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Biodiversity Development Assessment Report

Bonnyrigg Living Communities Project, Bonnyrigg, NSW 2177

Prepared for: Land & Housing Corporation

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Glossary and abbreviations

Acronym	Description
AOBV	Area of Outstanding Biodiversity Value
BAM	Biodiversity Assessment Method
BAMC	BAM Calculator
BC Act	NSW *Biodiversity Conservation Act 2016*
BC Reg	*Biodiversity Conservation Regulation 2017*
BDAR	Biodiversity Development Assessment Report
CPWS	Cumberland Plain Shale Woodland
BOS	Biodiversity Offset Scheme
BV Map	Biodiversity Values Map
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DFSI	NSW Department of Finance, Services and Innovation
DIWA	The Directory of Important Wetlands in Australia
DoEE	Commonwealth Department of the Environment and Energy (formerly DotE)
DotE	Commonwealth Department of the Environment
DPIE	NSW Department of Planning, Industry and Environment
EEC	Endangered Ecological Community
EP&A Act	NSW *Environment Protection and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
HTW	High Threat Weed

Acronym	Description
IBRA	Interim Biogeographic Regionalisation of Australia
LEP	Local Environment Plan
MNES	Matters of National Environmental Significance
NTSSC	NSW Threatened Species Scientific Committee
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
RBGDT	Royal Botanic Gardens and Domain Trust
SAII	Serious and Irreversible Impacts
SEPP	State Environmental Planning Policy
TEC	Threatened Ecological Community
VI	Vegetation Integrity
VIS	Vegetation Information System
WoNS	Weeds of National Significance

1 Introduction

1.1 Background

Ecoplanning have been engaged by Land & Housing Corporation to prepare a Biodiversity Development Assessment Report (BDAR) to accompany a development application for the proposed Bonnyrigg Living Communities Project ('the proposed development'). This BDAR has been approved by Brian Towle, an Accredited Person (BAAS17012) to apply the Biodiversity Assessment Method (BAM; DPIE 2020) under the NSW *Biodiversity Conservation Act 2016* (BC Act).

The BDAR has been prepared following the *Streamlined Assessment Module - Small Area* (Appendix C of the BAM). All credit calculations have been undertaken using the BAM Calculator (BAMC) version in case number 00033110/BAAS17057/22/00033111. This BDAR has been prepared on the basis of the requirements of (and information provided under) the BAM as of the 15 July 2022.

1.2 Biodiversity Offset Scheme Triggers

A BDAR is required (and the BAM applied) when any one of three Biodiversity Offset Scheme (BOS) thresholds for local development under Part 4 of the NSW *Environment Planning and Assessment Act 1997* (EP&A Act) are triggered:

- Exceeding the native vegetation clearing threshold (based on minimum lot size).
- Direct impacts occur on land included in the Biodiversity Values Map.
- Significant impact on threatened species, ecological communities (or their habitat).

As there is no minimum lot size for the development area under the *Fairfield Local Environmental Plan 2013*, the actual size of the smallest lot within the development area is used the determine the native vegetation clearing threshold, as per section 7.2 (2)(b) of the NSW *Biodiversity Conservation Regulation 2017* (BC Reg). For the development area, the smallest lot size is less than one hectare and therefore the native vegetation clearing threshold of 0.25 ha or more applies. Because the proposed development will affect greater than 0.25 ha of native vegetation, entry to the BOS is triggered, and a BDAR is required.

A search of the BV Map did not reveal that any portion of the subject land is identified on the BV Map as biodiversity values (DPE 2022a).

The proposed development qualifies for the Streamlined assessment module (Appendix C of the BAM) as the smallest actual lot size within the development area is less than 1 ha and less than or equal to 1 ha of native vegetation will be impacted.

1.3 Location and site context

The BAM defines ***subject land*** as the land subject to a development, activity, clearing, biodiversity certification or a biodiversity stewardship proposal. For this BDAR, the subject land is an area of approximately 14.31 ha which has been defined as the proposed development footprint including the full canopy extent of all trees proposed for removal (**Figure 1.1** and **Figure 1.2**).

The subject land is situated in Fairfield Local Government Area and is zoned under Fairfield LEP as mixed R1: General Residential. The land surrounding the subject land within approximately 1 km is zoned for a variety of land uses typical of outer suburbs. Immediately

to the north and south, land adjoining Edensor Road and Cabramatta Road are zoned as R2: Low Density Residential. Land to the east and west, across Bishop Crescent and Humphries Road is zoned R2: Low Density Residential and RE1: Public Recreation respectively.

1.4 Proposed development

The proposed development is for the demolition of the majority of the publicly owned dwellings and establishment of a new subdivision representing Stages 1-2 of the Bonnyrigg Living Communities. In addition to the demolition of existing site structures, the proposed works will include extensive site regrading, roadway & footpath reconfiguration and services infrastructure works (**Figure 1.3**)

Figure 1.1: The location of the subject land

Figure 1.2: The subject land, including Biodiversity Values mapping

Figure 1.3: The proposed development

1.5 Literature and database review

A site-specific literature and database review was undertaken for the subject land prior to undertaking the field survey and the preparation of this report, which included the following sources:

- BioNet Atlas (DPE 2022b)
- BioNet Vegetation Classification (DPE 2022c)
- Protected Matters Search Tool (DAWE 2021)
- NSW Hydrography (DFSI 2016)
- SIX Maps (DFSI 2021)
- NSW threatened species profiles (DPE 2022d)
- Fairfield LEP (2013)

The following policies and guideline were considered in the preparation of this report:

- The EPBC Act Matters of National Environmental Significance: Significant Impact Guidelines (DotE 2013)
- Threatened Species Test of Significance Guidelines (OEH 2018)
- Biodiversity Assessment Method (DPE 2022a)
- Biodiversity Assessment Method 2020 Operational Manual – Stage 1 (DPE 2022b)
- Biodiversity Assessment Method 2020 Operational Manual – Stage 2 (DPE 2022c).

2 Landscape context

2.1 Identifying landscape features

In accordance with the BAM, a number of features are assessed within and surrounding the subject land and within a 1,500 m buffer around the subject land (**Figure 2.1**). These landscape features are used to identify biodiversity values that are important for the subject land and inform the habitat suitability of the subject land for threatened species. The relevant details for each of these landscapes features are present in the following sections.

2.1.1 IBRA regions and subregions

The Interim Biogeographic Regionalisation of Australia (IBRA, DoEE 2018) represents 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 within the Cumberland IBRA subregion of the Sydney Basin IBRA region. The **Cumberland** subregion was entered into the BAM calculator.

2.1.2 NSW landscape regions (Mitchell landscapes)

The subject land and a large portion of the 1,500 m assessment circle is located within the 'Cumberland Plain' Landscape. Small areas of the 1,500 m assessment circle are also located within the 'Georges River Alluvial Plain' Landscape. The **'Cumberland Plain'** Landscape was entered into the BAM calculator.

2.1.3 Other features - Rivers, streams and estuaries

There are no creeks or drainage lines within the subject land that are mapped on the Spatial Services NSW Hydrography dataset (DFSI 2016). Rivers, streams and wetlands located within the 1,500 m buffer of the subject land, including the associated riparian buffers calculated in accordance with Appendix 3 of the BAM (**Figure 2.1**).

Green Valley Creek occurs 200 m to the east of the subject land, Clear Paddock Creek lies 800 m to the north and an unnamed watercourse lies approximately 1.3 km south-east within the 1,500 m assessment circle (**Figure 2.1**).

Figure 2.1: Location map (1500 m buffer)

Local and important wetlands

Under the BAM, a ***wetland*** is defined as an area of land that is wet by surface water or ground water, or both, for long enough periods that the plants and animals in it are adapted to, and depend on, moist conditions for at least part of their life cycle (DPIE 2020a). An ***Important Wetland*** is a wetland listed under the Directory of Important Wetlands of Australia (DIWA) (Environment Australia 2001) or an area included under the *State Environmental Planning Policy (Coastal Management) 2018* (Coastal Management SEPP).

No local or important wetlands were identified within the subject land. No mapped wetlands under the Coastal Management SEPP or associated proximity areas or wetlands listed within DIWA exist within the subject land or within the 1,500 m assessment circle.

Habitat connectivity

The subject land does not form part of any recognised biodiversity corridors, flyways or habitat connectivity features. Vegetation within the subject land is part of a mosaic of fragmented patches of native vegetation occurring in an urban landscape of low-density residential, commercial development and urban recreational development such as parks and golf courses.

Much of the local area has been previously cleared for urban development. Hard barriers surround the subject land, made up of roads, dwellings and buildings and urban transportation infrastructure. Habitat connectivity across these structures would be limited at ground level. Although limited by gaps between native vegetation fragments, limited connectivity does exist within the canopy, and mobile fauna such as birds, insects and bats may move between patches. Arboreal animals such as possums are also likely to be able to move among patches but would be required to descend to ground level and overcome hard barriers.

Areas of geological significance and soil hazard features

No other landscape features including areas of geological significance (including karst, caves, crevices and cliffs) or soil hazard features have been identified within the subject land and 1,500 m assessment circle.

Areas of outstanding biodiversity value

Areas of outstanding biodiversity value (AOBVs) as defined under the BC Act are currently limited to areas that were previously declared as critical habitat under the *Threatened Species Conservation Act 1995.* No declared areas of outstanding biodiversity value have been identified within the subject land or the 1,500 m assessment circle. However, areas of biodiversity value are present. Native vegetation identified along the 'Green Valley Creek' approximately 200 m east of the subject land is mapped on the BV Map as 'Threatened species or communities with potential for serious and irreversible impacts' (DPE 2022a) (**Figure 2.1**).

2.2 Determining site context

2.2.1 Assessing native vegetation cover

In accordance with Section 3.2 of the BAM, native vegetation cover must be estimated for a 1,500 m buffer around the subject land to determine the landscape context of the subject land. The extent of native vegetation on the subject land and immediate surrounds was mapped using the vegetation mapping of OEH (2016).

The total area of the 1,500 m buffer around the subject land is 986 ha, with the area of native vegetation mapped within the buffer being 61 ha. This is a native vegetation cover of **6%** (>10–30% class as defined in Section 3.2 of the BAM), and this value was entered into the BAM calculator.

2.2.2 Assessing patch size

Patch size is defined by the BAM as "*an area of native vegetation that occurs on the subject land and includes native vegetation that has a gap of less than 100 m from the next area of moderate to good condition native vegetation (or ≤30 m for non-woody ecosystems). A patch may extend onto adjoining land.*" Assessing patch size is also part of determining the site context.

Under the BAM, 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. Patch size was calculated for the vegetation within the subject land using the field validated map of vegetation types and the updated native vegetation extent data layer prepared for the 1,500 m buffer and based on the mapping of OEH (2016), as shown in **Figure 2.1**. The patch size for vegetation within the subject land was calculated as 0.97 ha, within the <5 ha class.

3 Native vegetation

3.1 Existing vegetation mapping

In accordance with Section 4.2 of the BAM, existing information relevant to the native vegetation of the subject land and the 1,500 m buffer area has been reviewed. No native Plant Community Types (PCTs) have been identified within the subject land by recent regional vegetation mapping (OEH 2016) (**Figure 3.1**). The subject land was identified by OEH (2016) as supporting 'Urban Exotic/Native' vegetation. One native PCT was mapped by OEH (2016) in proximity to the subject land, namely:

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

PCT 835 is described by OEH (2016) as occurring on broad alluvial flats and alongside streams and creeks that drain the Cumberland Plain. In proximity to the subject land this PCT is mapped in association with Green Valley Creek to the east of the subject land. This PCT forms part of the 'River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions' Endangered Ecological Community (EEC) listed under the BC Act.

Figure 3.1: Regional vegetation mapping of OEH (2016)

3.2 Field validated vegetation mapping

3.2.1 Survey methods

Field surveys were undertaken on the 13 May 2022 over approximately 6 hours by Brian Towle (Senior Ecologist). A plot-based survey, consistent with the BAM (DPE 2020), was undertaken as part of this survey. The locations of plot-based floristic vegetation survey consistent with Section 4.3.4.2 of the BAM is shown **Figure 3.2.** The plot location also represented the location of vegetation integrity (VI) plot in accordance with Section 4.3 of the BAM. The location of floristic vegetation plot sampled the largest patch of native vegetation within the subject land which was considered generally representative of vegetation across the subject land.

In addition to the plot-based survey, the field survey also included a general flora and fauna habitat and vegetation community assessment. This involved traversing the study area while recording visible flora species and fauna habitat values (e.g. hollow-bearing trees) and identifying any potential habitat for threatened species. It is noted that highly modified garden beds supporting exotic planted vegetation were not surveyed in detail as part of the field surveys. Areas supporting native vegetation, including native plantings were surveyed more extensively than the more degraded areas of the study area. Nomenclature follows the Flora of NSW (Harden 1990-2002) and updates provided in PlantNET (RBGDT 2020). Weather conditions during the surveys are summarised in **Table 3.1**.

Table 3.1: Daily weather observations at Horsley Park, located approximately 5 km north-west of the study area

Date	Temp (ºC)		Rainfall (mm)	9 am wind	
	Min	Max		Direction	Speed (km/h)
13/05/2022	16.9	22.2	9.4	Calm	

Figure 3.2: Location of the single BAM floristic plot surveyed within the subject land

3.2.2 Plant Community Types

Approximately 1.39 ha of the subject land was identified as supporting native vegetation, as defined under the BC Act, which includes all plants native to New South Wales. The small amount of native vegetation that exists was made up of planted and remnant eucalypts. Beneath the canopy the subject land is largely cleared. Current understorey vegetation consists of mown lawn and planted garden vegetation with both native and exotic species present. Although there are native and exotic shrubs surrounding the bases of trees, there is no extensive shrub layer within the subject land. Groundcover is dominated by exotic species.

Native vegetation within the subject was identified as including both locally native species representative of a native PCT and non-local native planted vegetation comprising species which do not naturally occur within the Sydney Basin. Of the 1.39 ha of native vegetation within the subject land, 0.63 ha was identified as belonging to PCT 849 while 0.76 ha consisted of mixed non-local native plantings (**Table 3.2**). The remainder of the subject consists of exotic plants and infrastructure, totalling 0.31 ha and 12.61 ha respectively (**Table 3.2**). Field-validated vegetation mapping is shown in. Flora and fauna inventories are found in **Figure 3.3**. **Appendix A**.

Descriptions of the vegetation communities within the subject land are provided in the following sections.

Table 3.2: Details of vegetation communities recorded within the subject land

Plant Community Type (PCTs)	Vegetation formation and class	Condition class	BC Act	EPBC Act	Area (ha)		
					Impacts	Retained	Within subject land
PCT 849 - Grey Box - Forest Red Gum grassy woodland	Grassy Woodlands and Coastal Valley Grassy Woodlands	Scattered trees	CE	Not listed	0.42	0.21	0.63
N/A	N/A	Planted native trees	-	-	0.55	0.21	0.76
		Native vegetation sub-total			**0.97**	**0.42**	**1.39**
		Exotic vegetation	-	-	0.31	0	0.31
		Cleared land / Infrastructure	-	-	N/A	N/A	12.61
Total							**14.31**

CE = Critically endangered, Not listed = Not equivalent due to poor condition (see **section 3.3**)

Figure 3.3: Field validated vegetation mapping

PCT 849: Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion

PCT 849 within the subject land consisted of scattered trees with an understorey (shrubs and ground covers) which is exotic dominated (**Plate 3.1**). The understorey across the subject land is generally either cleared, planted garden beds or exotic-dominated lawn, although small pockets of planted native vegetation exist in isolated patches across the subject land (**Figure 3.2**). The locally native trees present within the subject land includes both planted and self-seeded, and likely remnant, individuals. Common native canopy species include *E. moluccana* (Grey Box), *E. tereticornis* (Forest Red Gum) and *Corymbia maculata* (Spotted gum).

Over most of the subject land, there is no midstorey, as the subject land is actively maintained as landscaped open space, including evidence of regular mowing and pruning (**Figure 3.3**). Native understorey species observed included *Dichondra repens* (Kidney weed), *Desmodium varians* (Slender Tick-trefoil), *Oxalis perennans* (Yellow Wood-sorrel) and *Einadia nutans (Climbing Saltbush)*.

A single condition class is present for PCT 849, termed 'Scattered Trees'. The condition class is named to indicate that the PCT classification rests on the occurrence of individual trees characteristic of PCT 849, with the vegetation community within the subject land generally lacking a native mid-storey and groundcover layer. The extent of PCT 849 identified within the study area makes no distinction between planted and self-seeded, and likely remnant, locally native species.

The determination that locally native vegetation within the subject land was equivalent to PCT 849 utilised the BioNet VIS classification (DPE 2022) and was based upon the dominance of *E. moluccana*. Only five PCTs occurring within the Cumberland IBRA subregion include E. moluccana as a dominant species and of these PCT 849 was considered the best fit based upon the landscape in which this PCT typically occurs, the flats of the Cumberland Plain. The full profile of PCT 849 from the BioNet Vegetation Classification (DPE 2022) is provided in **Section 3.2.3**.

Plate 3.1: Scattered trees of PCT 849 within the subject land

Native vegetation – planted

This vegetation zone included a range of planted non-local canopy species over a landscaped and exotic dominated understorey. Common canopy species included within the 'native vegetation – planted' vegetation community included *Lophostemon confertus* (Brush Box), *Eucalyptus nicholii* (Narrow-leaved Peppermint), *Eucalyptus microcorys* (Tallowwood) and *Melaleuca quinquenervia* (Broad-leaved Paperbark).

Exotic/planted native garden vegetation

This vegetation zone included large areas which have been subject to historic clearing and now support landscaped gardens dominated by exotic grasses and herbaceous weeds. A range of planted exotic canopy and mid-storey species were included within this vegetation zone. Dominant understorey species are similar to those in the mowed lawn areas, including perennial exotic grasses including *Cenchrus clandestinus* (Kikuyu), *Eleusine tristachya (*Goose grass), *Cynodon dactylon* (Common couch) and *Chloris virgata* (Feathertop).

It is noted that there is debate, and doubt, over the status of C. dactylon within Australia (Langdon 1954), with the species having been recorded as an introduced species as early as 1802-1804 by Brown, R. (Groves 2002), although some authors recognise both indigenous and introduced populations within Sydney (Harden 1993 in Groves 2002) and Australia (Jessop et al. 2006). Bean (2007), assessed the status of the species using a combination of ecological, phytogeographical and historical criteria and concluded that the species was 'alien' within Australia. Within the subject land *C. dactylon* commonly occurred with an array of other

introduced grasses suggesting that it is indeed an introduced species. For this reason, *C. dactylon* has been treated as an exotic grass species for the purposes of this report.

3.2.3 Plant community type profile of PCT 849

Table 3.3: VIS plant community type profile (DPE 2022c) – Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849)

Plant community type (PCT)	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
PCT	PCT 849
Vegetation formation	Grassy Woodlands
Vegetation class	Coastal Valley Grassy Woodlands
Upper stratum	***Eucalyptus moluccana* (Grey Box), *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus crebra* (Narrow-leaved Ironbark), *Corymbia maculata* (Spotted Gum)**, *Eucalyptus eugenioides* (Thin-leaved Stringybark)
Middle stratum	*Bursaria spinosa subsp. spinosa* (Blackthorn)
Ground stratum	***Dichondra repens (Kidney Weed)***, *Cheilanthes sieberi subsp. sieberi (Mulga fern), Aristida vagans (Threeawn Speargrass), Microlaena stipoides var. stipoides (Weeping grass), Themeda triandra (Kangaroo grass), Brunoniella australis (Blue Trumpet), Desmodium gunnii (Slender tick trefoil), Opercularia diphylla (Stinkweed), Wahlenbergia gracilis (Sprawling Bluebell), Dichelachne micrantha (Shorthair Plumegrass),* ***Paspalidium distans (Shotgrass)***, *Eragrostis leptostachya (Paddock Lovegrass), Lomandra multiflora (Many-flowered Mat-rush), Dianella longifolia (Blueberry-Lily),* ***Oxalis perennans (Yellow Wood-sorrel)***, *Euchiton sphaericus (Star Cudweed), Goodenia hederacea (Forest goodenia), Aristida ramosa (Purple Wiregrass), Arthropodium milleflorum (Pale Vanilla-lily), Austrodanthonia tenuior (Purplish Wallaby-grass), Cymbopogon refractus (Barbed Wire Grass), Echinopogon caespitosus (Bushy Hedgehog-grass)*
Landscape position	PCT 849: Cumberland shale plains woodland is a grassy woodland occurring on the flats of the Cumberland Plain, Sydney Basin Bioregion is typically associated with the shale plains of western Sydney. It is dominated by Grey Box *(Eucalyptus moluccana)* and Forest Red Gum *(Eucalyptus tereticornis)* with other eucalypts occurring patchily. Tozer et al. (2010) define the primary habitat for the community as occurring at elevations less than 150 meters 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.
Full reference details	Tozer, M.G., Turner, K., Simpson, C., Keith, D.A., Beukers, P., MacKenzie, B., Tindall, D. & Pennay, C., 2010 Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. Version 1.0; NSW Department of Planning and Environment
Estimate remaining pre-European extent rounded to the nearest 5%	7%
TEC Name (Listing status)	BC Act: Cumberland shale plains woodland in the Sydney Basin Bioregion, Critically Endangered Ecological Community

Species identified within the subject land are indicated in **bold**.

3.3 Threatened ecological communities

PCT 849 is listed under the BC Act and the EPBC Act as Cumberland plains shale woodland of the Sydney Basin Bioregion CEEC (CPSW).

All areas of the subject land supporting locally native species were identified as forming part of the CPSW ecological community, as listed under the BC Act, including areas which were comprised of planted locally native species. The BC Act captures all stands of a vegetation community listed regardless of condition.

In contrast to BC Act listings, EPBC listings focus on capturing the most valuable stands of a community, while largely excluding heavily degraded patches which do not meet condition thresholds for listing. The EPBC Act condition threshold for CPSW states that very degraded patches do not meet the threshold for listing. The listed community includes all patches with an area of a size greater than 0.5 ha and ≥50% native understorey. The patch of PCT 849 within the subject land and study area may be greater than 0.5 ha in area, although the percentage of native understorey as measured by the BAM floristic plot is less than 50%. Therefore, the patch of CPSW that extends into the subject land does not form part of the EPBC Act listing of the ecological community (DAWE 2010).

3.4 Weeds

Weeds were present throughout the subject land. Species classified as High Threat Weeds (HTW) were present. **Table 3.4** lists the HTW identified on the subject land.

Table 3.4: HTW and WoNS identified on the subject land

Common Name	High Threat Weeds (BAM 2020)	WoNS	Duty
Alternanthera pungens Khaki weed	✓	N	**General biosecurity duty:** *Ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable*
Bidens pilosa Cobbler's pegs	✓	N	**General biosecurity duty:** *Ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable*
Ehrharta erecta Panic Veldtgrass	✓	Y	**Prohibition on certain dealings:** *Must not be imported into the state, sold, bartered, exchanged or offered for sale*
Eragrostis curvula African Lovegrass	✓	N	**General biosecurity duty:** *Ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable*
Cenchrus clandestinum Kikuyu Grass	✓	N	**General biosecurity duty:** *Ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable*
Paspalum dilatatum Paspalum	✓	N	**General biosecurity duty.** *Ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable*

3.5 Vegetation integrity

Vegetation integrity (VI) can be assessed under the Small area Streamlined assessment module by qualitatively observing values for the condition attributes set out in Table 2 of BAM Section 4.3.3 or by sampling plots in accordance with BAM Section 4.3.4. As identified above, VI was determined by applying a standard 1000 m^2 BAM plot, in accordance with the BAM, that incorporated the largest area of PCT 849 feasible (see **Figure 3.2**). The location of the assessment area was chosen to be representative of:

- the area of greatest impact,
- canopy from PCT 849 on the subject land, and
- groundcover representative of PCT 849 within the subject land.

The data for groundcover species composition, structure and function from the 1000 m^2 plot and the subplots was used to populate the BAMC (see plot data in **Appendix B**). The field data sheet for the plot is included as **Appendix C**. Vegetation integrity scores were calculated based on the single BAM plot surveyed with the scores for the single vegetation zone within the subject land shown in **Table 3.5.** The VI score for PCT 849 within the subject land is 14.2 which represents a condition score out of 100 and indicates that vegetation within the subject land is highly degraded. The VI score for PCT 849 after development is 0.

Table 3.5: Vegetation Integrity Scores

Veg zone	PCT	Condition class	Area impacted	Vegetation Integrity Score	
				Before development	After development
1	*PCT 849 Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*	Scattered trees	0.627 ha	14.2	0

4 Threatened species

Section 5 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 (predicted species). Targeted surveys are not required for ecosystem species, and potential impacts to these species are assessed in conjunction with impacts to PCTs.

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

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

4.1 Ecosystem credit species

The BAM credit calculator predicted 17 ecosystem credit species to occur, all of which were retained as ecosystem credit species for the purposes of the credit calculations (**Table 4.1**).

Table 4.1: Ecosystem credit species predicted on site

Scientific Name	Common Name	BC Act Status*	EPBC Act Status*	Sensitivity to Gain Class
Anthochaera phrygia	Regent Honeyeater	CE	CE	High
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	Moderate
Chthonicola sagittata	Speckled Warbler	v	-	High
Climacteris picumnus victoriae	Brown Treecreeper	V	-	High
Dasyurus maculatus	Spotted-tailed Quoll	V	E	High
Glossopsitta pusilla	Little Lorikeet	V	-	High
Haliaeetus leucogaster	White-bellied Sea-Eagle (Foraging)	V	-	High
Hirundapus caudacutus	White-throated Needletail	-	V	High
Lathamus discolor	Swift Parrot (Foraging)	E	CE	Moderate
Melanodryas cucullata	Hooded Robin (south-eastern form)	V	-	High
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V	-	High

Scientific Name	Common Name	BC Act Status*	EPBC Act Status*	Sensitivity to Gain Class
Miniopterus australis	Little Bent-winged Bat (Foraging)	V	-	High
Miniopterus orianae oceanensis	Large Bent-winged Bat (Foraging)	V	-	High
Petroica boodang	Scarlet Robin	V	-	High
Petroica phoenicea	Flame Robin	V	-	High
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	High
Stagonopleura guttata	Diamon Firetail	V	-	Moderate

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

4.2 Species credit species

Appendix C of the BAM ('Streamlined assessment module – small area') states that only candidate species credit species that are at a risk of an SAII (serious and irreversible impact) must be further assessed. Candidate species credit species that are not at risk of an SAII and are not incidentally recorded on the subject land do not require further assessment. The BAM credit calculator initially predicted 5 candidate species at risk of an SAII to occur on the subject land, four fauna species and one flora species.

Based on the habitat constraints, absence of microhabitats and substantially degraded nature of the site, all species have been excluded from further assessment (considered unlikely to use the subject land in accordance with Section 5.2.3 of the BAM). As such, targeted species searches were not required. Justification is provided below in **Table 4.2**.

Table 4.2: Candidate species for which the subject land is not considered suitable habitat

Scientific Name	Common Name	BC Act status*	EPBC Act status*	Sensitivity to Gain Class	Justification
Anthochaera phrygia (breeding)	Regent Honeyeater	CE	CE	High	The Regent Honeyeater inhabits dry open forest and woodland and riparian forests of River She-oak. There are only two known breeding areas in NSW, in the Capertee Valley and the Bundaraa-Barraba regions. Excluded: There is no suitable breeding habitat present in the subject area or locality. The subject land is not on the Regent Honeyeater Important Area Map.
Lathamus discolor (breeding)	Swift Parrot	E	CE	Moderate	The Swift Parrot breeds in Tasmania in spring and summer and migrates to south-eastern Australia in autumn and winter. Excluded: There is no suitable breeding habitat present in the subject area or locality. The subject land is not on the Swift Parrot Important Area map.

Scientific Name	Common Name	BC Act status*	EPBC Act status*	Sensitivity to Gain Class	Justification
Miniopterus australis (breeding)	Little Bent-winged Bat	V	-	Very High	The Little Bent-winged Bat roosts in caves, tunnels, tree hollows, abandoned mines and similar sheltered locations. There are only five known nursery sites in Australia. Excluded: The species' breeding habitat constraints are absent. There are no caves, tunnels, culverts or other structures suspected to be used for breeding present.
Miniopterus orianae oceanensis (breeding)	Large Bent-winged Bat	V	-	Very High	The Large Bent-winged Bat roosts primarily in caves in colonies of 100 to 150,000 individuals. It hunts in forested areas for moths and other flying insects above treetops. Excluded: The species' breeding habitat constraints are absent. There are no caves, tunnels, culverts or other structures suspected to be used for breeding present.
Caladenia tessellata	Thick Lip Spider Orchid	E	V	Very High	Despite historic records of this species from the Sydney Basin and Central Coast, this species has not been detected north of Jervis Bay in the last 20 years. All known extant populations in NSW are associated with heathlands or heathy woodlands, with a relatively intact structure and not mown exotic dominated landscapes such as those within the subject land.

* CE- Critically Endangered; E- Endangered, V- Vulnerable. Unless otherwise stated, habitat information is sourced from DPIE (2021c).

4.3 Identifying potential prescribed biodiversity impacts on threatened species

Prescribed biodiversity impacts are those that may affect biodiversity values in addition to, or instead of, impacts from clearing vegetation. The potential for impacts to biodiversity values prescribed by the BC Reg have been considered in context of the subject land (**Table 4.3**). It is unlikely that potential prescribed biodiversity impacts on threatened species would occur as a result of the proposal.

Table 4.3: Prescribed biodiversity impacts

Prescribed Biodiversity Impacts	Presence within the Subject Land
(a) the impacts of development on the following habitat of threatened species or ecological communities: (i) karst, caves, crevices, cliffs and other geological features of significance, (ii) rocks, (iii) human made structures, (iv) non-native vegetation,	The subject land does not contain areas of karst, caves, crevices, cliffs and other geological features of significance, rocks, or human made structures which have been identified as supporting threatened species or ecological communities. Non-native vegetation within the subject land does not conform to any ecological community, nor is it likely to support any threatened species. Similar habitat occurs across the 1500 m buffer area, in gardens and landscaped areas associated with a residential land use. Removal of this vegetation does not constitute a prescribed biodiversity impact.
(b) the impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range,	The subject land has not been identified as providing connectivity between areas of habitat for threatened species that facilitates the movement of that threatened species across its range. To the extent threatened species may use the canopy of the trees overhanging the subject land, connectivity will be retained through tree retention and future landscaping.
(c) the impacts of development on movement of threatened species that maintains their lifecycle,	The subject land has not been identified as providing movement for threatened species that maintains their lifecycle.
(d) the 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 or other development),	There is no mapped watercourse that crosses the subject land.
(e) the impacts of wind turbine strikes on protected animals,	Not applicable.
(f) the impacts of vehicle strikes on threatened species of animals or on animals that are part of a threatened ecological community.	Development within the subject land will not result in additional transport infrastructure and will therefore not affect connectivity and lead to risk of vehicle strike of fauna utilising movement corridors in the landscape.

5 Avoiding and minimising impacts on biodiversity

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

In accordance with Section 7 of the BAM, actions taken to avoid and minimise impacts through locating the project must be documented and justified in the BDAR. Impacts from clearing native vegetation and threatened species habitat can be avoided or minimised by locating the proposal in areas:

- lacking biodiversity values
- where the native vegetation or threatened species habitat is in the poorest condition (i.e. areas that have a low VI score)
- that avoid habitat for species with a high biodiversity risk weighting or land mapped on the important habitat map, or a TEC or a PCT that is highly cleared
- outside of the buffer area around breeding habitat features such as nest trees.

The overall context of the development, within an existing urban setting where historic vegetation clearing and residential development has previously occurred, represents the first step to avoiding impacts to biodiversity. The approved Bonnyrigg Masterplan, which incorporates the subject land, identified that the area was almost entirely cleared of all vegetation in the 1970s (**Figure 5.1**) and that the subject land and surrounding area was highly disturbed. By locating the proposed development within the historically cleared subject land, the development is located within an area generally lacking, or with low, biodiversity values. Further, the biodiversity values which are present within the development footprint are in poor condition as evidence by the very low VI score and do not include any mapped important habitat or significant fauna habitat features such as nest trees.

Within the context of the subject land, the proposal aims to minimise impacts to biodiversity by avoiding areas which support the greatest number and density of canopy trees. Specifically, the rows of native canopy trees along the southern and northern boundaries of the subject land (adjacent to Cabramatta Rd and Edensor Rd, respectively) are to be retained as part of the proposed development (**Figure 5.2; Figure 5.3**)..

Residual impacts to biodiversity after the efforts to avoid and minimise impacts to biodiversity would be limited to impacts to isolated trees within a landscaped and modified environment and would not fragment any currently interconnected areas of native vegetation. Through the proposed landscaping of the development, involving planting of more than 350 native trees (, these residual biodiversity impacts will be mitigated and values such as connectivity would be retained, and potentially improved over time.

5.2 Avoiding and minimising prescribed biodiversity impacts during project planning

As described in **Section 4.3**, no prescribed biodiversity impacts are anticipated from the proposed development.

Figure 5.1: Subject land and 1978 aerial imagery (source: NSW spatial services)

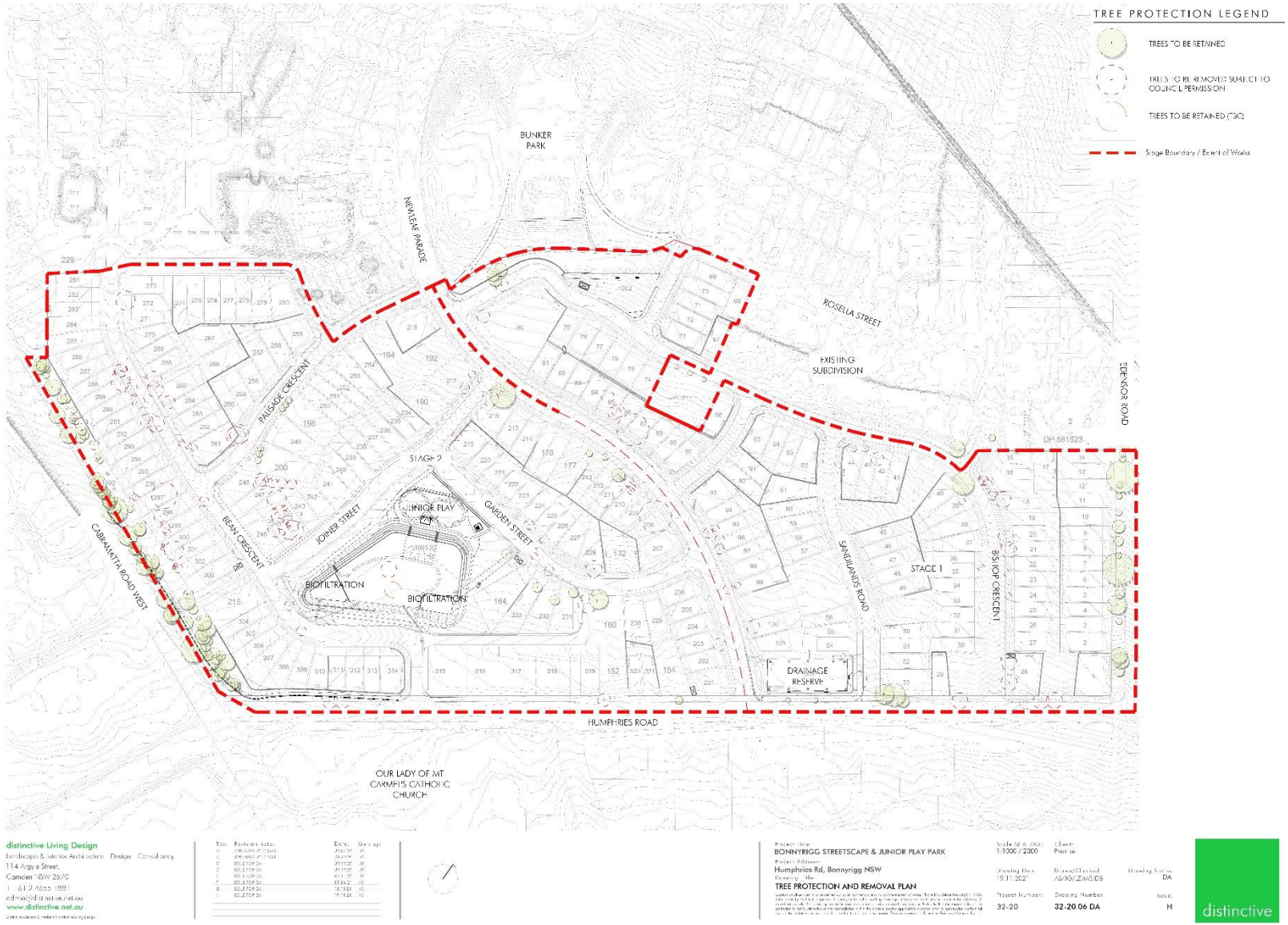

Figure 5.2: Tree retention / removal plan

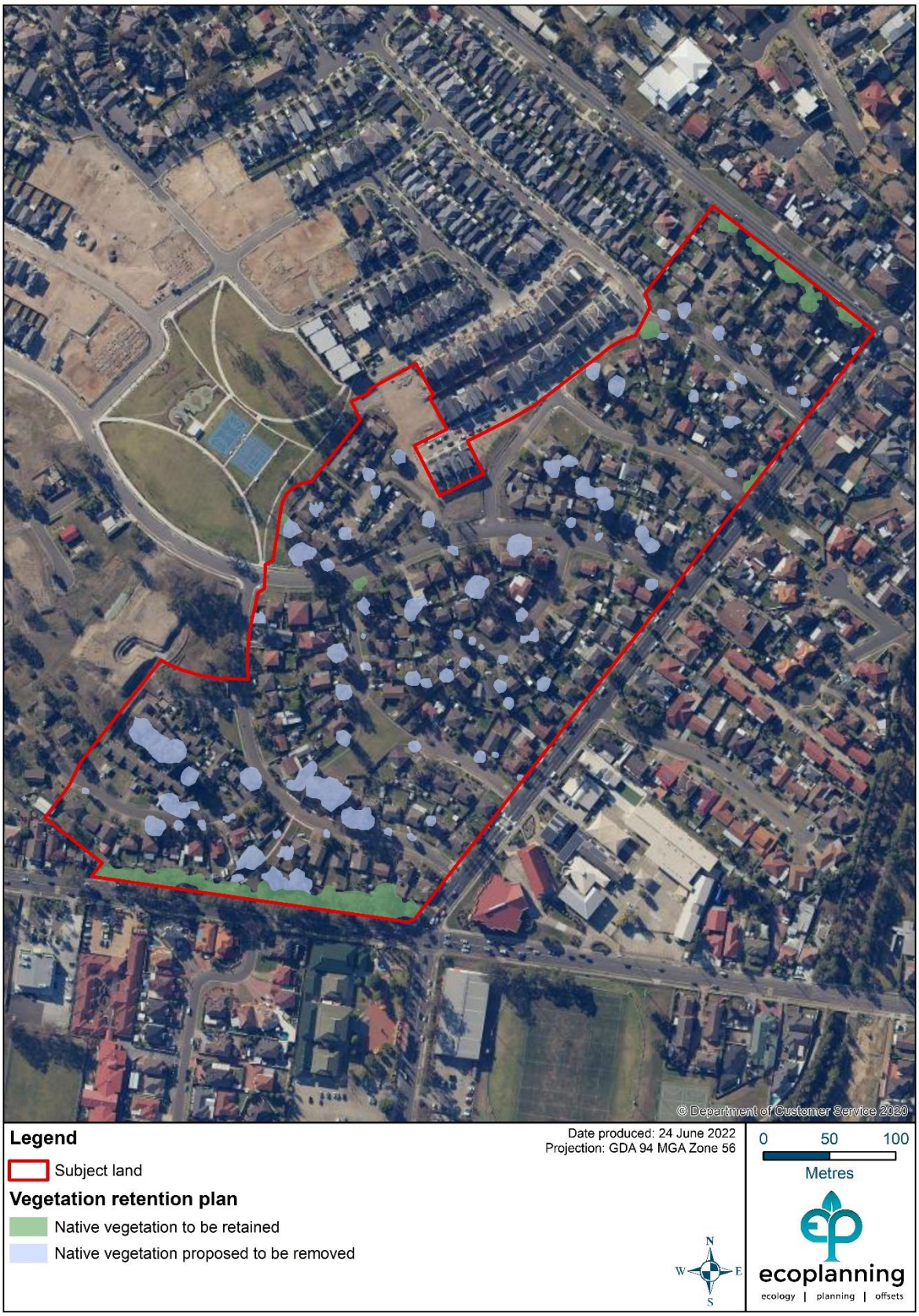

Figure 5.3: Vegetation retention/removal plan

6 Assessing impacts

6.1 Assessment of impacts BAM

6.1.1 Assessing impacts to native vegetation and habitat

The proposed development will include direct impacts to approximately 0.97 ha of native vegetation (including planted native vegetation and PCT 849), with approximately 0.42 ha of native vegetation retained within the subject land (**Figure 5.2**). For the purposes of calculating impacts in the BAM calculator, all native vegetation (0.97 ha) has been entered as PCT 849 and CPSW.

No impacts on threatened species (including species credit species) are anticipated from the proposal. No threatened species were opportunistically recorded during the field survey, and assessment of candidate SAII species excluded the requirement for further assessment (detail provided above in **Section 4.2**).

6.1.2 Assessing indirect impacts on native vegetation

It is difficult to quantify indirect impacts of the proposed development, but these may include impacts such as noise, light spill, erosion and the introduction of exotic species. Given the existing, highly modified nature of the study area, impacts such noise and light are considered to be relatively minor. Other indirect impacts, including erosion, impacts to water quality and the introduction of weed species, are considered avoidable impacts which can be managed as part of a Construction Environmental Management Plan.

6.1.3 Assessing prescribed biodiversity impacts

As described in **Section 4.3**, no prescribed biodiversity impacts are anticipated from the proposed development.

6.1.4 Serious and Irreversible Impacts (SAII)

This section documents the additional impact assessment provisions for communities and species at risk of SAII (Section 9.1.1 and Section 9.1.2 of the BAM) relevant to the proposal. As CPSW is an entity at risk of a SAII the following information is presented to assist the determining authority to evaluate the extent and severity of the impact on CPSW.

No SAII threshold for CPSW has been published. Detailed consideration of whether impacts on CPSW are serious and irreversible is included in **Table 6.1**. Consideration was given to the principles and criteria set out in the *Guidance to assist a decision-maker to determine a serious and irreversible impact* (DPIE 2019).

Table 6.1: SAII assessment for PCT 849 (Cumberland Plain Shale Woodland - CPSW)

SAII (BAM [2020], Section 9.1.1)	Response
The action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII	The actions and measures taken to avoid direct and indirect impacts on CPSW are outlined in Section 5 of this report. Specifically, the development has been located within an area lacking, or with low, biodiversity values. The CPSW within the development footprint was in a poor condition as evidenced by

SAII (BAM [2020], Section 9.1.1)	Response
	the very low VI score and did not include any mapped important habitat or significant fauna habitat features such as nest trees.
2) The assessor must consult the TBDC and/or 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.	The TBDC identifies that CPSW has had a reduction in extent by greater than 80% in 10 years or three generations.
2) b) extent of reduction in ecological function for the TEC using evidence that describes the degree of environmental degradation or disruption to biotic processes indicated 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, and vi) fragmentation of habitat.	The TBDC identifies that CPSW has undergone a reduction in ecological function, although this is not quantified. CPSW is among the most fragmented vegetation types occurring in the Sydney Region, resulting in a loss of ecological function including changes in tree density and age classes within regrowth areas, changes in understorey and midstory, structural changes such as the removal of logs and other woody debris, and altered fire regimes. Together these changes have resulted in a reduction in habitat for native fauna and a susceptibility to invasion by exotic species (NTSSC 2014).
2) 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 iii) number of threat-defined locations	CPSW is not listed under Principle 3 of the SAII principles (restricted geographic distribution). i) CPSW occurs across the Cumberland IBRA subregion, although is generally restricted to this IBRA subregion. ii) As part of the Biodiversity Investment Opportunities Map (OEH 2015b), the extent of CPSW within and outside NPWS estate was calculated for the 'Cumberland' IBRA subregion (extent of two PCTs which together comprise CPSW was calculated). A total of 7,732.3 ha of CPSW was identified within the Cumberland IBRA subregion with 1,139.1 ha (14.73 %) occurring within NPWS estate. iii) There are no known threat-defined locations.
2) d) evidence that the TEC is unlikely to respond to management.	CPSW is not listed under Principle 4 of the SAII principles (unlikely to respond to management).
3) Where the TBDC indicates data is "unknown" or "data deficient" for a TEC for a criterion listed in Subsection 9.1.2(2), the	N/A

SAII (BAM [2020], Section 9.1.1)	Response
assessor must record this in the BDAR or BCAR.	
4) a) 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 of geographic extent of the TEC by estimate the total area of the TEC to be impacted by the proposal: i) in hectares, and ii) as a percentage of the current geographical extent of the TEC in NSW. Data should include direct impacts and indirect impacts where partial loss of the TEC is likely as a result of the proposal.	i) The proposed development will result in the removal of 0.42 ha of CPSW from the subject land comprising isolated trees within an urban landscaped context. ii) Based upon the 7,732.3 ha of CPSW within the 'Cumberland' IBRA subregion (OEH 2015b), the removal of 0.42 ha within the subject land represents less than 0.001 % of the occurrence within NSW.
4) b) the extent that the proposed impacts are likely to contribute to further environmental degradation or the disruption of biotic processes 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 proposal ii) describing the impacts on connectivity and fragmentation of the remaining areas of TEC iii) describing the condition of the TEC according to the vegetation integrity score for the relevant vegetation zone. The assessor must also include the relevant composition, structure and function conditions scores for each vegetation zone.	The proposed development will not contribute substantially to greater fragmentation of CPSW, as occurrences of the ecological community within the subject land and within 500 m are within an urban landscape and already isolated and fragmented. While the proposed development would increase the degree of fragmentation, it would not create any isolate or fragment any currently interconnected areas of CPSW. i) The connectivity of the retained CPSW within the subject land (0.21 ha) would not be substantially altered by the proposed development as this habitat is already isolated. ii) Detailed analysis of the distance between retained patches of CPSW within the subject land cannot be completed as much of the CPSW within the subject land has not been included in regional vegetation mapping due to its small and isolated condition. Nonetheless, following the proposed development retained CPSW along the southern boundary of the subject land (adjacent to Cabramatta Rd) would be approximately 100 m form the nearest patch of mapped locally native vegetation, with existing separation approximately 75 m. Retained CPSW along the northern boundary of the subject land (adjacent to Edensor Rd) would be approximately 150 m from the nearest locally native vegetation following the proposal, which is similar to the current separation. iii) The CPSW within the subject land had an overall VI score of 14.2 (with a composition condition score of 17.7, a structure condition score of 2.2 and a function condition score of 73.9). This very low VI score is indicative of existing environmental degradation and disruption of biotic processes.

SAII (BAM [2020], Section 9.1.1)	Response
5.) The assessor may also provide new information that can be used to demonstrate that the principle identifying the TEC at risk of an SAII, is not accurate.	No new information is provided.

The proposed development is not considered to be a SAII to CPSW because only 0.42 ha comprising scattered trees will be removed, there is no native shrub layer within the subject land to be affected, impacts are limited to the removal sparse groundcover dominated by exotic species, and total impacts represent only 0.001 % of all CPSW in NSW.

6.2 Assessment of impacts (non-BAM)

Matters relating to impacts on flora and fauna which are not covered by the BC Act must also be addressed for the proposed development. Potential impacts on Matters of National Environmental Significance (MNES) in accordance with the EPBC Act have been addressed below. Impacts relating to regional and local planning and environmental instruments are addressed as well.

6.2.1 Matters of National Environmental Significance

The EPBC Act establishes a process for assessing the environmental impact of activities and developments where MNES may be affected. Under the Act, any action which 'has, will have, or is likely to have a significant impact on a matter of MNES' is defined as a 'controlled action', and requires approval from the Commonwealth Department of Agriculture, Water and the Environment (DAWE), which is responsible for administering the EPBC Act.

The process includes an assessment for listed threatened species and ecological communities that will be affected by the proposed action (one of the MNES). The Commonwealth has developed Significant Impact Guidelines (DotE 2013) and species-specific referral guidelines that outline several criteria, to provide assistance in assessing impacts on MNES and help decide whether or not a referral to the Commonwealth is required.

A search of the EPBC Protected Matters Search Tool was undertaken to identify any Matters of National Environmental Significance (MNES) within 10 kilometres of the subject land. Twelve potential TEC's were found to be potentially present within the buffer. As discussed in **Section 3.3**, vegetation within the subject land was equivalent to the listed Cumberland Plain Shale Woodland CEEC, although was too degraded to meet the definition of the ecological community under the EPBC Act.

No other MNES were considered relevant to the proposal.

6.2.2 Water Management Act

The *Water Management Act 2000* (WM Act) requires that any watercourses or riparian lands that may be affected by development be identified as waterfront land. Under the WM Act, any works within 40 m from the top bank of a watercourse will trigger a requirement for a controlled activity approval on waterfront land, and development is required to comply with applicable riparian buffer requirements under the *Guidelines for Controlled Activities on Waterfront Land*

(Controlled Activity Guidelines) (NRAR 2018). There are no mapped watercourses within the subject land.

6.2.3 Fairfield LEP 2013

Clause 6.5 of the *Fairfield Local Environmental Plan 2013* (Fairfield LEP) requires the consent authority to consider impacts to flora and fauna on land mapped as 'Terrestrial Biodiversity' under the LEP. No part of the study area is mapped as 'Terrestrial Biodiversity' under FLEP and therefore clause 6.5 does not apply.

6.2.4 Fairfield Development Control Plan (DCP) 2013

Section 3.3.3 of the Fairfield wide DCP 2013 'Designing to minimise impact on Biodiversity' aims to minimise the impact of development on areas with biodiversity significance, as determined by the Fairfield Biodiversity Strategy 2010. This strategy identifies areas of 'Low Conservation Significance' within the subject land. According to the Fairfield Biodiversity Strategy 2010, low conservation significance vegetation is associated with areas supporting small patches of EECs or 'Other Plantings', with limited connectivity to other native vegetation and which do not include records of any threatened species. Recommended measures for development impacting 'biodiversity issues' under section 3.3.3 of the Fairfield wide DCP 2013 are as follows:

a) *Seek advice from an environmental consultant with expertise in biodiversity issues. This can include consultants with qualifications in ecology, environmental science or related (relevant) fields.*

This BDAR has been prepared by suitably qualified consultants with expertise in biodiversity issues.

b) *Seek advice from Council about information Council has that identify areas that have some conservation significance. These areas have been identified using a Conservation Significance Assessment (CSA). The effect of the CSA areas is to highlight the existence of native vegetation so that the ecological value of the vegetation can be considered as an early part of the development process.*

The mapping associated with the CSA is not publicly accessible, although has been provided by Council and is reproduced in **Figure 6.1**. The CSA mapping does not accurately reflect the presence or absence of native vegetation communities as shown in the field validated vegetation mapping (**Figure 3.3**). Specifically, the CSA mapping identifies areas supporting recent residential development with no native vegetation cover as having conservation significance. Nonetheless, the largest areas of native vegetation included within the CSA mapping, which occur along the southern boundary of the subject land, are proposed to be largely retained to maintain biodiversity values within this location.

c) *The development should be designed to minimise impacts on the area with biodiversity significance. This can be achieved for example by not removing or disturbing areas containing indigenous vegetation, maximising the setback distance or buffer area from the development to the area with biodiversity significance.*

As detailed within **Section 5**, impacts to biodiversity values have been avoided and minimised by locating the proposed development within an existing urban setting where historic vegetation clearing and residential development has previously occurred. By locating the

proposed development within the historically cleared subject land, the development is located within an area generally lacking, or with low, biodiversity values. Those biodiversity values within the subject land which would be impacted are in poor condition as evidenced by the very low VI score. Within the context of the subject land, the proposal aims to minimise impacts to biodiversity by avoiding areas which support the greatest number and density of canopy trees. Specifically, the rows of native canopy trees along the southern and northern boundaries of the subject land (adjacent to Cabramatta Rd and Edensor Rd, respectively) are to be retained as part of the proposed development (**Figure 5.2** and **Figure 5.3**).

d) *Provide new planting or 'undisturbed' areas which maximise connection to adjoining areas of remnant indigenous vegetation retained on-site or on neighbouring sites.*

The proposed landscaping of the development includes planting of more than 350 native trees. Over time the proposed landscaping of the development, involving extensive plantings, aims to retain, or improve, the existing level of habitat connectivity and biodiversity corridors.

e) *Try to maximise not only the length but width of corridor supporting indigenous vegetation and movement on native fauna. Narrowing or bottlenecks within the biodiversity corridor should be avoided.*

The proposed development aims to retain the very limited connectivity or 'corridors' within the subject land by avoiding impacts to areas which support the greatest number and density of canopy trees. Specifically, the rows of native canopy trees along the southern and northern boundaries of the subject land (adjacent to Cabramatta Rd and Edensor Rd, respectively) are to be retained as part of the proposed development (**Figure 5.2** and **Figure 5.3**).

f) *Ensure any new access roads or provision of services (including stormwater drainage or sewerage systems) avoids indigenous vegetation. Where this is not possible, minimise the level of intrusion (including the length and width of the services) and consider providing for wildlife under/overpasses.*

The proposed development does not include any new access roads or services which would impact biodiversity corridors such that wildlife under/overpasses are relevant.

Figure 6.1: Conservation Significance Assessment mapping by Fairfield Council

7 Mitigation and management of impacts

As all impacts to biodiversity cannot be avoided by the proposal, the mitigation measures proposed below and in **Table 7.1** will assist with ensuring that direct and indirect impacts are mitigated to the fullest extent practical.

7.1 Construction Environmental Management Plan (CEMP)

A site-specific CEMP has been developed for the project. The CEMP will incorporates adaptive management principles and outlines management actions to avoid inadvertently causing additional impacts to those described in this BDAR. Management actions are identified to avoid and/or limit the potential for indirect offsite impacts and include appropriate erosion and sedimentation controls and vegetation/tree protection.

A number of non-threatened fauna species such as birds, arboreal mammals and amphibians are likely to be present at the subject land. The CEMP includes pre-clearance and fauna management protocols to avoid and mitigate any potential harm or injury to these individuals.

7.1.1 Pre-clearance protocols

It is possible that fauna, such as common birds and reptiles, may be present within the site at the time of construction. Appropriate pre-clearance protocols are to be put in place in accordance with the CEMP to mitigate and avoid potential harm or injury to these individuals. They include pre-clearance surveys, clearing supervision and soft-felling techniques where habitat trees are required to be removed. It is noted that none of the trees proposed to be removed were identified as providing sheltering or breeding habitat for fauna (such as hollow branches or stick nests) at the time of the field surveys.

Soft-felling techniques as part of vegetation clearing encourages fauna to relocate outside of the disturbance footprint prior to habitat clearing or alternatively provide an opportunity to move fauna during vegetation clearing works. Soft felling techniques should be adaptive depending on site species conditions and reduces the chance of injury to fauna.

Should habitat trees be present in the subject land at the time of construction and soft-felling techniques required, the project manager should develop a clearing procedure in co-ordination with any clearing contractors. This will include notifying WIREs or a local vet clinic prior to clearing, marking habitat trees, staged vegetation removal, and a plan for the relocation of any fauna and salvageable habitat features.

Table 7.1: Proposed mitigation measures

Identifier	Mitigation action	Development phase	Outcome	Timing	Responsibility
E01	A Construction Environmental Management Plan (CEMP) has been prepared.	Pre-construction	Flora and fauna would be managed in accordance with the requirements of the CEMP; prevention of over clearing of vegetation;.	Pre-construction and construction	Construction contractor
E02	Site inductions during construction to include a briefing regarding the local fauna of the site and protocols to be undertaken if fauna are encountered.	Construction	Prevents fauna injury/mortality	Construction	Construction contractor
E03	Prior to the commencement of clearing, a pre-clearing survey will be conducted to confirm the absence of any nesting fauna within the trees to be removed.	Construction	Prevents fauna injury/mortality	Pre-construction	Project manager
E04	Frequent maintenance of construction machinery and plant will be undertaken to minimise unnecessary noise or air pollution.	Construction	Minimises disruption to fauna foraging, nesting or roosting behaviours	Construction	Construction contractor
E05	If any animal is injured during the clearing process, contact the relevant local wildlife rescue agency (e.g. WIRES) and/or veterinary surgery as soon as practical. Until the animal can be cared for by a suitably qualified animal handler, if possible minimise stress to the animal and reduce the risk of further injury by: • Handling fauna with care and as little as possible. • Covering larger animals with a towel or blanket and placing in a large cardboard box. • Placing small animals in a cotton bag, tied at the top. • Keeping the animal in a quiet, warm, ventilated and dark location.	Construction / Operation	Prevents fauna injury/ mortality	Pre-construction, construction and operation	Construction contractor

8 Offset requirements and credit calculations

A biodiversity offset requirement for residual impacts of a proposed development must be calculated in accordance with section 10.1 and section 10.2 of the BAM. The following section outlines the credit requirements for the proposed development to achieve the 'no net loss standard' established by the BAM.

Section 9.2.1 of the BAM indicates that the following vegetation zones require offsets:

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

The single vegetation zone within the subject land had a vegetation integrity score of less than 15 and, therefore, does not require offsetting. Consequently, there is no requirement to retire any biodiversity credits to offset the impacts of the proposed development.

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Appendix A Flora and fauna inventories

Appendix Table A.1: Flora inventory

Family	Scientific Name	Common name	Status[1]
Amaranthaceae	*Alternanthera pungens**	Khaki Weed	Exotic
	*Gomphrena celosioides**	Gomphrena Weed	Exotic
Asteraceae	*Bidens pilosa**	Cobbler's Pegs	Exotic
	*Conyza bonariensis**	Flaxleaf Fleabane	Exotic
	Cotula australis	Common Cotula	Native
	*Gamochaeta calviceps**	Cudweed	Exotic
	*Hypochaeris radicata**	Catsear	Exotic
	*Soliva sessilis**	Bindyi	Exotic
	*Taraxacum officinale**	Dandelion	Exotic
Brassicaceae	*Lepidium africanum**	Common Peppercress	Exotic
Caryophyllaceae	*Paronychia brasiliana**	Chilean Whitlow Wort	Exotic
	*Polycarpon tetraphyllum**	Four-leaved Allseed	Exotic
Chenopodiaceae	*Einadia nutans*	Climbing Saltbush	Native
Convolvulaceae	*Dichondra repens*	Kidney Weed	Native
Cyperaceae	*Cyperus gracilis*	Slender Flat-sedge	Native
Fabaceae (Faboideae)	*Desmodium varians*	Slender Tick-trefoil	Native
	Lotus spp.		Native
	*Trifolium repens**	White Clover	Exotic
Malvaceae	*Modiola caroliniana**	Red-flowered Mallow	Exotic
	*Sida rhombifolia**	Paddy's Lucerne	Exotic
Myrtaceae	*Eucalyptus moluccana*	Grey Box	Native
Oxalidaceae	*Oxalis perennans*		Native
Plantaginaceae	*Plantago lanceolata**	Lamb's Tongues	Exotic
Poaceae	*Cenchrus clandestinus**	Kikuyu Grass	Exotic
	*Chloris virgata**	Feathertop Rhodes Grass	Exotic
	Cynodon dactylon†	Common Couch	Exotic
	*Ehrharta erecta**	Panic Veldtgrass	Exotic
	*Eleusine indica**	Crowsfoot Grass	Exotic
	*Eleusine tristachya**	Goose Grass	Exotic
	*Eragrostis curvula**	African Lovegrass	Exotic
	Eriochloa pseudoacrotricha	Cupgrass	Native
	Paspalidium distans		Native
	*Paspalum dilatatum**	Paspalum	Exotic

Family	Scientific Name	Common name	Status[1]
	*Poa annua**	Winter Grass	Exotic
	Rytidosperma spp.		Native
	*Setaria parviflora**		Exotic

1. Follows the definition of 'native vegetation' as included in Part 5A of the NSW *Local Land Services Act 2013: "A plant is native to New South Wales if it was established in New South Wales before European settlement."*
'*' indicates an exotic species.
'†' indicates a cosmopolitan species

Appendix Table A.2: Fauna inventory

Scientific name	Common name	Native/Exotic	Observation type
BIRDS			
Cacatua galerita	Sulphur-crested Cockatoo	Native	W
Sturnus vulgaris	Common Starling	Exotic	OW
Threskiornis molucca	Australian White Ibis	Native	O
Cracticus tibicen	Australian Magpie	Native	OW
Dacelo novaeguineae	Laughing Kookaburra	Native	W
Grallina cyanoleuca	Magpie-lark	Native	OW
Manorina melanocephala	Noisy Miner	Native	OW
Sturnus tristis	Common Myna	Exotic	OW
Trichoglossus haematodus	Rainbow Lorikeet	Native	OW

Observation type code: *F =Tracks or scratchings, O = Seen, OW = Seen and heard, W= Heard call*

Appendix B Plot data

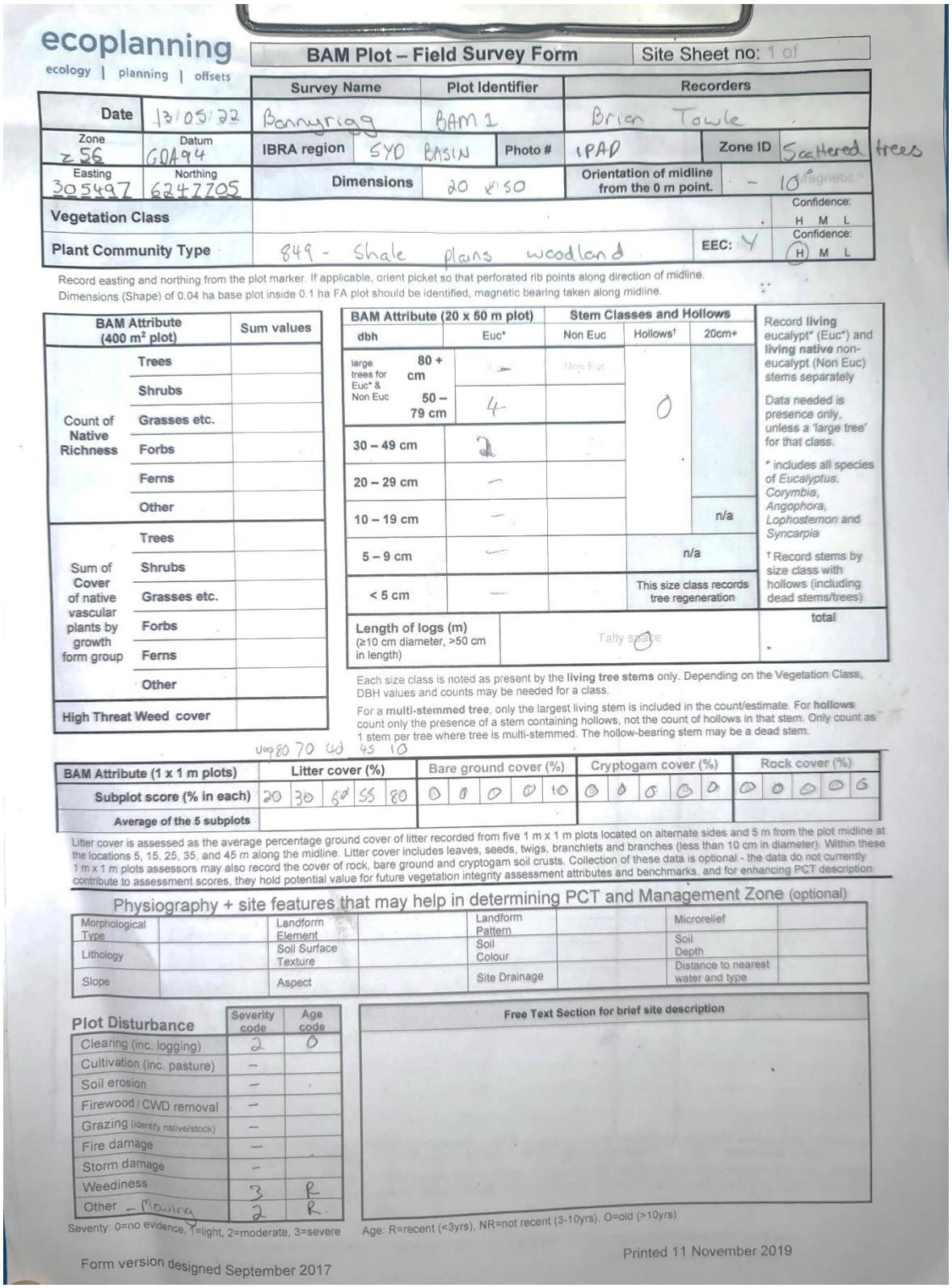
Plot No.	PCT	Area (ha)	Condition class	Zone	Easting	Northing	Bearing
BAM01 - CPSW	849	0.627	Scattered Trees	56	305497	6247705	10

Plot No.	Composition					
	Tree	Shrub	Grass	Forb	Fern	Other
BAM01 - CPSW	1	0	4	5	0	1

Plot No.	Structure					
	Tree	Shrub	Grass	Forb	Fern	Other
BAM01 - CPSW	6	0	0.6	0.6	0	0.2

Plot No.	Function										
	Large trees	Hollow trees	Litter cover (%)	Fallen logs (m)	Tree stem 5-10 cm	Tree stem 10-20 cm	Tree stem 20-30 cm	Tree stem 30-50 cm	Tree stem 50-80 cm	Tree regen	High threat exotic
BAM01 - CPSW	4	0	49		0	0	2	2	4	0	26.2

Appendix C Plot data sheet



ecoplanning
ecology | planning | offsets

BAM Plot – Field Survey Form Site Sheet no: 1 of

Survey Name	Plot Identifier	Recorders
Bonnyrigg	BAM 1	Brian Towle

Date	13/05/22	IBRA region	SYD BASIN	Photo #	IPAD	Zone ID	Scattered trees
Zone 56	Datum GDA94						
Easting 305497	Northing 6247705	Dimensions	20 x 50	Orientation of midline from the 0 m point.	~ 10° magnetic		
Vegetation Class						Confidence: H M L	
Plant Community Type	849 - Shale plains woodland			EEC: Y		Confidence: (H) M L	

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed cover		

BAM Attribute (20 x 50 m plot) dbh	Euc*	Non Euc	Stem Classes and Hollows: Hollows†	20cm+
large trees for Euc* & Non Euc: 80 + cm	—	Neg Euc	0	
50 – 79 cm	4			
30 – 49 cm	2			
20 – 29 cm	—			
10 – 19 cm	—			n/a
5 – 9 cm	—		n/a	
< 5 cm	—		This size class records tree regeneration	
Length of logs (m) (≥10 cm diameter, >50 cm in length)	Tally space			total

Record **living** eucalypt* (Euc*) and **living native** non-eucalypt (Non Euc) stems separately

Data needed is presence only, unless a 'large tree' for that class.

* includes all species of *Eucalyptus, Corymbia, Angophora, Lophostemon* and *Syncarpia*

† Record stems by size class with hollows (including dead stems/trees)

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a class.

For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

Veg 80 70 40 45 10

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	20	30	60	55	80	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots																				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description.

Physiography + site features that may help in determining PCT and Management Zone (optional)

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	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)	2	O
Cultivation (inc. pasture)	—	
Soil erosion	—	
Firewood / CWD removal	—	
Grazing (identify native/stock)	—	
Fire damage	—	
Storm damage	—	
Weediness	3	R
Other – Mowing	2	R

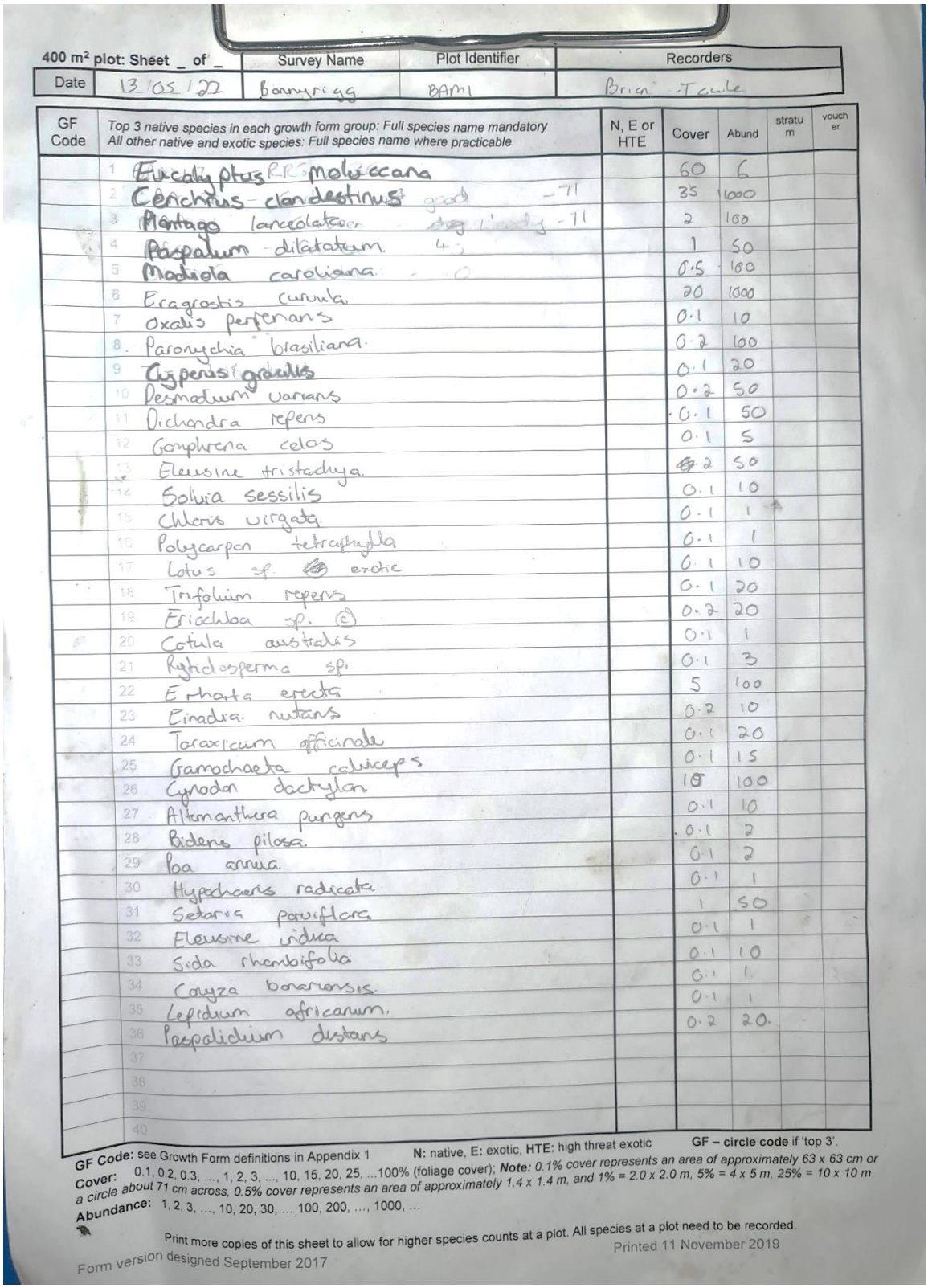
Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Free Text Section for brief site description

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Form version designed September 2017

Printed 11 November 2019



400 m² plot: Sheet _ of _ | Survey Name | Plot Identifier | Recorders

Date: 13/05/22 | Bonnyrigg | BAM1 | Brian Towle

GF Code	Top 3 native species in each growth form group: Full species name mandatory. All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
	1 Eucalyptus RR moluccana		60	6		
	2 Cenchrus clandestinus good -71		35	1000		
	3 Plantago lanceolata poor dog woody -71		2	100		
	4 Paspalum dilatatum. 4		1	50		
	5 Modiola caroliana.		0.5	100		
	6 Eragrostis curvula.		20	1000		
	7 Oxalis perfenans		0.1	10		
	8. Paronychia brasiliana.		0.2	100		
	9 Cyperus gracilis		0.1	20		
	10 Desmodium varians		0.2	50		
	11 Dichondra repens		0.1	50		
	12 Gomphrena celos		0.1	5		
	13 Eleusine tristachya.		2	50		
	14 Soliva sessilis		0.1	10		
	15 Chloris virgata.		0.1	1		
	16 Polycarpon tetraphylla		0.1	1		
	17 Lotus sp. exotic		0.1	10		
	18 Trifolium repens		0.1	20		
	19 Eriochloa sp.		0.2	20		
	20 Cotula australis		0.1	1		
	21 Rytidosperma sp.		0.1	3		
	22 Ehrharta erecta		5	100		
	23 Einadia nutans		0.2	10		
	24 Taraxacum officinale		0.1	20		
	25 Gamochaeta calviceps		0.1	15		
	26 Cynodon dactylon		10	100		
	27 Alternanthera pungens		0.1	10		
	28 Bidens pilosa.		0.1	2		
	29 Poa annua.		0.1	2		
	30 Hypochoeris radicata.		0.1	1		
	31 Setaria parviflora.		1	50		
	32 Eleusine indica		0.1	1		
	33 Sida rhombifolia		0.1	10		
	34 Conyza bonariensis.		0.1	1		
	35 Lepidium africanum.		0.1	1		
	36 Paspalidium distans		0.2	20.		
	37					
	38					
	39					
	40					

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***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*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

Form version designed September 2017 Printed 11 November 2019

Appendix D BAM calculator reports

BAM Candidate Species Report

Proposal Details

Assessment Id 00033110/BAAS17057/22/00033111	Proposal Name Bonnyrigg Living Communities	BAM data last updated * 16/06/2022
Assessor Name Brian Towle	Report Created 15/07/2022	BAM Data version * 54
Assessor Number BAAS17057	Assessment Type Part 4 Developments (Small Area)	BAM Case Status Open
Assessment Revision 0	Date Finalised To be finalised	BOS entry trigger BOS Threshold: Area clearing threshold

* 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

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
Large Bent-winged Bat	Miniopterus orianae oceanensis	Habitat constraints
Little Bent-winged Bat	Miniopterus australis	Habitat constraints
Regent Honeyeater	Anthochaera phrygia	Habitat constraints
Swift Parrot	Lathamus discolor	Habitat constraints
Thick Lip Spider Orchid	Caladenia tessellata	Refer to BAR

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00033110/BAAS17057/22/00033111	Bonnyrigg Living Communities	16/06/2022
Assessor Name	Report Created	BAM Data version *
Brian Towle	15/07/2022	54
Assessor Number	BAM Case Status	Date Finalised
BAAS17057	Open	To be finalised
Assessment Revision	Assessment Type	BOS entry trigger
0	Part 4 Developments (Small Area)	BOS Threshold: Area clearing threshold

* 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_Scattered_trees	Cumberland Plain Woodland in the Sydney Basin Bioregion	14.2	14.2	0.63	PCT Cleared - 93%	High Sensitivity to Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	True	0
											Subtotal	**0**
											Total	**0**

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