
Total Ecosystem Credits				3

### 9.2 Offset Requirement for Species Credits

No Species Credits are required to be offset as a result of this development.



## 10. Other Relevant Legislation and Planning Policies

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### 10.1 State Environmental Planning Policy (Koala Habitat Protection) 2021

SEPP (Koala Habitat Protection) 2021 applies to development applications that requires consent from council. As the proposed works are part of a State Significant Development application that does not require Council consent, this SEPP does not apply.

In addition, “Core Koala Habitat” is defined by the SEPP as:

- A) an area of land which has been assessed by a suitably qualified and experienced person as being highly suitable koala habitat and where koalas are recorded as being present at the time of assessment of the land as highly suitable koala habitat; or
- (b) an area of land which has been assessed by a suitably qualified and experienced person as being highly suitable koala habitat and where koalas have been recorded as being present in the previous 18 years.

Whilst listed feed trees were located within the Subject Land, no evidence of Koalas were identified during the time of the site assessment or targeted surveys and no records exists within a 2.5kmbuffer. The vegetation within the Subject Land therefore does not meet the criteria to be listed as Core Koala Habitat.

### 10.2 State Environmental Planning Policy No 19—Bushland in Urban Areas

SEPP 19 – Bushland in Urban Areas applies to the areas and parts of areas specified in Schedule 1 of the SEPP that adjoin bushland zoned or reserved for public open space purposes. Although Hawkesbury City Council is listed in Schedule 1 of the SEPP, the Subject Land does not adjoin any bushland zoned or reserved for public open space purposes. As such, this SEPP does not apply to the Subject Land.

### 10.3 State Environmental Planning Policy (Coastal Management) 2018

State Environmental Planning Policy (Coastal Management) 2018 applies to land within the coastal zone. The coastal zone means the area of land comprised of the following coastal management areas:

- the coastal wetlands and littoral rainforests area;
- the coastal vulnerability area;
- the coastal environment area; or
- the coastal use area.

As the Subject Land does not occur within any of these listed areas, this SEPP does not apply.

## 11. References

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Australian Government Department of the Environment and Energy (2018) Interim Biogeographic Regionalisation for Australia (IBRA), Version 7 (Subregions)

Australian Bureau of Meteorology (BOM) (2021) Richmond New South Wales. March 2021, August 2021, November 2021 Daily Weather Observations <http://www.bom.gov.au/>

Australian Standard 4970 (2009) Protection of Trees on Development Sites

Biodiversity Conservation Act (2016) <https://legislation.nsw.gov.au/#/view/act/2016/63/full>

Biodiversity Conservation Regulation (2017) <https://www.legislation.nsw.gov.au/#/view/regulation/2017/432>

Bushfire Planning Australia (2021) correspondence with NBR.

Department of Environment and Climate Change (DECC) (2007) Identification Guidelines for Endangered Ecological Communities: Riverflat Eucalypt Forest on Coastal Floodplains.

Department of Environmental Conservation (DEC) (2004) Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft), New South Wales Department of Environment and Conservation, Hurstville, NSW.

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## 12. Appendices

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Appendix A. BAM Site - Field Survey Forma (copied directly from Electronic Data Sheet).

Appendix B. BAMC Generated Biodiversity Credit Report.



Appendix A. BAM Site - Field Survey Form (copied directly from Electronic Data Sheet).

BAM Site – Field Survey Form					
Date:	17.03.21	Plot ID:	plot 1	Photo #:	0
Zone:	56H	Plot Dimensions:	50m x 20m	Easting:	291084.25 m E
Datum:	94	Middle bearing from 0m:	306	Northing:	6278015.80 m S
PCT:	Zone 1: PCT 835 - Grassland with exotic trees				
Growth Form	Scientific Name		Cover	Abundance	
High Threat Exotic	<i>Paspalum dilatatum</i>		70	1000	
High Threat Exotic	<i>Senecio madagascariensis</i>		3	100	
Exotic	<i>Conyza bonariensis</i>		0.5	20	
Exotic	<i>Solanum nigrum</i>		0.1	2	
Exotic	<i>Trifolium repens</i>		0.3	30	
Exotic	<i>Solanum sisymbriifolium</i>		0.1	1	
High Threat Exotic	<i>Eragrostis curvula</i>		7	30	
Exotic	<i>Setaria parviflora</i>		0.5	20	
Grass & grasslike (GG)	<i>Cynodon dactylon</i>		1	100	
Exotic	<i>Plantago lanceolata</i>		0.1	1	
Exotic	<i>Hypochaeris radicata</i>		0.1	3	
Exotic	<i>Vicia sativa</i>		0.1	1	
Exotic	<i>Verbena bonariensis</i>		0.1	1	
DBH		# Tree Stems Count	# Hollow Bearing Trees		
80+cm		0	0		
50-79cm		0	0		
30-49cm		absent	0		
20-29cm		absent	0		
10-19cm		absent	0		
5-9cm		absent	0		
<5cm		absent	0		
Length of Logs (m)		0			
BAM Attribute (1x1m)			Litter Cover (%)		
1 (5m)			0		
2 (15m)			0		
3 (25m)			0		
4 (35m)			0		
5 (45m)			0		
Average			0		
Growth Form	Composition Data (Count of Native Cover)		Structure Data (Sum of Cover)		
Tree	0		0		
Shrub	0		0		
Grass	1		1		
Forb	0		0		
Fern	0		0		
Other	0		0		
High Threat Exotics	3		80		

BAM Site – Field Survey Form					
Date:	17.03.21	Plot ID:	plot 2	Photo #:	0
Zone:	56H	Plot Dimensions:	50 x 20	Easting:	291002.36 m E
Datum:	94	Middle bearing from 0m:	311	Northing:	6278148.50 m S
PCT:	Zone 1: PCT 835 - Grassland with exotic trees				
Growth Form	Scientific Name		Cover	Abundance	
Grass & grasslike (GG)	<i>Cynodon dactylon</i>		90	2000	
Exotic	<i>Verbena bonariensis</i>		6	40	
Exotic	<i>Setaria parviflora</i>		6	500	
Exotic	<i>Sida rhombifolia</i>		2	20	
Exotic	<i>Plantago lanceolata</i>		1	30	
Exotic	<i>Conyza bonariensis</i>		0.3	20	
High Threat Exotic	<i>Senecio madagascariensis</i>		0.7	30	
Exotic	<i>Rumex crispus</i>		0.6	20	
High Threat Exotic	<i>Eragrostis curvula</i>		1	5	
Exotic	<i>Solanum nigrum</i>		0.2	2	
Forb (FG)	<i>Commelina cyanea</i>		0.1	1	
High Threat Exotic	<i>Paspalum dilatatum</i>		0.2	5	
Exotic	<i>Bromus catharticus</i>		0.3	10	
Exotic	<i>Cirsium vulgare</i>		0.3	5	
Exotic	<i>Trifolium repens</i>		0.1	3	
Exotic	<i>Vicia sativa</i>		0.3	15	
		# Tree Stems Count	# Hollow Bearing Trees		
80+cm		absent	0		
50-79cm		absent	0		
30-49cm		absent	0		
20-29cm		absent	0		
10-19cm		absent	0		
5-9cm		absent	0		
<5cm		absent	0		
Length of Logs (m)		0			
BAM Attribute (1x1m)			Litter Cover (%)		
1 (5m)			0		
2 (15m)			0		
3 (25m)			0		
4 (35m)			0		
5 (45m)			0		
Average			0		
Growth Form	Composition Data (Count of Native Cover)		Structure Data (Sum of Cover)		

Tree	0	0
Shrub	0	0
Grass	1	90
Forb	1	0.1
Fern	0	0
Other	0	0
High Threat Exotics	3	1.9

BAM Site – Field Survey Form					
Date:	17.03.2021	Plot ID:	plot 3	Photo #:	0
Zone:	56H	Plot Dimensions:	50 x 20	Easting:	290862.66 m E
Datum:	94	Middle bearing from 0m:	34	Northing:	13
PCT:	Zone 1: PCT 835 - Grassland with exotic trees				
Growth Form	Scientific Name	Cover	Abundance		
Grass & grasslike (GG)	<i>Cynodon dactylon</i>	70	1000		
High Threat Exotic	<i>Senecio madagascariensis</i>	6	100		
Exotic	<i>Setaria parviflora</i>	20	500		
Exotic	<i>Hypochaeris radicata</i>	7	100		
Exotic	<i>Lotus angustissimus</i>	0.1	1		
Exotic	<i>Cyperus brevifolius</i>	3	200		
High Threat Exotic	<i>Eragrostis curvula</i>	4	10		
Exotic	<i>Trifolium repens</i>	0.1	5		
Exotic	<i>Conyza bonariensis</i>	1	20		
High Threat Exotic	<i>Paspalum dilatatum</i>	3	100		
Exotic	<i>Plantago lanceolata</i>	0.1	5		
Exotic	<i>Verbena bonariensis</i>	0.1	1		
		# Tree Stems Count	# Hollow Bearing Trees		
80+cm		absent	0		
50-79cm		absent	0		
30-49cm		absent	0		
20-29cm		absent	0		
10-19cm		absent	0		
5-9cm		absent	0		
<5cm		absent	0		
Length of Logs (m)		0			
1 (5m)		0			
2 (15m)		0			
3 (25m)		0			
4 (35m)		0			
5 (45m)		0			
Average		0			
Growth Form	Composition Data (Count of Native Cover)	Structure Data (Sum of Cover)			
Tree	0	0			
Shrub	0	0			
Grass	1	70			
Forb	0	0			
Fern	0	0			
Other	0	0			
High Threat Exotics	3	13			



BAM Site – Field Survey Form					
Date:	17.03.2021	Plot ID:	plot 4	Photo #:	0
Zone:	56H	Plot Dimensions:	50 x 20	Easting:	290992.51 m E
Datum:	94	Middle bearing from 0m:	225	Northing:	6278127.53 m S
PCT:	Zone 2: PCT 835 - Grassland with planted <i>Casuarina glauca</i> 's				
Growth Form	Scientific Name	Cover	Abundance		
Tree (TG)	<i>Casuarina glauca</i>	15	7		
High Threat Exotic	<i>Eragrostis curvula</i>	3	6		
Exotic	<i>Plantago lanceolata</i>	1	20		
Exotic	<i>Sida rhombifolia</i>	0.4	20		
Grass & grasslike (GG)	<i>Cynodon dactylon</i>	20	1000		
High Threat Exotic	<i>Cenchrus clandestinus</i>	40	2000		
High Threat Exotic	<i>Senecio madagascariensis</i>	0.1	3		
Exotic	<i>Portulaca oleracea</i>	0.1	1		
High Threat Exotic	<i>Paspalum dilatatum</i>	3	100		
Exotic	<i>Verbena bonariensis</i>	1	20		
Exotic	<i>Conyza bonariensis</i>	0.2	10		
Exotic	<i>Setaria parviflora</i>	6	500		
Exotic	<i>Solanum nigrum</i>	0.1	3		
Exotic	<i>Phytolacca octandra</i>	0.1	2		
High Threat Exotic	<i>Cyperus eragrostis</i>	0.1	1		
Exotic	<i>Hypochoeris radicata</i>	0.1	1		
Grass & grasslike (GG)	<i>Sporobolus creber</i>	0.1	1		
Grass & grasslike (GG)	<i>Juncus usitatus</i>	0.1	1		
		# Tree Stems Count	# Hollow Bearing Trees		
80+cm		0	0		
50-79cm		0	0		
30-49cm		present	0		
20-29cm		present	0		
10-19cm		absent	0		
5-9cm		present	0		
<5cm		present	0		
Length of Logs (m)		0			
BAM Attribute (1x1m)			Litter Cover (%)		
1 (5m)			0		
2 (15m)			0		
3 (25m)			5		
4 (35m)			0		
5 (45m)			0		
Average			1		
Growth Form		Composition Data		Structure Data	

	(Count of Native Cover)	(Sum of Cover)
Tree	1	15
Shrub	0	0
Grass	3	20.2
Forb	0	0
Fern	0	0
Other	0	0
High Threat Exotics	5	46.2

BAM Site – Field Survey Form					
Date:	17.03.2021	Plot ID:	plot 5	Photo #:	0
Zone:	56H	Plot Dimensions:	50 x 20	Easting:	290703.65 m E
Datum:	94	Middle bearing from 0m:	354	Northing:	6278023.93 m S
PCT:	Zone 3: PCT 835 - Remnant Canopy				
Growth Form	Scientific Name	Cover	Abundance		
Tree (TG)	<i>Angophora subvelutina</i>	6	3		
High Threat Exotic	<i>Bidens subalternans</i>	10	200		
Forb (FG)	<i>Einadia hastata</i>	3	100		
Forb (FG)	<i>Commelina cyanea</i>	5	500		
Exotic	<i>Datura stramonium</i>	0.5	4		
Exotic	<i>Sida rhombifolia</i>	6	N/A		
High Threat Exotic	<i>Cinnamomum camphora</i>	2	1		
High Threat Exotic	<i>Lantana camara</i>	0.1	1		
Exotic	<i>Phytolacca octandra</i>	0.1	1		
Grass & grasslike (GG)	<i>Cynodon dactylon</i>	10	1000		
High Threat Exotic	<i>Eragrostis curvula</i>	1	4		
Exotic	<i>Solanum nigrum</i>	0.2	5		
Forb (FG)	<i>Dysphania pumilio</i>	1	100		
High Threat Exotic	<i>Cenchrus clandestinus</i>	6	500		
Exotic	<i>Setaria parviflora</i>	2	100		
Exotic	<i>Conyza bonariensis</i>	0.5	10		
Exotic	<i>Bromus catharticus</i>	0.5	20		
Exotic	<i>Digitaria ciliaris</i>	0.5	20		
High Threat Exotic	<i>Chloris gayana</i>	3	200		
Exotic	<i>Chenopodium album</i>	0.5	20		
Grass & grasslike (GG)	<i>Microlaena stipoides</i>	0.3	10		
Exotic	<i>Solanum sisymbriifolium</i>	0.5	10		
		# Tree Stems Count	# Hollow Bearing Trees		
80+cm		0	0		
50-79cm		1	1		
30-49cm		present	1		
20-29cm		present	0		
10-19cm		absent	0		
5-9cm		absent	0		
<5cm		absent	0		
Length of Logs (m)		0			
BAM Attribute (1x1m)			Litter Cover (%)		
1 (5m)			10		
2 (15m)			15		
3 (25m)			0		

4 (35m)	0	
5 (45m)	10	
Average	7	
Growth Form	Composition Data	Structure Data
	(Count of Native Cover)	(Sum of Cover)
Tree	1	6
Shrub	0	0
Grass	2	10.3
Forb	3	9
Fern	0	0
Other	0	0
High Threat Exotics	6	22.1



## Appendix B. BAMC Generated Biodiversity Credit Report.

## BAM Biodiversity Credit Report (Like for like)

### Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00024876/BAAS21009/21/00024877	Western Sydney University - Centre of Excellence	24/11/2021
Assessor Name	Assessor Number	BAM Data version *
	BAAS21009	50
Proponent Names	Report Created	BAM Case Status
Department Education	14/12/2021	Finalised
Assessment Revision	Assessment Type	Date Finalised
1	Major Projects	14/12/2021

\* 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.

### Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		
Species		
Nil		

### Additional Information for Approval

PCT Outside Ibra Added

Assessment Id	Proposal Name	Page 1 of 4
00024876/BAAS21009/21/00024877	Western Sydney University - Centre of Excellence	

## BAM Biodiversity Credit Report (Like for like)

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

### Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
835-Cumberland riverflat forest	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	11.3	2	1	3

835-Cumberland riverflat forest	Like-for-like credit retirement options					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region

Assessment Id	Proposal Name	Page 2 of 4
00024876/BAAS21009/21/00024877	Western Sydney University - Centre of Excellence	

## BAM Biodiversity Credit Report (Like for like)

	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 686, 828, 835, 941, 1108, 1109, 1212, 1228, 1293, 1318, 1326, 1386, 1504, 1556, 1594, 1618, 1720, 1794	-	835_Grassland_exot_trees	No		0 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.
	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 686, 828, 835, 941, 1108, 1109, 1212, 1228, 1293, 1318, 1326, 1386, 1504, 1556, 1594, 1618, 1720, 1794	-	835_Grassland_plant_Cas	No	1	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)

	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 686, 828, 835, 941, 1108, 1109, 1212, 1228, 1293, 1318, 1326, 1386, 1504, 1556, 1594, 1618, 1720, 1794	-	835_Remnant_canopy	Yes	2	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.

### Species Credit Summary

No Species Credit Data

### Credit Retirement Options

Like-for-like credit retirement options

Assessment Id

00024876/BAAS21009/21/00024877

Proposal Name

Western Sydney University - Centre of Excellence

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