Highland Views Estate - Stages 7 to 8 Residential Subdivision

Biodiversity Development Assessment Report

Client	: CCL Development
Prepared by	: Australian Wetlands Consulting Pty Ltd
Project #	: 3-211373
Date	: December 2021

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Highland Views Estate - Stages 7 to 8 Residential Subdivision

Biodiversity Development Assessment Report

Project control

Project name: **Highland Views Estate - Stages 7 to 8 Residential Subdivision**
Biodiversity Development Assessment Report

Project #: 3-211373
Client: CCL Development
Contact: Rachell Hewitt

Prepared by: Australian Wetlands Consulting Pty Ltd

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11.03.2021	A	Hannah Reid	Jacqui Coughlan	Natalie Adamou
19.04.2021	B	Hannah Reid	Jacqui Coughlan	Natalie Adamou
08.10.2021	C	Hannah Reid	Ian Colvin	Rachell Hewitt
16.12.2021	D	Hannah Reid	Ian Colvin	Rachell Hewitt

Accredited Assessor Authorisation

This BDAR has been prepared in accordance with the requirements of (and information provided under) the biodiversity assessment method (BAM) 2020 as at 16/12/2021.

Assessor Name	Accreditation Number	Role	Signed
Hannah Reid	BAAS18114	Reporting, BAMC	
Jacqui Coughlan	BAAS18139	Field Work, Report Review, Project Manager	
Ian Colvin	BAAS18055	Report Review, Reporting	

Table of Contents

List of Tables

List of Figures

1 Introduction and Background

1.1 Background

This Biodiversity Development Assessment Report (BDAR) has been undertaken to accompany a Development Application (DA) relating to the Highland Views Estate - Stages 7 to 8 Residential Subdivision. The study area is located wholly within the City of Penrith Local Government Area (LGA) and comprises a portion of Lot 700, part Lot 701, Lot 702 DP 1275647 Middlebrook Rise, Lot 445 DP 1268480 and and an existing sediment basin (Basin E) located within Lot 2000 DP1204777 Bradley Street.

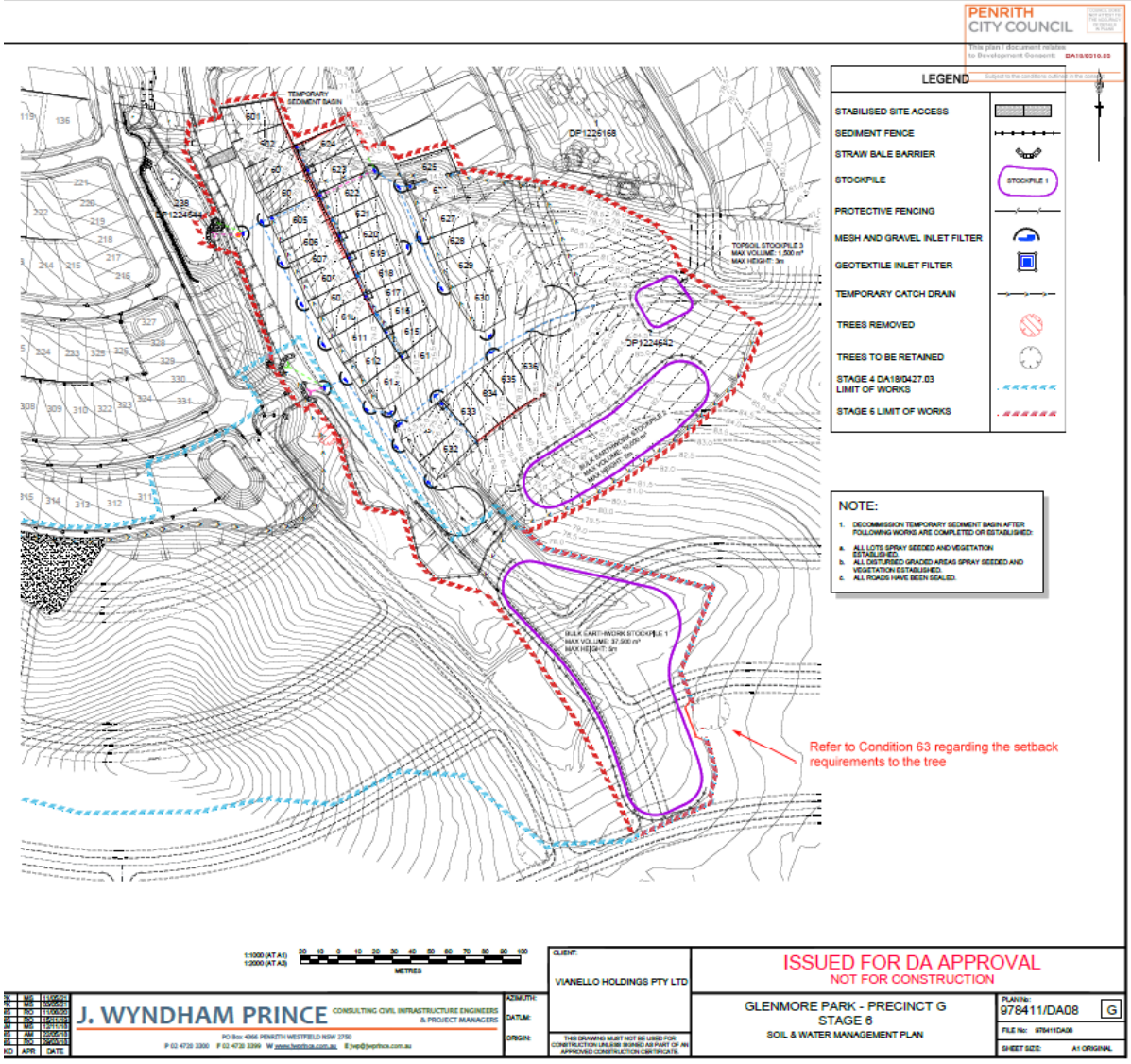
This BDAR has been prepared by Hannah Reid, Accredited Assessor (BAAS18114) and reviewed by Accredited Assessors Jacqui Coughlan (BAAS18139) and Ian Colvin (BAAS18055) under the Biodiversity Conservation Regulation 2017 and is consistent with the Biodiversity Assessment Method ('BAM'; DPIE 2020a).

A previous version of this BDAR (Stages 7-9) was prepared and submitted as part of the development application to Penrith City Council. Following some correspondence, the BDAR has been revised to address some comments by Council, in addition addressing a reduced footprint for the development (Stage 9 has been omitted) and including vegetation clearing requirements for a constructed stormwater detention basin (Basin E).

NOTE: part of the site (known as Stage 6) was subject to a previous biodiversity assessment (assessed under the *Threatened Species Conservation Act 1995*) and approved in 2018 as DA18/0310. A modification to this DA for earthworks and stockpiles was approved 6 February 2019 as DA18/0310.03 and areas of Stage 6 have been subject to filling and stockpiling as per the consent. The approval defines a large area within the site as subject to the Stage 6 limit of works, as noted by the red dashed line in Figure 1.1.

On this basis, all vegetation within the red dashed line in Figure 1.1 are recognised as having approval for clearing and disturbance and on this basis are excluded from this BDAR in terms of vegetation impacts and entry of areas into the BAM-Calculator.

This approach was presented to Council at a progress meeting on 03/11/2021 and was accepted.



1.2 Location and site identification

The land to which this application relates comprises a portion of Lot 700, part Lot 701, Lot 702 DP 1275647 Middlebrook Rise, Lot 445 DP 1268480 and an existing sediment basin (Basin E) located within Lot 2000 DP 1204777 Bradley Street (Figure 1.2). The site is located 2.8km south of the Western Motorway and ~7km south of Penrith Town Centre. The Nepean River runs south to north ~6km to the west and Mulgoa Nature Reserve occurs ~1.7km west of the site.

This BDAR comprises a regular BAM Assessment and Streamlined Assessment (Scattered Tree and Planted Native Vegetation modules). The Scattered Tree Assessment assesses a single tree at the southern section of the lots and a Planted Native Vegetation Assessment has been completed for an existing sediment basin (Basin E) which requires rectification works. The Streamlined Assessments are outlined in Section 5 of this report.

- The **Site** comprises:
  - Stages 7-8 (~6.8 ha) which includes all proposed lots, infrastructure (including roads and stormwater infrastructure), buffers and Asset Protection Zones (APZs). Note that 3 ha within Stages 7-8 has approval for filling and stockpiling under approved DA18/0310.03.
  - Two screening mounds to the east (0.64 ha).
  - Basin E to the north (~0.24 ha).

  On this basis, the Site totals approximately 7.68 ha, of which 4.68 ha is subject to assessment (due to 3 ha within Stages 7-8 being approved under DA18/0310.03).
- The **Study Area** comprises the whole of the Site and land within 50m of the Site.
- The **Locality** includes an area within a 1500 m buffer of the Site (as required by the BAM).

1.3 Proposed Development

This application seeks development consent for a proposed residential subdivision and associated recreation area (Pinnacle Park) within Stages 7-8, over an area of 6.8 ha (refer Figure 1.3). Stages 7 – 8 includes 88 residential lots and two 'superlots' in addition to an area of open space in the north (adjacent to the already established 'Pinnacle Park' to the north) and a small area of riparian corridor in the south-west. Figure 1.3 also shows the approved disturbance zone as per DA18/0310.03 (Figure 1.1).

Two screening mounds will also be constructed and landscaped along The Northern Road (to the east of the development) to provide screening from the newly constructed highway across to the residential development.

It is assumed that 100% of the trees within Pinnacle Park (assessment area) will be retained. The precautionary principle has been applied and the BAM Calculator (BAM-C) has assumed a 25% loss of understorey and ground cover vegetation within 20m of proposed works (subdivision), to account for any incidental damage and edge effects. This is reflected in the Management Zone (Park) in the BAM-C. Vegetation beyond 20m from the works footprint, will be retained.

An existing sediment basin (Basin E) located approx. 300m north of Stages 7-8 also requires modification to increase capacity to account for increasing demand associated with Stages 7-8. The works within Basin E require an adjustment to the bund wall (raising it by 400mm); refer Figure 1.4. Note that Figure 1.4 also shows a single planted tree to be removed (in red). Other planted trees occur along the bund (all of which require removal), but were not picked up by survey as they had a diameter at breast height of 200mm or less.

AWC

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Date	16/12/2021

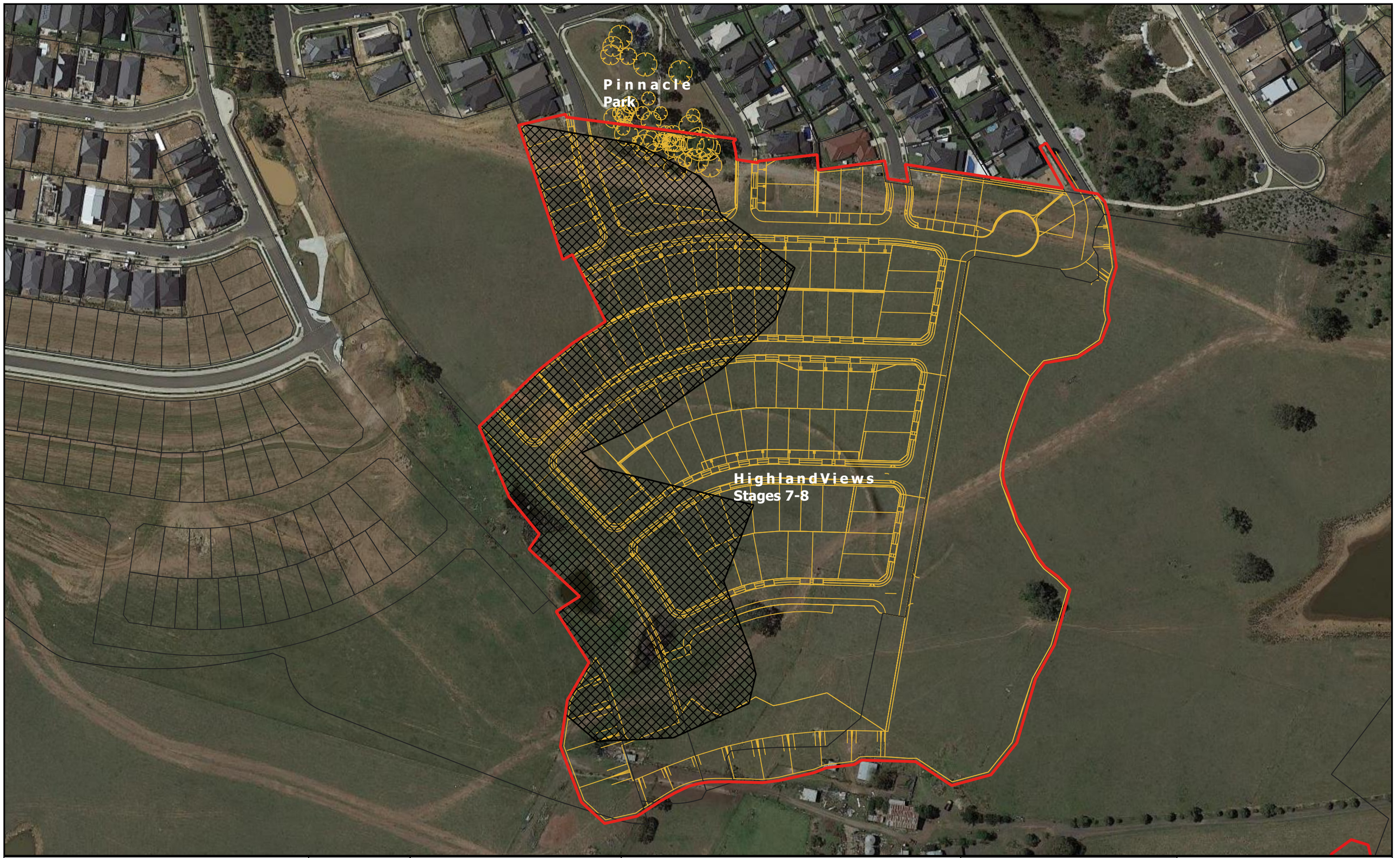
0 100 200 300 m

A3 Scale 1:4,250
Coordinate System: MGA 56 Projection: Transverse Mercator

Legend
- Site Boundary
- Approved Disturbance Area
- Cadastral

Figure 1.2

The Site



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Date	16/12/2021

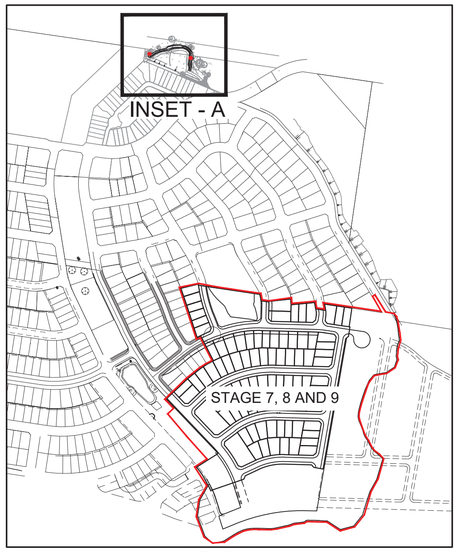
0 50 100 150 m

A3 Scale 1:2,000
Coordinate System: MGA 56 Projection: Transverse Mercator

Legend
- Site Boundary
- Approved Disturbance Area
- Cadastral
- Subdivision Layout

Figure 1.3

Proposed development: Stages 7-8



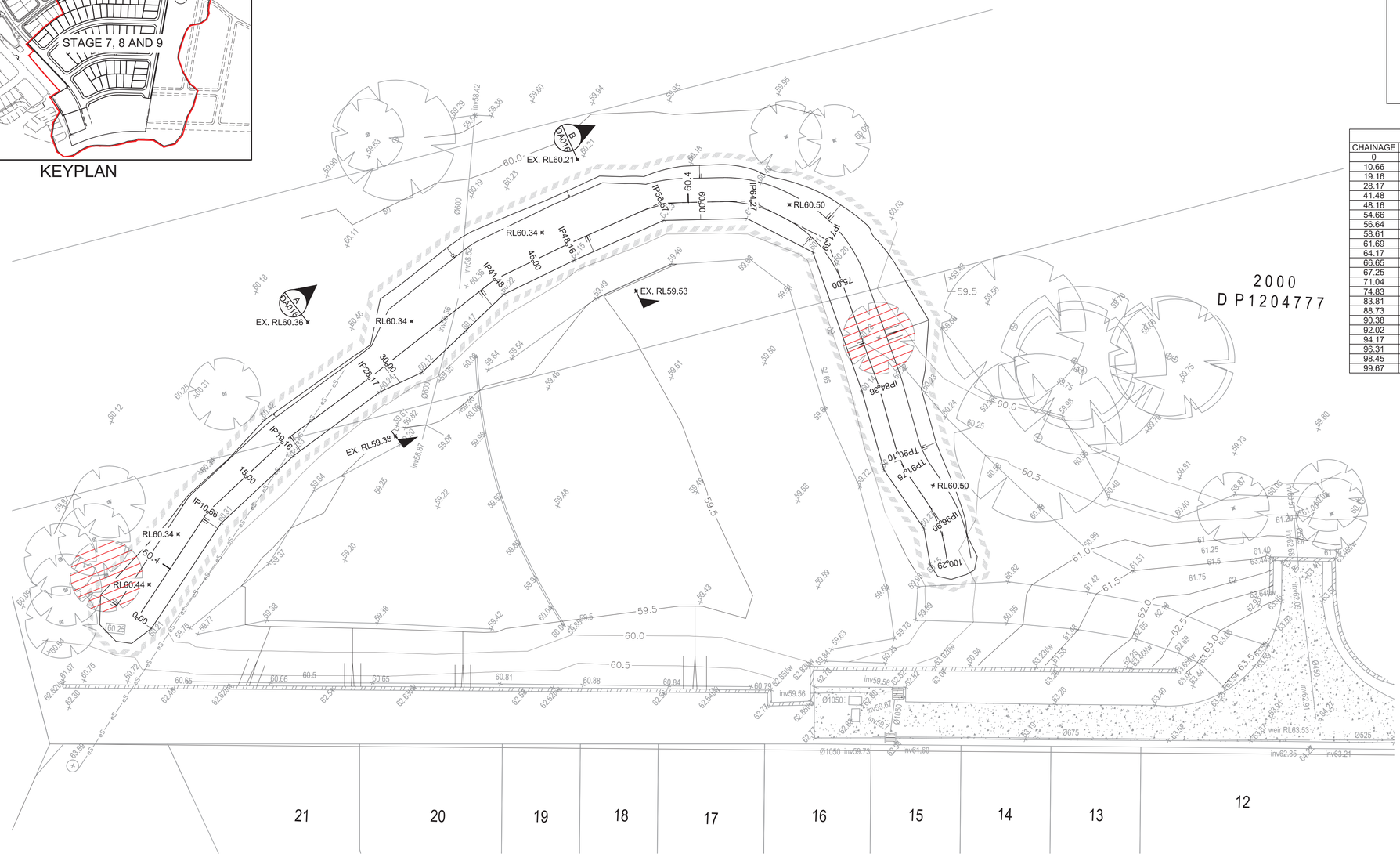
KEYPLAN

LEGEND

- 70.0 — DESIGN CONTOUR
- 70.0 — EXISTING CONTOUR
- LIMIT OF WORKS
- TREE TO BE REMOVED
- EXISTING TREE TO BE RETAINED

BASIN E					
CHAINAGE	EASTING	NORTHING	BEARING	RAD/SPIRAL	A.LENGTH
0	285761.45	6257115.54	56°12'46.64"		
10.66	285770.31	6257121.47			
19.16	285778.29	6257124.42			
28.17	285787.04	6257126.56			
41.48	285799.86	6257130.11			
48.16	285806.53	6257130.48			
54.66	285813.04	6257130.63	88°40'40.89"		
56.64	285815.04	6257130.67		10	3.95
58.61	285816.9	6257129.95	111°18'52.35"		
61.69	285819.76	6257128.83	111°18'52.35"		
64.17	285822.12	6257127.91		10	4.96
66.65	285823.76	6257125.98	139°44'12.97"		
67.25	285824.15	6257125.52	139°44'12.97"		
71.04	285826.72	6257122.48		10	7.59
74.83	285826.5	6257118.5	183°12'05.29"		
83.81	285826	6257109.53			
88.73	285825.39	6257104.65	187°09'57.53"		
90.38	285825.18	6257103.01		-10	3.28
92.02	285825.51	6257101.39	168°22'00.93"		
94.17	285825.95	6257099.27	168°22'00.93"		
96.31	285826.39	6257097.14		10	4.28
98.45	285825.9	6257095.03	192°52'22.52"		
99.67	285825.63	6257093.84	192°52'22.52"		

2000
D P1204777



INSET - A

1:200 (AT A1)
1:400 (AT A3)

4 2 0 4 8 12 16 20
METRES

A	ISSUED FOR DEVELOPMENT APPLICATION	CC	NAF	MS	RO	15/04/21
	AMENDMENT	DES	DRN	CKD	APR	DATE

J. WYNDHAM PRINCE
CONSULTING CIVIL INFRASTRUCTURE ENGINEERS & PROJECT MANAGERS
PO Box 4366 PENRITH WESTFIELD NSW 2750
P 02 4720 3300 W www.jwprince.com.au E jwp@jwprince.com.au

CLIENT: VIANELLO HOLDINGS PTY LTD

STATUS: ISSUE FOR DA APPROVAL
NOT FOR CONSTRUCTION
THIS DRAWING MUST NOT BE USED FOR CONSTRUCTION UNLESS SIGNED AS PART OF AN APPROVED CONSTRUCTION CERTIFICATE.

GLENMORE PARK - PRECINCT H
STAGE 7A, 7B, 8A AND 8B
BASIN PLAN

PROJECT No: 9784-13
SHEET No: DA006

AZIMUTH: M.G.A. | DATUM: A.H.D. | ORIGIN: | PLAN No: 9784-13-DA006 | A

Plotted: 27 April , 2021 11:06:18 AM File Name: J:\9784 - Glenmore Park Vianello Masterplan\01 - Civil Design\CD\DA\Stage 7, 8, & 9\9784-13-DA006.dwg

2 Landscape Context

2.1 Landscape Features

In accordance with the BAM, a number of features are assessed within and surrounding the subject site.

2.1.1 IBRA bioregions and IBRA subregions

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

2.1.2 NSW landscape regions (Mitchell Landscapes)

The subject site occurs entirely within the Cumberland Plain NSW Mitchell Landscape, shown in Figure 2.1.

2.1.3 Landforms

Rivers, Streams and Estuaries

- A first order stream runs from south to north adjoining the site at Pinnacle Park, where it has been highly modified. Only the very southern extent of the stream falls within the site boundary. The stream provides minimal habitat and does not have a well defined top of bank (Figure 2.3).
- A small dam/wetland of 195m^2 supporting native aquatic vegetation occurs on the northern boundary of Lot 700 at the end of Capstone Terrace.

Caves/Rocky Escarpment

- There are no caves or rocky escarpments on the site.

2.1.4 Soils and Geology

Soils at the site have been mapped by Morand (1994) as belonging to the Luddenham Erosional (ERlu) and Blacktown Residual (REbt) soil landscapes as follows (Figure 2.4):

Luddenham (ERlu) – Main Site

- **Landscape—**undulating to rolling low hills on Wianamatta Group shales, often associated with Minchinbury Sandstone. Local relief 50–80 m, slopes 5–20%. Narrow ridges, hillcrests and valleys. Extensively cleared tall open forest (wet sclerophyll forest).
- **Soils—**shallow (<100 cm) dark podzolic soils or massive earthy clays on crests; moderately deep (70–150 cm) red podzolic soils on upper slopes; moderately deep (<150 cm) yellow podzolic soils and prairie soils on lower slopes and drainage lines.
- **Limitations—**water erosion hazard, localised steep slopes, localised mass movement hazard, localised shallow soils, localised surface movement potential; localised impermeable highly plastic subsoil, moderately reactive.

Blacktown (REbt) – Basin E

- Landscape—gently undulating rises on Wianamatta Group shales. Local relief to 30 m, slopes usually >5%. Broad rounded crests and ridges with gently inclined slopes. Cleared Eucalypt woodland and tall open-forest (dry sclerophyll forest).
- Soils—shallow to moderately deep (>100 cm) hardsetting mottled texture contrast soils, red and brown podzolic soils on crests grading to yellow podzolic soils on lower slopes and in drainage lines.
- Limitations—localised seasonal waterlogging, localised water erosion hazard, moderately reactive highly plastic subsoil, localised surface movement potential.

2.1.5 Disturbance

Pre-European vegetation at the site would most likely have comprised a combination of dry sclerophyll forest (Cumberland Plain Woodland), dominated by *Eucalyptus tereticornis*, *Eucalyptus moluccana* and *Eucalyptus crebra*. The site has experienced high levels of disturbance through clearing for agricultural purposes. Elevated portions of the site have been changed historically by drain and dam construction.

2.2 Site Context

2.2.1 Native Vegetation Cover

As per the BAM 2020 methodology (Section 4.3.2) a buffer of 1500 metres was established around the site and a calculation of native vegetation cover was derived using native vegetation mapping (NSW Native Vegetation Extent v1.2 2017) summing values of 'tree cover' and 'tree cover matrix' values. Approximately 470 ha of native vegetation was identified within 1500 m of the site, therefore a native vegetation cover of 56% applies.

The total area of the 1,500m buffer around the study area is 893ha, with the area of vegetation mapped within the buffer being 200ha (Figure 2.2). This comprises a native vegetation cover of 22%, falling in the 10-30% class, which was entered into the BAM-C.

2.2.2 Patch Size

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

One patch was identified for vegetation within the subject land. Based upon vegetation mapping and air photo interpretation beyond the subject land, the total area of this patch of native vegetation was calculated as <5ha.

Legend

Site Boundary

1500m buffer

MitchellLandscapes_v31

Cumberland Plain

IBRASubegion_Aust70

Cumberland

Source:	NearMap / Google Satellite
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Date	15/12/2021

0 500 1,000 m

A3 Scale 1:14,000
Coordinate System: MGA 56 Projection: Transverse Mercator

Figure 2.1

Location Map (Mitchell Landscape and IBRA Subregion)

Source:	Google Satellite NSW Native Vegetation Extent v1.2
Disclaimer:	Care was taken in the creation of this map. AWC should be consulted as to the suitability of the information shown here in prior to the commencement of any works based on the information provided. AWC cannot accept any responsibility for errors, omissions or positional accuracy. There are no warranties expressed or implied as to the suitability of this map for a particular purpose. However, notification of any errors will be appreciated.
Date	15/12/2021

0 250 500 750 1,000 1,250 m

A3 Scale 1:15,000
Coordinate System: MGA 56 Projection: Transverse Mercator

Legend

- Site Boundary
- 1500m buffer

NSW_Native_Vegetation_Extent_v1p2_5m_2017

- Native Vegetation Absent
- Native Vegetation Present

Figure 2.2

Native Vegetation Extent

AWC

Source:	Google Satellite Streams - Six Maps
Disclaimer:	Care was taken in the creation of this map. AWC should be consulted as to the suitability of the information shown here in prior to the commencement of any works based on the information provided. AWC cannot accept any responsibility for errors, omissions or positional accuracy. There are no warranties expressed or implied as to the suitability of this map for a particular purpose. However, notification of any errors will be appreciated.
Date	16/12/2021

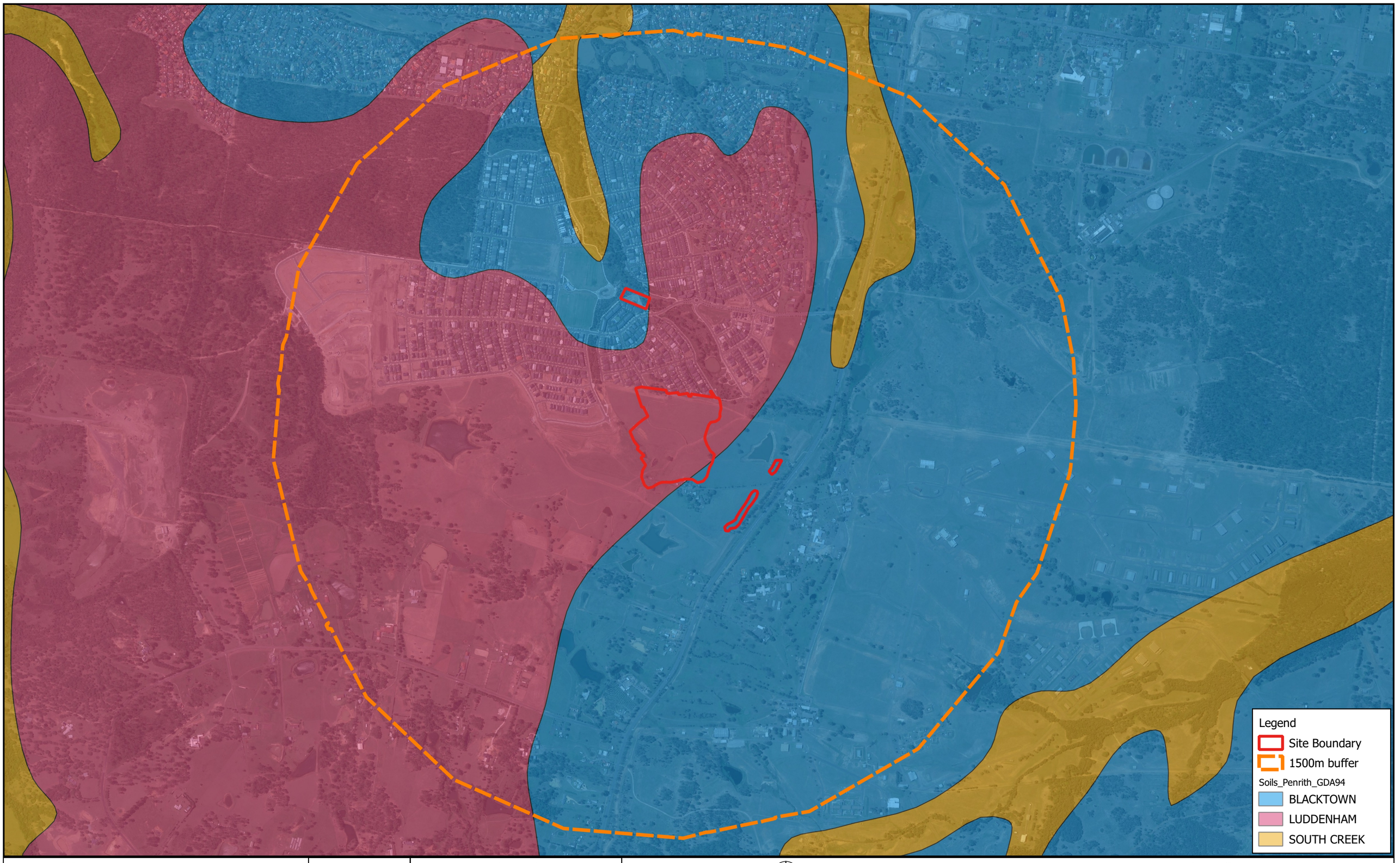
0 500 1,000 m

A3 Scale 1:14,000
Coordinate System: MGA 56 Projection: Transverse Mercator

Legend
- Site Boundary
- 1500m buffer
- Streams

Figure 2.3

Water Features



AWC

Source:	NearMap / Google Satellite
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Date	16/12/2021

0 500 1,000 m

A3 Scale 1:14,000
Coordinate System: MGA 56 Projection: Transverse Mercator

Figure 2.4

Soil Landscape

3 Native Vegetation

3.1 Methods

Assessment and mapping of Plant Community Types (PCTs) was undertaken on the 19th February 2021. The study area was traversed to identify the vegetation structure and dominant species within patches of native vegetation. The extent of each patch of vegetation was traversed to sample any spatial variation within each polygon, identify boundaries between vegetation communities and to identify and map vegetation zones in accordance with the BAM (variation in the broad condition state of vegetation polygons).

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

Identification of PCTs was in accordance with the NSW PCT classification as described in the BioNet Vegetation Classification. Determination of the most appropriate PCTs for vegetation communities within the study area used the BioNet Vegetation Classification database to identify PCT types which matched the geographic distribution (based upon IBRA subregions), vegetation formation and floristics of vegetation within the subject land.

3.2 Plant Community Types (PCTs)

Numerous studies have been conducted on the site, as such existing vegetation mapping was used to determine PCTs. Vegetation mapping by EcoLogical (2015) identified two vegetation types within the study area: Shale Plains Woodland (SPW) and Cleared land. SPW corresponds to the Threatened Ecological Community (TEC) 'Cumberland Plain Woodland in the Sydney Basin Bioregion' (CPW), listed as a critically endangered ecological community (CEEC) under the BC Act and EPBC Act.

Field assessment confirmed woody vegetation at the site is consistent with PCT 849 Cumberland shale plains woodland (refer Figure 3.1). A summary of the PCTs within the subject land including areas of vegetation zones, the percent cleared for the PCT and Serious and Irreversible Impact (SAII) candidate entities is included in Table 3.1.

Vegetation is shown in Figure 3.1. Vegetation that falls within the proposed works footprint and/or buffer and has been included in the BAMC includes:

- Zone 1 (20m buffer to account for edge effects, note that it is still intention to retain in situ)
- Zone 2 (direct impact).

For impacts on Planted Native Vegetation and Scattered Tree Assessment refer to Section 5.

Table 3.1 PCTs present on the Site and number of associated Vegetation Zones

Types (PCTs)	Vegetation Formation & class	Vegetation zones (footprint and buffer)	Area (Total)	Threatened Ecological Communities	SAII candidate entity
PCT 849 Cumberland shale plains woodland	Formation- Grassy Woodlands Class- Coastal Valley Grassy Woodlands	2 (plus scattered tree)	0.909*	Yes	Yes

* allowing for areas approved for filling and stockpiling under approved DA18/0310.03

Details of PCT 849 at the site (Zones 1 and 2) are provided at Table 3.2.

Table 3.2 PCT 849

Feature	Benchmark	Zone	
		1	2
		CPW_Moderate	Derived_Grassland
Canopy (Tree)	Richness: 5 Cover: 53% Species: *Eucalyptus moluccana, Eucalyptus tereticornis*	*E. tereticornis, E. crebra, E. moluccana*	N/A
Middle Stratum (Shrub)	Richness: 8 Cover: 16% Species: *Bursaria spinosa subsp. spinosa*	*Bursaria spinosa* subsp. *spinosa*	N/A
Ground Stratum (Grass, forb, fern)	Richness: 28 Cover: 68% Species: *Dichondra repens, Cheilanthes sieberi subsp. sieberi, Aristida vagans, Microlaena stipoides var. stipoides, Themeda australis, Brunoniella australis, Desmodium gunnii, Opercularia diphylla, Wahlenbergia gracilis, Paspalidium distans, Eragrostis leptostachya, Lomandra filiformis, Dianella longifolia, Oxalis perennans, Goodenia hederacea, Euchiton sphaericus, Aristida ramose, Arthropodium milleflorum, Cymbopogon refractus, Echinopogon caespitosus*	*Chloris gayana, Oplismenus aemulus, Bidens subalternans, Microlaena stipoides*	*Bothriochloa macra, Cynodon dactylon, Enteropogon acicularis, Plantago lanceolata*
Condition	-	Moderate Condition	Absent canopy, low condition, high abundance of native grasses. Weed presence is high. Experiences cattle grazing and slashing. Main native grass species (*Cynodon dactylon*) is not characteristic of this PCT

Legend

- Site Boundary - Assessment Area
- Approved Disturbance Area
- Proposed Works 8.12.21

Vegetation Zones

- Zone 1 - PCT849 - CPW
- Zone 2 - PCT849 - Derived Grassland
- Scattered Tree
- Planted Native Vegetation
- Exotic Grassland
- PCT849 outside of footprint

AWC

Source:	NearMap / Google Satellite
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Date	15/12/2021

0 100 200 300 m

A3 Scale 1:3300
Coordinate System: MGA 56 Projection: Transverse Mercator

Figure 3.1

Plant Community Types and Zones

PCT Justification

Definition: "The gentle topography associated with the shale plains of western Sydney carries an open grassy woodland dominated by grey box (*Eucalyptus moluccana*), forest red gum (*Eucalyptus tereticornis*) and ironbark (*Eucalyptus crebra/Eucalyptus fibrosa*). Localised patches of spotted gum (*Corymbia maculata*) may occur in the Fairfield LGA. Cumberland Shale Plains Woodland is the second of the grassy woodlands that comprise the Cumberland Plain Woodland in the Sydney Basin Bioregion Critically Endangered Ecological Community listed under the NSW TSC Act. Like the related community Cumberland Shale Hills Woodland (S_GW02) it is typified by a sparse to moderate cover of shrubs and a high cover of grasses and forbs. Tozer *et al.* (2010) define the primary habitat for the community as occurring at elevations less than 150 metres above sea level with some sites occurring at higher elevations where the landscape remains gently inclined. Rainfall is restricted to a narrow band between 750 and 950 millimetres per annum. The community occupies the north-west and west zones of the study area but is widespread elsewhere across the Cumberland Plain."

Justification: The site comprises shale plains of western Sydney. Dominant canopy species comprise *Eucalyptus tereticornis*, *E. moluccana* and *E. crebra*. The understorey is sparse and dominated by *Bursaria spinosa, Breynia oblongifolia* and *Cheilanthes sieberi.* The dense ground cover comprises a mixture of grasses and forbs including: *Aristida ramosa, Arthropodium minus, Asperula conferta, Bothriochloa marra, Chloris truncata* and *Chloris ventricosa.*

3.3 Vegetation Zones

3.3.1 Condition classes, subcategories and areas

PCTs identified within the development footprint and buffer were classified into vegetation zones for credit calculation purposes. The vegetation zones are based on the condition descriptions above with the area of each vegetation zone shown in Table 3.3.

3.3.2 Vegetation integrity survey plots

Three vegetation integrity survey plots were completed on site (see Appendix B & C for data captured and Appendix D for photos); refer Figure 3.1. The number of plots surveyed within each vegetation zone is consistent with the requirements as outlined within Table 4 of the BAM.

3.3.3 Current and future integrity scores

Vegetation integrity scores were calculated based on the vegetation integrity survey plots collected for each vegetation zone assigned to a native PCT. Vegetation integrity scores are provided in Table 3.3. All vegetation zones within the immediate development footprint (with the exception of proposed Lot 700) will require complete clearing of all vegetation and the default future vegetation integrity score of 0 was retained. A 20m wide buffer area has been allowed between the development footprint and the vegetation adjacent to Pinnacle Park (proposed Lot 700) to account for indirect impacts arising from the construction and operation phases of the development (e.g. road edge effects, batters, edge effects, batters, weed invasion, trampling, machinery etc). Although no trees are proposed to be removed within this buffer a 75% loss in understorey and canopy (precautionary principle) has been assumed within the 20m buffer.

Table 3.3 Vegetation Integrity Score

Zone	PCT	Condition class	Management Zone	Area impacted (ha)	Plots	Veg integrity score – before	Veg integrity score – after development	Total change in integrity Score
1	849	CPW Moderate	Park – no trees, shrubs, understorey or ground cover to be removed. 50% loss in 20m buffer assumed for indirect impacts.	0.05	1	56.1	25.2	30.9
2	849	Derived Grassland	Lot Footprint – all vegetation to be lost	0.86	2	12.1	0	12.1

4 Threatened Species

4.1 Introduction

Section 6 of the BAM details the process for determining the habitat suitability for threatened species. Under the BAM, threatened species are separated into two classes, 'ecosystem' and 'species' credit species. Those threatened species where the likelihood of occurrence of a species or elements of the species' habitat can be predicted by vegetation surrogates and landscape features, or for which a targeted survey has a low probability of detection, are identified as 'ecosystem' credit species. Targeted surveys are not required for ecosystem species and potential impacts to these species are assessed in conjunction with impacts to PCTs.

Previous studies of the site as well as a preliminary site assessment conducted in February 2021 were used to form justifications prior to detailed field assessments.

4.2 Ecosystem credit species

Table 4.1 lists threatened species reliably predicted to utilise the site by the BAM-C. No surveys are required for these species because they are associated with the occurrence of a particular PCT, and ecosystem credits apply to these species.

Table 4.1 Ecosystem credit species

Common Name	Scientific Name	Plant Community Types (PCT)	Maintained as Ecosystem Credit Species	Justification/comment
Barking Owl	*Ninox connivens*	849-Cumberland shale plains woodland	Y	
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	849-Cumberland shale plains woodland	Y	
Diamond Firetail	*Stagonopleura guttata*	849-Cumberland shale plains woodland	Y	
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	849-Cumberland shale plains woodland	N	Insufficient suitable habitat, small patch of woodland with degraded understorey.
Eastern Coastal Free-tailed Bat	*Micronomus norfolkensis*	849-Cumberland shale plains woodland	Y	
Flame Robin	*Petroica phoenicea*	849-Cumberland shale plains woodland	N	Insufficient suitable habitat, small patch of woodland with degraded understorey.
Gang-gang Cockatoo	*Callocephalon fimbriatum*	849-Cumberland shale plains woodland	N	Insufficient suitable habitat, small patch of woodland with degraded understorey.
Greater Broad-nosed Bat	*Scoteanax rueppellii*	849-Cumberland shale plains woodland	Y	

Common Name	Scientific Name	Plant Community Types (PCT)	Maintained as Ecosystem Credit Species	Justification/comment
Grey-headed Flying- fox	*Pteropus poliocephalus*	849-Cumberland shale plains woodland	Y	
Hooded Robin (south-eastern form)	*Melanodryas cucullata cucullata*	849-Cumberland shale plains woodland	N	Insufficient suitable habitat, small patch of woodland with degraded understorey
Koala	*Phascolarctos cinereus*	849-Cumberland shale plains woodland	N	Very small isolated patch of woodland surrounded by urban environment and open paddocks. Not sufficient to sustain a Koala.
Large Bent-winged Bat	*Miniopterus orianae oceanensis*	849-Cumberland shale plains woodland	Y	
Little Bent-winged Bat	*Miniopterus australis*	849-Cumberland shale plains woodland	Y	
Little Eagle	*Hieraaetus morphnoides*	849-Cumberland shale plains woodland	Y	
Little Lorikeet	*Glossopsitta pusilla*	849-Cumberland shale plains woodland	Y	
Masked Owl	*Tyto novaehollandiae*	849-Cumberland shale plains woodland	Y	
Painted Honeyeater	*Grantiella picta*	849-Cumberland shale plains woodland	N	Not recorded in the locality since 1989. No mistletoe.
Powerful Owl	*Ninox strenua*	849-Cumberland shale plains woodland	N	Site does not support prey habitat. Insufficient sheltered foraging habitat.
Regent Honeyeater	*Anthochaera phrygia*	849-Cumberland shale plains woodland	N	No dry woodland or riparian River She-oak woodland
Scarlet Robin	*Petroica boodang*	849-Cumberland shale plains woodland	N	Very small patch of woodland on site lacks open and grassy understorey.
Speckled Warbler	*Chthonicola sagittata*	849-Cumberland shale plains woodland	N	Preferred habitat not present, insufficient ground layer complexity
Spotted Harrier	*Circus assimilis*	849-Cumberland shale plains woodland	N	Habitat on site would not support preferred prey species. No prey habitat and no suitable foraging habitat.
Spotted-tailed Quoll	*Dasyurus maculatus*	849-Cumberland shale plains woodland	N	No denning and limited foraging habitat. Site surrounded by residential development and major roads.
Square-tailed Kite	*Lophoictinia isura*	849-Cumberland shale plains woodland	N	Site is insufficiently timbered.
Swift Parrot	*Lathamus discolor*	849-Cumberland shale plains	Y	

Common Name	Scientific Name	Plant Community Types (PCT)	Maintained as Ecosystem Credit Species	Justification/comment
		woodland		
Turquoise Parrot	*Neophema pulchella*	849-Cumberland shale plains woodland	N	No native grassy woodland on site.
Varied Sittella	*Daphoenositta chrysoptera*	849-Cumberland shale plains woodland	Y	
White-bellied Sea- Eagle	*Haliaeetus leucogaster*	849-Cumberland shale plains woodland	N	No large areas of open water, prey habitat or suitable perches.
White-throated Needletail	*Hirundapus caudacutus*	849-Cumberland shale plains woodland	Y	
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	849-Cumberland shale plains woodland	Y	

4.3 Species credit species (Candidate Species)

Species credit species are predicted in the BAM-C from assessment of geographic and habitat features in the credit calculator. Some species require further assessment of habitat constraints and/or geographic limitations before being confirmed as candidate species for assessment. Table 4.2 outlines species confirmed as a candidate species.

A candidate species that is not considered to have suitable habitat on the subject site (or specific vegetation zones) does not require further assessment on the subject site (or specific vegetation zones). The reasons for determining that a predicted species credit species is unlikely to have suitable habitat on the subject land (or specific vegetation zones) must be documented.

The potential for each threatened species to occur was considered following review of location and date of records of threatened species, available habitat within the subject land, and the condition of such habitat. Table 4.2 outlines the predicted candidate species which were deemed to not have suitable habitat within the study area, including justification for this decision.

Table 4.2 Species credit species – assessment of habitat constraints

Species	Survey Timing	Maintained as Candidate Species	Justification/comment	SAII Candidate
Thesium australe Austral Toadflax	Nov - Feb	Y		
Persoonia bargoensis Bargo Geebung	All months	Y		
Cynanchum elegans White-flowered Wax Plant	All months	Y		
Eucalyptus benthamii Camden White Gum	All months	Y		
Acacia bynoeana Bynoe's Wattle	All months	Y		
Caladenia tessellata Thick Lip Spider Orchid	Sept-Oct	N	Unlikely to occur due to weed occurrence, sparseness of understory, past disturbance and isolated nature of the vegetation onsite.	Y

Species	Survey Timing	Maintained as Candidate Species	Justification/comment	SAII Candidate
Persicaria elatior Tall Knotweed	Dec - May	Y		
Dillwynia tenuifolia	Aug-Oct	Y		
Acacia pubescens Downy Wattle	All months	Y		
Dillwynia tenuifolia - endangered population *Dillwynia tenuifolia*, Kemps Creek	Aug-Oct	N	The endangered population occurs in the area bounded by Western Road, Elizabeth Drive, Devonshire Road and Cross Street, Kemps Creek in the Liverpool Local Government Area. The site supports a transition from Castlereagh Ironbark Forest to Castlereagh Scribbly Gum Woodland. Portions of the site contain a form of Shale Gravel Transition Forest. Location and vegetation of the subject site do not fall within this description.	
Grevillea juniperina subsp. *juniperina* *Juniper-leaved Grevillea*	All months	Y		
Marsdenia viridiflora subsp. viridiflora - endangered population	Nov - Feb	Y		
Pultenaea pedunculata Matted Bush-pea	Sept - Nov	Y		
Pimelea curviflora var. *curviflora*	Oct - Mar	Y		
Pommerhelix duralensis Dural Land Snail	All months	Y		
Pimelea spicata Spiked Rice-flower	All months	Y		
Pterostylis saxicola *Sydney Plains Greenhood*	Oct	Y		
Meridolum corneovirens Cumberland Plain Land Snail	All months	Y		
Cercartetus nanus Eastern Pygmy-possum	Oct - Mar	N	No habitat on site, vegetation onsite degraded and isolated.	
Callocephalon fimbriatum Gang-gang Cockatoo (Breeding)	Oct - Jan	N	No suitable hollows on site.	
Litoria aurea Green and Golden Bell Frog	Nov - Mar	Y	Small amount of potential breeding habitat on site.	
Pteropus poliocephalus Grey-headed Flying-fox (Breeding)	Oct - Dec	N	No breeding camps/breeding habitat present onsite.	
Phascolarctos cinereus Koala (breeding)	All months	N	Very small, isolated patch of woodland surrounded by urban environment and open paddocks. Not sufficient to sustain a Koala. Does not fall within areas identified as important habitat.	
Miniopterus orianae oceanensis	Dec - Feb	N	No breeding habitat onsite.	

Species	Survey Timing	Maintained as Candidate Species	Justification/comment	SAII Candidate
Large Bent-winged Bat (Breeding)				
Chalinolobus dwyeri Large-eared Pied Bat	Nov - Jan	N	Found in well-timbered areas containing gullies. Roosts in caves (near their entrances), crevices in cliffs, old mine workings. No caves, cliffs or other suitable roosting habitat on the site. The landscape on the site is dominated by cleared exotic pasture with one very small patch of woodland.	Y
Miniopterus australis Little Bent-winged Bat (Breeding)	Dec - Feb	N	No breeding habitat onsite (caves, tunnel, mine, culvert), numbers of individuals less than 500.	
Hieraaetus morphnoides Little Eagle (breeding)	Aug - Oct	N	No nest trees occur.	
Tyto novaehollandiae Masked Owl (breeding)	May - Aug	N	No large hollows occur.	
Ninox strenua Powerful Owl (breeding)	May - Aug	N	No large hollows occur.	
Ninox connivens Barking Owl (Breeding)	May - Aug	N	No large hollows occur.	
Anthochaera phrygia Regent Honeyeater (Breeding)	-	N	The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. There are three known key breeding areas, two of them in NSW - Capertee Valley and Bundarra-Barraba regions. The site is not a known breeding site, and no suitable breeding habitat exists onsite. No important area mapping is depicted on site.	
Myotis macropus Southern Myotis	Oct - Mar	Y	Potential foraging habitat present (dam).	
Lophoictinia isura Square-tailed Kite (Breeding)	Sept - Jan	N	No nest trees present onsite. Site degraded.	
Petaurus norfolcensis Squirrel Glider	All months	N	No suitable nest hollows or foraging habitat. Site lacks Acacia and Banksia understorey. Degraded and isolated nature of site makes it unsuitable.	
Lathamus discolor Swift Parrot (Breeding)	-	N	No important habitat mapping on the site.	Y
Haliaeetus leucogaster White-bellied Sea-Eagle (Breeding)	Jul - Dec	N	No large areas of open water, prey habitat or suitable perches.	
Burhinus grallarius Bush Stone-curlew	All months	N	Habitat is highly degraded surrounded by residential development posing high risk of predation by domestic animals. Lack of fallen/standing dead timber.	

4.4 Presence/absence of candidate species

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

The following flora and fauna surveys were undertaken during February 2021 by Jacqui Coughlan and James Schlunke (CVs in Appendix A).

4.4.1 Targeted Field Survey – Flora

A targeted flora survey was conducted over two days (Table 4.3). The site was traversed in transects throughout the entire development footprint (with a focus on the Cumberland Plain Woodland in the north of the site). Searches were focused on areas of native vegetation; however, grassland and landscaped areas were also searched. Refer to Figure 4.1 for location of BAM plots in each vegetation zone.

No threatened flora species were recorded during the survey.

The following Candidate Species were assumed present, as survey was conducted outside of the dedicated survey time: *Dillwynia tenuifolia, Pterostylis saxicola, Pultenaea pedunculata.*

Table 4.3 Flora Survey Times

Date	PCT	Method
19 February 2021	849 – Cumberland Plain Woodland	BAM plots (1)
19 February 2021	849 –CPW derived grassland	BAM plots (2)
19 February 2021	Exotic Grassland	BAM plots (2)
19 February 2021	849 – Cumberland Plain Woodland	Targeted Flora transect x1
19 February 2021	849 – CPW derived grassland	Targeted Flora Transect x1
26 February 2021	849 – CPW derived grassland	Targeted Flora Transect x1

AWC

Source:	NearMap / Google Satellite
Disclaimer:	Care was taken in the creation of this map. AWC should be consulted as to the suitability of the information shown here in prior to the commencement of any works based on the information provided. AWC cannot accept any responsibility for errors, omissions or positional accuracy. There are no warranties expressed or implied as to the suitability of this map for a particular purpose. However, notification of any errors will be appreciated.
Date	16/12/2021

0 50 100 150 m

A3 Scale 1:2000
Coordinate System: MGA 56 Projection: Transverse Mercator

Figure 4.1

Flora Survey Effort

4.4.2 Targeted Field Survey – Fauna

Targeted surveys for candidate threatened fauna species are outlined for each of the candidate threatened fauna species in Table 4.4 below. Fauna survey effort is depicted in Figure 4.2. Results of all fauna surveys are provided in Table 4.5. Four threatened species were detected during the survey: Large Bent-winged Bat, Little Bent-winged Bat, Eastern Coastal Freetail-bat and Greater Broad-nosed Bat. All of these species are ecosystem species credit species.

Table 4.4 Fauna Survey Effort and Threatened Species Results

Survey	Target Species	Person hours	Effort	Total Effort	Threatened Species Detected
Nocturnal Survey (Spotlight)	Grey-headed Flying Fox	2 Nights x 1 person	1 hour	2 hours	nil
Frog Survey – call playback	Green and Golden Bell Frog	2 Nights x 1 person	1 hour each survey	2 hours	nil
Microbat (Anabat Survey)	Southern Myotis	5 nights x 1 device	All night	5 nights	Large Bent-winged Bat Little Bent-winged Bat Eastern Coastal Freetail-bat Greater Broad-nosed Bat
Bird Survey	White-bellied Sea-eagle Swift Parrot			4 transects	nil
Raking of litter and logs	Cumberland Plain Land Snail Dural Land Snail			2 hours	nil
Opportunistic survey	All threatened fauna	All times while on site	All times while onsite	3 days	nil

Table 4.5 Fauna observed on site

Scientific Name	Common Name	Survey
Birds		
Acridotheres tristis	Indian Mynah*	Bird Survey
Anas superciliosa	Black Duck	Opportunistic at dam
Cacatua galerita	Sulphur-crested cockatoo	Bird Survey
Cacatua sanguinea	Little Corella	Bird Survey
Cracticus torquatus	Grey Butcherbird	Bird Survey
Grallina cyanoleuca	Magpie-lark	Bird Survey
Gymnorhina tibicen	Australian Magpie	Bird Survey
Hirundo neoxena	Welcome Swallow	Bird Survey
Manorina melanocephala	Noisy Miner	Bird Survey
Ocyphaps lophotes	Crested Pigeon	Bird Survey
Psephotus haematonotus	Red-rumped Parrot	Bird Survey
Rhipidura leucophrys	Willie Wagtail	Bird Survey
Sturnus vulgaris	Common Starling*	Opportunistic
Mammals		
Austronomus australis	White striped Freetail Bat	Anabat Detection
Bos taurus	Cow*	Opportunistic
Chalinolobus gouldii	Gould's Wattled Bat	Anabat Detection
Chalinolobus morio	Chocolate Wattled Bat	Anabat Detection
Lepus europaeus occidentalis	Hare*	Opportunistic
Miniopterus australis	#Little Bent-winged Bat	Anabat Detection
Miniopterus orianae oceanensis	#Large Bent-winged Bat	Anabat Detection
Mormopterus ridei	Eastern Freetail Bat (sp. 2)	Anabat Detection
Mormopterus/Micronomus norfolkensis	#Eastern Coastal Freetail-bat	Anabat Detection
Nyctophilis spp.	Long-eared bats not identifiable to species.	Anabat Detection
Scoteanax rueppellii	#Greater Broad-nosed Bat	Anabat Detection
Scotorepens orion	Eastern Broad-nosed Bat	Anabat Detection
Vespadelus vulturnus	Little Forest Bat	Anabat Detection
Amphibians		
Litoria fallax	Eastern Dwarf Tree Frog	Frog survey at dam
Limnodynastes peronii	Striped Marsh Frog	Frog survey at dam
Reptiles		
Amphibolurus muricatus	Jacky Lizard	Opportunistic

** Introduced species; # Threatened species (BC Act)*

Anabat results are provided at Appendix E.

AWC

Source:	NearMap / Google Satellite
Disclaimer:	Care was taken in the creation of this map. AWC should be consulted as to the suitability of the information shown here in prior to the commencement of any works based on the information provided. AWC cannot accept any responsibility for errors, omissions or positional accuracy. There are no warranties expressed or implied as to the suitability of this map for a particular purpose. However, notification of any errors will be appreciated.
Date	16/12/2021

0 25 50 75 m

A3 Scale 1:2000
Coordinate System: MGA 56 Projection: Transverse Mercator

Figure 4.2

Fauna Survey Effort

5 Streamlined Assessment

5.1 Scattered Tree Assessment

Three scattered 'paddock' trees are located within the exotic grassland adjacent to Stages 7-8 (refer Figure 3.1).

Due to their isolated nature in the centre of cleared exotic grassland, habitat values associated with these trees are restricted to highly mobile species. The trees provide nominal habitat for common bird species only and provide poor resources for fauna species that rely on dense understorey, complex ground layers or connectivity between habitat trees. Tree #1 supports two medium sized spout hollows; hollows are absent from other trees. However, given the isolation of tree #1 it is unlikely to provide nesting or denning habitat for arboreal mammals such as gliders given its isolation from any other trees (and limitations of glide distance of arboreal mammals). Swift Parrot (breeding) was not retained as a Candidate species, as no Swift Parrot Important Area is mapped over the scattered tree assessment area. Details of the Scattered Tree Assessment (as per Appendix B of the BAM) are summarised at Table 5.1.

Table 5.1 Scattered Tree Assessment

#	Species	PCT	TEC	DBH	Height	Habitat Features	Ecosystem Credit Species	Species Credit Species
1	*Eucalyptus crebra*	849	Yes	102cm	24m	Two medium sized spout hollows, some small hollows, nectar source, nesting habitat, refuge.	Spotted Harrier, Square-tailed Kite, Eastern False Pipistrelle, Little Lorikeet, Little Eagle, Swift Parrot, Eastern Coastal Free-tailed Bat, Yellow-bellied Sheathtail-bat	No species credit species. Swift Parrot was removed as there is no suitable habitat and important habitat is not mapped.
2	*Angophora floribunda*	849	Yes	100cm	18m	Nectar source, nesting habitat, refuge.		
3	*Angophora floribunda*	849	Yes	70cm	15m	Nectar source, nesting habitat, refuge.		

Based on the loss of three scattered trees, Table 11 of Appendix B indicates three credits are required to offset the tree loss; this has been included in the BAM-C (refer Section 8.3).

5.2 Planted Native Vegetation

5.2.1 Introduction

Modification of a constructed sediment basin (Basin E) located in Lot 2000 DP1204777 (approx. 300m north of Stages 7-8) is required in order to increase capacity required for Stages 7-8. Works in Basin E require an adjustment to the bund wall (raising it by 400mm); refer Figure 1.4. All planted vegetation on the bund wall (planted with a variety of native species) requires removal for the works. Note that Figure 1.3 also shows a single planted tree to be removed (in red). Other planted trees occur along the bund (all of which require removal) but were not picked up by survey as they had a diameter at breast height of 200mm or less.

Following the works the bund will be replanted with similar native species to that which presently occur. Details of revegetation works including species and planting locations are provided in the Vegetation Management Plan prepared by AWC (2021).

On this basis, vegetation impacts have been assessed as per the 'Planted Native Vegetation' module in Appendix D of the BAM.

5.2.2 Decision making key

Appendix D includes a decision making key in Section D.1. The vegetation within Basin E is planted for functional, aesthetic, horticultural or plantation forestry purposes, consistent with Criteria 5 of Section D.1. The decision-making key then directs the assessor to Section D.2 of Appendix D which states: *"The assessor must assess the suitability of the planted native vegetation for use by threatened species and record any incidental sightings or evidence (e.g. scats, stick nests) of threatened species credit species (flora and fauna) using, inhabiting or being part of the planted native vegetation. If there is evidence that threatened species are using the planted native vegetation as habitat, the assessor must apply Section 8.4 of the BAM to mitigate and manage impacts on these species. Species credits are not required to offset the proposed impacts. The steps taken to assess threatened species habitat and all reasonable measures proposed to be taken to mitigate or minimise impacts must be set out in the BDAR or BCAR".*

Decision making key

Does the planted native vegetation occur within an area that contains a mosaic of planted and remnant native vegetation and which can be reasonably assigned to a PCT known to occur in the same IBRA subregion as the proposal?

i. Yes …. The planted native vegetation must be allocated to the best-fit PCT and the BAM must be applied.

ii. No…… Go to 2. – All vegetation is planted, no remnant, cannot be allocated to a PCT.

2. Is the planted native vegetation: a. planted for the purpose of environmental rehabilitation or restoration under an existing conservation obligation listed in BAM Section 11.9(2.), and b. the primary objective was to replace or regenerate a plant community type or a threatened plant species population or its habitat?

i. Yes …. The planted native vegetation must be assessed in accordance with Chapters 4 and 5 of the BAM.

ii. No…… Go to 3. – Purpose of planting is not for environmental rehabilitation or restoration under an obligation

3. Is the planted/translocated native vegetation individuals of a threatened species or other native species planted/translocated for the purpose of providing threatened species habitat under one of the following: a. a species recovery project b. Saving our Species project c. other types of government funded restoration project d. condition of consent for a development approval that required those species to be planted or translocated for the purpose of providing threatened species habitat e. legal obligation as part of a condition or ruling of court. This includes regulatory directed or ordered remedial plantings (e.g. Remediation Order for clearing without consent issued under the BC Act or the Native Vegetation Act) f. ecological rehabilitation to re-establish a PCT or TEC that was, or is carried out under a mine operations plan, or g. approved vegetation management plan (e.g. as required as part of a Controlled Activity Approval for works on waterfront land under the NSW Water Management Act 2000)?

i. Yes …. The planted native vegetation must be assessed in accordance with Chapters 4 and 5 of the BAM.

*ii. **No…… Go to 4. No, vegetation has not been planted to provided threatened species habitat, translocation of threatened species etc.***

4. Was the planted native vegetation (including individuals of a threatened flora species) undertaken voluntarily for revegetation, environmental rehabilitation or restoration without a legal obligation to secure or provide for management of the native vegetation?

i. Yes…… Go to D.2 Assessment of planted native vegetation for threatened species habitat (the use of Chapters 4 and 5 of the BAM are not required to be applied).

*ii. **No……. Go to 5 – vegetation was not planted for revegetation or environmental rehabilitation***

5. Is the native vegetation (including individuals of a threatened flora species) planted for functional, aesthetic, horticultural or plantation forestry purposes? This includes examples such as: windbreaks in agricultural landscapes, roadside plantings (including street trees, median strips, roadside batters), landscaping in parks, gardens and sport fields/complexes, macadamia plantations or teatree farms?

*i. **Yes …. Go to D.2 Assessment of planted native vegetation for threatened species habitat (the use of Chapters 4 and 5 of the BAM are not required to be applied). – Vegetation was planted for functional, aesthetic purposes (water retention basin) – D.2 applies***

ii. No…… Go to 6.

5.2.3 Methods

Basin E was assessed 06/10/2021 over a period of 2.5 hours. Weather conditions were sunny and warm with little wind. The bund wall was walked on foot in addition to general investigation of adjacent vegetation within the basin and adjacent woodland. Field assessment focused on determining any signs of threatened species habitat within the planted native vegetation on the bund wall.

5.2.4 Results

Vegetation planted along the bund includes species such as *Lomandra longifolia*, *Hardenbergia violaceae*, *Indigofera australis*, *Melaleuca linariifolia* with occasional small trees such as *Eucalyptus crebra*, *Eucalyptus tereticornis*, and *Acacia parramattensis*. There is a significant occurrence of weed species including *Plantago lanceolata, Senecio madagascariensis*, *Diplotaxis muralis, Sonchus*

oleraceus and *Cirsium vulgare*. Vegetation within the basin is largely dominated by *Carex appressa* with *Rumex crispus* intermixed. Photographs of planted vegetation are provided in Plates 5.1 - 5.3.

A variety of common fauna were observed including Crested Pigeon, Noisy Miner, Pied Currawong, Magpie-lark, Australian Magpie and White-faced Heron. Field assessment did not record any evidence that threatened species are using planted native vegetation on the bund as habitat, and as such Section 8.4 of the BAM does not apply to Basin E. No credits for the removal of planted vegetation are required.

Plate 5.1. Planted vegetation, top of bund

	*Plate 5.2. Planted vegetation, top of bund - Lomandra longifolia, Melaleuca linariifolia.*
	*Plate 5.3. Planted vegetation within detention basin, Carex appressa.*

6 Impact Assessment

6.1 Impact assessment

Biodiversity impacts which may result from development of the site are discussed below.

6.1.1 Vegetation clearing

Clearing of native vegetation within Stages 7-8 will include:

- Indirect impact on 0.05 ha of moderate quality native vegetation (PCT 849 – Zone 1) within the development footprint (integrity score of 56.1). It is intended that this community will be retained in situ, however the precautionary principle has been applied to a 20m buffer to account for edge effects and any incidental damage.
- Direct impact (complete removal) of 0.86 ha of low-quality vegetation (PCT 849 – Zone 2 [derived grassland]) within the development footprint (integrity score of 12.1). This vegetation has an absent/sparse canopy, is dominated by exotic pastoral grasses and obtained an integrity score < 20.
- Removal of 6.68 ha of exotic grassland.
- Removal of three scattered trees (1 x *E. crebra* and 2 x *Angophora floribunda*).

Refer to Table 6.1 for details of vegetation and PCTs to be cleared.

Note: planted vegetation removal for Basin E does not require compensation via the BAM-C so is not considered further. As noted, the basin will be replanted following works, so no net loss of native vegetation will occur. On this basis, works proposed for Basin E are not discussed further.

Table 6.1 Areas of each PCT to be cleared (Stage 7-8)

PCTs	Vegetation zones	Area – ha (Total)
849	1 – CPW Moderate	0.05
849	2 - Derived Grassland	0.86

The majority of the native vegetation to be cleared (0.91 ha) comprises derived grassland, with an absent canopy and mixture of exotic and native ground covers (Zone 2). This community is in low condition (integrity score of 12.1), is regularly slashed and provides very low habitat value.

6.1.2 Removal of threatened species habitat

Four threatened species were recorded on site and three were assumed present since surveys were undertaken outside of the prescribed survey period for the species:

- Large Bent-winged Bat – Ecosystem Credit Species (recorded)
- Little Bent-winged Bat – Ecosystem Credit Species (recorded)
- Eastern Coastal Freetail-bat - Ecosystem Credit Species (recorded)
- Greater Broad-nosed Bat (recorded)
- *Dillwynia tenuifolia* - Species Credit Species (assumed present)
- *Pterostylis saxicola* - Species Credit Species (assumed present)
- *Pultenaea pedunculata* - Species Credit Species (assumed present).

The proposed development of Stages 7-8 will result in the clearing or impacts to the habitat of the

species listed above. Habitat on the site is of low value for all species listed above and habitat of the same or better value is present in the locality.

6.1.3 Direct mortality of fauna

There is potential for direct mortality of fauna via clearing of habitat and destruction. However, clearing of vegetation for the proposed works will be minimal, as the majority of the development footprint is within highly disturbed area that does not support diverse fauna habitat. A qualified ecologist experienced in clearing supervision should be present for the removal of the three scattered trees (*E. crebra and Angophora floribunda*) in the south of the development footprint.

6.1.4 Spread of declared weeds

Disturbance of soil provides the opportunity for weed invasion. Weeds may also be transported to the site from vehicles, personnel and via construction materials. Weed invasion varies over the site. The majority of the proposed development is within cleared pastoral grassland which is already exposed to high levels of weed invasion. The outer edge of native vegetation is currently exposed to weed invasion as an edge effect. The proposed development is unlikely to increase weed occurrence throughout the site, however weed hygiene measures will be put in place during the works.

6.1.5 Fragmentation

Vegetation on the site comprises a small patch of CPW which is completely isolated from other areas of woody native vegetation. Restoration activities in the larger development area adjacent to the site will link the existing vegetation patches to the west to form corridors for fauna movement. The development of Stage 7-8 would be unlikely to have any significant impact on most local wildlife movements.

6.1.6 Erosion and sedimentation

Sedimentation and erosion impacts can occur at both the construction and built phases. Erosion/sedimentation may occur via erosion of fill material and disturbed soils, scouring of exposed soil, banks and habitats adjacent to the development area via directed flow (e.g. stormwater), or where runoff is concentrated. Works may increase sedimentation levels or affect water quality both during and following the completion of construction. Erosion and sedimentation issues arising from the proposed development are likely be minimal. All construction works will be guided by an erosion and sediment control plan prepared by an IECA certified practitioner.

6.1.7 Disturbance from lighting

The development may result in an overall increase in the amount and intensity of lighting compared to the existing condition which could disturb (or attract) native fauna and pest species. Increased lighting associated with the proposed development has the potential to increase negative effects on fauna such as disorientation and high exposure to predators. This risk will require consideration within the urban design and positioning of ecological buffers.

6.1.8 Noise, vibration and anthropogenic disturbances

Currently the main source of anthropogenic noise and disturbance comes from traffic along The Northern Road to the east, construction to the west and residential area to the north. During the development's establishment, noise will be highest during construction, but limited to day time and so would only impact diurnal birds and mammals. Following construction, the site will see an increase in disturbance from increased human presence, vehicle traffic and lighting. It is expected that the outskirts of vegetation will experience these to the greatest extent, with vegetation along the eastern extents of the site to experience the least amount of disturbance due increased size and reduced edge effects.

6.2 Assessing additional prescribed biodiversity impacts

The BC Regulation (clause 6.1) identifies impacts which are to be assessed under the biodiversity offsets scheme, but which are not to be taken into account in calculating the number of credits required to offset biodiversity impacts. These impacts are assessed in Table 6.2.

Table 6.2 Additional prescribed biodiversity impacts and their relevance to the Development Site

Prescribed Biodiversity Impact	Relevance to Development Site
Impacts of development on the habitat of threatened species or ecological communities associated with: (i) karst, caves, crevices, cliffs and other geological features of significance, or (ii) rocks, or (iii) human made structures, or (iv) non-native vegetation	There are no karst, caves, crevices, cliffs and other geological features of significance, or rocks, human made structures that will be removed as a result of the proposed works. Exotic grassland will be removed as part of the proposed works. This vegetation is highly disturbed, experiences slashing and cattle grazing and provides little habitat for native fauna. The conversion of exotic grassland to residential estate may impact on the movement of some of the more mobile species such as Flying foxes and birds of prey that use the site as a fly over. No important habitat for these species will be impacted.
Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range	Exotic grassland will be removed as part of the proposed works. This vegetation is highly disturbed, experiences slashing and cattle grazing and provides little habitat for native fauna. The conversion of exotic grassland to residential estate may impact on the movement of some of the more mobile species such as Flying foxes and birds of prey that use the site as a fly over. No important habitat for these species will be impacted. Restoration activities associated with previous stages (outlined in the master plan) will aim to link the existing vegetation patches together to form corridors for fauna movement. It is expected that long term linkages between the vegetation communities to be retained at and adjacent the site will be improved.
Impacts of development on movement of threatened species that maintains their life cycle	The development should not result in restrictions of the movements of any threatened species to maintain their life cycle. A majority off habitat to be removed is in relatively poor condition. Additionally, restoration activities associated with previous stages (outline in master plan) aim to link the existing vegetation patches together to form corridors for fauna movement.
Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining	There is one small water body on the site (a constructed dam) that supports native aquatic vegetation and habitat for birds and frogs and provides minor foraging habitat for microbats. The dam will be removed for the development.
Impacts of wind turbine strikes on protected animals	N/A
Impacts of vehicle strikes on threatened species or on animals that are part of a TEC.	The potential for roadkill in an urban area with low speed roads is low.

7 Avoiding and minimising impacts on biodiversity values

7.1 Avoidance of Impacts

The majority of the development occurs within the most highly disturbed areas of the site, which comprises exotic grassland (6.67 ha). A small amount of native vegetation will require removal, with core areas of PCT 849 retained in-situ. The majority of affected vegetation currently experiences cattle grazing, slashing, underscrubbing and exposure to edge effects. A total of 0.86 ha of native vegetation comprising Cumberland Plain Woodland derived grassland would be removed as a result of the proposed works. An additional 0.05 ha of CPW would be indirectly affected via edge effects.

The impacts associated with the proposal, including the clearing of native vegetation, have been situated within specific areas in order to avoid impacts to better condition, more intact and more connected areas of native vegetation. In most cases, lots are sited within areas of exotic vegetation or native vegetation in very low condition (all native vegetation to be directly removed falls within Vegetation Zone 2, scoring an integrity score of 12.1).

7.2 Minimising and Mitigating impacts on Biodiversity Values

The project is designed such that the impact on native vegetation and habitat is minimal with the majority of the subdivision occurring over cleared and grazed exotic pasture. No direct impact on the patch of CPW will occur and this vegetation is retained in situ within parkland. Indirect impacts are assumed on 50% of the 0.08 ha of CPW within the 20m buffer between the development footprint and this vegetation. Residual impacts on flora, fauna and fauna habitat will be minimised and mitigated as outlined below.

7.2.1 Restoration of CPW

Areas of CPW with existing canopy (including vegetation within Pinnacle park) will be retained in situ. A buffer has been established from the edge of the development footprint, into existing CPW (Zone 1), to account for any edge effects. The precautionary principle has been applied and as such any vegetation in Zone 1 that falls within 20m (0.05ha) of the proposed footprint has an assumed loss of 25% loss of understorey and ground cover. This is precautionary and the impact is actually expected to be less. CPW in the locality will be restored via a Vegetation Management Plan (refer AWC 2021) which will include:

- A corridor of CPW vegetation to the west of the site ('Surveyors Creek west') will be rehabilitated via planting and assisted regeneration techniques. Restoration of CPW will facilitate linkage to adjacent areas of CPW to the north.
- CPW within the site along the north eastern boundary ('Green Corridor) will be rehabilitated via planting and assisted regeneration techniques (refer to the VMP)
- Weed control and infill plantings within southern section of Pinnacle Park (extension to Pinnacle Park) for the isolated patch of CPW subject to this BDAR.

Woody vegetation within southern section of Pinnacle Park will be retained within open space which

will become part of the existing Pinnacle Park to the north. A separate Vegetation Management Plan will be prepared for this land and includes actions to manage weeds (grasses and forbs, African Boxthorn) within the stand of CPW and installation of protection measures to prevent mowing or human incursion (permanent fencing, vegetation buffers, which will include supplementary planting of understorey and groundcover species). Infill plantings of native groundcovers and shrubs (e.g. *Bursaria spinosa, Cymbopogon refractus, Daviesia ulicifolia, Dianella longifolia, Echinopogon ovatus, Hardenbergia violacea, Lomandra filiformis subsp. filiformis, Lomandra multiflora subsp. multiflora, Poa labillardieri var. labillardieri, Themeda triandra*) will be installed following weed control works.

7.2.2 Mitigation measures implemented for threatened species recorded onsite

Microchiropteran bats are likely to forage over the small dam in the north east of the site as well as along the edges and gaps in remnant woodland vegetation. The retention and restoration of remnant vegetation to the north east of the site (via the VMP) will retain and enhance foraging habitat. The size of the dam being removed is 195m^2 so is unlikely to represent a substantial foraging resource to microbats in a local context. Additional areas of forested vegetation adjacent to the site (inclusive of restoration areas such as Surveyors Creek) provide suitable foraging habitat. Some secondary foraging habitat within the development footprint would continue to be available post development as some species would forage along edges of remnant vegetation and along streetscapes, where street lighting may benefit some species.

The single paddock tree (Narrow-leaved Ironbark) to be removed contains two medium sized spout hollows which provide potential microbat roosting habitat. Loss of these hollows will be compensated for by the installation of microbat roost boxes within retained CPW within southern section of Pinnacle Park at a ratio of one roost box per hollow removed.

7.3 Thresholds for the assessment and offsetting of impacts of development

7.3.1 Serious and Irreversible Impacts

A serious and irreversible impact (SAII) is listed under the BC Act as an impact that is likely to contribute significantly to the risk of extinction of a threatened entity. The BAM requires additional information is provided for any impact that is a potential SAII (see Section 9.1 of the BAM).

<u>Cumberland Plain Woodland</u>

Cumberland Plain Woodland (CPW) is a community at risk of a SAII as it meets criteria listed under Principle 2 as per clause 6.7 of the BC Regulation 2017:

(2) An impact is to be regarded as serious and irreversible if it is likely to contribute significantly to the risk of a threatened species or ecological community becoming extinct because:

a) it will cause a further decline of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline, or

b) it will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size, or

c) it is an impact on the habitat of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution, or

d) the impacted species or ecological community is unlikely to respond to measures to improve its habitat and vegetation integrity and therefore its members are not replaceable.

An SAII assessment has been undertaken for Cumberland Plain Woodland consistent with Section 9.1.1 of the BAM and with reference to the DPIE (2019) guideline '*Guidance to assist a decision-maker to determine a serious and irreversible impact'* (refer Table 7.1).

Table 7.1 Impact assessment provisions for threatened ecological communities at risk of an SAII

Requirement (refer Section 9.1.1 of BAM 2020)	Response
1. *The assessor is required to provide further information in the BDAR or BCAR regarding the impacts on each TEC at risk of an SAII. This must include the action and measures taken to avoid the direct and indirect impact on the TEC at risk of an SAII. Where these have been addressed elsewhere the assessor can refer to the relevant sections of the BDAR and BCAR.*	Good/moderate quality Cumberland Plain Woodland [CPW] (Zone 1) has been retained in-situ. The precautionary principle has been applied and as such any vegetation in Zone 1 that falls within 20m (0.05ha) of the proposed footprint has an assumed loss of 25% loss of understorey and ground cover. This is precautionary and the impact is actually expected to be less. This patch of CPW is small and isolated and the proposed development will not further fragment this community. A total of 0.86 ha of low quality (VI Score 12.1) CPW (derived grassland – Zone 2) will be removed. Due to the current management regime (cattle grazing/frequent slashing) and high weed occurrence, derived grassland CPW does not provide connectivity to other patches of CPW within the locality. And is of low biodiversity significance.
2. *The assessor must consult the TBDC and/or other sources to report on the current status of the TEC including:*	
a. *evidence of reduction in geographic distribution as the current total geographic extent of the TEC in NSW AND the estimated reduction in geographic extent of the TEC since 1970 (not including impacts of the proposal)*	As per the TBDC: Before European settlement CPW was extensive across the Cumberland Plain (western Sydney). Today, only 9% of the original extent remains intact, with the remnants scattered widely across the Cumberland Plain. As per the Final Determination (NSW Scientific Committee, 2009): *Cumberland Plain Woodland is restricted to the Sydney Basin Bioregion (sensu Thackway and Cresswell) and is currently known to occur within the local government areas of Auburn, Bankstown, Baulkham Hills, Blacktown, Camden, Campbelltown, Fairfield, Hawkesbury, Holroyd, Liverpool, Parramatta, Penrith and Wollondilly, but may occur elsewhere within the bioregion. Using map data from Tozer (2003), Cumberland Plain Woodland was estimated to occur within an extent of occurrence of 2810 km², and an area of occupancy of just under 2 100 km² based on 2 x 2 km grid cells.* *Based on aerial photography flown in November 1998, Tozer (2003) estimated the total extent of woody vegetation referred to as Cumberland Plain Woodland was 11 054 (±1 564) ha (upper and lower plausible bounds, sensu Keith et al.*

Requirement (refer Section 9.1.1 of BAM 2020)	Response
	2009), representing 8.8 (±1.2)% of the pre-European distribution of the community. Patches of the community lacking woody vegetation are very small in extent and can be considered to be included within the plausible bounds. For that part of the community's distribution to the east of the Hawkesbury-Nepean River, earlier mapping at coarser resolution by Benson & Howell (1990b) suggests a similar level of depletion, with an estimated 6 420 ha of 'Cumberland Plain Woodlands', representing 6% of the pre-European distribution east of the Hawkesbury-Nepean River. An update of Tozer's (2003) map, based on interpretation of imagery flown in January-March 2007 shows that the extent of Cumberland Plain Woodland east of the Hawkesbury – Nepean River had declined by 442±46 ha, a reduction of 5.2±0.6% in 9 years (NSW Scientific Committee & Simpson 2008). These estimates indicate that the geographic distribution of the community has undergone a very large reduction over a time frame appropriate to the life cycle and habitat characteristics of its component species. *The reduction in the geographic distribution of Cumberland Plain Woodland was initially due to tree-felling for timber and clearing for crops and pastures (Benson & Howell 1990a). Benson & Howell (1990b) estimated that the community had been reduced to approximately half of its pre-European extent by 1850. Following World War II, there was a marked acceleration in urban and industrial development, which continues to deplete the distribution of the community to the present day. These trends appear likely to continue into the future as the urban area continues to expand to accommodate Sydney's increasing population, which is projected to grow by 1.0-1.1 million people during the 20 years 2007-2026 and 2.2-3.3 million during the 50 years 2007-2056 (Australian Bureau of Statistics 2008). Recent draft plans to develop growth centres in north-west and south-west Sydney, for example, identify staged release of land for residential and employment development over the next 25 years. These areas contain approximately 2000 ha (one-fifth) of the estimated remaining Cumberland Plain Woodland based on Tozer (2003), of which about two-thirds will be available for development, the loss of which is planned for offsetting through voluntary land acquisition and/or the establishment of conservation agreements on lands outside the Growth Centres (Growth Centres Commission 2007) for the primary purpose of biodiversity conservation.*

Requirement (refer Section 9.1.1 of BAM 2020)	Response
b. extent of reduction in ecological function for the TEC using evidence that describes the degree of environmental degradation or disruption to biotic processes by: *i. change in community structure* *ii. change in species composition* *iii. disruption of ecological processes* *iv. invasion and establishment of exotic species* *v. degradation of habitat,* *vi. fragmentation of habitat*	The Final Determination (NSW Scientific Committee, 2009) notes that CPW has been subject to significant clearing fragmentation, burning, thinning and grazing which has resulted in a substantial reduction in ecological function. Changes in structure contribute to a significant reduction in the ecological function of CPW, with almost all of the remaining area of the community is regrowth forest and woodland from past clearing activities. CPW also includes 'derived' native grasslands which result from removal of the woody strata from woodlands and forests. Weed invasion also poses a major threat to CPW, while grazing by livestock and rabbits results in the decline and disappearance of palatable plant species, including shrubs and herbs, and compaction and erosion of topsoil. Remaining areas of CPW are severely fragmented, with half of all mapped patches of CPW being < 3 ha. The integrity and survival of small, isolated stands of CPW is impaired by the small population size of many species, enhanced risks from environmental stochasticity, disruption to pollination and dispersal of fruits or seeds, and likely reductions in the genetic diversity of isolated populations.
c. evidence of restricted geographic distribution, based on the TEC's geographic range in NSW according to the: *i. extent of occurrence* *ii. area of occupancy, and* *iii. number of threat-defined locations*	Cumberland Plain Woodland is restricted to the Sydney Basin Bioregion with an estimated extent of occurrence of 2810 km², and an area of occupancy of approximately 2 100 km². Only small areas of CPW occur within the reserves system; areas of CPW in private land are at continued threat from development, weed invasion, grazing, urban heat effects, Bell Miner associated dieback, pest animals (cats and foxes), mowing and disturbance.
d. evidence that the TEC is unlikely to respond to management	The TBDC indicates CPW has a very poor likelihood of a response to management (scores of zero).
3. Where the TBDC indicates data is 'unknown' or 'data deficient' for a TEC for a criterion listed in Subsection 9.1.1(2.), the assessor must record this in the BDAR or BCAR.	n/a - CPW is not noted as 'data deficient' in the TBDC.
4. In relation to the impacts from the proposal on the TEC at risk of an SAII, the assessor must include data and information on:	
a. the impact on the geographic extent of the TEC (Principles 1 and 3) by estimating the total area of the TEC to be impacted by the proposal:	The small stand of CPW will be retained in the development by inclusion within open space in proposed section of Pinnacle Park. This vegetation will not be

Requirement (refer Section 9.1.1 of BAM 2020)	Response
i. in hectares, and *ii. as a percentage of the current geographic extent of the TEC in NSW.*	directly impacted. Edge effects have been assumed and a reduction of CPW values has been accounted for in the BAM-C with a 25% loss in understorey and ground cover (precautionary principle) assumed within a 20m buffer. On this basis no direct impacts to woody CPW would occur and any reduction in values via edge effects is negligible in terms of the current geographic extent of CPW in NSW. Similarly, the loss of 0.86 ha of CPW as low condition derived grassland which lacks any woody vegetation is negligible in terms of the current geographic extent of CPW in NSW, which is unlikely to capture low condition derived grasslands at a meaningful scale.
b. the extent that the proposed impacts are likely to contribute to further environmental degradation or the disruption of biotic processes (Principle 2) of the TEC by: *i. estimating the size of any remaining, but now isolated, areas of the TEC; including areas of the TEC within 500 m of the development footprint or equivalent area for other types of proposals* *ii. describing the impacts on connectivity and fragmentation of the remaining areas of TEC measured by:* • *distance between isolated areas of the TEC, presented as the average distance if the remnant is retained AND the average distance if the remnant is removed as proposed, and* • *estimated maximum dispersal distance for native flora species characteristic of the TEC, and* • *other information relevant to describing the impact on connectivity and fragmentation, such as the area to perimeter ratio for remaining areas of the TEC as a result of the development* *iii. describing the condition of the TEC according to the vegetation integrity score for the relevant vegetation zone(s) (Section 4.3). The assessor must also include the relevant composition, structure and function condition scores for each vegetation zone.*	The proposed development would result in the loss of 0.86 ha of poor-quality derived grassland, in addition to potential for a minor increase in edge effects on the existing small stand of CPW which will be retained in open space within proposed Lot 700. Edge effects are already existing to retained CPW and it is anticipated that substantial further degradation of this community would be unlikely within an urban context, and where weeds will be actively managed and controlled. Areas of woody CPW mapped within 500m of the site are scattered, fragmented and small in area. The proposal has no potential to impact any of these areas. A disturbed areas of woody CPW occurs in the far east of the site and will be retained in-situ and rehabilitated as part of a green corridor (refer to VMP prepared by AWC, 2021). The patch of CPW (derived grassland) within the site is isolated from other patches of the community. The derived grassland at the site is of such low quality, it is not considered to provide connectivity to vegetation east of the site. Currently no genetic mixing of tree and shrub species is occurring throughout derived grassland at the site. A 360m stretch of derived grassland and exotic grassland exists between two patches of good/moderate quality CPW. Following development of the site, seed dispersal of native grasses would still occur within these communities via local vectors. As noted, derived grassland (to be removed) was allocated a very low VI score of 12.1 in the BAM-C, based on the following 'sub' scores:

Requirement (refer Section 9.1.1 of BAM 2020)	Response
	• composition: 43.1 • structure: 41.5 • function: 0 These values clearly demonstrate the low condition of this community and its reduced biodiversity values. The woody stand of CPW to be retained was allocated a VI score of 56.1 in the BAM-C, based on the following 'sub' scores: • composition: 84.1 • structure: 31.8 • function: 66 All of the CPW that falls within the direct impact area comprises derived grassland, with an absent canopy and understorey. The ground cover comprises a mixture of native and exotic grasses including (*Bothriochloa macra, Cynodon dactylon, Enteropogon acicularis, Plantago lanceolata*, Setaria parviflora*, Paspalum dilatatum*, Sporobolus creber*). Of the seven most abundant species present within the derived grassland, only four are native and of these only two are characteristic of CPW, as listed in the Final Determination and none are characteristic of PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion. The average ground cover vegetation cover within the derived grassland is 79%. The most abundant species (*Cynodon dactylon, Enteropogon acicularis*), which comprise an average cover in the derived grassland of 60% are not characteristic of CPW or PCT 849. Of all of the 51 species recorded within the derived grassland, only four are characteristic of PCT 849 and make up an average 0.5% cover over both plots. Additionally, species characteristic of CPW (final determination) only comprise an average cover of 7.4% over the two plots. With such a low level of characteristic species, the community would not provide connectivity between the patch of good/moderate CPW on the site and other patches of better quality CPW east of the site. If management of the land is to continue as it currently is, it is expected that weed invasion within the derived grassland will continue to increase, until the community has transitioned into exotic grassland.
5. The assessor may also provide new information that demonstrates that the	n/a

Requirement (refer Section 9.1.1 of BAM 2020)	Response
principle identifying that the TEC is at risk of an SAII is not accurate.	

7.3.2 Impacts which require an offset

Impacts associated with PCT 849 and the scattered tree require offset under the BAM. The removal of habitat for the following species (Species Credit Species) requires offsetting under the BAM.

- *Dilwynia tenuifolia*
- *Pterostylis saxicola*
- *Pultenaea pedunculata*.

Further details regarding offsets are included in Section 8.

8 Final Credit Calculations

8.1 Ecosystem Credits

Ecosystem credits required to offset the impacts of the proposal are provided in Table 8.1.

Table 8.1 Ecosystem Credit Summary

PCT	Zone	Area (ha)	Credits
849	1 – CPW_Moderate	0.05	1
849	2 – Derived_grassland	0.86	0
		TOTAL	**1**

8.2 Species Credits

Species credits are calculated for species observed onsite or assumed present and require offsetting due to the proposal (refer Table 8.2).

Table 8.2 Species Credits

Species	Area	Credits
Dilwynia tenuifolia	0.05	1
Pterostylis saxicola Sydney Plains Greenhood	0.05	1
Pultenaea pedunculata Matted Bush-pea	0.05	1
	TOTAL	**3**

8.3 Scattered Tree Assessment

Three isolated ('scattered') trees will be removed from within the exotic grassland. Credits required for the loss of these trees are included in Table 8.3.

Table 8.3 Scattered Tree Credit requirements

PCT	Contains hollows	Number of trees	Ecosystem Credits
849	True	1	1
849	False	2	2
		Total	**3**

*HBT = Hollow Bearing Tree

8.4 Credit Costs

The total cost of credits are to be advised by the Biodiversity Conservation Trust (BCT) should the BCT be used to offset the impacts. The proponent may also wish to purchase credits available on the market or may wish to pursue other offset sites as required.

BAM-C outputs are provided at Appendix F.

9 Statutory Assessment

9.1 Introduction

The proposal has been examined in the context of the following environmental legislation (discussed at Sections 9.1.1 - 9.1.6 and Section 9.2):

- *The Environmental Planning and Assessment (EPA) Act 1979:*
  - *SEPP Coastal Management 2018*
  - *SEPP Koala Habitat Protection 2021*
- *The Biodiversity Conservation Act 2016,*
- *The Fisheries Management (FM) Act 1994,*
- *The EPBC Act 1999.*

9.1.1 Environmental Planning and Assessment Act 1979

The proposal is designated development under Part 4 of the *Environmental Planning and Assessment Act 1979* and requires an approval under the *Protection of the Environment Operations Act 1997.* Tests of Significance under Part 1, Section 1.7 of the *EP&A Act 1979* are not required for those threatened species having potential to be impacted. As the works trigger the BAM thresholds the proponent has applied the Biodiversity Offsets Scheme and a BDAR has been prepared.

9.1.2 SEPP Coastal Management 2018

The site is not within the coastal zone and as such the Policy does not apply.

9.1.3 SEPP Koala Habitat Protection 2021

State Environmental Planning Policy (Koala Habitat Protection) 2021 was made and commenced on 17 March 2021. The Koala SEPP 2021 reinstates the policy framework of SEPP Koala Habitat Protection 2019 to 83 Local Government Areas (LGA) in NSW. At this stage:

- In nine of these LGAs – Metropolitan Sydney (Blue Mountains, Campbelltown, Hawkesbury, Ku-Ring-Gai, Liverpool, Northern Beaches, Hornsby, Wollondilly) and the Central Coast LGA – Koala SEPP 2021 applies to all zones.
- In all other identified LGAs, Koala SEPP 2021 does not apply to land zoned RU1 Primary Production, RU2 Rural Landscape or RU3 Forestry.

The City of Penrith is not an LGA listed in Schedule 1 of the Policy; therefore the Policy does not apply.

9.1.4 Biodiversity Conservation Act 2016

The BAM is triggered due to the following attributes: There is Biodiversity Values Mapping present on the site (within the impact area). The Biodiversity Assessment Methodology (BAM) has been applied to determine credit requirements.

9.1.5 Fisheries Management Act 1994

The *FM Act 1994* lists a number of threatened species, populations and communities and lists a number of Key Threatening Processes (KTPs). Section 220ZZ of the *FM Act 1994* lists the factors requiring consideration when determining whether a proposed action (development) is likely to have a significant effect upon threatened species, populations or ecological communities, and their habitats, therefore determining if a SIS is required (as also required under Section 5C of the *EPA Act 1979*). An Assessment of Significance under the *FM Act* is not required as:

- No threatened species, populations or ecological communities and their habitats occur or would be likely to occur at the site; and
- The proposal is not characteristic of any KTP.

The proposed development is not within an area mapped as Key Fish Habitat.

9.2 Commonwealth

9.2.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act considers nine matters of national environmental significance (MNES):

- World heritage properties
- National heritage places
- Wetlands of international importance ('Ramsar' wetlands)
- Nationally threatened species and ecological communities
- Migratory species
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- Nuclear actions (including uranium mining)
- A water resource, in relation to coal seam gas development and large coal mining development.

Under the EPBC Act, actions that have, or are likely to have, a significant impact on a matter of national environmental significance (MNES) require approval from the Australian Government Minister for the Environment (the Minister). Based on the search results and site assessment, no significant impacts to any MNES would be likely to result from the proposal (refer to Table 9.1), therefore referral to the Minister for the Environment is not required.

Table 9.1 Assessment of MNES

MNES	Impact
Any impact on a World Heritage property?	
One World Heritage Properties (Greater Blue Mountains Area) occurs within a 5km radius of the site. This site would not be impacted by the proposal.	Nil
Any impact on National heritage places?	
One National Heritage Place (The Greater Blue Mountains Area) occurs within a 5km radius of the site. This site would not be impacted by the proposal.	Nil
Any impact on wetlands of international importance?	
No wetlands of international importance occur within five kilometres of the site.	Nil
Any impact on nationally threatened ecological communities?	
Eight listed Threatened Ecological Communities (TEC) occur in the locality: • Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion • Coastal Swamp Oak Forest of the NWS and SEQ • Cooks River/Castlereagh Ironbark Forest of the Sydney Bioregion • Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest • River-flat eucalypt forest on coastal floodplains of southern NSW and eastern Vic • Shale Sandstone Transition Forest of the Sydney Basin Bioregion • Upland Basalt Eucalypt Forest of the Sydney Basin Bioregion • Western Sydney Dry Rainforest and Moist Woodland on Shale. Cumberland Plain Woodland (CPW) occurs within the development footprint; this patch comprises 0.86 ha of derived grassland. All of the CPW that falls within the direct impact area comprises derived grassland, with an absent canopy and understorey. The ground cover comprises a mixture of native and exotic grasses including (*Bothriochloa macra, Cynodon dactylon, Enteropogon acicularis, Plantago lanceolata*, Setaria parviflora*, Paspalum dilatatum*, Sporobolus creber*). Of the seven most abundant species present within the derived grassland, only four are native and of these only two are characteristic of CPW, as listed in the Final Determination. A small patch of woodland occurs in the very north of the site, within the proposed Pinnacle Park. In the woodland the understory and ground cover is highly degraded with many exotic species and tracks trampled by cattle. This section will be retained in situ.	Negligible
Any impact on nationally threatened ecological species?	
Search results indicate potential habitat for 43 threatened species occurs within a 5km radius of the site. The following species were recorded or have the potential to occur on site: • Grey-headed Flying-fox (records) • Large-eared Pied Bat (recorded). The proposed development will not have a significant impact on these species due to the minor habitat loss required and the retention of better quality habitat.	Negligible
Any impact on migratory species?	
Search results indicate potential habitat for 16 threatened species occurs within a 5km radius of the site. One listed migratory species (Rufous Fantail) was recorded; several other migratory species have potential to occur on an opportunistic and seasonal basis. Habitat loss arising from the proposal would not affect any migratory species based on the extent of habitat in the locality and the minor nature of the proposal.	Nil
Any impact on Commonwealth marine areas?	
No Commonwealth marine areas occur within 5 km of the site.	Nil
Any impact on the Great Barrier Reef Marine Park?	

MNES	Impact
Not applicable.	Nil
Does the activity involve a nuclear action (including uranium mining)?	
The activity does not involve a nuclear action.	Nil
Any impact on a water resource from coal seam gas development or a large coal mining development?	
Not applicable.	Nil

10 References

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Appendix A – CVs

Jacqui Coughlan

Principal Ecologist

Capabilities

- Biodiversity survey and assessment
- Ecological impact assessment
- Field survey design, coordination & implementation
- Peer review of ecological assessments
- Preparation of Management Plans
- Monitoring and Research
- Provision of expert advice in the Land and Environment Court

Qualifications / Training

- Bachelor of Science (Hons Freshwater Ecology) (James Cook University, 1989)
- PhD Bird Ecology (James Cook University, 2000)
- Graduate Diploma Environmental Law (Sydney University, 2009)

Professional Experience

Jacqui's practical ecological skills in terrestrial and freshwater ecology have been developed over 30 years in several states. She has conducted and managed numerous fauna and flora surveys and impact assessments (EIS, SIS, SEE, REF) in New South Wales, ACT, Queensland and Western Australia and has a thorough working knowledge of State and Commonwealth environmental legislation.

She has a broad knowledge base of ecological issues and is able to provide clients with sound and practical advice regarding environmental legislation and assessment protocols. She is a committed environmental professional with 25+ years' experience in the industry. Her depth and breadth of knowledge is extensive, covering both terrestrial and aquatic flora and fauna. Jacqui has worked in a broad range of sectors including residential development, energy (coal, LNG, wind, solar, transmission lines), extractive industry, water and sewerage, transport (roads, rail), Defence and Local Government.

Jacqui provides high level technical advice and peer review for ecological projects. In her various roles as ecology team manager, Jacqui has been responsible for recruitment, resourcing, workload management, coordinating tenders, performance reviews and training, mentoring, coordination of interstate resources and staff.

From 1992 to 2000 Jacqui worked as an ecological consultant for the Australian Centre for Tropical Freshwater Research (ACTFR) and Sinclair Knight Merz (SKM) in north Queensland working on projects from Townsville north to Cape York and west to Mt Isa as well as offshore islands and Western Australia. This included dozens of REFs for Queensland Department of Main Roads and flora and fauna assessments for optic fibre cables, power lines, sand extraction, marinas and boat ramps. Jacqui has conducted ecological surveys and reporting on Curtis Island (off Gladstone) and Keswick Island (off Mackay).

Key Projects - Renewable Energies - Wind / Solar Farms

› Jacqui is the Department of Planning Approved Expert for implementation of bird and bat monitoring for the Gullen Range and Boco Rock Wind Farms in NSW. She has prepared and implemented several Bird and Bat monitoring programs including threatened species monitoring and agency liaison.

› UPC Renewables. Central Highlands Energy Zone and Stubbo solar farm. Design BAM biodiversity assessments for 5000 ha solar hub and wind farm. Client liaison to inform layout as results emerged.

› Wind Prospects. Boco Rock Wind Farm – Department of Planning approved expert for implementation of post construction monitoring program. Preparation of adaptive Bird and Bat Management Plans and monitoring program, liaison with OEH, establishment of baseline monitoring sites and bird surveys with OEH personnel. Expert peer review of monthly reports and annual report.

› Goldwind. Gullen Range Wind Farm. Preparation of Bird and Bat Adaptive Management Plan. Expert technical advice – birds and bats. preparation of Powerful Owl Management plan and implementation of Powerful Owl monitoring and management plans, liaison with OEH, large scale surveys to determine Powerful Owl population, regular monitoring of onsite powerful owl breeding pair to assess risk.

› Epuron. Liverpool Windfarm Biodiversity Assessment. Project Director, field work, reporting, client liaison. Options assessment of 4 transmission line route options and placement of 270 turbines. Jacqui managed large field team and undertook field work and reporting.

› Epuron. Silverton Wind Farm. Targeted surveys for threatened Tawny Rock Dragon on the Barrier Range, western NSW as part of impact assessment studies for large wind farm.

› Bird Surveys and Impact Assessment for proposed wind farm in Xilinhot, Inner Mongolia, China. Jacqui designed and conducted bird and habitat surveys for an approved wind farm in Inner Mongolia according to AUSWEA standards. She led a team in the field including local experts and interpreters and driver and was responsible for all analyses and reporting. International client required assessment for financial investment decision.

› Origin Energy. Cullerin Range Wind Farm – Design and implementation of Bird and Bat Monitoring program to meet conditions of approval. Jacqui was responsible for conducting and managing bird and bat surveys, carcass searches and reporting in order to assess impacts of operational wind farm on birds and bats.

› Ratch Australia Corporation (RAC). Collector Wind Farm. Strategic advice and liaison with OEH regarding offsets.

› AGL. Nyngan Solar Farm (102MW). Biodiversity assessment including assessment of potential impacts to threatened bird species Grey-crowned Babbler.

Key Projects - Roads & Linear Infrastructure

› Transport for NSW – review and update of Vegetation Offset Guidelines (2016).

› RTA/RMS. Biodiversity Guidelines. Jacqui was the lead author of the RMS (2011) Best Practice Guidelines - Protection of Biodiversity During Construction and Maintenance on RTA projects.

› Lend Lease /Bilfiinger Berger/ Conneq – Long term monitoring of Squirrel Glider population (2008 to 2013) to determine impacts of Hume Highway Albury. Landscape scale assessment of population impacts.

› RTA. Camden Valley Way Ecological Assessment (REF) for widening of 10 km stretch of road. Bird and bat surveys, hollow bearing tree assessment, clearing supervision. Surveys, assessment and reporting of potential impacts for EPBC referral.

› RTA/Blake Dawson Waldron – Land and Environment Court expert witness – fauna ecology. Preparation of Statement of Evidence, joint conferencing and court appearance.

› NSW Roads and Traffic Authority. An investigation of the movements of Koalas in relation to major roads in north-east New South Wales (Buladelah to Coolongolook, Yelgun to Chinderah, Raleigh, Brunswick Heads). - Project Management, field work, koala capture, radio tracking, client liaison, meetings, presentations, monitoring reports.

› Queensland Hunter Gas Pipeline Biodiversity Survey and constraints analysis of proposed pipeline corridor (>600km). Coordination of large field team, vertebrate fauna survey, analyses reporting and impact assessment.

Key Projects - Residential Development

› Wakefield Ashurst Developments – Ecological impact assessment for 100 ha Mawsons Ridge site. Threatened species issues included Tetratheca juncea, Callistemon linearifolius, Rhodamnia rubescens, powerful owl, squirrel glider and microbats. All field surveys and reporting, engagement of specialist subconsultants, liaison with Lake Macquarie City Council and OEH.

› Wakefield Ashurst Developments – Ecological impact assessment for 40 ha Swansea Valley site. Threatened species issues included Diuris praecox, Cryptostylis hunteriana, masked owl, squirrel glider. All field work and reporting, engagement of specialist subconsultants, liaison with Lake Macquarie City Council and OEH.

› Stockland Developments. Breeding season surveys for Masked, Powerful and Sooty Owls over two years to document and map all breeding habitat and resident owls. Annual Reporting. Preparation of expert advice in relation to presence of Masked Owl on Wallarah Peninsula. Liaison with national owl experts.

› Stockland Developments. Preparation and implementation of 10 year Masked Owl Management Plan and monitoring program. Responsible for all monitoring and reporting.

› Stockland Developments. Preparation of multiple Section 96 amendments under Environmental Planning and Assessment Act 1979 for proposed residential developments on Wallarah Peninsula.

› Stockland Developments. Preparation of Species Impact Statement for a proposed residential and commercial development on a 120 hectare site in Jervis Bay, NSW (Vincentia/Bayswood). Threatened species included Eastern Bristlebird, Ground Parrot, Yellow-bellied Glider, Glossy Black Cockatoo, Prasophyllum affine, Cryptostylis hunteriana

Key Projects - Defence

› Department of Defence. Kangaroo Management Plans – Defence Establishment Orchard Hills and HMAS Creswell (strategic advice, field work, review and client liaison).

› Department of Defence. Garden Island Western Australia (Fleet Base West). Jacqui undertook field and desktop surveys of the flora and fauna of Garden Island for input to Defence Heritage Management Plan as required to fulfil Defence's obligations under the EPBC Act 1999. The site is listed on the Register of the National Estate and the Commonwealth Heritage Register.

› Department of Defence. Baseline fauna assessment for a 220 hectare site within the Holsworthy Military area. Fauna survey for all terrestrial vertebrate fauna groups. Liaison with botanists at Wollongong University who were concurrently mapping vegetation of the area.

Affiliations / Memberships

› Birdlife Australia (formerly Birds Australia and RAOU) since 1991

› Australasian Network for Ecology and Transportation (ANET) since 2013

› Environment Institute of Australia and New Zealand (EIANZ)

› Royal Zoological Society of New South Wales (RZS)

Hannah Reid

Senior Ecologist

Capabilities

› Flora and fauna field surveys

› Targeted threatened species surveys

› Statutory ecological assessments and reports

› Scientific and environmental research and writing

› Natural resource analysis and management

› Statutory ecological assessments

› GIS desktop analysis, mapping and data management

› Water quality and soil sampling

› Project management

Qualifications / Training

› B Sci (Double Major - Biology & Marine Science) – University of Sydney 2012

› M EnvSci (University of Sydney, 2014)

› Accredited Assessor under the *Biodiversity Conservation Act 2016*

Professional Experience

Hannah has over 7 years experience in ecology and environmental consulting working extensively throughout New South Wales and Queensland. During this time Hannah has developed a broad range of professional skills including broad scale ecological assessments, targeted flora and fauna surveys, threatened species management and environmental monitoring.

Hannah has also been involved in preparing numerous reports for development approval submissions. These projects have required collaborative partnerships with council staff, heritage consultants, bushfire specialists, environmental scientists, engineers, developers and town planners.

Combining her experience working with and managing project teams, Hannah brings a strong suite of skills to best enable clients and project partners to deliver sustainable environmental solutions.

Key Projects

› Burnum Burnum Review of Environmental Factors (REF) - Environmental assessment for proposed boat ramp, car park and wetland upgrade

› South Golden Beach Review of Environmental Factors (REF) - Environmental assessment for proposed urban drainage and vegetation removal

› Port Macquarie Rural Subdivision - Threatened flora and fauna surveys, vegetation community mapping, Assessments of Significance, GIS mapping and report preparation

› Koala Plan of Management (KPoM) - SAT surveys, field assessments and spotlighting, mitigation measure development, Assessment of Significance and report preparation

› Proposed Quarry Development - Intensive field surveys including targeted frog surveys, Elliot and pitfall trapping, PIR camera trapping, visual and acoustic bird surveys, and call playbacks

› Carbon Farming Initiative - Detailed threatened species surveys, vegetation biomass and weed mapping surveys throughout western and northern NSW

› Aviation Wildlife Hazard Management Plans - Various Population Management Reports and associated trapping, baiting and pest dispersal field work

DR JAMES SCHLUNKE

4 Bedford Street Earlwood NSW 2206 | 0429198660 | james.schlunke@axisecological.com.au | ABN: 27720918015

I am a botanist and ecologist with over ten years of experience flora and fauna surveys throughout NSW, for both consulting and ecological research. My primary area of expertise is in botany, and I have extensive experience in plant and community identification, vegetation mapping, threatened species survey and analysis of plant community data using multivariate statistical techniques. I have experience throughout NSW, primarily in the Sydney, Hunter, Southern Highlands, South-west Slopes and Nandewar Range regions, with experience also in the Southern Tablelands and ACT, Central-western Plains and Murray. I have experience in a range of fauna survey techniques and field identification of vertebrate fauna, particularly birds and frogs. I have a background in bush regeneration and have a working knowledge of practical restoration ecology techniques and approaches. I am proficient in a range of statistical analysis techniques, including using the R statistical package. I have a working knowledge of invertebrate fauna and have a solid background in sampling, identification, and field experimentation with ants through my BSc (Hons) and PhD research. I am a BAM Accredited Assessor and a member of the NSW Ecological Consultants Association.

WORK EXPERIENCE

Axis Ecological Services (formerly James Schlunke Ecological Surveys)

Principal botanist/ecologist (sole trader) **2016-ongoing**

Since January 2016 I have operated as a sole trader botanist and ecologist. I have worked on a broad range of ecological projects across NSW, including:

- Extensive vegetation surveys (166 full-floristic vegetation plots) within the Wollondilly local government area for a Saving Our Species Koala monitoring and vegetation mapping project, for the Wollondilly Shire Council and NSW Office of Environment and Heritage;
- Extensive vegetation surveys (over 300 rapid and full-floristic plots) within the Wingecarribee local government area for a Saving Our Species Koala monitoring and habitat mapping project for the NSW Office of Environment and Heritage, Wingecarribee Shire Council and USyd;
- Population assessment surveys, production and implementation of of monitoring plans for several threatened plant species under the Saving Our Species program for Office of Environment and Heritage
- Landholder liaison, conducting site surveys and producing site values reports and Voluntary Conservation Agreements for the NSW Biodiversity Conservation Trust.
- Ecological monitoring (both flora and fauna) of numerous offset properties in the Northern Tablelands and North-west Slopes bioregions for AMBS Ecology and Heritage;
- Targeted threatened flora and fauna, due diligence, vegetation mapping and BioBanking assessment/BAM surveys for a range of projects across NSW for AMBS Ecology and Heritage;
- Baseline data collection for an ecological thinning trial within River Red Gum forests for the NSW Office of Environment and Heritage;
- Impact assessment surveys and report preparation, BioBanking and BAM impact and offset site surveys, and pre-clearance surveys for NGH Environmental;

- Flora and fauna assessment surveys, targeted threatened flora surveys, BioBanking and BAM assessment surveys, Kangaroo population estimation surveys (DISTANCE method), and report preparation for Ecoplanning;
- Threatened species and vegetation mapping surveys for EcoFocus Environmental Consulting;
- Monitoring of mine site rehabilitation for Koru Environmental;
- BAM and threatened flora surveys as part of the Snowy Hydro 2.0 project for EMM consulting; and
- Invertebrate sampling and identification as part of biodiversity monitoring of urban bushland reserves for Ryde Shire Council.

Australian Museum Consulting (now AMBS Ecology and Heritage)

Botanist/fauna ecologist (casual) **2013-2015**

I worked on a range of flora and fauna projects while completing my PhD, including:

- Extensive plant community data collection for remote vegetation mapping projects for NSW Office of Environment and Heritage, in the Central Western Plains, Southern Tablelands and South-west slopes bioregions, including the Hay Plains, Matakana mallee, Lachlan River-associated communities and Murray/Murrumbidgee sub-regions.
- Ecological monitoring (flora and fauna) of Biobanking offset properties in the Northern Tablelands and North-west Slopes bioregions; and
- Preparation of impact assessment reports for projects in the Sydney region.

Biosphere Environmental

Fauna ecologist (sub-contractor) **2012-2015**

I worked on a multi-year monitoring project tracking impacts of coal mining activities on the state and nationally listed Great Barred Frog (*Mixophes iteratus*) near Stroud NSW. This consisted of detailed population and habitat data collection, including frog microchipping.

Cumberland Ecology

Botanist/ecologist (casual) **2010-2014**

I continued to work for Cumberland Ecology for around 4.5 years as a casual ecologist while completing my PhD. In this role I was lead botanist on dozens of field surveys throughout NSW, particularly in the Sydney, Hunter Valley, North-west Slopes and Northern Tablelands regions. Projects have included community description, vegetation mapping and targeting threatened species searches. Much of this work has had a focus on the nationally listed Grassy Box Woodlands CEEC and associated communities of these regions. I have also carried out a number of fauna surveys in NSW and Queensland on a variety of vertebrate fauna groups.

University of Sydney

Lab/field Demonstrator **2010-2014**

I demonstrated in several undergraduate courses while completing my PhD, including *Australian Flora: Ecology and Conservation, Entomology* and *Terrestrial Field Ecology*. This has included providing lab instruction in identification of plants and insects and plant communities, and field instruction in a variety of sampling techniques for flora and fauna. I have also given lectures on ecological consultancy as part of the *Masters of Environmental Science* degree.

Cumberland Ecology

Botanist/ecologist/project manager (full-time) **2008-2010**

In this role I further developed my botanical survey, plant identification and vegetation mapping skills, conducting many surveys primarily within the Sydney and Hunter Valley regions of NSW, working in a range of vegetation communities. I also managed a range of projects, including production of impact assessment reports (7-part tests, EPBC referrals and Species Impact Statements) and Bushland Management Plans. I also produced numerous

Kangaroo Management Plans for Department of Defence, incorporating long-term monitoring of effects of kangaroo grazing on plant community composition. I also developed a working knowledge of NSW and Commonwealth biodiversity conservation legislation.

National Trust of Australia
Bush regenerator **2007, 2010**
As a bush regenerator I developed plant identification skills and an understanding of plant communities in the Sydney region, working within a number of plant communities. I also developed a competency in the conceptual and practical process of bushland rehabilitation, including a variety of weed management techniques.

Bush Habitat Co-operative
Bush regenerator **2009**
Further bush regeneration, primarily in the East and Inner-west of Sydney.

EDUCATION

University of Sydney
Doctor of Philosophy (PhD)
Supervisors: Ass. Prof. Dieter Hochuli and Ass. Prof. Matthew Crowther. **2010-2015**

Thesis title: Disentangling the drivers of ant community composition: integrating structural, spatial and inter-specific competition at multiple scales. Submitted September 2015.
My project evaluated the strategy of using plant community surrogates (i.e. listed Threatened Ecological Communities) as a strategy for conserving cryptic fauna, using ants as a model system. This project was designed to utilize and compliment my existing skills in plant and invertebrate identification, while developing a range of new skills in multivariate analysis of community data in a range of statistical packages (including R), advanced survey techniques and analysis of spatial data using ArcGis. In this project I conducted extensive vegetation surveys in a variety of plant communities, including threatened ecological communities in the Sydney and South-west Slopes regions of NSW.

University of Sydney
Bachelor of Science (Honours Class I) **2004-2008**
I completed my science degree completed with a double biology major, focusing on ecology and zoology. For my Honours project I studied the impacts of natural regeneration of woodland on the process of ant-seed dispersal. This project encompassed a number of field survey and experimental procedures including ant pitfall trapping and application of burning treatments to buried seeds in the field.

OTHER RELEVANT QUALIFICATIONS

Current Remote First Aid certificate
RIIVEH305A 4wd certificate
QLD Blue Card (Green Card equivalent - valid for NSW)
Open Water Diver (PADI)

MEMBERSHIPS

Ecological Consultants Association of NSW
Birdlife Australia
Frog and Tadpole Study Group of NSW (FATS)

REFEREES

Belinda Pellow
Senior Botanist
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Katrina Wolf
Principal Ecologist
Cumberland Ecology
Email: katrina.wolf@cumberlandecology.com.au
Phone: 0405 615 350

Ian Colvin

Principal Ecologist

Capabilities

- Vegetation survey and mapping
- Threatened flora surveys
- Fauna survey and assessment
- Biodiversity Assessment reporting
- Statutory Assessment
- Biodiversity Development Assessment Reports (BDARs) – accredited BAM Assessor
- Review of Environmental Factors (REF) reports
- Koala Plan of Management (KPoM) reports
- Vegetation Management Plans

Qualifications / Training

- B App Sci (Southern Cross University, 2001)
- Biodiversity Assessment Methodology Accreditation (BAAS18055) – March 2018
- Certificate II Bushland Regeneration
- WHS Construction Induction Training Certificate
- Planning for Bushfire Prone Areas

Professional Experience

Ian commenced work as a consulting ecologist in 2004 and has worked extensively within northern NSW and south-east Queensland during this time. As an experienced ecologist, Ian has extensive knowledge and practice in vegetation mapping and assessment, flora and fauna surveys,biodiversity reporting and statutory assessment and has worked on numerous projects for infrastructure, development and environmental management projects.

Ian is highly experienced in report preparation, ranging from development applications and REFs through to management and mitigation plans. Since commencement of the *Biodiversity Conservation Act 2016*, Ian has prepared several Biodiversity Development Assessment Reports (BDARs) using the Biodiversity Assessment Method (BAM), as an Accredited Biodiversity Assessor.

Ian possesses high level project-management and liaison skills (including consultation with Councils and government agencies) and has managed multidisciplinary teams.

Key Projects

- Koala Plan of Management (KPoM), mitigation measure development Assessment of Significance and report preparation. Bluesfest Site Tyagarah, Bluesfest
- Biodiversity Conservation Management Plan (BCMP) West Byron Urban Release Area
- Vegetation Managment Plan, Bayside Brunswick Heads, Clarence Property
- Species Impact Statement for Clarence Valley Council for Stage 1 of the Yamba Bypass
- Targeted flora and fauna assessment for the rezoning of land at Skennars Head 'Aureus'

- Vegetation Management Plan for Lockyer Valley Regional Council for a dedicated offset site at Balaam Hills
- Flora and Fauna Assessment and Review of Environmental Factors for Stage 2 of the Yamba Bypass
- Detailed fauna assessment and reporting for the East Coast Blues and Roots Festival for the 2011, 2012 and 2013 events
- Koala Plan of Management for a residential subdivision at Goonellabah, NSW
- Preparation of acid frog management plan for a large scale residential development at Caloundra, Sunshine Coast
- Frog monitoring and reporting for Moreton Bay Regional Council for the AFL precinct at Burpengary, Sunshine Coast
- Nerang River Estuary Health Plan - vegetation assessment, mapping and reporting for Gold Coast City Council
- Coolangatta Creek Catchment Management Plan – vegetation assessment and reporting for Gold Coast City Council
- Frog monitoring and reporting for Moreton Bay Regional Council for the AFL precinct at Burpengary, Sunshine Coast
- Detailed ecological assessment for the West Byron Urban Release Area (including targeted survey for acid frogs, koalas and cryptic orchids)
- Flora and fauna assessment for Tipplers Hub re-development, South Stradbroke Island
- Flora and fauna assessment (including targeted Koala survey) at Helensvale Waste Transfer station for Gold Coast City Council
- Detailed ecological assessment for the Cumbalum (Precinct B) Urban Release Area, including detailed surveys for Hairy Jointgrass
- Wetland flora monitoring at compensatory habitat site for the Ballina Bypass
- Iluka Bay flora survey, habitat assessment and reporting (Review of Environmental Factors, Soil and Water Management Plan, Construction Environment Management Plan) for Clarence Valley Council
- Tugun Bypass – detailed weed survey and landscape assessment

Affiliations / Memberships

- Member, Ecological Consultants Association of NSW Inc (since 2013)
- Scientific Investigation Licence holder (DPIE) - authorised to carry out native fauna research (trapping and releasing).
- Animal Research Authority, Issued by Director-General of NSW Dept Primary Industries

Appendix B – Vegetation Plot Data

Bearing = 270° W

400 m² floristics plot:	Survey name	Plot identifier	Recorders
Date 19 / 2 / 2021	HV7 ~~8~~ 9	CPW1	JS + JC

	GF code	Species name Full species name, or a unique means of identifying separate taxa within a survey is mandatory. Data from here will be used to assign growth form richness and cover.	N, HTW or non-HTW	[2] Foliage cover	Abund-ance	Voucher	
1		Eucalyptus tereticornis	N	25	4		U
2		Eucalyptus crebra	N	1	5		~~U~~ M
3		Bursaria spinosa	N	10	500		M
4		Olea europea cuspidata	E	2	50		M
5		Lantana camara	E	0.2	3		M
6		Breynia oblongifolia	N	0.3	20		M
7		Hardenbergia violacea	N	0.1	3		M
8		Eucalyptus melucana	N	0.3	2		~~M~~ G
9		Oplismenus ~~undulatifolius~~ aemulus	N	~~1000~~	2,1000		G
10		Enchiton sphaericus	N	0.1	20		G
11		Eragrostis curvula	N	0.4	500		G
12		Oxalis perrenans	N	0.1	50		G
13		Eragrostis leptostachya	N	0.1	20		G
14		Carex inversa	N	0.1	50		G
15		Desmodium varians	N	0.1	2		G
16		Vernonia cinerea	N	0.1	20		G
17		Brunoniella australis	N	0.1	20		G
18		Senecio madagascariensis	E	0.1	50		G
19		Bidens subalternans	E	4	>1000		G
20		Cheilanthes sieb. sieb.	N	0.1	20		G
21		Sida ~~sp.~~ rhombifolia	E	0.1	50		G
22		Sigesbeckia orientalis orientalis	N	0.2	100		G
23		Setaria parviflora	E	6.2	100		G
24		Glycine tabacina	N	0.1	28		G
25		Commelina cyanea	N	0.1	20		G
26		Cyperus gracilis	N	0.1	50		G
27		Dichondra repens	N	0.1	50		G
28		Plantago lanceolata	E	0.1	20		G
29		Bidens pilosa	E	3	>1000		G
30		Paspalum dilatatum	E	1	500		G
31		Conyza sp.	E	0.1	6		G
32		Microlaena stip. stip.	N	2~~0~~	1000		G
33		Cirsium vulgare	E	0.1	1		G
34		Gomphocarpus fruticosus	E	0.1	1		M
35		Cynodon dactylon	N	0.2	50		G

Print more copies of this page to allow for higher species counts at a plot. All vascular plant species in a plot need to be recorded.

GF Code: see growth form definitions in BAM 2020 Appendix F. **N:** native, **HTW:** high threat weed.

[2] **Foliage cover:** 0.1, 0.2, 0.3, ..., 1, 2, 3, 4, 5, 10, 15, 20, 25, ...100%; Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately *1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m.* Note the top 3 dominant native species within each GF group.

* Plot running along fence - dissecting 20x20 into two halves. Grazed, shrubby section w/ surprisingly high native diversity, + ungrazed with very high cover of Rhodes Grass + other weeds.

400 m² floristics plot:	Survey name	Plot identifier	Recorders
Date 19 2 2021	HV7-9	CP1	JS + JC

GF code	Species name Full species name, or a unique means of identifying separate taxa within a survey is mandatory. Data from here will be used to assign growth form richness and cover.	N, HTW or non-HTW	[2] Foliage cover	Abund-ance	Voucher
	Lotus angustissimus	E	0.1	1	
	Medicla carolinicma	E	0.1	2	
	Euphorbia drummondii	N	0.1	3	
	Bothriochloa macra	N	0.1	20	
	Solanum sisymbriifolium	E	0.1	4	
	Urochloa panicoides	E	0.1	3	
	Enteropogon acicularis	N	0.1	20	
	Eriochloa pseudoatricha	N	0.1	20	
	Lomandra filiformis filiformis	N	0.1	2	
	Sporobolus creber	N	0.1	10	
	Chloris truncata	N	0.1	5	
	Wahlenbergia communis	N	0.1	20	
	Rumex brownii	N	0.1	4	
	Digitaria sanguinalis	E	0.1	3	
	Tricoryne elatior	N	0.1	5	
	Cymbonotus lawsonianus	N	0.1	2	
	Cyclospermum leptophyllum	E	0.1	1	
	Hydrocotyle sibthorpioides	N	0.1	1	
	Chloris gayana	E	5	500	
	Themeda triandra	N	0.2	20	
	Centella asiatica	N	0.1	6	
	Hypoxis hygrometrica	N	0.1	2	
	Hypochaeris albiflorus	E	0.1	2	
	Cenchrus clandestinum	E	0.3	20	
	Sonchus oleraceus	E	0.1	5	
	Aristida ramosa	N	0.1	2	
	Paspalidium distans	N	0.1	3	
	Desmodium (Oxytes) brachypodum	N	0.1	20	
	Hypochaeris radicata	E	0.1	1	
	Briza subaristata	E	0.1	2	
	Cyperus brevifolius	E	0.1	1	
	Taraxacum officionale	E	0.1	3	
	Arthropodium minus	N	0.1	6	
	Wahlenbergia gracilis	N	0.1	1	
	Sclevia macbarlenois	N	0.1	5	

Print more copies of this page to allow for higher species counts at a plot. All vascular plant species in a plot need to be recorded.

GF Code: see growth form definitions in BAM 2020 Appendix F. **N:** native, **HTW:** high threat weed.

[2] **Foliage cover:** 0.1, 0.2, 0.3, ..., 1, 2, 3, 4, 5, 10, 15, 20, 25, ...100%; Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately *1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m.* Note the top 3 dominant native species within each GF group.

400 m² floristics plot:	Survey name	Plot identifier	Recorders
Date 19 2 2021	HV 7-9	CPW1	JS + JC

	GF code	Species name Full species name, or a unique means of identifying separate taxa within a survey is mandatory. Data from here will be used to assign growth form richness and cover.	N, HTW or non-HTW	[2] Foliage cover	Abund-ance	Voucher
1		Aspevula conferta	N	0.1	10	
2		Hypericum gramineum	N	0.1	2	
3		Fimbristylis dichotoma	N	0.1	1	
4		Phyllanthus virgatus	N	0.1	2	
5		Verbonica plebia	N	0.1	2	
6		Chloris ventricosa	N	0.1	5	
7		Glycine microphylla	N	0.1	20	
8		Echinopogon ovatus	N	0.1	1	
9		Gomphrena celasioides	E	0.1	2	
10		Rytilospema racemosum subsp. racemosum	N	0.1	2	
11		Bromus catharticus	E	0.1	1	
12		Verbena bonariensis	E	0.3	20	
13		Cymbopogon refractus	N	0.1	3	
14		Araujia sericifera	E	0.1	1	
15		Ehrharta erecta	E	0.1	20	
16		Solanum pseudocapsicum	E	0.2	10	
17		Geranium solanderi solanderi	N	0.1	4	
18		Indigofera australis	N	0.2	2	M
19		Cyperus eragrostis	E	0.1	4	
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						

Print more copies of this page to allow for higher species counts at a plot. All vascular plant species in a plot need to be recorded.

GF Code: see growth form definitions in BAM 2020 Appendix F. **N:** native, **HTW:** high threat weed.

[2] **Foliage cover:** 0.1, 0.2, 0.3, …, 1, 2, 3, 4, 5, 10, 15, 20, 25, ...100%; Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately *1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m.* Note the top 3 dominant native species within each GF group.

Numbers [1-8] on this page correlate with the numbers and explanatory notes on page 3

Site sheet # 1 of **Date** 9/22/ **Survey name** HIGHLAND VIEWS HV7-9 **Plot identifier** GRASSLAND GRC1.

Recorders Jacqui C James Schlunke. **IBRA region** SYD BASIN **Veg zone ID**

[1]Datum **Coordinate system** ☐ Projected ☐ Geographic **MGA zone** **[1]X coordinate** **[1]Y coordinate**

Location description

[1] Plot dimensions **[1] Orientation of midline from 0 m point** 105°E 105°E **Photo #** JC iphone

Datum: AGD66, WGS84, GDA94, GDA2020 or Other (specify). **MGA Zone** (for Projected coordinate. system only): 56 (Coastal NSW), 55 (Central NSW or 54 (Western NSW). **X/Y coordinate**: Long/Lat (for Projected coordinate. system), Easting/Northing (for geographic coordinate. system)

Vegetation Integrity

Composition and structure sum values may be completed after entering data into available tools. It is not required while in the field

Composition (400 m² plot)		Sum values	**Structure** (400 m² plot)		Sum values (%) (may sum to >100%)	**Function** (1000 m² plot) **[3]Tree stem size class (DBH)**	If data are to be used as more appropriate local data i.e. to generate local benchmarks, stems must be counted
Total count of native plant species **(richness)** in each growth form group (not individual plants within each growth form)	Trees (TG)		Sum of **[2] foliage cover** of native plant species by growth form group	Trees (TG)		80 + cm	0
	Shrubs (SG)			Shrubs (SG)		50 – 79 cm	0
	Grasses etc. (GG)			Grasses etc. (GG)		30 – 49 cm	0
	Forbs (FG)			Forbs (FG)		20 – 29 cm	0
	Ferns (EG)			Ferns (EG)		10 – 19 cm	0
	Other (OG)			Other (OG)		5 – 9 cm	0
						[4]Tree regeneration <5 cm	
			Total high threat weed cover			[5] Length of fallen logs	
						[6] Hollow bearing trees	

Vegetation integrity - function cont. (five 1 m²) **plots)**	[7] Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	0 0 0 0 0			
Average of the 5 subplots				

These attributes require consideration of site observations and may be completed after field work:

Vegetation class **[8] Large tree benchmark size** 20/ 30/ 50/ 80 DBH Confidence H/ M/ L

Plant community type (PCT) **EEC** Tick Confidence H/ M/ L

Physiography and site features that may help in determining PCT and management zone (optional) or for BioNet systematic flora survey purposes:

Morphological type	Landform element	Landform pattern	Microrelief
Lithology	Soil surface texture	Soil colour	Soil depth
Slope	Aspect	Site drainage	Distance to nearest water and type

Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood, CWD removal		
Grazing (id. native/stock)		
Fire damage		
Storm damage		
Weediness		

Brief site description or other notes

Emergents heights			Upper stratum heights			Middle stratum heights			Lower stratum heights		
Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom

Numbers [1-8] on this page correlate with the numbers and explanatory notes on page 3

Site sheet # 1 of 2 **Date** 19/12/21 **Survey name** GR2 **Plot identifier** GR2

Recorders Jacqui C James Schumacher **IBRA region** SYD BASIN **Veg zone ID** grassland

[1]**Datum** **Coordinate system** ☐ Projected ☐ Geographic **MGA zone** **[1]X coordinate** 464WP **[1]Y coordinate**

Location description

[1] Plot dimensions **[1] Orientation of midline from 0 m point** 340°N **Photo #** JC 1pm

Datum: AGD66, WGS84, GDA94, GDA2020 or Other (specify). **MGA Zone** (for Projected coordinate system only): 56 (Coastal NSW), 55 (Central NSW) or 54 (Western NSW). **X/Y coordinate**: Long,Lat (for Projected coordinate system), Easting,Northing (for geographic coordinate system)

Vegetation integrity

Composition and structure data values may be completed after entry data into available tools. It is not required while in the field

Composition (400 m² plot)		Sum values	**Structure** (400 m² plot)		Sum values (%) (may sum to >100%)	**Function** (1000 m² plot) [3]Tree stem size class (DBH)	If data are to be used as more appropriate local data i.e. to generate local benchmarks, stems must be counted
Total count of native plant species **(richness)** in each growth form group (not individual plants within each growth form)	Trees (TG)		Sum of [2] **foliage cover** of native plant species by growth form group	Trees (TG)		80 + cm	
	Shrubs (SG)			Shrubs (SG)		50 – 79 cm	
	Grasses etc. (GG)			Grasses etc. (GG)		30 – 49 cm	
	Forbs (FG)			Forbs (FG)		20 – 29 cm	
	Ferns (EG)			Ferns (EG)		10 – 19 cm	
	Other (OG)			Other (OG)		5 – 9 cm	
						[4]Tree regeneration <5 cm	
			Total high threat weed cover			[5]Length of fallen logs	
						[6]Hollow bearing trees	

Vegetation integrity - function cont. (five 1 m²) **plots)**

	[7]Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	0 0 0 0 0			
Average of the 5 subplots				

These attributes require considered on-site observations and may be completed after field work

Vegetation class **[8]Large tree benchmark size** 20/ 30/ 50/ 80 DBH Confidence H/ M/ L

Plant community type (PCT) exotic dom. grassland/pasture. **EEC** Tick Confidence H/ M/ L

Physiography and site features that may help in determining PCT and management zone (optional) or for BioNet system etc flora survey purposes.

Morphological type	Landform element	Landform pattern	Microrelief
Lithology	Soil surface texture	Soil colour	Soil depth
Slope	Aspect	Site drainage	Distance to nearest water and type

Disturbance	Severity code	Age code
Clearing (incl. logging)		
Cutting of trees (not pasture)		
Soil erosion		
Fire (wild, CWD removal)		
Grazing (incl. native/stock)		
Fire damage		
Storm damage		
Weed mass		

Brief site description or other notes

Emergents heights			Upper stratum heights			Middle stratum heights			Lower stratum heights		
Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom

340° N - Bearing

400 m² floristics plot:	Survey name	Plot identifier	Recorders
Date 19 / 2 / 2021	AV7-9	CR2	JS + JC

GF code	Species name Full species name, or a unique means of identifying separate taxa within a survey is mandatory. Data from here will be used to assign growth form richness and cover.	N, HTW or non-HTW	[2] Foliage cover	Abund-ance	Voucher
	Paspalum dilatatum	E	50	>1000	
	Cynodon dactylon	N	30	>1000	
	Schkuhria pinnata abrotanoides	E	0.1	7	
	Setaria parviflora	E	4	1000	
	Sporobolus creber	N	2	500	
	Senecio madagascariensis	E	0.1	20	
	Urochloa panicoides	E	0.1	7	
	Chloris gayana	E	0.1	20	
	Conyza sp.	E	0.1	50	
	Elensine tristachya	E	0.2	100	
	Gamochaeta americana	E	0.1	20	
	Oxalis exilis	N	0.1	10	
	Eragrostis curvula	E	0.3	100	
	Fimbristylis dichotoma	N	0.2	500	
	Cyperus gracilis	N	0.1	50	
	~~Cyperus~~ Cyperus brevifolius	E	0.2	500	
	Axonopus fissifolius	E	0.1	10	
	Enteropogon acicularis	N	0.1	20	
	Eragrostis ~~leptostachya~~ parviflora	N	0.1	20	
	Hypochaeris albiflorus	E	0.1	2	
	Lepidium africanum	E	0.1	1	
	Solanum sisymbrifolium	E	0.1	3	
	Bothriochloa macra	N	0.2	100	
	Gomphrena celosioides	E	0.1	4	
	Sida rhombifolia	E	0.1	2	
	Paspalidium distans	N	0.1	5	
	Plantago lanceolata	E	0.1	10	
	Lysimachia arvensis	E	0.1	5	
	Cenchrus clandestina	E	0.1	3	
	Carex inversa	N	0.2	100	
	Briza subaristata	E	0.1	1	
	Portulaca oleracea	N	0.1	1	
	Centaurium tenuiflorum	E	0.1	1	
	Wahlenbergia gracilis	N	0.1	2	

Print more copies of this page to allow for higher species counts at a plot. All vascular plant species in a plot need to be recorded.

GF Code: see growth form definitions in BAM 2020 Appendix F. **N:** native, **HTW:** high threat weed.

[2] **Foliage cover:** 0.1, 0.2, 0.3, …, 1, 2, 3, 4, 5, 10, 15, 20, 25, ...100%; Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately *1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m.* Note the top 3 dominant native species within each GF group.

30 cm = 10 dbh

125° SE

Scanned JC 22.2.21

Numbers [1-8] on this page correlate with the numbers and explanatory notes on page 3

Site sheet # 1 of **Date** 9/2/21 **Survey name** HV 7-9 **Plot identifier** CPW1

Recorders LS+JC **IBRA region** **Veg zone ID** CPW

[1]**Datum** **Coordinate system** □ Projected □ Geographic **MGA zone** [1]**X coordinate** [1]**Y coordinate**

Location description along fenceline Pinnacle park

[1] **Plot dimensions** [1] **Orientation of midline from 0 m point** 125° SE **Photo #**

Datum: AGD66, WGS84, GDA94, GDA2020 or Other (specify). **MGA Zone** (for Projected coordinate. system only): 56 (Coastal NSW), 55 (Central NSW or 54 (Western NSW). **X/Y coordinate**: Long/Lat (for Projected coordinate. system), Easting/Northing (for geographic coordinate. system)

Vegetation integrity

Composition and structure sum values may be completed after entering data into available tools. It is not required while in the field

Composition (400 m² plot)		Sum values	**Structure** (400 m² plot)		Sum values (%) (may sum to >100%)	**Function** (1000 m² plot) [3]Tree stem size class (DBH)	If data are to be used as more appropriate local data i.e. to generate local benchmarks, stems must be counted
Total count of native plant species **(richness)** in each growth form group (not individual plants within each growth form)	Trees (TG)		Sum of [2] **foliage cover** of native plant species by growth form group	Trees (TG)		80 + cm	✓
	Shrubs (SG)			Shrubs (SG)		50 – 79 cm	[redacted] 61, 57
	Grasses etc. (GG)			Grasses etc. (GG)		30 – 49 cm	[redacted] 38, 46, 34, 42
	Forbs (FG)			Forbs (FG)		20 – 29 cm	[redacted] ✓
	Ferns (EG)			Ferns (EG)		10 – 19 cm	✓
	Other (OG)			Other (OG)		5 – 9 cm	✓
						[4]Tree regeneration <5 cm EUCS	✓
			Total high threat weed cover			[5]Length of fallen logs	5m+1+50
5, 15, 25, 35, 45						[6]Hollow bearing trees	

Vegetation integrity - function cont. (five 1 m²) **plots)**	[7]Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	0	0	0	0
~~Average of the 5 subplots~~				

These attributes require consideration of site observations and may be completed after field work.

Vegetation class [8]**Large tree benchmark size** 20/ 30/ 50/ 80 DBH Confidence H/ M/ L

Plant community type (PCT) CPW. **EEC** Tick Confidence H/ M/ L

Physiography and site features that may help in determining PCT and management zone (optional) or for BioNet systematic flora survey purposes.

Morphological type	Landform element	Landform pattern	Microrelief
Lithology	Soil surface texture	Soil colour	Soil depth
Slope	Aspect	Site drainage	Distance to nearest water and type

Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (id. native/stock)		
Fire damage		
Storm damage		
Weediness		

Brief site description or other notes

Emergents heights			Upper stratum heights			Middle stratum heights			Lower stratum heights		
Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom

400 m² floristics plot: | **Survey name** | **Plot identifier** | **Recorders**

Date 19 2 21 | HV7-9 | GR1 | JS + JC

GF code	Species name Full species name, or a unique means of identifying separate taxa within a survey is mandatory. Data from here will be used to assign growth form richness and cover.	N, HTW or non-HTW	[2] Foliage cover	Abund-ance	Voucher
	Bothriochloa macra	N	5	>1000	
	Aristida ramosa	N	0.3	500	
	Plantago lanceolata	E	10	>1000	
	Senecio madagascariensis	E	0.2	500	
	Aster subulata	E	0.1	2	
	Centaurium tenuiflorum	E	0.2	500	
	Enteropogon acicularis	N	30	>1000	
	Conyza sp.	E	0.2	500	
	Sporobolus creber	N	0.6	500	
	Dichanthium sericeum sericeum	N	0.1	5	
	Paspalum dilatatum	E	3	500	
	Glycine tabacina	N	0.1	100	
	Dichondra repens	N	0.1	50	
	Eragrostis curvula	E	2	500	
	Setaria parviflora	E	0.4	500	
	Chloris gayana	E	1	500	
	Phyllanthus virgatus	N	0.1	4	
	Oxalis ~~perennans~~ exilis	N	0.1	50	
	Cynodon dactylon	N	20	>1000	
	Solanum sisymbriifolium	E	0.1	3	
	Hypochaeris glabra	E	0.1	4	
	Lysimachia arvensis	E	0.1	20	
	Richardia stellaris	E	0.1	1	
	Cirsium vulgare	E	0.1	10	
	Chloris truncata	N	0.1	10	
	Euphorbia drummondii	N	0.1	50	
	Rytidosperma sp.	N	0.1	1	2-1
	Wahlenbergia ~~gracilis~~ communis	N	0.1	4	
	Cyperus gracilis	N	0.1	10	
	Chloris ventricosa	N	0.1	1	
	Wahlenbergia gracilis	N	0.1	7	
	Euchiton sphaericus	N	0.1	1	
	Leontodon saxatilis	E	0.1	2	
	Lotus angustissimus	E	0.1	2	
	Linum trigynum	E	0.1	2	
	Sida rhombifolia	E	0.1	1	

Print more copies of this page to allow for higher species counts at a plot. All vascular plant species in a plot need to be recorded.

GF Code: see growth form definitions in BAM 2020 Appendix F. **N:** native, **HTW:** high threat weed.

[2] **Foliage cover:** 0.1, 0.2, 0.3, ..., 1, 2, 3, 4, 5, 10, 15, 20, 25, ...100%; Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately *1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m.* ~~Note the top 3 dominant native species within each GF group.~~

	Carex inversa	N	0.1	2	
	Gamochaeta americana	E	0.1	1	
	Paronychia brasiliana	E	0.1	20	
	Hypochaeris albiflora	E	0.1	2	
	Verbena bonariensis	E	0.1	1	

Numbers [1-8] on this page correlate with the numbers and explanatory notes on page 3

Site sheet #	1 of	**Date**	19/2/21	**Survey name**	[redacted] HV7-9	**Plot identifier**	GR3.
Recorders	K + JS.			**IBRA region**		**Veg zone ID**	
[1]Datum		**Coordinate system**	□ Projected □ Geographic	**MGA zone**		**[1]X coordinate**	**[1]Y coordinate**
Location description	descriptive notes to locate site without grid reference						
[1] Plot dimensions	For composition & structure (400m²): 20 m x 20 m For function (1000m²): 20 m x 50 m			**[1] Orientation of midline from 0 m point**	Magnetic 140°SE	**Photo #**	

Datum: AGD66, WGS84, GDA94, GDA2020 or Other (specify). **MGA Zone** (for Projected coordinate. system only): 56 (Coastal NSW), 55 (Central NSW or 54 (Western NSW). **X/Y coordinate**: Long/Lat (for Projected coordinate. system), Easting/Northing (for geographic coordinate. system)

Vegetation integrity

Composition and structure sum values may be completed after entering data into available tools. It is not required while in the field

Composition (400 m² plot)		Sum values	**Structure** (400 m² plot)		Sum values (%) (may sum to >100%)	**Function** (1000 m² plot) [3] Tree stem size class (DBH)	If data are to be used as more appropriate local data i.e. to generate local benchmarks, stems must be counted
Total count of native plant species **(richness)** in each growth form group (not individual plants within each growth form)	Trees (TG)		Sum of [2] **foliage cover** of native plant species by growth form group	Trees (TG)		80 + cm	Count
	Shrubs (SG)			Shrubs (SG)		50 – 79 cm	Count (best practice)/tick. If [8] large tree benchmark size ≥50 cm, count
	Grasses etc. (GG)			Grasses etc. (GG)		30 – 49 cm	Count (best practice)/tick. If [8] large tree benchmark size ≥ 30 cm, count
	Forbs (FG)			Forbs (FG)		20 – 29 cm	Count (best practice)/tick. If [8] large tree benchmark size ≥ 20 cm, count
	Ferns (EG)			Ferns (EG)		10 – 19 cm	Count (best practice)/tick
	Other (OG)			Other (OG)		5 – 9 cm	Count (best practice)/tick
						[4]Tree regeneration <5 cm	Tick
			Total high threat weed cover		%	[5] Length of fallen logs	Tally space / Total m
						[6] Hollow bearing trees	Tick

Vegetation integrity - function cont. (five 1 m²) **plots)**	[7] Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	a 0 b 0 c 0 d 0 e 0	a b c d e	a b c d e	a b c d e
Average of the 5 subplots				

These attributes require consideration of site observations and may be completed after field work:

Vegetation class		[8] **Large tree benchmark size**	20/ 30/ 50/ 80 DBH	Confidence	H/ M/ L
Plant community type (PCT)		**EEC**	Tick	Confidence	H/ M/ L

Physiography and site features that may help in determining PCT and management zone (optional) or for BioNet systematic flora survey purposes:

Morphological type		Landform element		Landform pattern		Microrelief	
Lithology		Soil surface texture		Soil colour		Soil depth	
Slope		Aspect		Site drainage		Distance to nearest water and type	

Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (id. native/stock)		
Fire damage		
Storm damage		
Weediness		

Brief site description or other notes

Emergents heights			Upper stratum heights			Middle stratum heights			Lower stratum heights		
Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom

PTO species list

HV7-9 GR3 19.2.21 140°

SPECIES	N/E/HTW	Foliage Cover	Abundance
Paspalum dilatatum	E	75	71000
Cynodon dactylon	N	10	71000
Sporobolus creber	N	2	1000
Conyza sp.	E	0.5	500
Senecio madagascariensis	E	2	1000
Hypochaeris albiflora	E	0.1	20
Leontodon saxatilis	E	0.2	500
Bothriochloa macra	N	0.5	500
Gamochaeta americana	E	0.1	3
Centaurium tenuiflorum	E	0.1	7
Cenchrus clandestina	E	1	50
Plantago lanceolata	E	0.3	500
Asperula conferta	N	0.1	1
Carex inversa	N	0.1	20
Malva parviflora	E	0.1	1
Solanum sisymbrifolium	E	0.1	20
Chloris gayana	E	1	50
Cymbonotus lawsonianus	N	0.1	1
Sida rhombifolia	E	0.1	6
Eragrostis curvula	E	0.2	20
Wahlenbergia gracilis	N	0.1	2
Setaria parviflora	E	2	500
Centella asiatica	N	0.1	20
Oxalis exilis	N	0.1	8
Lysimachia arvensis	E	0.1	5
Cirsium vulgare	E	0.1	10
Lepidium bonariense	E	0.1	1
Portulaca oleracea	N	0.1	5
Paronychia brasiliana	E	0.1	4
Solanum nigrum	E	0.1	1
Enteropogon acicularis	N	0.1	5
Verbena bonariensis	E	0.1	2
Trifolium repens	E	0.1	1
Cyperus brevifolius	E	0.1	4
Dichondra repens	N	0.1	7

Numbers [1-8] on this page correlate with the numbers and explanatory notes on page 3

Site sheet #	1 of	**Date**	/ /	**Survey name**	~~GR4~~ HV7-9.	**Plot identifier**	GR4
Recorders	James Jacqui			**IBRA region**	SYD BASIN	**Veg zone ID**	
[1]Datum		**Coordinate system**	□ Projected □ Geographic	**MGA zone**		**[1]X coordinate** JC GPS	**[1]Y coordinate**
Location description	descriptive notes to locate site without grid reference						
[1] Plot dimensions	For composition & structure (400m²): 20 m x 20 m For function (1000m²): 20 m x 50 m			**[1] Orientation of midline from 0 m point**	Magnetic 78°E	**Photo #**	JC iphone

Datum: AGD66, WGS84, GDA94, GDA2020 or Other (specify). **MGA Zone** (for Projected coordinate. system only): 56 (Coastal NSW), 55 (Central NSW) or 54 (Western NSW). **X/Y coordinate**: Long/Lat (for Projected coordinate. system), Easting/Northing (for geographic coordinate. system)

Vegetation integrity

Composition and structure sum values may be completed after entering data into available tools. It is not required while in the field

Composition (400 m² plot)		Sum values	**Structure** (400 m² plot)		Sum values (%) (may sum to >100%)	**Function** (1000 m² plot)	
Total count of native plant species **(richness)** in each growth form group (not individual plants within each growth form)	Trees (TG)		Sum of **[2] foliage cover** of native plant species by growth form group	Trees (TG)		[3] Tree stem size class (DBH)	If data are to be used as more appropriate local data i.e. to generate local benchmarks, stems must be counted
	Shrubs (SG)			Shrubs (SG)		80 + cm	Count
	Grasses etc. (GG)			Grasses etc. (GG)		50 – 79 cm	Count (best practice)/tick. If [8] large tree benchmark size ≥50 cm, count
	Forbs (FG)			Forbs (FG)		30 – 49 cm	Count (best practice)/tick. If [8] large tree benchmark size ≥ 30 cm, count
	Ferns (EG)			Ferns (EG)		20 – 29 cm	Count (best practice)/tick. If [8] large tree benchmark size ≥ 20 cm, count
	Other (OG)			Other (OG)		10 – 19 cm	Count (best practice)/tick
						5 – 9 cm	Count (best practice)/tick
						[4]Tree regeneration <5 cm	Tick
			Total high threat weed cover		%	[5] Length of fallen logs	Tally space / Total m
						[6] Hollow bearing trees	Tick

Vegetation integrity - function cont. (five 1 m²) **plots)**	[7] Litter cover (%)	Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	a 0 b 0 c 0 d 0 e 0	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots																

These attributes require consideration of site observations and may be completed after field work:

Vegetation class		**[8] Large tree benchmark size**	20/ 30/ 50/ 80 DBH	Confidence	H/ M/ L
Plant community type (PCT)		**EEC**	Tick	Confidence	H/ M/ L

Physiography and site features that may help in determining PCT and management zone (optional) or for BioNet systematic flora survey purposes:

Morphological type		Landform element		Landform pattern		Microrelief	
Lithology		Soil surface texture		Soil colour		Soil depth	
Slope		Aspect		Site drainage		Distance to nearest water and type	

Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (id. native/stock)		
Fire damage		
Storm damage		
Weediness		

Brief site description or other notes

Emergents heights			Upper stratum heights			Middle stratum heights			Lower stratum heights		
Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom

HV 7-9 19/2/2021 JS + JC

GR4 - in Native dominated low diversity GL

Species	E or N	Cover	Abund.
Enteropogon acicularis	N	50	>1000
Cynodon dactylon	N	20	>1000
Setaria parviflora	E	3	1000
Conyza sumatrensis	E	0.6	500
Bothriochloa macra	N	3	500
Plantago lanceolata	E	0.2	100
Sporobolus creber	N	4	71000
Paspalum dilatatum	E	2	500
Cenchrus clandestinus	E	0.1	20
Oxalis exilis	N	0.1	20
Wahlenbergia gracilis	N	0.1	8
Carex inversa	N	0.1	10
Senecio madagascariensis	E	0.2	50
Gamochaeta calviceps	E	0.1	20
Cyperus gracilis	N	0.1	20
Phyllanthus virgatus	N	0.1	50
Euphorbia drummondii	N	0.1	50
Paronychia brasiliana	E	0.1	20
Spergularia levis	E	0.1	3
Gamochaeta americana	E	0.1	20
Eleusine tristachya	E	0.1	20
Lysimachia arvensis	E	0.1	10
Einadia polygonoides	N	0.1	20
Glycine tabacina	N	0.1	8
Aristida ramosa	N	0.1	50
Leontodon saxatilis	E	0.1	50
Dichondra repens	N	0.1	4
Eragrostis curvula	E	0.7	50
Wahlenbergia communis	N	0.1	10
Cirsium vulgare	E	0.1	1
Portulaca oleracea	N	0.1	6
Cyperus brevifolius	E	0.1	7
Linum trigynum	E	0.1	1
Hypochaeris albiflorus	E	0.1	1
Schkuhria pinnata abrobotanoides	E	0.1	1
Gomphrena celosioides	E	0.1	2
Solanum sisymbriifolium	E	0.1	4
Fimbristylis dichotoma	N	0.1	20

Fenced off "restoration area" in NE of site

Scattered remnant large Euc. tereticornis, Euc. crebra + a few smaller Euc. melliodora, with abundant Euc. tereticornis regen + a few Euc. crebra regen.
Understorey patchy, ~~some~~ most areas dominated by Chloris gayana, Paspalum dilatatum, Setaria parviflora, but some areas dominated by Themeda triandra.
Some midstorey of Bursaria spinosa in patches. Abundant Euc. seedlings.

Also present

Briza subaristata
Fimbristylis dichotoma
Solanum sisymbriifolium
Senecio madagascariensis
Tricoryne elatior
Conyza sumatrensis
Euchiton ~~sphaericus~~ involucratus
Sida rhombifolia
Cyperus gracilis
Verbena bonariensis
Plantago lanceolata
Glycine microphylla

Appendix C – Site Flora Species List

Scientific Name	Common Name	NSW Status	Comm. Status	Native	Exotic
Araujia sericifera	Moth Vine	Not Listed	Not Listed		YES
Aristida ramosa	Purple Wiregrass	Not Listed	Not Listed	YES	
Arthropodium minus	Small Vanilla Lily	Not Listed	Not Listed	YES	
Asperula conferta	Common Woodruff	Not Listed	Not Listed	YES	
Aster subulatus	Wild Aster	Not Listed	Not Listed		YES
*Axonopus fissifolius**	Narrow-leaved Carpet Grass	Not Listed	Not Listed		YES
Bidens pilosa	Cobbler's Pegs	Not Listed	Not Listed		YES
Bidens subalternans	Greater Beggar's Ticks	Not Listed	Not Listed		YES
Bothriochloa macra	Red Grass	Not Listed	Not Listed	YES	
Breynia oblongifolia	Coffee Bush	Not Listed	Not Listed	YES	
Briza subaristata		Not Listed	Not Listed		YES
Bromus catharticus	Prairie Grass	Not Listed	Not Listed		YES
Brunoniella australis	Blue Trumpet	Not Listed	Not Listed	YES	
Bursaria spinosa	Native Blackthorn	Not Listed	Not Listed	YES	
Carex inversa	Knob Sedge	Not Listed	Not Listed	YES	
Cenchrus clandestinus	Kikuyu Grass	Not Listed	Not Listed		YES
Centaurium tenuiflorum	Branched Centaury, Slender centaury	Not Listed	Not Listed		YES
Centella asiatica	Indian Pennywort	Not Listed	Not Listed	YES	
Cheilanthes sieberi	Rock Fern	Not Listed	Not Listed	YES	
Chloris gayana	Rhodes Grass	Not Listed	Not Listed		YES
Chloris truncata	Windmill Grass	Not Listed	Not Listed	YES	
Chloris ventricosa	Tall Chloris	Not Listed	Not Listed	YES	
Cirsium vulgare	Spear Thistle	Not Listed	Not Listed		YES
Commelina cyanea	Native Wandering Jew	Not Listed	Not Listed	YES	
Conyza Spp.		Not Listed	Not Listed		YES
Cyanthillium cinereum		Not Listed	Not Listed	YES	
Cyclospermum leptophyllum	Slender Celery	Not Listed	Not Listed		YES
Cymbonotus lawsonianus	Bear's Ear	Not Listed	Not Listed	YES	
Cymbopogon refractus	Barbed Wire Grass	Not Listed	Not Listed	YES	
Cynodon dactylon	Common Couch	Not Listed	Not Listed	YES	
Cyperus brevifolius		Not Listed	Not Listed		YES
Cyperus eragrostis	Umbrella Sedge	Not Listed	Not Listed		YES
Cyperus gracilis	Slender Flat-sedge	Not Listed	Not Listed	YES	
Desmodium brachypodum	Large Tick-trefoil	Not Listed	Not Listed	YES	
Desmodium varians	Slender Tick-trefoil	Not Listed	Not Listed	YES	
Dichanthium sericeum	Queensland Bluegrass	Not Listed	Not Listed	YES	
Dichondra repens	Kidney Weed	Not Listed	Not Listed	YES	
Digitaria sanguinalis	Crab Grass	Not Listed	Not Listed		YES
Echinopogon ovatus	Forest Hedgehog Grass	Not Listed	Not Listed	YES	
Ehrharta erecta	Panic Veldtgrass	Not Listed	Not Listed		YES
Einadia polygonoides	Knotweed Goosefoot	Not Listed	Not Listed	YES	
Eleusine tristachya	Goose Grass	Not Listed	Not Listed		YES
Enteropogon acicularis	Curly Windmill Grass	Not Listed	Not Listed	YES	
Eragrostis curvula	African Lovegrass	Not Listed	Not Listed		YES
Eragrostis leptostachya	Paddock Lovegrass	Not Listed	Not Listed	YES	
Eragrostis parviflora	Weeping Lovegrass	Not Listed	Not Listed	YES	

Scientific Name	Common Name	NSW Status	Comm. Status	Native	Exotic
Eriochloa pseudoacrotricha	Early Spring Grass	Not Listed	Not Listed	YES	
Eucalyptus crebra	Narrow-leaved Ironbark	Not Listed	Not Listed	YES	
Eucalyptus moluccana	Grey Box	Not Listed	Not Listed	YES	
Eucalyptus tereticornis	Forest Red Gum	Not Listed	Not Listed	YES	
Euchiton sphaericus	Star Cudweed	Not Listed	Not Listed	YES	
Euphorbia drummondii	Caustic Weed	Not Listed	Not Listed	YES	
Fimbristylis dichotoma	Common Fringe-sedge	Not Listed	Not Listed	YES	
Gamochaeta americana	Purple Cudweed	Not Listed	Not Listed		YES
Gamochaeta calviceps	Cudweed	Not Listed	Not Listed		YES
Geranium solanderi	Native Geranium	Not Listed	Not Listed	YES	
Glycine microphylla	Small-leaf Glycine	Not Listed	Not Listed	YES	
Glycine tabacina	Variable Glycine	Not Listed	Not Listed	YES	
Gomphocarpus fruticosus	Narrow-leaved Cotton Bush	Not Listed	Not Listed		YES
Gomphrena celosioides	Gomphrena Weed	Not Listed	Not Listed		YES
Hardenbergia violacea	False Sarsaparilla	Not Listed	Not Listed	YES	
Hydrocotyle sibthorpioides		Not Listed	Not Listed	YES	
Hypericum gramineum	Small St John's Wort	Not Listed	Not Listed	YES	
Hypochaeris albiflora	White Flatweed	Not Listed	Not Listed		YES
Hypochaeris glabra	Smooth Catsear	Not Listed	Not Listed		YES
Hypochaeris radicata	Catsear	Not Listed	Not Listed		YES
Hypoxis hygrometrica	Golden Weather-grass	Not Listed	Not Listed	YES	
Indigofera australis	Australian Indigo	Not Listed	Not Listed	YES	
Lantana camara	Lantana	Not Listed	Not Listed		YES
Leontodon taraxacoides	Lesser Hawkbit	Not Listed	Not Listed		YES
Leontodon taraxacoides	Lesser Hawkbit	Not Listed	Not Listed		YES
Lepidium africanum	Common Peppercress	Not Listed	Not Listed		YES
Linum trigynum	French Flax	Not Listed	Not Listed		YES
Lomandra filiformis	Wattle Matt-rush	Not Listed	Not Listed	YES	
Lotus angustissimus	Slender Birds-foot Trefoil	Not Listed	Not Listed		YES
Lysimachia arvensis	Scarlet Pimpernel	Not Listed	Not Listed		YES
Microlaena stipoides	Weeping Grass	Not Listed	Not Listed	YES	
Modiola caroliniana	Red-flowered Mallow	Not Listed	Not Listed		YES
Olea europaea subsp. cuspidata	African Olive	Not Listed	Not Listed		YES
Oplismenus aemulus		Not Listed	Not Listed	YES	
Oxalis exilis		Not Listed	Not Listed	YES	
Oxalis perennans		Not Listed	Not Listed	YES	
Paronychia brasiliana	Chilean Whitlow Wort, Brazilian Whitlow	Not Listed	Not Listed		YES
Paspalidium distans		Not Listed	Not Listed	YES	
Paspalum dilatatum	Paspalum	Not Listed	Not Listed		YES
Phyllanthus virgatus	Wiry Spurge	Not Listed	Not Listed	YES	
Plantago lanceolata	Lamb's Tongues	Not Listed	Not Listed		YES
Portulaca oleracea	Pigweed	Not Listed	Not Listed	YES	
Richardia stellaris		Not Listed	Not Listed		YES
Rumex brownii	Swamp Dock	Not Listed	Not Listed	YES	
Rytidosperma racemosum var. racemosum	Wallaby Grass	Not Listed	Not Listed	YES	
Rytidosperma spp.		Not Listed	Not Listed	YES	
Schkuhria pinnata	Dwarf Marigold	Not Listed	Not Listed		YES
Scleria mackaviensis		Not Listed	Not Listed	YES	
Senecio madagascariensis	Fireweed	Not Listed	Not Listed		YES

Scientific Name	Common Name	NSW Status	Comm. Status	Native	Exotic
Setaria parviflora		Not Listed	Not Listed		YES
Sida rhombifolia	Paddy's Lucerne	Not Listed	Not Listed		YES
Sigesbeckia orientalis	Indian Weed	Not Listed	Not Listed	YES	
Solanum pseudocapsicum	Madeira Winter Cherry	Not Listed	Not Listed		YES
Solanum sisymbriifolium		Not Listed	Not Listed		YES
Sonchus oleraceus	Common Sowthistle	Not Listed	Not Listed		YES
Spergularia levis		Not Listed	Not Listed		YES
Sporobolus creber	Slender Rat's Tail Grass	Not Listed	Not Listed	YES	
Taraxacum officinale	Dandelion	Not Listed	Not Listed		YES
Themeda triandra		Not Listed	Not Listed	YES	
Tricoryne elatior	Yellow Autumn-lily	Not Listed	Not Listed	YES	
Urochloa panicoides	Urochloa Grass	Not Listed	Not Listed		YES
Verbena bonariensis	Purpletop	Not Listed	Not Listed		YES
Veronica plebeia	Trailing Speedwell	Not Listed	Not Listed	YES	
Wahlenbergia communis	Tufted Bluebell	Not Listed	Not Listed	YES	
Wahlenbergia gracilis	Sprawling Bluebell	Not Listed	Not Listed	YES	

Appendix D – Vegetation Plot Photos

Plot	1	2
1A CPW		

Plot	1	2
2A Grassland 1		

Plot	1	2
2B – Grassland 4		

Appendix E – Anabat Report

Biodiversity Research Pty Ltd
trading as Biodiversity Monitoring Services
ACN 617 530 686

167 McKanes Falls Road
South Bowenfels, NSW 2790
E: andrew.lothian@biodiversitymonitoring.com.au
M: 0421 841 726

Date	A.aus	C.gou	C.mor	Mi.aus	Mi.ori	Mo.nor	Mo.rid	Ny. spp.	Scote.ru	Scoto.or	V.vul	Total Passes
25/2/2021	2(1)	4(1)	0(0)	0(0)	0(0)	0(0)	0(0)	1(0)	0(0)	0(0)	0(0)	7
26/2/2021	1(0)	14(3)	3(0)	1(0)	4(3)	0(0)	2(2)	1(0)	0(0)	1(0)	8(0)	35
27/2/2021	0(0)	26(3)	2(0)	1(0)	1(0)	0(0)	8(4)	2(1)	0(0)	0(0)	3(0)	43
28/2/2021	1(0)	15(5)	1(0)	1(0)	1(0)	3(0)	1(0)	0(0)	1(0)	0(0)	2(0)	26
1/3/2021	4(2)	21(3)	0(0)	0(0)	5(2)	0(0)	1(0)	0(0)	0(0)	0(0)	1(0)	32

The number of echolocation calls identified to a high level of confidence to a species are marked in brackets. Species codes explained below, those in bold are listed as threatened.

A.aus = *Austronomus australis* **C.dwy = *Chalinolobus dwyeri*** C.gou = *Chalinolobus gouldii* C.mor = *Chalinolobus morio* **F.ta = *Falsistrellus tasmaniensis***
Mi.aus = Miniopterus australis **Mi.ori = *Miniopterus orianae oceanensis*** **Mo.nor = *Mormopterus norfolkensis***
Mo.rid = *Mormopterus ridei* **My.ma = *Myotis macropus*** R.meg = *Rhinolophus megaphyllus* **Sa.fla = *Saccolaimus flaviventris***
Nyctophilus spp. = bats from the following three species which are difficult to distinguish based on call:
N.cor = *Nyctophilus corbeni* N.geo = *Nyctophilus geoffroyi* N.gou = *Nyctophilus gouldii*
Scote.ru = *Scoteanax rueppellii* Scoto.or = *Scotorepens orion* V.dar = *Vespadelus darlingtoni* V.reg = *Vespadelus regulus* V.vul = *Vespadelus vulturnus*

Appendix F – BAM Calculator Reports

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00024108/BAAS18139/21/00024124

Proposal Name
Highland Views stage 7 to 9

BAM data last updated *
24/11/2021

Assessor Name
Jacqueline Frances Coughlan

Assessor Number
BAAS18139

BAM Data version *
50

Proponent Names

Report Created
15/12/2021

BAM Case Status
Open

Assessment Revision
0

Assessment Type
Part 4 Developments (General)

Date Finalised
To be finalised

BOS entry trigger
BOS Threshold: Biodiversity Values Map

* 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
Cumberland Plain Woodland in the Sydney Basin Bioregion	Critically Endangered Ecological Community	849-Cumberland shale plains woodland

Species
Nil

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

BAM Biodiversity Credit Report (Like for like)

Name
Dasyurus maculatus / Spotted-tailed Quoll
Grantiella picta / Painted Honeyeater
Callocephalon fimbriatum / Gang-gang Cockatoo
Petroica phoenicea / Flame Robin
Petroica boodang / Scarlet Robin
Hieraaetus morphnoides / Little Eagle
Haliaeetus leucogaster / White-bellied Sea-Eagle
Lophoictinia isura / Square-tailed Kite
Melanodryas cucullata cucullata / Hooded Robin (south-eastern form)
Neophema pulchella / Turquoise Parrot
Ninox strenua / Powerful Owl
Phascolarctos cinereus / Koala
Chthonicola sagittata / Speckled Warbler
Anthochaera phrygia / Regent Honeyeater
Circus assimilis / Spotted Harrier

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

BAM Biodiversity Credit Report (Like for like)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
849-Cumberland shale plains woodland	Cumberland Plain Woodland in the Sydney Basin Bioregion	7.6	0	1	1

849-Cumberland shale plains woodland

Like-for-like credit retirement options

Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 849, 850	-	849_CPW_Moderate	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.
Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 849, 850	-	849_Derived_Grassland	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.
Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 849, 850	-	849_Exotic_Grassland	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.

BAM Biodiversity Credit Report (Like for like)

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Dillwynia tenuifolia / Dillwynia tenuifolia	**849_CPW_Moderate**	0.1	1.00
Pterostylis saxicola / Sydney Plains Greenhood	**849_CPW_Moderate**	0.1	1.00
Pultenaea pedunculata / Matted Bush-pea	**849_CPW_Moderate**	0.1	1.00

Credit Retirement Options

Like-for-like credit retirement options

Dillwynia tenuifolia / Dillwynia tenuifolia	Spp	IBRA subregion
	Dillwynia tenuifolia / Dillwynia tenuifolia	Any in NSW
Pterostylis saxicola / Sydney Plains Greenhood	Spp	IBRA subregion
	Pterostylis saxicola / Sydney Plains Greenhood	Any in NSW
Pultenaea pedunculata / Matted Bush-pea	Spp	IBRA subregion
	Pultenaea pedunculata / Matted Bush-pea	Any in NSW

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id

00024108/BAAS18139/21/00024124

Proposal Name

Highland Views stage 7 to 9

BAM data last updated *

24/11/2021

Assessor Name

Jacqueline Frances Coughlan

Assessor Number

BAAS18139

BAM Data version *

50

Proponent Name(s)

Report Created

15/12/2021

BAM Case Status

Open

Assessment Revision

0

Assessment Type

Part 4 Developments (General)

Date Finalised

To be finalised

BOS entry trigger

BOS Threshold: Biodiversity Values Map

* 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
Cumberland Plain Woodland in the Sydney Basin Bioregion	Critically Endangered Ecological Community	849-Cumberland shale plains woodland

Species
Nil

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
Dasyurus maculatus / Spotted-tailed Quoll
Grantiella picta / Painted Honeyeater
Callocephalon fimbriatum / Gang-gang Cockatoo
Petroica phoenicea / Flame Robin
Petroica boodang / Scarlet Robin
Hieraaetus morphnoides / Little Eagle
Haliaeetus leucogaster / White-bellied Sea-Eagle
Lophoictinia isura / Square-tailed Kite
Melanodryas cucullata cucullata / Hooded Robin (south-eastern form)
Neophema pulchella / Turquoise Parrot
Ninox strenua / Powerful Owl
Phascolarctos cinereus / Koala
Chthonicola sagittata / Speckled Warbler
Anthochaera phrygia / Regent Honeyeater
Circus assimilis / Spotted Harrier

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

BAM Biodiversity Credit Report (Variations)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
849-Cumberland shale plains woodland	Cumberland Plain Woodland in the Sydney Basin Bioregion	7.6	0	1	1.00

849-Cumberland shale plains woodland

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 849, 850	-	849_CPW_Moderate	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.
Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 849, 850	-	849_Derived_Grassland	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.
Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 849, 850	-	849_Exotic_Grassland	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.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Dillwynia tenuifolia / Dillwynia tenuifolia	**849_CPW_Moderate**	0.1	1.00

Pterostylis saxicola / Sydney Plains Greenhood	**849_CPW_Moderate**	0.1	1.00
Pultenaea pedunculata / Matted Bush-pea	**849_CPW_Moderate**	0.1	1.00

Credit Retirement Options

Like-for-like options

Dillwynia tenuifolia/ Dillwynia tenuifolia	Spp	IBRA region	
	Dillwynia tenuifolia/Dillwynia tenuifolia	Any in NSW	
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Flora	Vulnerable	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.
Pterostylis saxicola/ Sydney Plains Greenhood	Spp	IBRA region	
	Pterostylis saxicola/Sydney Plains Greenhood	Any in NSW	
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

	Flora	Endangered	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.
Pultenaea pedunculata/ Matted Bush-pea	Spp	IBRA region	
	Pultenaea pedunculata/Matted Bush-pea	Any in NSW	
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Flora	Endangered	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 Candidate Species Report

Proposal Details

Assessment Id 00024108/BAAS18139/21/00024124	Proposal Name Highland Views stage 7 to 9	BAM data last updated * 24/11/2021
Assessor Name Jacqueline Frances Coughlan	Report Created 15/12/2021	BAM Data version * 50
Assessor Number BAAS18139	Assessment Type Part 4 Developments (General)	BAM Case Status Open
Assessment Revision 0	Date Finalised To be finalised	BOS entry trigger BOS Threshold: Biodiversity Values Map

* 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.

List of Species Requiring Survey

Name	Presence	Survey Months
Cynanchum elegans White-flowered Wax Plant	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Dillwynia tenuifolia Dillwynia tenuifolia	Yes (assumed present)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Eucalyptus benthamii Camden White Gum	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Grevillea juniperina subsp. juniperina Juniper-leaved Grevillea	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Litoria aurea Green and Golden Bell Frog	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Marsdenia viridiflora subsp. viridiflora - endangered population Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Meridolum corneovirens Cumberland Plain Land Snail	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Myotis macropus Southern Myotis	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Persoonia bargoensis Bargo Geebung	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Pimelea curviflora var. curviflora Pimelea curviflora var. curviflora	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Pimelea spicata Spiked Rice-flower	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Pommerhelix duralensis Dural Land Snail	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Pterostylis saxicola Sydney Plains Greenhood	Yes (assumed present)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Pultenaea pedunculata Matted Bush-pea	Yes (assumed present)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Thesium australe Austral Toadflax	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Threatened species Manually Added

None added

Threatened species assessed as not on site

Refer to BAR for detailed justification

Common name	Scientific name	Justification in the BAM-C
Barking Owl	Ninox connivens	Habitat constraints
Bush Stone-curlew	Burhinus grallarius	Habitat degraded Habitat constraints
Bynoe's Wattle	Acacia bynoeana	Habitat degraded
Dillwynia tenuifolia, Kemps Creek	Dillwynia tenuifolia - endangered population	Refer to BAR
Downy Wattle	Acacia pubescens	Habitat degraded
Eastern Pygmy-possum	Cercartetus nanus	Habitat degraded
Gang-gang Cockatoo	Callocephalon fimbriatum	Refer to BAR
Grey-headed Flying-fox	Pteropus poliocephalus	Habitat constraints
Koala	Phascolarctos cinereus	Habitat constraints
Large Bent-winged Bat	Miniopterus orianae oceanensis	Habitat constraints
Large-eared Pied Bat	Chalinolobus dwyeri	Habitat constraints
Little Bent-winged Bat	Miniopterus australis	Habitat constraints
Little Eagle	Hieraaetus morphnoides	Habitat constraints
Masked Owl	Tyto novaehollandiae	Habitat constraints
Powerful Owl	Ninox strenua	Habitat constraints
Regent Honeyeater	Anthochaera phrygia	Habitat degraded Habitat constraints
Square-tailed Kite	Lophoictinia isura	Habitat constraints

Squirrel Glider	Petaurus norfolcensis	Habitat degraded
Swift Parrot	Lathamus discolor	Habitat constraints
Thick Lip Spider Orchid	Caladenia tessellata	Refer to BAR
White-bellied Sea-Eagle	Haliaeetus leucogaster	Habitat constraints

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00024108/BAAS18139/21/00024124	Highland Views stage 7 to 9	24/11/2021
Assessor Name	Report Created	BAM Data version *
Jacqueline Frances Coughlan	15/12/2021	50
Assessor Number	BAM Case Status	Date Finalised
BAAS18139	Open	To be finalised
Assessment Revision	Assessment Type	BOS entry trigger
0	Part 4 Developments (General)	BOS Threshold: Biodiversity Values Map

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

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

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Cumberland shale plains woodland												
1	849_CPW_Moderate	Cumberland Plain Woodland in the Sydney Basin Bioregion	56.1	18.4	0.05	PCT Cleared - 93%	High Sensitivity to Potential Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	TRUE	1

2	849_Derived_Grassland	Cumberland Plain Woodland in the Sydney Basin Bioregion	12.1	12.1	0.86	PCT Cleared - 93%	High Sensitivity to Potential Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	TRUE	0
3	849_Exotic_Grassland	Cumberland Plain Woodland in the Sydney Basin Bioregion	9	9.0	6.7	PCT Cleared - 93%	High Sensitivity to Potential Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	TRUE	0
											Subtotal	**1**
											Total	**1**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAII	Species credits
Dillwynia tenuifolia / Dillwynia tenuifolia (Flora)									
849_CPW_Moderate	18.4	18.4	0.05			Vulnerable	Not Listed	False	1
								Subtotal	**1**
Pterostylis saxicola / Sydney Plains Greenhood (Flora)									
849_CPW_Moderate	18.4	18.4	0.05			Endangered	Endangered	False	1
								Subtotal	**1**

Pultenaea pedunculata / Matted Bush-pea (Flora)									
849_CPW_Moderate	18.4	18.4	0.05			Endangered	Not Listed	False	1
								Subtotal	**1**

Biodiversity payment summary report

Assessment Id	Payment data version	Assessment Revision	Report created
00024108/BAAS18139/21/00024124		0	15/12/2021

Assessor Name	Assessor Number	Proposal Name	BAM Case Status
Jacqueline Frances Coughlan	BAAS18139	Highland Views stage 7 to 9	Open

Assessment Type	Date Finalised	BOS entry trigger
Part 4 Developments (General)	To be finalised	BOS Threshold: Biodiversity Values Map

PCT list

Price calculated	PCT common name	Credits
Yes	**849 -** Cumberland shale plains woodland	1

Species list

Price calculated	Species	Credits
Yes	***Dillwynia tenuifolia*** (Dillwynia tenuifolia)	1
Yes	***Pterostylis saxicola*** (Sydney Plains Greenhood)	1
Yes	***Pultenaea pedunculata*** (Matted Bush-pea)	1

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

Biodiversity payment summary report

IBRA sub region	PCT common name	Threat status	Offset trading group	Risk premium	Administrative cost	Methodology adjustment factor	Price per credit	No. of ecosystem credits	Final credits price
Cumberland	**849 -** Cumberland shale plains woodland	Yes	Cumberland Plain Woodland in the Sydney Basin Bioregion	18.83%	$ 1,097.37	1.6350	$ 33,697.42	1	$33,697.42

Subtotal (excl. GST)	**$33,697.42**
GST	**$3,369.74**
Total ecosystem credits (incl. GST)	**$37,067.16**

Species credits for threatened species

Species profile ID	Species	Threat status	Price per credit	Risk premium	Administrative cost	No. of species credits	Final credits price
10226	***Dillwynia tenuifolia*** (Dillwynia tenuifolia)	Vulnerable	$54.59	20.6900%	$80.00	1	$145.88
10705	***Pterostylis saxicola*** (Sydney Plains Greenhood)	Endangered	$865.08	20.6900%	$80.00	1	$1,124.07
10716	***Pultenaea pedunculata*** (Matted Bush-pea)	Endangered	$1,730.17	20.6900%	$80.00	1	$2,168.14

Biodiversity payment summary report

	Subtotal (excl. GST)	**$3,438.09**
	GST	**$343.81**
Total species credits (incl. GST)		**$3,781.90**
	Grand total	**$40,849.06**

BAM Predicted Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00024108/BAAS18139/21/00024124	Highland Views stage 7 to 9	24/11/2021
Assessor Name	Report Created	BAM Data version *
Jacqueline Frances Coughlan	15/12/2021	50
Assessor Number	Assessment Type	BAM Case Status
BAAS18139	Part 4 Developments (General)	Open
Assessment Revision	BOS entry trigger	Date Finalised
0	BOS Threshold: Biodiversity Values Map	To be finalised

* 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.

Threatened species reliably predicted to utilise the site. No surveys are required for these species. Ecosystem credits apply to these species.

Common Name	Scientific Name	Vegetation Types(s)
Barking Owl	Ninox connivens	849-Cumberland shale plains woodland
Brown Treecreeper (eastern subspecies)	Climacteris picumnus victoriae	849-Cumberland shale plains woodland
Diamond Firetail	Stagonopleura guttata	849-Cumberland shale plains woodland
Dusky Woodswallow	Artamus cyanopterus cyanopterus	849-Cumberland shale plains woodland
Eastern Coastal Free-tailed Bat	Micronomus norfolkensis	849-Cumberland shale plains woodland
Grey-headed Flying-fox	Pteropus poliocephalus	849-Cumberland shale plains woodland
Large Bent-winged Bat	Miniopterus orianae oceanensis	849-Cumberland shale plains woodland
Little Bent-winged Bat	Miniopterus australis	849-Cumberland shale plains woodland
Little Lorikeet	Glossopsitta pusilla	849-Cumberland shale plains woodland
Masked Owl	Tyto novaehollandiae	849-Cumberland shale plains woodland

Swift Parrot	Lathamus discolor	849-Cumberland shale plains woodland
Varied Sittella	Daphoenositta chrysoptera	849-Cumberland shale plains woodland
White-throated Needletail	Hirundapus caudacutus	849-Cumberland shale plains woodland
Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris	849-Cumberland shale plains woodland

Threatened species Manually Added

None added

Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

Common Name	Scientific Name	Plant Community Type(s)
Flame Robin	Petroica phoenicea	849-Cumberland shale plains woodland
Gang-gang Cockatoo	Callocephalon fimbriatum	849-Cumberland shale plains woodland
Hooded Robin (south-eastern form)	Melanodryas cucullata cucullata	849-Cumberland shale plains woodland
Koala	Phascolarctos cinereus	849-Cumberland shale plains woodland
Little Eagle	Hieraaetus morphnoides	849-Cumberland shale plains woodland
Painted Honeyeater	Grantiella picta	849-Cumberland shale plains woodland
Powerful Owl	Ninox strenua	849-Cumberland shale plains woodland
Regent Honeyeater	Anthochaera phrygia	849-Cumberland shale plains woodland
Scarlet Robin	Petroica boodang	849-Cumberland shale plains woodland
Speckled Warbler	Chthonicola sagittata	849-Cumberland shale plains woodland
Spotted Harrier	Circus assimilis	849-Cumberland shale plains woodland
Spotted-tailed Quoll	Dasyurus maculatus	849-Cumberland shale plains woodland
Square-tailed Kite	Lophoictinia isura	849-Cumberland shale plains woodland
Turquoise Parrot	Neophema pulchella	849-Cumberland shale plains woodland
White-bellied Sea-Eagle	Haliaeetus leucogaster	849-Cumberland shale plains woodland

Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

Refer to BAR for detailed justification

BAM Predicted Species Report

Common Name	Scientific Name	Justification in the BAM-C
Flame Robin	Petroica phoenicea	Refer to BAR
Gang-gang Cockatoo	Callocephalon fimbriatum	Refer to BAR
Hooded Robin (south-eastern form)	Melanodryas cucullata cucullata	Refer to BAR
Koala	Phascolarctos cinereus	Refer to BAR
Little Eagle	Hieraaetus morphnoides	Refer to BAR
Painted Honeyeater	Grantiella picta	Refer to BAR
Powerful Owl	Ninox strenua	Refer to BAR
Regent Honeyeater	Anthochaera phrygia	Refer to BAR
Scarlet Robin	Petroica boodang	Refer to BAR
Speckled Warbler	Chthonicola sagittata	Refer to BAR
Spotted Harrier	Circus assimilis	Refer to BAR
Spotted-tailed Quoll	Dasyurus maculatus	Refer to BAR
Square-tailed Kite	Lophoictinia isura	Refer to BAR
Turquoise Parrot	Neophema pulchella	Refer to BAR
White-bellied Sea-Eagle	Haliaeetus leucogaster	Refer to BAR

BAM Vegetation Zones Report

Proposal Details

Assessment Id	Assessment name	BAM data last updated *
00024108/BAAS18139/21/00024124	Highland Views stage 7 to 9	24/11/2021
Assessor Name	Report Created	BAM Data version *
Jacqueline Frances Coughlan	15/12/2021	50
Assessor Number	Assessment Type	BAM Case Status
BAAS18139	Part 4 Developments (General)	Open
Assessment Revision	Date Finalised	BOS entry trigger
0	To be finalised	BOS Threshold: Biodiversity Values Map

* 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.

Vegetation Zones

#	Name	PCT	Condition	Area	Minimum number of plots	Management zones
1	849_CPW_Moderate	849-Cumberland shale plains woodland	CPW_Moderate	0.05	1	Park (0.05 ha)

2	849_Derived_Grassland	849-Cumberland shale plains woodland	Derived_Grassland	0.86	1	
3	849_Exotic_Grassland	849-Cumberland shale plains woodland	Exotic_Grassland	6.68	3	

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00024108/BAAS18139/21/00024109

Proposal Name
Highland Views Stages 7-9

BAM data last updated *
24/11/2021

Assessor Name
Jacqueline Frances Coughlan

Assessor Number
BAAS18139

BAM Data version *
50

Proponent Names

Report Created
14/12/2021

Date Finalised
To be finalised

Assessment Revision
0

Assessment Type
Scattered Trees

BAM Case Status
Open

BOS entry trigger
BOS Threshold: Biodiversity Values Map

* 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

Nil

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Ecosystem Credit Summary

BAM Biodiversity Credit Report (Like for like)

PCT	TEC	HBT Cr	No HBT Cr	Credits
849-Cumberland shale plains woodland	Cumberland Plain Woodland in the Sydney Basin Bioregion	1	2	3

Credit classes for 849

Like-for-like options

TEC	Trading group	HBT	Credits	IBRA region
Cumberland Plain Woodland in the Sydney Basin Bioregion	-	Yes	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.
Cumberland Plain Woodland in the Sydney Basin Bioregion	-	No	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.

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id
00024108/BAAS18139/21/00024109

Proposal Name
Highland Views Stages 7-9

BAM data last updated *
24/11/2021

Assessor Name
Jacqueline Frances Coughlan

Assessor Number
BAAS18139

BAM Data version *
50

Proponent Name(s)

Report Created
14/12/2021

Assessment Type
Scattered Trees

Date Finalised
To be finalised

Assessment Revision
0

BAM Case Status
Open

BOS entry trigger
BOS Threshold: Biodiversity Values Map

* 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

Nil

Additional Information for Approval

PCTs With Customized Benchmarks
No Changes

Ecosystem Credit Summary

PCT	TEC	HBT Cr	No HBT Cr	Credits
849-Cumberland shale plains woodland	Cumberland Plain Woodland in the Sydney Basin Bioregion	1	2	3

BAM Biodiversity Credit Report (Variations)

Credit classes for 849	Like-for-like options				
	TEC	Trading group	HBT	Credits	IBRA region
	Cumberland Plain Woodland in the Sydney Basin Bioregion	-	Yes	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.
	Cumberland Plain Woodland in the Sydney Basin Bioregion	-	No	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.

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00024108/BAAS18139/21/00024109	Highland Views Stages 7-9	24/11/2021
Assessor Name	Report Created	BAM Data version *
Jacqueline Frances Coughlan	14/12/2021	50
Assessor Number	BAM Case Status	Date Finalised
BAAS18139	Open	To be finalised
Assessment Revision	Assessment Type	BOS entry trigger
0	Scattered Trees	BOS Threshold: Biodiversity Values Map

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Scattered Trees Credit Requirement

Class	Contains hollows	Number of trees	Ecosystem credits
849-Cumberland shale plains woodland			
3	True	1.0	1
3	False	2.0	2
			3
			3

Species credits for threatened species

Nil

Biodiversity payment summary report

Assessment Id	Payment data version	Assessment Revision	Report created
00024108/BAAS18139/21/00024109		0	14/12/2021

Assessor Name	Assessor Number	Proposal Name	BAM Case Status
Jacqueline Frances Coughlan	BAAS18139	Highland Views Stages 7-9	Open

Assessment Type	Date Finalised	BOS entry trigger
Scattered Trees	To be finalised	BOS Threshold: Biodiversity Values Map

PCT list

Include	PCT common name	Credits
Yes	**849 -** Cumberland shale plains woodland	3

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

IBRA sub region	PCT common name	Baseline price	Dynamic coefficient	Market coefficient	Risk premium	Administrative cost	Methodology adjustment factor	Price per credit	No. of ecosystem credits	Final credits price
Cumberland	**849 -** Cumberland shale plains woodland	$ 17,700.43	0.72141840	2.67146100	18.83%	$ 1,097.37	1.6350	$ 33,697.42	3	$101,092.26

Subtotal (excl. GST)	**$101,092.26**
GST	**$10,109.23**

Biodiversity payment summary report

Total credits (incl. GST)	**$111,201.49**

BAM Predicted Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00024108/BAAS18139/21/00024109	Highland Views Stages 7-9	24/11/2021
Assessor Name	Report Created	BAM Data version *
Jacqueline Frances Coughlan	14/12/2021	50
Assessor Number	BAM Case Status	Date Finalised
BAAS18139	Open	To be finalised
Assessment Revision	Assessment Type	BOS entry trigger
0	Scattered Trees	BOS Threshold: Biodiversity Values Map

* 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.

Threatened species reliably predicted to utilise the site. No surveys are required for these species. Ecosystem credits apply to these species.

Common Name	Scientific Name
Barking Owl	Ninox connivens
Black-chinned Honeyeater (eastern subspecies)	Melithreptus gularis gularis
Brown Treecreeper (eastern subspecies)	Climacteris picumnus victoriae
Dusky Woodswallow	Artamus cyanopterus cyanopterus
Eastern Coastal Free-tailed Bat	Micronomus norfolkensis
Eastern False Pipistrelle	Falsistrellus tasmaniensis
Flame Robin	Petroica phoenicea
Hooded Robin (south-eastern form)	Melanodryas cucullata cucullata
Koala	Phascolarctos cinereus
Little Eagle	Hieraaetus morphnoides
Little Lorikeet	Glossopsitta pusilla
Masked Owl	Tyto novaehollandiae
Painted Honeyeater	Grantiella picta
Scarlet Robin	Petroica boodang
Speckled Warbler	Chthonicola sagittata
Spotted Harrier	Circus assimilis
Swift Parrot	Lathamus discolor

Varied Sittella	Daphoenositta chrysoptera
White-bellied Sea-Eagle	Haliaeetus leucogaster
White-throated Needletail	Hirundapus caudacutus
Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris

Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

Refer to BAR for detailed justification

Common Name	Scientific Name	Justification in the BAM-C

Scattered Tree Report

Proposal Details

Assessment Id
00024108/BAAS18139/21/00024109

Assessment name
Highland Views Stages 7-9

BAM data last updated *
24/11/2021

Assessor Name
Jacqueline Frances Coughlan

Report Created
14/12/2021

BAM Data version *
50

Assessor Number
BAAS18139

BAM Case Status
Open

Date Finalised
To be finalised

Assessment Revision
0

Assessment Type
Scattered Trees

BOS entry trigger
BOS Threshold: Biodiversity Values Map

* 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.

Scattered Trees

PCT code	PCT name	No. of trees	Species	DBHOB Category	Contain hollows	Class	Assessment required
849	Cumberland shale plains woodland	1	Eucalyptus crebra	>= 50cm	True	3	Visual assessment for hollows, presence of important habitat features and habitat suitability for threatened species

Scattered Tree Report

849	Cumberland shale plains woodland	2	Angophora floribunda	>= 50cm	False	3	Visual assessment for hollows, presence of important habitat features and habitat suitability for threatened species

Appendix G – Protected Matters Search Tool (EPBC Act)

Australian Government

Department of Agriculture, Water and the Environment

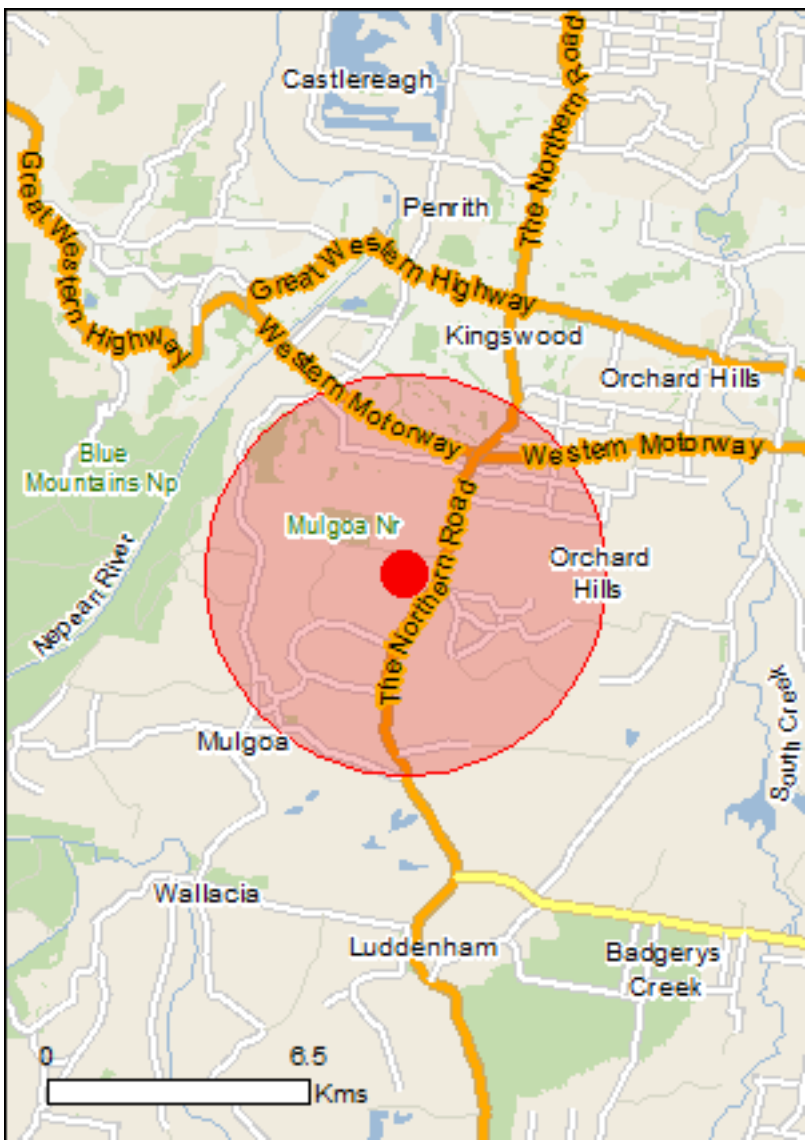
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 08/11/21 11:15:47



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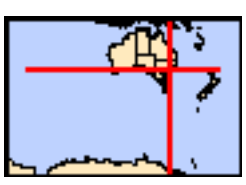
Coordinates

Buffer: 5.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	1
National Heritage Places:	1
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	8
Listed Threatened Species:	43
Listed Migratory Species:	16

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	6
Commonwealth Heritage Places:	1
Listed Marine Species:	22
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	2
Regional Forest Agreements:	None
Invasive Species:	49
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

World Heritage Properties		[Resource Information]
Name	State	Status
Greater Blue Mountains Area	NSW	Declared property

National Heritage Properties		[Resource Information]
Name	State	Status
Natural		
The Greater Blue Mountains Area	NSW	Listed place

Listed Threatened Ecological Communities		[Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion	Endangered	Community may occur within area
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community may occur within area
Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion	Critically Endangered	Community likely to occur within area
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	Critically Endangered	Community likely to occur within area
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria	Critically Endangered	Community likely to occur within area
Shale Sandstone Transition Forest of the Sydney Basin Bioregion	Critically Endangered	Community likely to occur within area
Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion	Endangered	Community may occur within area
Western Sydney Dry Rainforest and Moist Woodland on Shale	Critically Endangered	Community likely to occur within area

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour likely to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat may occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur

Name	Status	Type of Presence within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Fish		
Macquaria australasica Macquarie Perch [66632]	Endangered	Species or species habitat may occur within area
Prototroctes maraena Australian Grayling [26179]	Vulnerable	Species or species habitat may occur within area
Frogs		
Heleioporus australiacus Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat likely to occur within area
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat known to occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat likely to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat likely to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat may occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Other		
Pommerhelix duralensis Dural Land Snail [85268]	Endangered	Species or species habitat likely to occur within area
Plants		
Acacia bynoeana Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species

Name	Status	Type of Presence
		habitat may occur within area
Acacia pubescens Downy Wattle, Hairy Stemmed Wattle [18800]	Vulnerable	Species or species habitat may occur within area
Allocasuarina glareicola [21932]	Endangered	Species or species habitat likely to occur within area
Cynanchum elegans White-flowered Wax Plant [12533]	Endangered	Species or species habitat likely to occur within area
Eucalyptus aggregata Black Gum [20890]	Vulnerable	Species or species habitat may occur within area
Eucalyptus benthamii Camden White Gum, Nepean River Gum [2821]	Vulnerable	Species or species habitat may occur within area
Genoplesium baueri Yellow Gnat-orchid, Bauer's Midge Orchid, Brittle Midge Orchid [7528]	Endangered	Species or species habitat may occur within area
Haloragis exalata subsp. exalata Wingless Raspwort, Square Raspwort [24636]	Vulnerable	Species or species habitat may occur within area
Melaleuca deanei Deane's Melaleuca [5818]	Vulnerable	Species or species habitat known to occur within area
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat may occur within area
Persoonia hirsuta Hairy Geebung, Hairy Persoonia [19006]	Endangered	Species or species habitat likely to occur within area
Persoonia nutans Nodding Geebung [18119]	Endangered	Species or species habitat may occur within area
Pimelea spicata Spiked Rice-flower [20834]	Endangered	Species or species habitat known to occur within area
Pomaderris brunnea Rufous Pomaderris, Brown Pomaderris [16845]	Vulnerable	Species or species habitat may occur within area
Pterostylis saxicola Sydney Plains Greenhood [64537]	Endangered	Species or species habitat may occur within area
Pultenaea parviflora [19380]	Vulnerable	Species or species habitat known to occur within area
Rhizanthella slateri Eastern Underground Orchid [11768]	Endangered	Species or species habitat may occur within area
Rhodamnia rubescens Scrub Turpentine, Brown Malletwood [15763]	Critically Endangered	Species or species habitat may occur within area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry	Vulnerable	Species or species habitat may occur within

Name	Status	Type of Presence
[20307]		area
Thelymitra kangaloonica		
Kangaloon Sun Orchid [81861]	Critically Endangered	Species or species habitat may occur within area
Thesium australe		
Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus		
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus		
White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Monarcha melanopsis		
Black-faced Monarch [609]		Species or species habitat known to occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius leschenaultii		
Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Pandion haliaetus		
Osprey [952]		Species or species habitat known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Defence Housing Authority
Commonwealth Land - Defence Service Homes Corporation
Defence - 1CAD ORCHARD HILLS KINGSWOOD
Defence - RANMME (DEOH)

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		
Orchard Hills Cumberland Plain Woodland	NSW	Listed place

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius leschenaultii		
Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
[Chrysococcyx osculans](#) Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
[Gallinago hardwickii](#) Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area
[Haliaeetus leucogaster](#) White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
[Hirundapus caudacutus](#) White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
[Lathamus discolor](#) Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
[Merops ornatus](#) Rainbow Bee-eater [670]		Species or species habitat may occur within area
[Monarcha melanopsis](#) Black-faced Monarch [609]		Species or species habitat known to occur within area
[Motacilla flava](#) Yellow Wagtail [644]		Species or species habitat may occur within area
[Myiagra cyanoleuca](#) Satin Flycatcher [612]		Species or species habitat known to occur within area
[Neophema chrysostoma](#) Blue-winged Parrot [726]		Species or species habitat may occur within area
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
[Pandion haliaetus](#) Osprey [952]		Species or species habitat known to occur within area
[Rhipidura rufifrons](#) Rufous Fantail [592]		Species or species habitat known to occur within area
[Rostratula benghalensis (sensu lato)](#) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
[Tringa nebularia](#) Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Blue Mountains	NSW
Mulgoa	NSW

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Carduelis chloris European Greenfinch [404]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Nassella neesiana Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur

Name	Status	Type of Presence within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-33.80835 150.68681

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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