Biodiversity Management Plan (BMP)

Lakes Ridge

285 – 335 Pacific Highway, Lake Munmorah, NSW 2259

Report prepared for:
Rose Living Pty Ltd c/- Barker Ryan Stewart

Version 3.0
07 November 2024

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285 – 335 Pacific Highway, Lake Munmorah, NSW 2259

Prepared for:
Rose Living Pty Ltd,
C/ Barker Ryan Stewart
T2/34 Karalta Road,
Erina, NSW
Australia

Prepared by:

Wedgetail Project Consulting Pty Ltd

PO Box 234,
Cardiff NSW 2285
ABN: 93 640 388 683

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1. INTRODUCTION

1.1 BACKGROUND

Wedgetail Project Consulting Pty Ltd (Wedgetail) was engaged by Barker Ryan Stewart (BRS), on behalf of the Rose Living Pty Ltd Group, to complete a Biodiversity Management Plan (BMP) to support the proposed Biocertification of land at 285, 295, 305, 315, 325 and 335 Pacific Highway Lake Munmorah, New South Wales (NSW) 2259 (inclusive of Lot 1 DP 626787, Lot 437 DP 755266, Lot 438 DP 755266, Lot 27 DP 755266, Lot 12 DP 771284, Lot 83 DP 650114) (hereafter referred to as the 'Subject Site') (see **Figure 1**).

The following terms are used throughout this report to describe particular geographical areas:

- **Subject Site** – 285 – 335 Pacific Highway, Lake Munmorah, NSW (inclusive of Lot 1 and 2 DP 626787, Lot 438 and 437 DP 755266, Lot 27 DP 755266, Lot 83 DP650114 and Lot 12 DP 771284) (**Figure 1**).
- **Development Site** - The area within the Subject Site to be subject to the proposed residential subdivision (rezoning to *R2 Low Density Residential*) (**Figure 2**).
- **Conservation Area** – The area within the Subject Site to be rezoned and maintained as a *C2 Environmental Conservation*, inclusive of areas of temporary impact and restoration associated with detention basins (constructed wetlands) (**Figure 2**).
- **Locality** - Land within a 5 kilometre (km) radius of the Subject Site (**Figure 1**).

1.2 SITE DESCRIPTION

The Subject Site is located within the suburb of Lake Munmorah within the Central Coast Council Local Government Area (LGA). The majority of the site is zoned *R2 Low Density Residential*, with areas of *C2 Environmental Conservation*, *RE1 Private Recreation* and *SP2 Road* under the Central Coast Local Environmental Plan (LEP) 2022. The proposed road corridor to the west lies within an area that is currently Zoned *RE1 – Public Recreation*.

The Subject Site is currently comprised of semi-rural properties, characterised by a mix of residence, sheds, and existing infrastructure, including two large telecommunication towers. The vegetation throughout the site is characterised by a mix of remnant low woodland vegetation, scattered mature eucalypts, managed grassland, and windbreaks comprised of planted Radiata Pine (*Pinus radiata*). Groundcover within the Subject Site is comprised of native and exotic species (mainly introduced perennial grasses). The lack of plant diversity in the groundcover is likely to be the result of land management practises including grazing and slashing by the current landowners.

Low-lying areas within the eastern portion of the Subject Site are predominantly cleared. A small wetland dominated by rush species occurs near in the north-east corner of the Subject Site. Four constructed dams also occur in the south. A drainage channel intersects the location of the proposed road reserve adjacent to Chisholm Avenue to the west. A poorly defined drainage channel also flows in a northern direction through the eastern portion of the Subject Site.

1.3 PROPOSED DEVELOPMENT

The proposed Development Application is for a 288 lot land subdivision, comprising:

- 283 residential allotments;
- 2 drainage reserves;
- 2 conservation allotments; and
- 1 public park.

The proposed subdivision complies with the applicable development standards and is consistent with the zone objectives. The proposal is permissible with consent under the provisions of Central Coast LEP 2022 and is consistent with the Central Coast DCP 2022.

The land was rezoned in 2022 to facilitate residential subdivision, creation of conservation lots and a public park.

- Supporting documents prepared as part of the rezoning process include:
- Draft State Planning Agreement for Pacific Highway upgrades (currently being finalised);
- Local Planning Agreement for construction of a collector road, creation of conservation lands and a local park;
- Biodiversity Certification Agreement and Biodiversity Certification Order;
- Site specific DCP Chapter 5.54 Lake Munmorah 285-325 Pacific Highway; and
- Aboriginal Cultural Heritage Assessment report.

1.4 MANAGEMENT PLAN OBJECTIVES

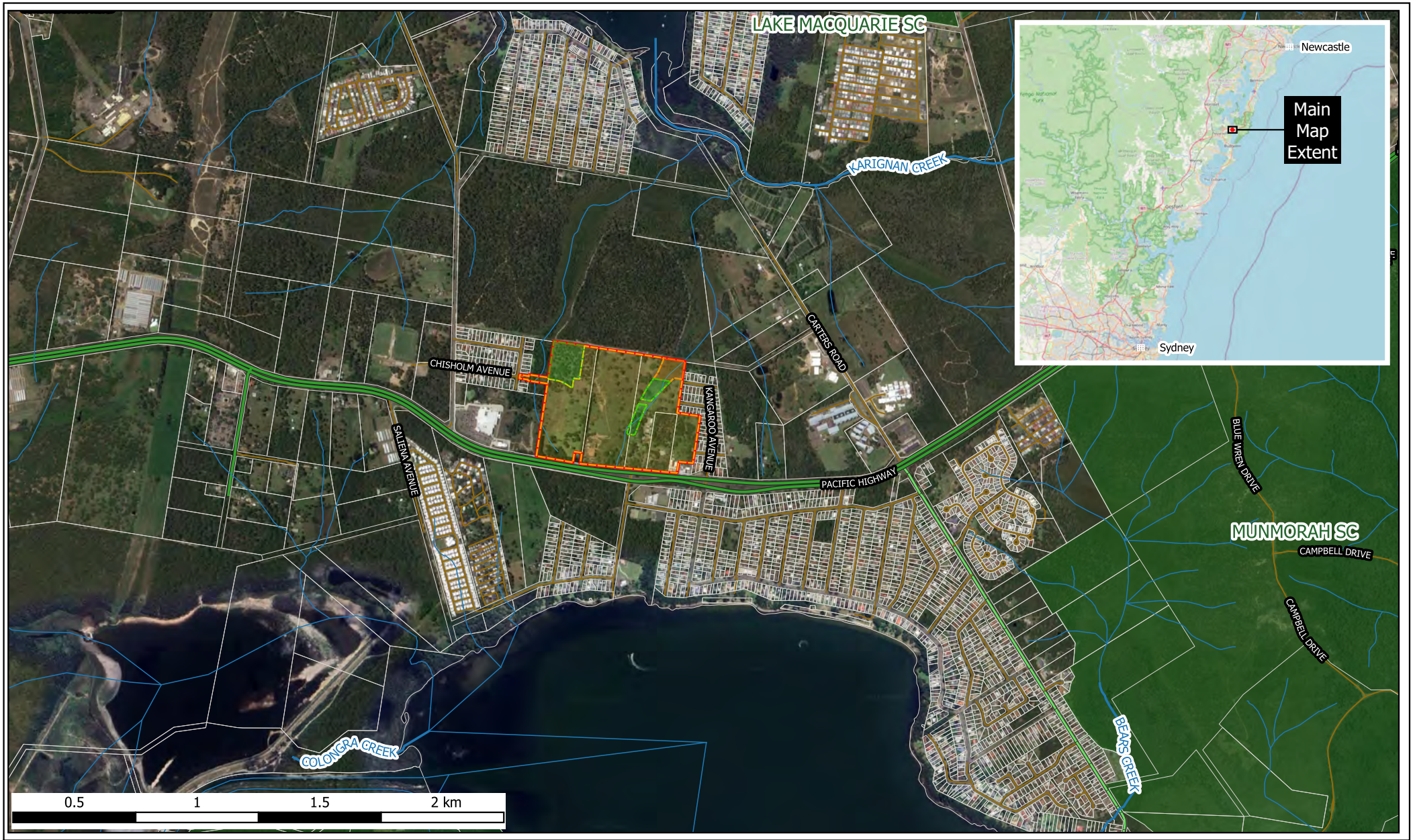
1.4.1 Objectives

This BMP is a requirement of Schedule 4 of the Order conferring biodiversity certification – 285 – 325 Pacific Highway and (part) 6W Kemira Road, Lake Munmorah. The BMP was completed following correspondence with Biodiversity Conservation Science, NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW). The BMP has been prepared by a suitably qualified and experienced ecologist (see **Appendix 3**) and in accordance with *Chapter 3.6 – Tree and Vegetation Management* of the Wyong Development Control Plan (DCP) 2013 (the "Wyong DCP"), and relevant guidelines including:

- Appendix 8.2 – Guidelines for Vegetation Management Plans – Version 1 of the Wyong Shire Council Flora and Fauna Survey Guidelines Version 2.4 (Wyong Shire Council 2016),
- Central Coast Council Flora and Fauna Guidelines (CCC 2019),
- National Recovery Plan for the Swift Parrot (*Lathamus discolor*) (DAWE 2019)

The key objectives of the BMP are:

1. To minimise impacts to flora and fauna, and their habitats, during the construction phase of the residential subdivision project.
2. To improve the condition of the existing remnant woodland within the 'North-western Conservation Area' to ensure that it is maintained in a healthy condition.
3. To improve the condition of the existing low-lying managed wetland areas 'Eastern Conservation Area' to ensure that it is rehabilitated and maintained in a healthy condition.
4. To ensure that landscaping and any additional plantings within the proposed development are consistent with the objectives of Swift Parrot (*Lathamus discolor*) conservation.
5. To maintain and improve fauna habitat values within the conservation areas as part of the proposed development, and to ensure the maintenance of these features and functionality throughout the implementation period.



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Legend

- Subject Site
- Development Site
- Development Site (to be rehabilitated)
- Conservation Area
- NPWS Reserve
- Cadastre
- Named creek
- Minor creek
- Primary Road
- Arterial Road
- Local Road

Locality

Figure: 1

Rose Living Pty Ltd, C-/ Barker Ryan Stewart
Lakes Ridge, 285 - 335 Pacific Highway,
Lake Munmorah NSW 2259

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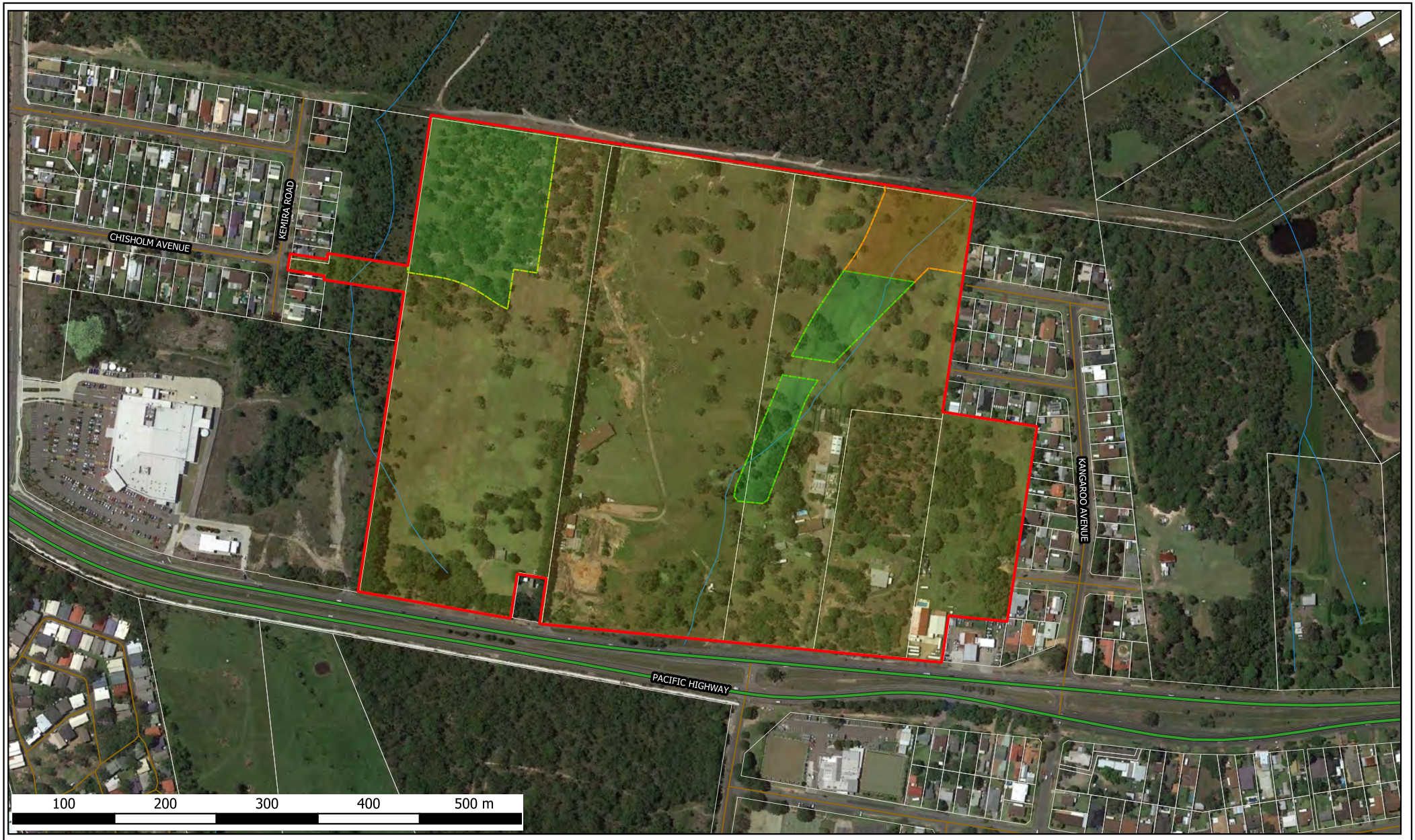

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Legend

- Subject Site
- Development Site
- Development Site (to be rehabilitated)
- Conservation Area
- Cadastre
- Minor creek
- PrimaryRoad
- LocalRoad

Subject Areas

Figure: **2**

Rose Living Pty Ltd, C-/ Barker Ryan Stewart
Lakes Ridge, 285 - 335 Pacific Highway,
Lake Munmorah NSW 2259

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2. BIODIVERSITY VALUES

2.1 KEY BIODIVERSITY VALUES

A Biodiversity Certification Assessment Report (BCAR) was prepared for the project by Kleinfelder to support the proposed biocertification of the Subject Site (Kleinfelder 2022a). The key results of the BCAR are detailed below.

2.1.1 Flora Species

A total of 149 flora species were identified during field surveys, 44 of these were exotic species, of which eleven (11) are considered 'High Threat Exotics" and four (4) are listed Priority Weeds for the Greater Sydney Local Land Services Region under the *Biosecurity Act 2015* (NSW). Priority Weed species, Weeds of National Significance, High Threat Weed Species identified within the Subject Site are listed in **Table 1**.

Table 1 Priority Weed Species within the Subject Site.

Scientific Name	Common Name	Weeds of National Significance (WONS)	Priority weeds of the Greater Sydney LLS (Biosecurity Act)	High hreat Weeds (BAM)
Andropogon virginicus	Whiskey Grass			X
Asparagus aethiopicus	Ground Asparagus		X	X
Axonopus fissifolius	Narrow-leaved Carpet Grass			X
Cenchrus clandestinum	Kikuyu			X
Cinnamomum camphora	Camphor Laurel			X
Ehrharta erecta	Panic Veldt Grass			X
Hyparrhenia hirta	Coolatai Grass			X
Lantana camara	Lantana	X	X	X
Paspalum dilatatum	Paspalum			X
Rubus anglocandicans	Blackberry	X	X	X
Senecio madagascariensis	Fire Weed	X	X	X
Andropogon virginicus	Whiskey Grass			X
Asparagus aethiopicus	Ground Asparagus		X	X
Axonopus fissifolius	Narrow-leaved Carpet Grass			X
Cenchrus clandestinum	Kikuyu			X

One (1) threatened flora species was identified within the Subject Site during field surveys, *Angophora inopina* (Charmhaven Apple), listed as vulnerable under the Biodiversity Conservation Act (BC Act) 2016. The species was recorded mainly within woodland areas (Vegetation Zones 4 and 5). A list of the flora species identified within the Subject Site is provided in **Appendix 1**. Further discussion on exotic species within the Subject Site is provided in **Section 2.2.2** of this BMP.

2.1.2 Vegetation Communities

Three (3) native vegetation communities occur within the Subject Site *PCT 1649 - Smooth-barked Apple - Red Mahogany - Swamp Mahogany - Melaleuca sieberi heathy swamp woodland of coastal lowlands* (EEC), *PCT 1638 - Smooth-barked Apple - Red Bloodwood - Scribbly Gum grass - shrub woodland on lowlands of the Central Coast* and *PCT 1737 - Typha rushland* (EEC).

The above PCTs were further assigned to eight (8) vegetation zones based on floristics and vegetation condition as shown in **Table 2**. The table provides a summary of areas of each vegetation zone to be retained with no direct impacts (Conservation Areas [C2]), development impacts, and impacts resulting from the establishment of two constructed wetlands (which will ultimately be rehabilitated). Note that the Constructed Wetlands form part of both the Disturbance Footprint and the Conservation Area.

2.1.3 Fauna and Habitat Values

The Subject Site is characterised by mix of fragmented open woodlands (managed and unmanaged) with a grassy groundcover, grasslands, small areas of shrub regrowth, and scattered mature eucalypts (various species).

Shallow drainage channels intersect the Subject Site where surface flows are concentrated. Low-lying wet areas occur in the north-east in an Subject Site of Typha Rushland. Five constructed dams occur in the southern portion of the Subject Site .

As stated previously, the coverage of native vegetation within the Subject Site has been reduced due to historical vegetation clearing and land management practises such as slashing, mowing and grazing by livestock. The coverage of native shrubs and groundcover species is particularly low throughout most areas of the site, hence, habitat for fauna species that require dense vegetation for cover (refugia) is limited. Additionally, the low lack of native plant diversity also reduces the availability of foraging resources.

Despite historical disturbance within the Subject Site, an abundance of hollow-bearing trees (HBTs) occurs. Site inspections revealed that several hollows are occupied by fauna species, mostly locally occurring bird and possum species.

A summary of the key fauna habitat features identified within the Subject Site is as follows:

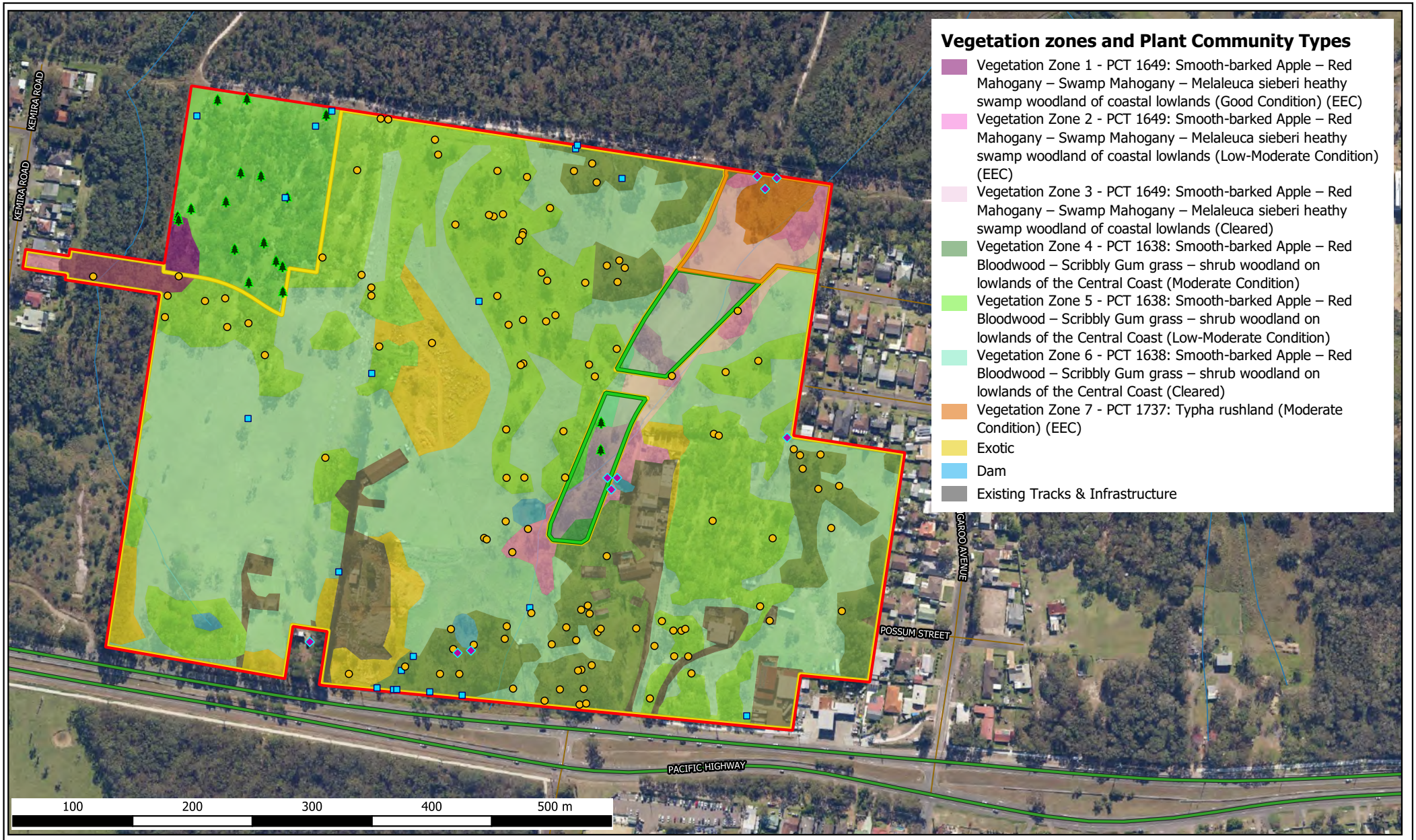
- A total of 131 Hollow-bearing Trees (HBTs) were recorded (including four dead stags with hollows). Of these trees 33 were recorded as having large hollows (>30cm diameter), 28 trees had a maximum size hollow being “medium” (20-29cm diameter) and 70 trees only had small hollows (10-19cm).
- Fallen logs and timber (limited to unmanaged areas).
- Mature eucalypts that may provide foraging and nesting habitat for native bird species.
- Two shallow ephemeral drainage channels that contain pools of water for short periods following high rainfall.
- A small Typha Rushland (0.25 ha) in the north-east corner of the Subject Site, though limited open water is present.
- Five constructed dams that contain water on a permanent/semi-permanent basis.

A total of 66 species of fauna (six amphibians, 43 birds, 17 mammals) were detected within the Subject Site during field surveys. A total of six (6) species detected within the Subject Site are listed as vulnerable under the BC Act, including the following:

- Southern Myotis (*Myotis macropus*) [Vulnerable BC Act],
- Greater Broad-nosed Bat (*Scoteanax rueppellii*) [Vulnerable BC Act],
- Little Bent-winged Bat (*Miniopterus australis*) [Vulnerable BC Act],
- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) [Vulnerable BC Act],
- Glossy Black Cockatoo *(Calyptorhynchus lathami*) [Vulnerable BC Act],
- Eastern Osprey (*Pandion cristatus)* [Vulnerable BC Act]

Table 2 Vegetation Zones within the Subject Site

PCT	Vegetation Zone	Condition Class	Development Site*	Conservation Area		Total Disturbance Footprint	Total Conservation Area	Subject Site (ha)
				Constructed Wetland (Temporary Impacts)	Conservation Areas (C2)			
PCT 1649 – *Smooth-barked Apple – Red Mahogany – Swamp Mahogany – Melaleuca sieberi heathy swamp woodland of coastal lowlands(EEC)*	Zone 1	Good (EEC)	0.20	0	0.11	0.20	0.11	0.32
	Zone 2	Low- Moderate (EEC)	0.43	0.16	0.40	0.59	0.56	0.99
	Zone 3	Cleared	0.21	0.36	0.42	0.57	0.78	0.99
PCT 1638 – Smooth-barked Apple – Red Bloodwood – Scribbly Gum grass – shrub woodland on lowlands of the Central Coast	Zone 4	Moderate	2.87	0.01	0.04	2.88	0.05	2.92
	Zone 5	Low-Moderate	6.66	0	1.93	6.66	1.93	8.59
	Zone 6	Cleared	10.26	0.04	0.05	10.30	0.10	10.41
PCT 1737 – Typha rushland (EEC)	Zone 7	Moderate (EEC)	0	0.26	0	0.26	0.26	0.26
Exotic Vegetation	Zone 8	N/A	1.43	0	0	1.43	0	1.51
Existing Tracks & Infrastructure			1.53	0	0	1.53	0	1.80
Dams and Watercourse			0.14	0	0	0.14	0	0.14
Total			**23.73**	**0.83**	**2.95**	**24.56**	**3.78**	**27.92**



Vegetation zones and Plant Community Types

- Vegetation Zone 1 - PCT 1649: Smooth-barked Apple – Red Mahogany – Swamp Mahogany – Melaleuca sieberi heathy swamp woodland of coastal lowlands (Good Condition) (EEC)
- Vegetation Zone 2 - PCT 1649: Smooth-barked Apple – Red Mahogany – Swamp Mahogany – Melaleuca sieberi heathy swamp woodland of coastal lowlands (Low-Moderate Condition) (EEC)
- Vegetation Zone 3 - PCT 1649: Smooth-barked Apple – Red Mahogany – Swamp Mahogany – Melaleuca sieberi heathy swamp woodland of coastal lowlands (Cleared)
- Vegetation Zone 4 - PCT 1638: Smooth-barked Apple – Red Bloodwood – Scribbly Gum grass – shrub woodland on lowlands of the Central Coast (Moderate Condition)
- Vegetation Zone 5 - PCT 1638: Smooth-barked Apple – Red Bloodwood – Scribbly Gum grass – shrub woodland on lowlands of the Central Coast (Low-Moderate Condition)
- Vegetation Zone 6 - PCT 1638: Smooth-barked Apple – Red Bloodwood – Scribbly Gum grass – shrub woodland on lowlands of the Central Coast (Cleared)
- Vegetation Zone 7 - PCT 1737: Typha rushland (Moderate Condition) (EEC)
- Exotic
- Dam
- Existing Tracks & Infrastructure

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Legend

- Study Area
- Development Area
- Conservation Area Retained
- Conservation Area Impacted
- Hollow Bearing Trees to be retained
- Hollow Bearing Trees to be removed
- Threatened flora location
- Threatened fauna location
- PrimaryRoad
- LocalRoad
- Minor creek

Vegetation and Biodiversity Values

Figure: **3**

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Lakes Ridge, 285 - 335 Pacific Highway,
Lake Munmorah NSW 2259

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2.2 KEY THREATS

2.2.1 Inappropriate Grazing and Management of Groundcover

Inappropriate livestock grazing can have a detrimental impact on areas of native vegetation by altering the species composition and structure of the community through selective grazing of more palatable species and regenerating species (i.e. canopy species), soil compaction and facilitating weed incursion (DECCW 2010). The Subject Site is currently subject to a medium to high level of grazing (horses and sheep) which is likely to be influencing the diversity and cover of native flora, along with reduced tree and shrub recruitment. These impacts are compounded by regular management of the groundcover through mowing.

Grazing will be excluded from areas of retained vegetation under this BMP during the **Construction** and **Operational** phases of the proposed development.

2.2.2 Weed Incursions

Weeds are recognised as a key threat to the retained vegetation within the Subject Site, with the fertile and productive nature of low-lying wet areas leading to an increased vulnerability to weed species invasion and spread (DAWE 2020). Weed establishment and dominance can lead to changes in nutrient cycling, species composition, structure and fauna habitat values (DAWE 2020).

A total of five (4) Priority Weed species for the Greater Sydney Local Land Services Region (DPI, 2022) were identified within the Subject Site. Weed mapping will occur during the first monitoring event.

Weed incursions will continue to be a threat to biodiversity values during:

- ***Construction Phase:*** Construction activities occurring on site as part of the proposed development, namely vehicle movements and transport of materials (i.e. soil and mulch) have the potential to facilitate the spread of exotic flora species within the Subject Site.
- ***Operational Phase:*** The proposed development, if unmanaged, may further exacerbate local weed incursions or facilitate the introduction of novel weed species through the movement of weed seeds/propagules and changes to nutrient inputs from increase runoff.

2.2.3 Invasive Fauna Species

Invasive fauna species are potentially a key threat to native vegetation retained within the Subject Site, particularly to areas of Conservation Areas. Species relevant to the Subject Site include introduced herbivores (i.e. Horses, Sheep and Goats) – discussed in **Section 2.2.1**), introduced predators (i.e. Mosquito fish [*Gambusia holbrooki*]) and invasive native species (Noisy Miner [*Manorina melanocephala*]). Introduced predators such as the Mosquito fish pose a key threat to

native fauna through predation, especially locally occurring frog species, limiting the ability for locally occurring frog populations to persist within the Subject Site. A range of threatened woodland and forest bird species listed under the Threatened Species Conservation Act 1995 are adversely affected by aggressive exclusion by abundant Noisy Miners including the Swift Parrot (*Lathamus discolor).*

Invasive fauna species are likely to be a key threat to biodiversity values during:

- ***Operational Phase:*** The proposed development may further exacerbate the threat of invasive species through the reduction of suitable refuge habitats for frogs and tadpoles (protection from Mosquito fish).

2.2.4 Vegetation Clearing and Habitat Loss

The proposed development will require the clearing of native vegetation, including 24.01 ha of native forest/woodland (PCT 1649 – *Smooth-barked Apple – Red Mahogany – Swamp Mahogany – Melaleuca sieberi heathy swamp woodland of coastal lowlands, PCT 1638 – Smooth-barked Apple – Red Bloodwood – Scribbly Gum grass – shrub woodland on lowlands of the Central Coast and PCT 1737 – Typha rushland* (EEC)). Vegetation clearing will involve the removal of 115 hollow-bearing trees (containing 58 small hollows 102 medium sized hollows and 49 large hollows), representing potential nesting habitat for various native bird and arboreal mammal species. Incursions into areas of native forest may exacerbate existing weed management threats and adversely impact threatened species and ecological communities proposed to be retained within the Subject Site.

Vegetation clearing and habitat loss represents a threat to biodiversity values during:

- ***Construction Phase:*** Other than the direct impacts to native vegetation and fauna habitat detailed above, construction activities within the Subject Site have the potential to impact retained vegetation through accidental incursions, and the introduction and facilitation of weed incursions.
- ***Operational Phase:*** The proposed residential subdivision may further exacerbate habitat loss and degradation of vegetation through inappropriate management of retained vegetation.

2.2.5 Erosion and Sedimentation

Erosion resulting from earthworks such as the operation of machinery during the construction phase may facilitate the movement of water-borne sediments that have the potential to adversely impact important biodiversity values on site. This may include impacts on the condition of native vegetation

including wetlands, threatened ecological communities (*Typha Rushland* EEC) and threatened species habitat.

2.2.6 Lighting, Noise and Water Pollution

Urban developments can result in a number of indirect impacts native vegetation communities and the habitat they provide, including increased lighting (light pollution) and noise (noise pollution), and changes to surface water runoff and quality. Threats to local biodiversity values pertaining to the proposed development include the following:

- ***Construction Phase:*** Increased noise from construction activities and changes to surface water runoff patterns and quality into adjacent wetland.
- ***Operational Phase:*** The proposed development may result in changes to soil nutrient status from increased runoff, and increased/inappropriate lighting and noise from traffic during operation.

Stormwater Quality

A total of two (2) stormwater retention basins are proposed within the Subject Site, located within along the western boundary and within the north-eastern corner of the Subject Site. The location and layout of the western basin was selected so as to minimise impacts to native vegetation, especially mature trees known to provide foraging habitat for the threatened Swift Parrot (*Lathamus discolor*). Both basins are to be designed as constructed wetlands, involving the rehabilitation of wetland vegetation occurring within the Subject Site and representative of *PCT 1737 – Typha Rushland* (Vegetation Zone 7). The water flow and pollutants into the coastal wetland have avoided direct and indirect impacts to the sensitive ecosystem. The design ensures that the water flow and pollutants to the coastal wetland will now be equal to or less than that modelled for the pre-development state.

The establishment of the two constructed wetlands is further detailed in **Section 3.4.10**.

3. MANAGEMENT PLAN

3.1 MANAGEMENT ZONES

A total of four (4) Management Zones within the Subject Site have been delineated based on current condition/status, management requirements, and proposed future land use. The management zones are shown in Figure 4, and detailed in Table 3.

- **Management Zone 1:** Development Site
- **Management Zone 2:** Eastern Conservation Area (Detention Basin – Constructed Wetland)
- **Management Zone 3:** Eastern Conservation Area
- **Management Zone 4**: North-western Conservation Area

Table 3: Management Zones within the Subject Site

Management Zone	Description
Management Zone 1: Development Site	**Total area within Subject Site:** 23.73 ha **Community:** PCT 1649 – Smooth-barked Apple – Red Mahogany – Swamp Mahogany – Melaleuca sieberi heathy swamp woodland of coastal lowlands, PCT 1638 – Smooth-barked Apple – Red Bloodwood – Scribbly Gum grass – shrub woodland on lowlands of the Central Coast and Exotic Vegetation. Also including existing infrastructure and dams. **Description:** The vegetation throughout the site is characterised by a mix of remnant low woodland vegetation, scattered mature eucalypts, managed grassland, and windbreaks comprised of planted Radiata Pine (Pinus radiata). Groundcover within the Subject Site is comprised of native and exotic species (mainly introduced perennial grasses). The lack of plant diversity in the groundcover is likely to be the result of land management practices including grazing and slashing by the current landowners. **Management Goals:** Goals associated with this vegetation zone include the appropriate management of impacts such as vegetation clearing, weed establishment, erosion and nutrient movement. This area will be subject to ongoing operational impacts with landscaping. Landscaping is to be consistent with the adjacent retained native vegetation communities, with street trees to be selected so as to provide foraging habitat for the Swift Parrot.
Management Zone 2: Eastern Conservation Area (Detention Basin – Constructed Wetland)	**Total area within Subject Site:** 0.84 ha **Community:** PCT 1737 – Typha rushland (Moderate Condition - EEC) **Form:** Moderate Condition Freshwater Wetlands **Description:** The vegetation within Management Zone 3 is dominated by Typha orientalis (Broad-leaved Cumbungi) with a mix Gahnia clarkei (Tall Saw-sedge), of herbs including Ranunculus inundatus (River Buttercup), Baumea rubiginosa, Cyperus polystachyos, and Schoenus apogon (Fluke Bog-rush). The canopy and midstorey is absent, with the exception of occasional emergent of Melaleuca quinquenervia (Broad-leaved Paperbark) and Eucalyptus robusta (Swamp Mahogany). The vegetation Zone 7 is characterised by a predominantly low cover of exotic species, however Andropogon virginicus (Whiskey Grass) is invading the edges of the community. **Disturbances:** This zone has a low cover of exotic species, however Andropogon virginicus (Whiskey Grass) is invading the edges of the community. **Management Goals:** Goals will include the restoration and maintenance of a native constructed wetland, with the restored vegetation being commensurate with PCT 1737 – Typha rushland.

Management Zone	Description
Management Zone 3: Eastern Conservation Area	**Total area within Subject Site:** 0.94 ha **Community:** PCT 1649 – Smooth-barked Apple – Red Mahogany – Swamp Mahogany – Melaleuca sieberi heathy swamp woodland of coastal lowlands (Low – Moderate Condition – EEC) and PCT 1649 – Smooth-barked Apple – Red Mahogany – Swamp Mahogany – Melaleuca sieberi heathy swamp woodland of coastal lowlands (Cleared) **Form:** Low – Moderate Condition **Description:** The vegetation within this Management Zone 2 was characterized by largely cleared land with areas including an open canopy of Angophora floribunda (Rough-barked Apple), Eucalyptus resinifera (Red Mahogany), Eucalyptus robusta (Swamp Mahogany), Melaleuca quinquenervia (Broad-leaved Paperbark), and Eucalyptus haemastoma (Broad-leaved Scribbly Gum). The midstorey is variable, with areas around waterbodies (constructed dams) and wetlands (Vegetation Zone 7) being characterised by Melaleuca quinquenervia juveniles, and Melaleuca sieberi. The shrub layer and groundcover is predominantly managed throughout the vegetation zone with occasional Pittosporum undulatum (Sweet Pittosporum) and Livistona australis (Cabbage Tree Palm). The groundcover is dominated by a mix of native and exotic grasses including Andropogon virginicus (Whisky Grass), Themeda triandra (Kangaroo Grass), Sporobolus virginicus (Sand Couch), and Eragrostis leptostachya (Paddock Lovegrass). Low lying areas had a greater abundance of species such as Baumea rubiginosa, Cyperus polystachyos, Schoenus apogon (Common Bog-rush), and Juncus holoschoenus. **Disturbances:** Historic vegetation clearing, grazing, and moderate weed invasion. The vegetation zone generally has a low cover of exotic species, however Andropogon virginicus (Whiskey Grass) occurs throughout the vegetation zone. **Management Goals:** This zone will be retained and subject to active restoration of a native vegetation closely to PCT 1649. Goals within this zone include the planting of native canopy species, improve fauna habitat values, and a reduction of weed impacts. Active restoration of the riparian zone within this Management Zone aims to provide a stable watercourse and riparian corridor which will emulate local native vegetation communities.
Management Zone 4: North-western Conservation Area	**Total area within Subject Site:** 1.99 ha **Community:** PCT 1638 – Smooth-barked Apple – Red Bloodwood – Scribbly Gum grass – shrub woodland on lowlands of the Central Coast (Low-Moderate Condition) Form: Low to Moderate Condition **Description:** The vegetation within this Management Zone is characterised by a canopy dominated by Angophora costata (Smooth-barked Apple), Eucalyptus haemastoma (Broad-leaved Scribbly Gum), with Corymbia gummifera (Red Bloodwood) and Eucalyptus capitellata (Brown Stringybark). The midstory is sparse and comprised of species including Allocasuarina littoralis (She-oak). The ground layer is variable across the Subject Site based on management regime (grazing, mowing, or left idle) but can be generally characterized by a mix of native and exotic grasses including Themeda triandra, Andropogon virginicus (Whiskey Grass), Aristida vagans, Entolasia stricta (Wiry Panic), Microlaena stipoides (Weeping Grass) and Eragrostis brownii (Brown's Lovegrass) **Disturbances:** Exotic species cover is variable, with Whiskey Grass being widespread and patches of Rubus anglocandicans (Blackberry) within the south of the Subject Site. Historic grazing and slashing practices have occurred intensively over the area. Management Goals: This zone will be retained and subject to active management to maintain and restore native vegetation condition, improve fauna habitat values and reduce weed impacts.

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Legend

- Study Area
- Management Zone 1
- Management Zone 2
- Management Zone 3
- Management Zone 4
- 5m Vegetation buffer
- Primary Road
- Local Road
- Minor creek

Management Zones

Figure: **4**

Rose Living Pty Ltd, C-/ Barker Ryan Stewart
Lakes Ridge, 285 - 335 Pacific Highway,
Lake Munmorah NSW 2259

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3.2 MANAGEMENT STAGES

The BMP will be implemented over a 10-year period. The BMP will apply to the Certified Land (i.e. Management Zone 1) throughout construction, and will apply to the Conservation Land in perpetuity.

The timing of management tasks and performance criteria are based on Management Stages defined by the progress of the proposed development. These include the following:

- Pre-clearing / Pre-construction
- Clearing / construction
- Pre-certification - Prior to issue of the first subdivision works certificate
- Early Management - In place - within 12 - 24 months from issue of the subdivision works certificate (and / or until targets met, whichever is the greater)
- Management - Years 2 – 10 (and / or until targets met, whichever is the greater)
- Maintenance In perpetuity

Key milestones for the BMP were developed in consultation with the BCS and are summarized below for Management Zone 1 (Impact Area) (**Table 5**) and Management Zones 2-4 (Conservation Areas) (**Table 4**).

3.3 PERFORMANCE CRITERIA

The overall performance criterion of this BMP are as follows:

- **Vegetation Condition (Management Zones 3 and 4):** The condition of native vegetation within Management Zones 3, and 4 will be maintained and improved, based on baseline plot data recorded during initial impact assessments (Kleinfelder 2022) by the end of the implementation period (10 years). Performance targets to be achieved by the end of the implementation period are detailed in **Table 4**. These targets will be achieved through the implementation of active management measures including; removal of High Threat Weeds (HTWs) (see **Section 3.4.12**), supplementary plantings (see **Section 3.4.10**), and additional habitat augmentation (see **Section 3.4.10**). Vegetation Condition targets for Management Zone 2 are based on the restoration of the pre-development community following the construction of the basin. As such, targets assumed maintenance of the variables measured during the BCAR surveys with the removal of HTWs. Performance targets for each Management Zone are detailed in **Table 4.**
    - Impacts to threatened flora species occurring along the southern boundary of the Subject Site will be avoided through the limiting of earthworks to a minimum of 5 from all *Angophora inopina* trees. These trees will be retained within lots and offset through the planting of *Angophora inopina* tubestock within the Conservation Areas at a 5:1 ratio.

- **Vegetation Extent:** The area of native vegetation within Management Zone 2 (Retention Basin) is to be rehabilitated with active restoration and planting of flora species commensurate with *PCT 1737 – Typha rushland* after its construction (**Appendix 2**). Performance targets are detailed in **Table 4.** Completion of this performance criteria will be based on the absence of incursions (clearing, under scrubbing, groundcover management) into the proposed conservation areas.
- **Fauna Management (Management Zone 1):** Management of impacts such as vegetation clearing, weed establishment, erosion and nutrient movement. This area will be subject to ongoing operational impacts with landscaping. Landscaping is to be consistent with the adjacent retained native vegetation communities.
- Other:
    - The maintenance of boundary fencing and signage around the Conservation Areas where practical.
    - The establishment and maintenance of habitat features (i.e. nest boxes and/or repurposed hollows). All nest boxes will be maintained/replaced throughout the implementation period.
    - Reduction of Priority Weeds, Weeds of National Significance (WoNS), and High Threat Weeds (HTWs).
    - No signs of firewood collection, dumping of waste (inc. garden waste)

3.3.1 Completion of Adaptive Management Phase

Performance targets are to be met by the end of the implementation period (10 years) and summarized within the Final Summary Report (detailed in **Section 3.5.2**). If performance targets are not met by the conclusion of the initial implementation period, monitoring will continue in accordance with this plan until met. Once the Performance Targets are met, the Final Summary Report will detail the long-term maintenance of the site in perpetuity.

Table 4: Key BMP Milestones / Performance Criteria – Conservation Management Zones (Mgnt 2, 3, and 4)

Management Zone	PRE-CERTIFICATION Prior to issue of the first subdivision works certificate	EARLY MANAGEMENT In place - within 12 - 24 months from issue of the subdivision works certificate (and / or until targets met, whichever is the greater)	MANAGEMENT Management - Years 2 - 10 (and / or until targets met, whichever is the greater)	MAINTENANCE Maintenance In perpetuity
Management Zone 2, 3, and 4	The following biodiversity offset works are in place: • 105 nest boxes* installed • Seed collection / tubestock of A. inopina** at a ratio of at least 5:1 (170 seedlings) • grazing to cease, permanent post and cable fencing or equivalent is to be provided adjacent to the conservation area unless otherwise agreed with BCD • baseline monitoring	The following biodiversity works are to be in place: • a further 105 nest boxes* preferably from reclaimed / augmented hollows • Planting of A. inopina** at a ratio of 5:1 (170 seedlings) in the Zone 4 (NW conservation area) (A. inopina must be at least 12 months old by end of 'In place' phase) • minimum canopy tree planting(s)* every 25m2 with species consistent with pre-existing PCT sites and include swift parrot feed trees. 90% of canopy tree planting(s) to be in the ground for at least 12 months before progressing to Management phase • achieve 90% eradication of Biosecurity and High Threat weeds, and 75% eradication of all other weeds (with the exclusion of pasture grasses) • naturally regenerating seedlings from the pre-existing PCT to be protected / encouraged to establish • permanent post and cable fencing or equivalent is to be maintained in working order unless otherwise agreed with BCD • annual monitoring reports to be provided to the Environmental Agency Head reporting on how key milestones are progressing.	The following biodiversity works are 'managed' consistently at the performance target level for three years: • 90% of nest boxes in working condition • 90% of A.inopina plantings have been planted. At completion of the management phase they should be at least 3 years of age, and be healthy, and self-sustaining • 90% of canopy plantings have been in the ground for at least 3 years of age. At completion of the management phase they should be at least 3 years of age, healthy, and self-sustaining • 80% of canopy and shrub species and 65% of ground cover species should be consistent with the pre-existing PCT for zone 2, 3 ,4 and maintained consistently for the 3 year management phase. In the event targets are not being reached through natural regeneration then supplementary planting is required • 100% of biosecurity and high threat weeds removed and 80% consistently suppressed to this level for three years • annual monitoring reports to be provided to the Environmental Agency Head reporting on how key milestones are progressing	Final monitoring report provided demonstrating achievement of in place targets and management at performance target level for minimum 3 years. Standards achieved at the end of the management phase are to be maintained in perpetuity.

Management Zone	PRE-CERTIFICATION Prior to issue of the first subdivision works certificate	EARLY MANAGEMENT In place - within 12 - 24 months from issue of the subdivision works certificate (and / or until targets met, whichever is the greater)	MANAGEMENT Management - Years 2 - 10 (and / or until targets met, whichever is the greater)	MAINTENANCE Maintenance In perpetuity
			• permanent post and cable fencing or equivalent is to be maintained in working order unless otherwise agreed with BCD	

**Nest box installation is based on a ratio of 1:1 for each of the 209 hollows proposed to be removed. Installation will be staged to allow for nest boxes to be available to displaced fauna prior to clearing and to allow for the reclamation / augmentation of hollows after felling of habitat trees.*

** 38 *Angophora inopina* occur on site, four within the north west conservation area. Best endeavours will made to retain the 24 *Angophora inopina* along the Pacific Highway boundary and planting of *Angophora inopina* at a ratio of 5:1 will be completed (i.e. a total of 170 *Angophora inopina* seedlings to be in the ground for at least 3 years, healthy and self-sustaining at completion of the management phase).

Canopy planting with a focus on preferred swift parrot feed trees (Corymbia gummifera, Eucalyptus resinifera and E. robusta) will be planted in zones 2/3 at a minimum density of 1/25m2 unless otherwise agreed with BCD. This is to minimise the impacts of the proposed removal of approximately 156 preferred feed trees.

Table 5: Key BMP Milestones / Performance Criteria – Development Management Zone (Mgnt 1)

Management Zone	PRE-CERTIFICATION Prior to issue of the first subdivision works certificate	PRE-CLEARANCE / PRE-CONSTRUCTION	CLEARING / CONSTRUCTION
Management Zone 1	• CEMP prepared and accepted by BCD/ Council	• Boundary to conservation area clearly delineated • Sedimentation / erosion controls in place • Habitat trees marked	• felling of all habitat trees are supervised by a qualified ecologist in accordance with habitat tree protocol outlined in BMP • CEMP implemented • best endeavours to incorporate proposed 1290 swift parrot trees into landscaping

3.4 MANAGEMENT ACTIONS

3.4.1 Construction Environmental Management Plan (CEMP)

A Construction Environmental Management Plan (CEMP) will be established prior to the commencement of construction. The CEMP must include:

- The environmental site management measures must remain in place and be maintained throughout the period of the development.
- The CEMP must address all environmental aspects of the development's construction phases, and include where relevant, but not be limited to, the following:
  - Project Contact Information
  - Site Security Details
  - Timing and Sequencing Information
  - Site Soil and Water Management Plan
  - Noise and Vibration Control Plan
  - Air Quality monitoring and management
  - Health and Safety Plan
  - Incident Management Contingency
  - Implementation of mitigation measures specified in Section 5 (subsections 5.3) of the Biodiversity Certification Assessment Report (BCAR) (Kleinfelder 2022).
  - Unexpected Finds Protocol

3.4.2 Baseline Monitoring - Establishment

Floristic monitoring plots and photo monitoring points are to be established within the Conservation Areas in accordance with monitoring program detailed in **Section 3.5.** Baseline monitoring is to be completed within one (1) month of the commencement of construction works within the Subject Site. Reference plots for each vegetation type are to be established within representative vegetation occurring within bushland north of the site.

3.4.3 Seed Collection / Tube Stock

Prior to vegetation clearing seed collection should be undertaken for *Angophora inopina* (Charmhaven Apple) on site, or tube stock should be obtained (preferably of local providence). A total of 170 *Angophora inopina* trees are required to be planted within the Subject Site to offset impacts to the species 5:1.

3.4.4 Construction Impact Mitigation

The procedures and mitigation measures detailed below are to be followed/implemented to minimize direct and indirect impacts to biodiversity values within the Subject Site:

- Vegetation may only be removed from the approved development footprint
- Exclusion fencing will be installed around the boundaries of vegetation to be retained (including Management Zone 3, and 4). The exclusion fencing will extend out to at least 5 m from trees and native vegetation.
- A pre-clearing inspection will be completed prior to construction to mark all *Angophora inopina* trees located along the southern boundary of the Subject Site. Once marked, exclusion fencing will be installed to protect these trees. Fencing will extend to at least 5m from the trees and sign posted as a **'No Go' zone**.
- Trees to be retained within the Development footprint will have bunting installed around their drip line, to prevent any disturbance that may impact on their health; this must remain around the tree until all construction activities have been completed.
- The areas of retained vegetation within the exclusion fencing shall be marked as **'No-Go' zones**. All vehicles, construction materials and refuse will be prohibited from these areas. Compaction and the placement of fill within 5 metres of trees and native vegetation will be prohibited.

3.4.5 Vegetation Clearing Supervision

The following procedures in relation to vegetation clearing are to be followed to minimise impacts to biodiversity values within the Subject Site and to maximise the salvage of habitat features to be used in restoration works within the Conservation Areas.

- Vegetation clearing should be avoided during the months of spring, to avoid the peak breeding period of hollow-dependent fauna.
- Preclearing surveys will be conducted by the project ecologist and will include the following procedures:
  - The project ecologist will inspect vegetation within the clearing footprint and advise the site manager and tree clearing staff of any habitat potential and precautions necessary during vegetation removal.
  - Any significant, salvageable habitat features (such as large ground logs and bush rocks) will be clearly marked with flagging tape or spray paint and are to be salvaged and redistributed in the Conservation Areas, under the supervision of the project ecologist.

- All hollow-bearing trees in the clearing footprint will be clearly marked with flagging tape and/or spray paint.
- All hollows will be identified based on diameter, location on tree (i.e. trunk, spout etc.), the size and function of the hollows to determine potential species use and determined potential species use and appropriate nest box materials.

- Removal of hollow-bearing trees will be done under the supervision of the project ecologist and will include the following tree felling procedures:
  - Prior to clearing, local wildlife carers and veterinary services should be notified of the impending actions. The costs for the treatment and care of any injured/orphaned fauna are to be covered by the developer.
  - Immediately prior to felling, hollow-bearing trees are to be knocked (with an excavator bucket or other machinery) to encourage fauna to evacuate the tree. The hollow-bearing tree will then be “soft-felled”. Sectional dismantling will be undertaken where hollows are to be reused (on instruction from the project ecologist).
  - Felled trees will be inspected by the project ecologist or licensed wildlife carer immediately following tree felling. Any displaced fauna will be relocated into adjacent habitat, as close to the development area as possible. Any injured fauna will be placed into the care of a local veterinary hospital or wildlife rescue group. In circumstances where native fauna species are detected, clearing will cease until the ecologist or wildlife carer has relocated the animal.
  - Before being stock-piled, felled trees must be left for at least 24 hours on the ground to allow fauna to escape.
  - Any salvaged hollows will then be stockpiled, to be used as ground habitat in the retained Conservation Areas. These hollows are to be placed in such a way as to look natural, not add to bushfire risks, and to provide benefit to native fauna (on instruction from the project ecologist).
  - Note that nest box installation, maintenance and monitoring will be undertaken to offset the loss of the hollows in the development footprint. Nest boxes/repurposed hollows must be installed in trees that do not currently have natural hollows present. As many trees within the Conservation Areas already contain multiple hollows, nest boxes may need to be installed at appropriate alternative sites. DCCEEW approval is required where alternate sites are to be used.
  - Cleared vegetation (that is not salvageable as ground habitat, see above) will be mulched and re-used throughout the site, where necessary, as part of any vegetation regeneration

or landscaping activities. Non-salvageable material shall be disposed of at an approved waste management facility.

- If any injured or displaced fauna are encountered onsite in the absence of an ecologist or licensed wildlife carer, the advice of the ecologist and/or a local wildlife rescue group will be sought immediately.
- During site inductions, all contractors, sub-contractors, and personnel must be notified of these vegetation protection requirements.

3.4.6 Nest Box Installation

Potential roosting and denning habitat occurs within the Development Site for a range of locally occurring fauna species. A total of 115 habitat trees containing 209 hollows will be removed during construction. A 1:1 nest box / hollow replacement ratio (or 1:1 hollow relocation ratio where applicable) is to be implemented for the proposed development. The ratio was deemed suitable following a review of local plans and development applications. The proponent plans on implementing a hollow replacement strategy comprising a combination of nest boxes and hollow augmentation where possible.

A total of 105 nest boxes will be installed prior to construction, providing compensatory nesting habitat for any displaced fauna. It is recommended that nest boxes be sought from commercial suppliers that produce a range of nest boxes that have been designed to suit specific species/groups of wildlife. The requirement for further nest boxes will be determined following the clearing of the 115 habitat trees within the Development site, allowing for a more accurate estimate of total hollow removal within the Subject Site.

The final number of nest boxes to be installed as part of this development will be determined following the completion of tree clearing as follows:

1. Prior to construction a total of **105 nest boxes** (types outlined below) will be installed within the conservation areas and adjacent remnant bushland.
2. A pre-clearance survey will be completed prior to construction to identify and mark all Hollow-bearing trees (HBTs) to be removed and determine which trees are likely to be suitable for hollow augmentation (removal and relocation). These trees will be identified separately.
3. The pre-clearance survey will identify suitable locations for relocated hollows and nest box installation within the Conservation Areas and adjacent remnant bushland,
4. Clearance supervision will be undertaken by a suitably qualified ecologist (as described in **Section 3.4.5**). The ecologist will record the:
    - total number of hollows removed (refine the HBT data with only hollows suitable for nesting – determined following close inspection)
    - total number of salvageable hollows that can be relocated
5. Final nest box requirements will be determined considering the number of hollows that will be relocated. The remaining hollows cleared as part of development and unable to be relocated will be replaced at a 1:1 ratio (i.e. *Number of nest boxes required = (Total number of suitable hollows removed – total number of salvageable hollows relocated)*)

Detailed nest box requirements and standards for relocated hollows are provided below.

Nest boxes

Important characteristics when constructing or commissioning nest boxes include the following:

- Nest boxes must be constructed from a durable material such as High Density Polyethylene (HDPE) and cypress pine, marine grade hardwood plywood, solid seasoned hardwood (>15 mm thick) or similar materials to ensure maximum durability
- The box should include a hinged lid to allow easy inspection during monitoring/maintenance checks (the hinge should be stainless steel or aluminum).
- Lids are to be pitched on an adequate angle to permit runoff by rain. Hinges are to be robust (not small) and made of brass, stainless steel or galvanized. Lids are to be larger than the overall cross-sectional size of the box and placed so that a small eave exists on all sides to prevent entry of rain
- The design of the tree attachment method is to ensure the box is well secured to the tree, preventing any movement, but with no long-term detrimental health to the host tree. The method should therefore facilitate future tree growth (expansion of the cambium). No more than 3 screws into the tree is permissible, providing that the screws are stainless steel, go into the heartwood and no open wounds are left for fungal attack into the cambium
- Boxes are to be designed and sized for a target species based on available literature. Entry holes are best placed in the front for birds or the sides/rear for arboreal mammals. It should however be galvanized that boxes are often used also by non-target species and can be modified as more suitable for other species also, such as reducing the entry size
- Bird boxes should permit perching on the exterior and allow an inside wall to be climbed from the entry hole down to the base
- All joins are to be glued AND screwed for strength. Glue should be labelled as non-toxic wood glue
- All fasteners used in box construction are to be weather resistant stainless steel, galvanized, treated pine screws or otherwise; All fasteners for tree attachment are to be supplied. These are to be a suitable gauge and length to ensure a secure fix whilst permitting space for growth. Heartwood penetration will depend on the size of the box
- 5 mm drainage holes are to be drilled in the lowest corner in the floor of the box

- The complete box exterior is to be painted with a minimum of two coats of external non-toxic acrylic paint. The colour selected should ideally be consistent with the colour of the recipient trunk and therefore recipient trees should be prior selected
- Only non-toxic paint should be used on the outside and the inside and the entrance hole should be left un-painted.
- Grooves should be cut on the inside face to allow ease of access/exit.
- Drainage holes should be included in the base.
- Wood shavings or sawdust should be placed in the bottom of the box prior to installation.
- Carpet placed on the inside ceiling of the boxes will prevent establishment of European Honeybees.
- Rear entrances should be included in the design where appropriate.

A total of 105 nest boxes are to be installed prior to construction, the following nest box types are to be installed:

- Microbat boxes: 15.
- Small Parrot (Lorikeet) boxes: 15
- Medium Parrot (Galah) boxes: 20
- Small Arboreal Mammal boxes: 20
- Medium Arboreal Mammal boxes: 20
- Possum boxes: 15

Nest boxes are to be installed in the retained portion of the Subject Site and adjacent areas. The exact location of nest box placement within these areas should be determined by a qualified Ecologist during installation and should consider the following factors:

- Target species home range and likely territory to be defended.
- Fauna access (e.g. flight path for birds).
- Aspect (i.e. overheating can increase mortality of young).
- Distance to feeding resources.
- Camouflage from potential predators.
- Access for monitoring.

Nest boxes should be mounted in healthy living trees without existing hollows. Aspect of the nest box should aim to provide shelter from the sun and rain (Freegard and Richter 2009), with the exception that bat boxes may be positioned to receive late afternoon sun providing warmth prior to

nocturnal exit (Goldingay and Stevens 2009). Bat boxes should be installed on a tree clear of branches above or below the box (de Souza-Daw 2003) and where possible nest boxes should be installed on opposite sides of a single tree to provide two approaches and exit options. Labelled nest boxes should be placed within Management Zone 3 and 4 and alternate sites if required. Each nest box will be marked using GPS to aid in the next years monitoring event. Monitoring of installed nest boxes is detailed in **Section 3.5.** DCCEEW approval is required for any reduction in nest box number or location. A reduction in the number of nest boxes to be installed will only be considered where it is demonstrated that:

- Best endeavors have been made to find an alternate site location (e.g. any written correspondence from Crown Lands regarding opportunities to install nest boxes in land to the north)
- It is not reasonably possible to install the required number of nest boxes on site.

Relocated Hollows

Installation standards for relocated, augered and artificial hollows are outlined below:

- The recipient area is to be appropriately marked prior to installations to prevent any incorrect tree selections;
- Appropriate trees are to be prior selected by an experienced fauna ecologist;
- The fauna ecologist is to select recipient trees based on general ecological standards, personal experience, the available trees present and concealed from interference (away from public access). Larger and more mature recipient trees are most preferred. Trees located close to the future perimeter of the reserve area are less preferred. Consideration to nest box location needs to consider orientation for seasonal sun and weather exposure depending on the target species;
- Nest boxes are best paced on the trunk for structural stability and access/monitoring purposes;
- Nest boxes are to be placed at a minimum height of 4m above ground level (as a regular standard), but preferably higher than 8m;
- Nest boxes are to be placed in a location that will provide ease of access and placement of recovered fauna and for direct monitoring and maintenance. Boxes are therefore best placed where they can be safely accessed by an extension ladder;

- The design of the tree attachment method is to ensure the box is well secured to the tree, preventing any movement, but with no long-term detrimental health to the host tree. The method should therefore facilitate future tree growth (expansion of the cambium). No more than 3 screws into the tree is permissible, providing that the screws are stainless steel, go into the heartwood and no open wounds are left for fungal attack into the cambium.

3.4.7 Management of Erosion and Sedimentation

Hydrological and erosion / sediment controls must be implemented to maintain the quality and quantity of pre-development water flows into downstream wetland areas.

Measures to reduce soil erosion and pollutant run-off during construction activities include:

- Installation of erosion and sediment control measures (including silt fencing) around the boundary of the Conservation Areas prior to any works.
- Regular inspection of erosion and sediment control measures, particularly following rainfall events, to ensure their ongoing functionality.
- Management of excavated materials to reduce the movement of sediments during high wind or rainfall events.
- Avoiding stockpiling of materials within or adjacent to the Conservation Areas, stockpiling should be undertaken in areas that are already cleared/ disturbed.
- Undertake maintenance of silt fences and other mitigation measures to isolate runoff.

Erosion and sediment control measures should be designed and installed following the Guidelines for Erosion and Sediment Control on Building Sites (DLWC 2001). Useful information can also be found within the Blue Book (Landcom 2004).

3.4.8 Weed Management During Construction

Appropriate weed control measures must be implemented during the construction phase, including the following:

- All weeds removed from the site must be transported in a sealed container or bag and disposed at a waste management facility licensed to accept green waste.
- Vehicles, machinery and equipment must be free from weed material (including seeds) before entering the construction corridor.

3.4.9 Establishment of Conservation Areas

Permanent boundary fencing must be erected around the boundaries of the Conservation Areas. Fencing must be of a type that is durable, restricts vehicle access and allows movement of native fauna (i.e. fauna friendly fencing). Suitable fencing could include open post and rail or post and wire (no barbed wire on the top or bottom strand), or a low fence largely restricting vehicle access and delineating the boundary of the Conservation Areas.

Permanent educational conservation signs must be installed at multiple points around the boundary of the Conservation Areas, so they are clearly visible to the residents of the new residential development. Information must include a summary of restrictions associated with the Conservation Areas (e.g. no firewood collection, vehicle access or livestock grazing). Signage must also include suggestions on how to minimize impacts on the native vegetation, by undertaking activities such as planting local species in gardens, minimising clearing, erecting nest boxes, limiting use of fertilisers, controlling pets and managing weeds.

3.4.10 Restoration of Conservation Areas

Active restoration of Conservation Areas will occur in Management Zones 2 and 3, with the adaptive management being the preferred method for Management Zone 4 (i.e. natural regeneration, monitoring and intervention only where required). Consequently, each zone has specific restoration requirements based on current state, future use, and condition. Detailed goals for each management zone are detailed in **Table 3**, performance criterion for the Conservation Areas are summarised in **Table 4.**

The restoration of the Conservation Areas within Subject Site will adopt a strategy of adaptive management, informed by annual monitoring results and recommendations.

Restoration techniques used within the Conservation Areas include removal of livestock (horses, sheep and goats), weed management, tubestock planting/direct seeding, habitat augmentation, and fire management. These are detailed below.

Removal of Livestock Grazing

The site has a long history of use for horse, sheep and goat grazing and has been exposed to various agricultural management regimes including slashing of grasslands. These practices have likely impacting native floristic diversity and structure, canopy regeneration, weed abundance, and resulted in elevated nutrient loads. As such, grazing fauna will be excluded from the Conservation Areas within the **Pre-Construction Phase**. Monitoring will inform the adaptive management of the Conservation Areas to reverse the impacts of previous land use (i.e. soil nutrient management) (see Rawlings, *et al*. 2010).

Weed Management

Weed management will be undertaken within Management Zones 2, 3 and 4 in accordance with **Section 3.4.12**.

Revegetation and Supplementary Planting

The Conservation Areas are characterized by sparse mature woodland, minimal scattered native shrubs, and a high cover and diversity non-native grasses. Fauna grazing is likely to have limited the natural regeneration of native canopy within the Subject Site. The exclusion of livestock from the Conservation Areas during the **Pre-Construction Phase** is expected to result in increased native species recruitment and survival, negating the need for extensive supplementary planting within Management Zone 4 and much of Management Zone 3. Natural regeneration is expected to be further assisted through the control and suppression of weeds throughout the BMP implementation period.

The following planting is recommended:

- **Management Zone 1**: Planting of tree species characteristic of the local vegetation community onsite (see **Appendix 2**) will be utlised within the road reserve along the Eastern boundary of the Subject Site.
- **Management Zone 2:** Planting of wetland species characteristic of the local vegetation community (PCT 1737) (see **Appendix 2**) will be required after the sediment basin has been completed within the Management Zone.
- **Management Zone 3:** Planting of tree, shrub and groundcover species characteristic of the local vegetation community (PCT 1649) is required (see **Appendix 2**). The requirement for supplementary planting of canopy and groundcover species will be addressed within recommendations of annual monitoring reports.
- **Management Zone 4:** Supplementary planting of shrub species characteristic of the local vegetation community (PCT 1638) (see **Appendix 2**). No planting of canopy or groundcover species initially. The requirement for supplementary planting of canopy and groundcover species will be addressed within recommendations of annual monitoring reports.

All planting should utilize the species listed within **Appendix 2**, with preference for local provenance stock. Where these species cannot be sourced, only local species commensurate with the PCT's that occur onsite can be utilized.

Habitat Augmentation

Fallen and standing timber (coarse woody debris and dead branches, snags, stumps etc) provides essential or important breeding, foraging or shelter habitat for many threatened species. All tree trunks and larger branches (over 10 cm diameter) are to be removed from the development area during vegetation clearing. Suitable logs and branches are then to be cut up into long pieces (i.e.

over 4 m where possible) and carefully placed into woodland and grassland areas within the Conservation Areas. Placement of logs and branches are to be in such a way as to look natural, not add to bushfire risks, and to provide benefit to native fauna (on instruction from the project ecologist).

3.4.11 Landscaping of Parks and Open Spaces

Landscape planting in parks and open spaces within the Subject Site will include plant species consistent with local vegetation. Species recommended for planting are detailed within **Appendix 2**. The following measures are to be implemented in the landscaping of parks and open space areas:

- Any native trees to be retained within proposed parks and open space areas will be protected during construction and appropriately maintained throughout the implementation period.
- Stockpiled topsoil and mulched vegetation from the development site will be utilised in site landscaping and revegetation works for any areas that require rehabilitation.
- Where any plantings are required, locally indigenous flora will be used. Plants must be sourced from nurseries that grow seed sourced from local areas, to avoid planting of human created cultivars.
- Street trees within the Development Site will include locally occurring **Swift Parrot Feed Tree species** including *Eucalyptus robusta* (Swamp Mahogany) and *Corymbia gummifera* (Red Bloodwood).
- For any park areas that require turfing or direct seeding, only non-invasive (and preferably locally native) grasses/groundcovers will be used.
- Fertiliser use will be strictly limited to a specifically designed Australian native plant fertiliser or an organic based fertiliser with low levels of phosphorus (P). Artificial and chemical fertilisers are strictly prohibited.

3.4.12 Weed Management

Weed management within the Conservation Areas will prioritise the management of the four (4) listed Priority Weed species detected within the Subject Site, including:

- *Asparagus aethiopicus* (Ground Asparagus) [Priority Weed]
- *Lantana camara* (Lantana) [WoNS and Priority Weed]
- *Senecio madagascariensis* (Fireweed) [WoNS and Priority Weed]
- *Rubus anglocandicans* (Blackberry) [WoNS and Priority Weed]

Weed mapping should be conducted during the first monitoring event of the Subject Site to determine areas of weed incursions and methods of control.

Management will adopt the ‘Bradley method’, which involves the progressive removal of weeds from less disturbed areas (outside of mapped weed infestations), followed by removal from more weed infested areas (i.e. mapped weed infestation areas). This method also aims to remove weeds with minimal disturbance and allow native species to re-establish naturally from the existing seed bank and rootstock.

The following steps are to be followed when controlling weeds on the site:

1. The weed removal team will require a site-specific induction, to understand what weeds are to be removed, the process of removal, identification of the native species, and the procedures to be followed.
2. Manual weed removal. Due to the high cover of native species within the groundcover and seedbank in the Conservation Areas the manual removal of weeds will be prioritised where possible.
3. Weed propagules collected during weed control activities are to be taken offsite. This will stop weed material smothering native plants and prevent re-establishment. This material is to be taken to an appropriate waste disposal center to prevent further weed spread in the region.
4. Chemical weed control. Chemical should be applied only where application to larger weeds can be isolated (i.e. no broad application).

For concentrations and dosage rates on targeted chemical control, refer to the Department of Primary Industries New South Wales ‘WeedWise’ webpage (DPI, 2021a). Any weed spraying should be conducted by an authorised person, having a Chemical Application Certificate or similar qualification. This would ensure that best practice is adhered to in consideration of the sensitive nature of the surrounding ecosystems.

The removal of general exotic species (of which 44 were recorded – see **Appendix 1** for full list of exotic plant species recorded within the Subject Site [Kleinfelder 2022]) will be based on the recommendations provided in annual monitoring reports. It is expected that other restoration tasks including the removal of livestock grazing, slashing and additional plantings will assist in the natural reduction of general exotic species cover over the duration of the BMP implementation period (5 years).

3.5 MONITORING PROGRAM

A monitoring program will be implemented to ensure that the measures detailed within this BMP are implemented and successful. The program will be completed throughout the implementation period, a summary of key monitoring events and deliverables are shown in **Table 6**. Monitoring program methods are detailed below. Reporting requirements are detailed in **Section 3.5.2**.

Table 6: Monitoring and Reporting Summary

Monitoring Event	Timing	Scope	Deliverable
Baseline Monitoring Survey	Completed within one (1) month prior to the beginning of construction	Establishment of permanent monitoring plots and completion of the Monitoring Programme	Baseline Monitoring Report
Pre-clearance Survey	Prior to vegetation clearing	Assessment of habitat features to be removed.as per Section 3.6.2	Pre-clearance Survey
Clearance Supervision	During vegetation clearing	Supervision of vegetation clearing of habitat features to be removed.as per Section 3.6.2	Clearance Supervision
Nest box Installation	After nest box installation	Nest boxes that have been installed to cover hollow losses.	Nest box Installation Letter Report
Nest box Monitoring	Completed after 6 months and 12 months of installation and then at 12 month intervals thereafter for the 10-year implementation period.	Monitoring of nest boxes to determine species use and the need for any repairs.	Nest box Monitoring Letter Report
Annual Monitoring Survey	Completed six months following the completion of construction. Completed annually thereafter for entire implementation period (10 Years) An adaptive management review will be completed every 5-years to assess progress and amend management for the next 5-year period where required.	Completion of the Monitoring Programme	Annual Monitoring Survey Reports
Final Summary Report	Completed at the end of the 10-year implementation period.	Summary of the Monitoring Programme throughout implementation period.	Final Summary Report

3.5.1 Monitoring Program Methods

Monitoring will be completed within the Conservation Reserves and the Sediment Basin (Once it has been planted) throughout the implementation period as per the schedule detailed in **Table 6**. Monitoring methods address key performance criterion listed in **Section 3.4**, and are informed by the following resources:

- The Biodiversity Assessment Method 2020 (known hereafter as "BAM 2020") (DPIE 2020),

The Monitoring Program is comprised of three (3) key components: *Vegetation Extent*, *Vegetation Condition*, and *Reserve Maintenance* detailed below.

Nest Box Monitoring

Nest boxes are to be monitored by a qualified Ecologist to determine their usage and to carry out repairs or replacement annually throughout the implementation period following erection and in conjunction with Annual Monitoring detailed in **Table 6**. Fauna usage should be confirmed by inspecting the nest box with the use of a ladder or monitoring from the ground using a 'burrow scope'/GoPro camera.

The following data should be recorded during each nest box monitoring event:

- Date.
- Type of nest box and its specifications.
- Nest box number and location.
- Signs of animal presence (i.e. scats, fur, feathers, nesting material).
- Species present (i.e. may be inferred from secondary evidence).
- Breeding data.
- Number of individuals.
- Sex and age of individuals.
- Condition of each nest box.
- Requirements for maintenance or replacement.

During each monitoring event, the entrance to the nest box should be blocked prior to inspection to reduce the chance of nocturnal inhabitants escaping and risking predation (Freegard and Richter 2009). Handling of species occupying a nest box should be avoided unless identification is uncertain. The Ecologist should minimise disturbance in the vicinity of the nest box, as recent inhabitants may be inclined to escape on approach. If any species exits the nest box on approach, the Ecologist should quietly move away to enable the animal to re-enter the box.

Surveillance of bat boxes may be undertaken via watching for exiting bats at dusk (de Souza-Daw 2003), or through use of a 'burrow' scope during the day. If exiting bats have been recorded, identification may be possible through use of Anabat detection units. Bat boxes should not be opened once occupied by bats (de Souza-Daw 2003) as disturbing hibernating bats can lead to exhaustion of food reserves and death of the animal.

In situations where fauna signs within a nest box are inconclusive for determination of the species, remote monitoring cameras may be placed on the tree facing the nest box to assist in identification, where practicable. For example, this may be useful to identify a species of glider that has built a leaf nest if the glider is not present in the box at the time of inspection.

Nest boxes are to be maintained or replaced as required. Results of the monitoring will be provided in the annual monitoring reports, including locations of any threatened species identified. The box manufacturer is to be notified where any boxes (or relocated hollows) do not last for more than 5 years, so that alterations to future constructions can be facilitated.

Nest Box Maintenance

The Conservation Areas adjoin large areas of native vegetation and residential developments. As such, various risks to nest box condition exist, which may affect the success of implementation of the measures detailed within this BMP. These include:

- Vandalism and bushfire.
- Adverse weather conditions and weathering could damage or dislodge nest boxes.
- Feral animals, such as the Indian Myna, Black Rat, Honeybees, may occupy nest boxes and prevent occupancy by native fauna species.

In the event that any of the above events occur, the landowner, in consultation with the Ecologist, is to take suitable steps to reduce these impacts. Amelioration measures include the flowing:

- Any damaged nest boxes should be replaced like-for-like and in a timely manner.
- If feral birds are identified inhabiting the nest box any eggs and nesting material should be removed. In the case of the Indian Mina, consideration should be given to installation of a Myna 'baffle' on the nest box (Homan 2000) or replacing the nest box with a rear-entry design (Dobson 2002; Beyer 2003; Goldingay et al. 2009).
- A natural insecticide should be sprayed to kill any lice within nest boxes (Franks and Franks 2006). Ant infestations within nest boxes may be controlled using Coopex ® powder.
- Feral bees should be managed at dusk or night when they are less active using a non-residue insecticide (Franks and Franks 2006). Insecticide treated nest boxes will likely need to be cleaned out, which is to be done 24-48 hours later (Franks and Franks 2006).

Vegetation Extent

The mapped extent of native woodland (comprising native canopy species) and weed infestation are to be updated during every monitoring event using a hand-held GPS.

Vegetation Condition

A total of three (3) 20 m x 50m permanent quadrats will be established within the Conservation Reserves during baseline monitoring, with one (1) quadrat in the each of the Management Zones. The quadrats are to be sampled as per Section 5.3.4 of the NSW Biodiversity Assessment Method (BAM) (DPIE, 2020), with a 20 m x20 m nested quadrat and a central 50 m north-south bearing transect. Quadrats are to be marked at the start and end of the 50 m transect with permanent markers. Location and bearing of transects are to be recorded to ensure accuracy of repeat monitoring.

Within each plot the following metrics are collected:

- Floristic diversity (number of native and exotic species within the nested 20 m x 20 m quadrat)
- Floristic cover and abundance for each species (within the nested 20 m x 20 m quadrat).
- Stem size classes and the presence of native canopy regeneration (as per BAM 2020) (within the 20 m x 50 m quadrat)
- Cover of litter and bare ground (as per BAM 2020) (within the 20 m x 50 m quadrat)
- Total length of fallen logs (dbh <10 cm) (as per BAM 2020) (within the 20 m x 50 m quadrat)
- Photo monitoring: a single photo is to be taken at the start and end of the 50 m transect looking into the quadrat.

Monitoring should consider species mix and whether this is moving towards that represented in the reference plots to the north of the site. Any succession characteristics for these vegetation communities should be considered to ensure that the seedbanks are being appropriately revegetated. Supplementary plantings of species notably absent from the management zone will be recommended as part of annual reporting and undertaken during the implementation period.

Conservation Area Maintenance

The monitoring program will assess condition of the Conservation Area through a general meander of the site and notes on the following features:

- Condition of boundary fencing and signage around the Conservation Area
- Signs of firewood collection, dumping of waste (inc. garden waste)

- Condition of habitat features (i.e. nest boxes and/or repurposed hollows)
- Condition and composition of native vegetation within constructed stormwater retention basins
- Monitoring and maintenance of weeds within all three areas.

3.5.2 Reporting

Reporting requirements and timing of deliverables are summarised within **Table 6**, all monitoring and reporting will be completed by a suitably qualified person (i.e. Ecologist), content of reporting deliverables will are detailed below:

- **Baseline Monitoring Survey Report:** This report will provide details on location of monitoring points, baseline measurements of key extent and condition variables within the Conservation Reserves.
- **Pre-clearance Survey Report:** This report will detail the results of the pre-clearance survey, including identification of fauna habitat features to be removed and those that have potential for salvage and utilisation within the Conservation Areas.
- **Clearance Supervision:** This report will detail the results of the clearance supervision including identification of any fauna recorded during clearing works and the location of habitat features re-distributed within the Conservation Areas to provide for habitat.
- **Nest box Installation:** This report will detail the results of the nest box installation (number, type and location).
- **Nest box Monitoring:** This report will be conducted biannually and will detail the results of the monitoring of the nest boxes that have been installed including condition and usage from locally occurring fauna species.
- **Annual Monitoring Survey Report:** This report will detail the results of annual monitoring, with comparison to baseline results and preceding survey events. Reporting will provide recommendations for future monitoring and management within the reserve. These reports are to be submitted annually to the BCD. An adaptive management review will be completed every 5-years to assess progress and amend management for the next 5-year period where required. Any changes to the management of the Subject Site will require review by the BCD.
- **Final Summary Report:** Summary of the Monitoring Programme throughout the 10 year implementation period with recommendations provided for the in-perpetuity management of the Subject Site, with consultation with the BCD.

3.6 RISK ASSESSMENT AND CONTIGENCY

A summary of key threats identified in **Section 2.2**, potential risks and consequences, key management actions and amelioratory actions in scenarios in which proposed mitigation measures fail are provided below in **Table 7**.

Table 7: Risk Assessment and contingency strategy

Threat	Risk of Occurrence	Consequences	Remedial Measure	Responsibility
Construction Phase				
Failure to prevent vegetation clearing impacts on vegetation outside of the Development Site	Low-Moderate	Impacts to native vegetation outside that approved under this Planning Proposal, impacts to threatened flora, threatened fauna habitat or key habitat features (i.e. hollow-bearing trees).	Inspections will occur as detailed in **Section 3.5**. Any unintentional impacts to native vegetation will be assessed and addressed through consultation with Central Coast Council and DCCEEW. This may require the retirement of additional biodiversity credits, installation of replacement nest-boxes, or additional revegetation.	Proponent / Landowner
Failure to follow vegetation clearing and fauna management requirements detailed within the BCAR and Vegetation Clearing procedure provided in the BMP.	Low-Moderate	This can result in fauna injury and mortalities, including to threatened fauna.	A suitably qualified ecologist / fauna spotter catcher is required to conduct a pre-clearance survey prior to clearing and identify all fauna habitat features that may be inhabited. The ecologist is required to supervise all clearing of habitat trees within the Development Site. Local wildlife carers are to be notified of works prior to clearing works being undertaken. Any failure of this procedure will require the following: ▪ Immediate Action – Stop Work to ensure the safety of any animal at risk of injury. ▪ Recovery – the animal will be safely removed from risk and assessed for injury by the ecologist and wildlife carer. ▪ Treatment – the most appropriate treatment for the animal will be determined. The costs for the treatment and care of any injured/orphaned fauna	Proponent / Landowner

Threat	Risk of Occurrence	Consequences	Remedial Measure	Responsibility
			are to be covered by the developer. Notification – any injury or mortality occurring within the Development Site during clearing or construction will be recorded and discussed within monitoring reports required by the site-specific BMP. The NSW Department of Planning and Environment will be notified accordingly.	
Failure of erosion and sedimentation mitigation measures.	Low-Moderate	Failure of these measures can result in impacts to sensitive habitat adjacent to the Development Site (conservation areas and wetlands).	Regular inspection of erosion and sediment control measures are required (see **Section 3.4.7**), particularly following rainfall events, to ensure their ongoing functionality. These measures will be maintained throughout the construction and operation phases (where applicable). In the event of failure the Construction Site Manager is responsible for implementing sufficient remedial risk management works. Any failures and associated impacts will be reported to DCCEEW and Central Coast Council.	Proponent / Landowner
Failure of weed management requirements.	Low-Moderate	Introduction and spread of introduced species including Priority Weeds and High Threat Weeds that pose a risk to the condition of sensitive environmental areas within and adjacent to the Study Area (i.e. conservation areas and wetlands).	Regular inspections are required in accordance with the measures listed in **Section 3.4.8** and **Section 3.5**. In the event of failure of weed mitigation measures appropriate weed management will be implemented in accordance with the requirements of **Section 3.4.12**	Proponent / Landowner
Failure of waste management measures	Low-Moderate	The movement of rubbish and/or building waste into environmentally sensitive areas can impact vegetation condition and habitat suitability.	Any breach of waste management measures will be remedied immediately, with the removal of waste to be coordinated by the Construction Site Manager. Removal of waste will need to	Proponent / Landowner

Threat	Risk of Occurrence	Consequences	Remedial Measure	Responsibility
			avoid any further impacts to native vegetation.	
Operational Phase				
Failure of weed management requirements.	Low-Moderate	Introduction and spread of introduced species including Priority Weeds and High Threat Weeds that pose a risk to the condition of sensitive environmental areas within and adjacent to the Study Area (i.e. conservation areas and wetlands).	Regular inspections are required throughout the implementation period in accordance with the measures listed in **Section 3.4.8**, **Section 3.4.12** and **Section 3.5**. The requirement for additional weed management will be implemented following the completion of annual monitoring and based on the advice of a qualified ecologist or restoration ecologist.	Proponent / Landowner
Failure of Street Tree plantings	Low-Moderate	Tree mortality during establishment.	All street trees or native trees/shrubs/groundcover species planted as part of proposed revegetation plans will need to be replaced like-for-like in accordance with **Section 3.4.11**.	Proponent / Landowner
Weed incursions through dumping of garden waste	Moderate	Introduction of additional weeds into the conservation areas	Regular inspections are required throughout the implementation period in accordance with the measures listed in **Section 3.4.8**, **Section 3.4.12** and **Section 3.5**. The requirement for additional weed management will be implemented following the completion of annual monitoring and based on the advice of a qualified ecologist or restoration ecologist.	Proponent / Landowner
Removal of habitat features by the public	Moderate	Habitat features including fallen timber, litter and bush rock may be removed by residents within the locality. The consequences are the degradation of fauna habitat.	Regular inspections are required throughout the implementation period in accordance with **Section 3.5**. The requirement for additional habitat augmentation / replacement will be determined through the completion of annual monitoring and based on the advice of a qualified ecologist or restoration ecologist.	Proponent / Landowner

Threat	Risk of Occurrence	Consequences	Remedial Measure	Responsibility
Damage of nest boxes	Moderate	Nest boxes can be damaged through environmental or human-caused factors. Damage of installed nest boxes will result in a degradation of fauna habitat within the conservation areas and reduce the effectiveness of nest box offsetting.	Nest box monitoring is required in accordance with **Section 3.5.** Any damaged nest boxes will be repaired or replaced in accordance with the requirements of **Section 3.5**.	Proponent / Landowner
Unauthorized clearing of native vegetation or incursions by the public	Moderate	Impacts to native vegetation outside that approved under this Planning Proposal, impacts to threatened flora, threatened fauna habitat or key habitat features (i.e. hollow-bearing trees).	Inspections will occur as detailed in **Section 3.5**. Any unintentional impacts to native vegetation will be assessed and addressed through consultation with Central Coast Council and the DCCEEW. This may require the retirement of additional biodiversity credits, installation of replacement nest-boxes, or additional revegetation.	Proponent / Landowner

3.7 RESPONSIBILITIES

Implementation and funding of this BMP is the responsibility of the proponent who will be the proprietor of the Certified Land during construction and the Conservation Areas throughout the implementation period and into perpetuity. This BMP will be implemented over a ten (10) year period. Management of the reserve will adopt an adaptive management process and may be subject to review of monitoring results and recommendations. A review of management requirement will be completed at the end of the 10 year implementation period, with recommendations for management into perpetuity to be provided in consultation with the BCD and Central Coast Council.

Strategies outlined in the BMP will be undertaken by suitably experienced and qualified persons or companies engaged by the proprietor of the site and reserve. Any vegetation restoration works (including weed management, plantings and landscaping) will be undertaken by a suitably qualified and experienced professional bush regeneration contractor. The minimum qualifications and experience required for the bush regeneration contractor are a TAFE Certificate IV in Conservation and Land Management (or equivalent) and three years demonstrated experience (for site supervisor) and a TAFE Certificate 2 in Conservation and Land Management and one year demonstrated experience (for other personnel). Monitoring and reporting will be undertaken by suitably qualified Ecologists

4. REFERENCES

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APPENDIX 1. FLORA SPECIES LIST

Table A1: Subject Site Flora Species List (Kleinfelder 2022a)

No.	Family	Scientific Name	Common Name	Form
	Alismataceae	*Damasonium minus*	Starfruit	Forb
	Amaryllidaceae	*Agapanthus praecox*	Africa Lilly	Exotic
	Apiaceae	*Cyclospermum leptophyllum*	Slender Celery	Exotic
	Apiaceae	*Hydrocotyle bonariensis*	-	Exotic
	Apiaceae	*Trachymene incisa*	Trachymene	Forb
	Apocynaceae	*Gomphocarpus fruticosus*	Narrow-leaved Cotton Bush	Exotic
	Apocynaceae	*Parsonsia straminea*	Common Silkpod	Other
	Arecaceae	*Archontophoenix cunninghamiana*	Bangalow Palm	Tree
	Arecaceae	*Livistona australis*	Cabbage Palm	Tree
	Asparagaceae	*Asparagus aethiopicus*	Asparagus Fern	High Threat Weed
	Asparagaceae	*Themeda australis*	Many-flowered Mat-rush	Grass (Grass Like)
	Asphodelaceae	*Bulbine bulbosa*	Bulbine Lily	Exotic
	Asteraceae	*Conyza bonariensis*	Flaxleaf Fleabane	Exotic
	Asteraceae	*Gamochaeta americana*	Cudweed	Exotic
	Asteraceae	*Hypochaeris radicata*	Catsear	Exotic
	Asteraceae	*Lagenifera stipitata*	Blue Bottle-daisy	Forb
	Asteraceae	*Senecio madagascariensis*	Fireweed	High Threat Weed
	Asteraceae	*Tagetes minuta*	Stinking Roger	Exotic
	Asteraceae	*Taraxacum officinale*	Dandelion	Exotic
	Campanulaceae	*Lobelia purpurascens*	whiteroot	Forb
	Casuarinaceae	*Allocasuarina littoralis*	Black She-Oak	Shrub
	Clusiaceae	*Hypericum perforatum*	St. Johns Wort	Exotic
	Commelinaceae	*Commelina cyanea*	Native Wandering Jew	Forb
	Convolvulaceae	*Dichondra repens*	Kidney Weed	Forb
	Crassulaceae	*Crassula multicalva*	Fairy Crassula	Exotic
	Cyperaceae	*Baumea rubiginosa*	--	Grass (Grass Like)
	Cyperaceae	*Carex inversa*	Knob Sedge	Grass (Grass Like)
	Cyperaceae	*Cyathochaeta diandra*	-	Grass (Grass Like)
	Cyperaceae	*Cyperus polystachyos*	-	Exotic
	Cyperaceae	*Cyperus sanguinolentus*	-	Grass (Grass Like)
	Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-sedge	Grass (Grass Like)

No.	Family	Scientific Name	Common Name	Form
	Cyperaceae	*Gahnia clarkei*	Tall Saw-sedge	Grass (Grass Like)
	Cyperaceae	*Lepidosperma concavum*	-	Grass (Grass Like)
	Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge	Grass (Grass Like)
	Cyperaceae	*Lepidosperma neesii*	-	Grass (Grass Like)
	Cyperaceae	*Ptilothrix deusta*	-	Grass (Grass Like)
	Cyperaceae	*Schoenus apogon*	Fluke Bogrush	Grass (Grass Like)
	Cyperaceae	*Schoenus brevifolius*	-	Grass (Grass Like)
	Ericaceae	*Epacris pulchella*	Wallum Heath	Shrub
	Ericaceae	*Monotoca elliptica*	Tree Broom-heath	Shrub
	Euphorbiaceae	*Euphorbia drummondii*	Caustic Weed	Forb
	Fabaceae	*Pultenaea sp.*	-	Shrub
	Fabaceae	*Securigera varia*	Crownvetch	Exotic
	Fabaceae (Faboideae)	*Daviesia ulicifolia*	Gorse Bitter Pea	Shrub
	Fabaceae (Faboideae)	*Dillwynia retorta*	-	Shrub
	Fabaceae (Faboideae)	*Glycine tabacina*	Hairy Apple Berry	Other
	Fabaceae (Faboideae)	*Gompholobium latifolium*	Golden Glory Pea	Shrub
	Fabaceae (Faboideae)	*Hardenbergia violacea*	False Sarsaparilla	Other
	Fabaceae (Faboideae)	*Hovea linearis*	-	Shrub
	Fabaceae (Faboideae)	*Medicago lupulina*	Black Medic	Exotic
	Fabaceae (Faboideae)	*Mirbelia rubiifolia*	Heathy Mirbelia	Shrub
	Fabaceae (Faboideae)	*Pultenaea rosmarinifolia*	-	Shrub
	Fabaceae (Faboideae)	*Pultenaea tuberculata*	-	Shrub
	Fabaceae (Faboideae)	*Trifolium repens*	White Clover	Exotic
	Fabaceae (Mimosoideae)	*Acacia fimbriata*	Fringed Wattle	Shrub
	Fabaceae (Mimosoideae)	*Acacia longifolia*	-	Shrub
	Fabaceae (Mimosoideae)	*Acacia suaveolens*	Sweet Wattle	Shrub
	Fabaceae (Mimosoideae)	*Acacia ulicifolia*	Prickly Moses	Shrub
	Geraniaceae	*Geranium solanderi*	Native Geranium	Forb

No.	Family	Scientific Name	Common Name	Form
	Gleicheniaceae	*Gleichenia dicarpa*	Pouched Coral Fern	Fern
	Goodeniaceae	*Dampiera stricta*	-	Forb
	Goodeniaceae	*Goodenia bellidifolia*	-	Forb
	Haemodoraceae	*Haemodorum planifolium*	-	Forb
	Haloragaceae	*Gonocarpus micranthus*	-	Forb
	Haloragaceae	*Gonocarpus teucrioides*	Germander Raspwort	Forb
	Iridaceae	*Iris sp.*	-	Exotic
	Iridaceae	*Patersonia sericea*	Silky Purple-Flag	Forb
	Juncaceae	*Juncus cognatus*	-	Exotic
	Juncaceae	*Juncus holoschoenus*	-	Grass (Grass Like)
	Juncaceae	*Juncus sp.*	-	Exotic
	Juncaceae	*Juncus subsecundus*	Finger Rush	Grass (Grass Like)
	Lamiaceae	*Stachys arvensis*	Stagger Weed	Exotic
	Lauraceae	*Cassytha glabella*	-	Other
	Lauraceae	*Cinnamomum camphora*	Camphor Laurel	Exotic
	Lindsaeaceae	*Lindsaea linearis*	Screw Fern	Fern
	Lomandraceae	*Lomandra cylindrica*	-	Grass (Grass Like)
	Lomandraceae	*Lomandra multiflora*	#N/A	Grass (Grass Like)
	Lomandraceae	*Lomandra obliqua*	-	Grass (Grass Like)
	Malvaceae	*Sida rhombifolia*	Paddy's Lucerne	Exotic
	Myrtaceae	*Angophora costata*	Sydney Red Gum	Tree
	Myrtaceae	*Angophora floribunda*	Rough-barked Apple	Tree
	Myrtaceae	*Corymbia gummifera*	Red Bloodwood	Tree
	Myrtaceae	*Eucalyptus acmenoides*	White Mahogany	Tree
	Myrtaceae	*Eucalyptus capitellata*	Brown Stringybark	Tree
	Myrtaceae	*Eucalyptus haemastoma*	Broad-leaved Scribbly Gum	Tree
	Myrtaceae	*Eucalyptus racemosa*	Narrow-leaved Scribbly Gum	Tree
	Myrtaceae	*Eucalyptus resinifera*	Red Mahogany	Tree
	Myrtaceae	*Eucalyptus robusta*	Swamp Mahogany	Tree
	Myrtaceae	*Leptospermum polygalifolium*	Tantoon	Shrub
	Myrtaceae	*Leptospermum trinervium*	Slender Tea-tree	Shrub
	Myrtaceae	*Melaleuca quinquenervia*	Broad-leaved Paperbark	Tree
	Myrtaceae	*Melaleuca sieberi*	-	Shrub
	Myrtaceae	*Melaleuca thymifolia*	Thyme Honey-myrtle	Shrub

No.	Family	Scientific Name	Common Name	Form
	Orchidaceae	*Caladenia catenata*	White Caladenia	Forb
	Orchidaceae	*Cryptostylis subulata*	Large Tongue Orchid	Forb
	Orchidaceae	*Microtis sp.*	#N/A	Forb
	Orchidaceae	*Thelymitra branwhitei*	-	Forb
	Orchidaceae	*Thelymitra pauciflora*	Slender Sun Orchid	Forb
	Oxalidaceae	*Oxalis perennans*	-	Forb
	Philydraceae	*Philydrum lanuginosum*	Frogsmouth	Forb
	Phormiaceae	*Dianella caerulea*	Blue Flax-lily	Forb
	Phyllanthaceae	*Glochidion ferdinandi*	Cheese Tree	Tree
	Pinaceae	*Pinus radiata*	Radiata Pine	Exotic
	Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry	Other
	Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum	Shrub
	Plantaginaceae	*Plantago lanceolata*	Lamb's Tongues	Exotic
	Poaceae	*Andropogon virginicus*	Whisky Grass	High Threat Weed
	Poaceae	*Aristida vagans*	Threeawn Speargrass	Grass (Grass Like)
	Poaceae	*Axonopus fissifolius*	Narrow-leafed Carpet Grass	Exotic
	Poaceae	*Briza maxima*	Quaking Grass	Exotic
	Poaceae	*Cenchrus clandestinum*	Kikuyu Grass	High Threat Weed
	Poaceae	*Cynodon dactylon*	Common Couch	Exotic
	Poaceae	*Cynodon incompletus*	-	Exotic
	Poaceae	*Echinopogon caespitosus*	Bushy Hedgehog-grass	Grass (Grass Like)
	Poaceae	*Ehrharta erecta*	Panic Veldtgrass	High Threat Weed
	Poaceae	*Entolasia stricta*	Wiry Panic	Grass (Grass Like)
	Poaceae	*Eragrostis brownii*	Brown's Lovegrass	Grass (Grass Like)
	Poaceae	*Eragrostis leptostachya*	Paddock Lovegrass	Grass (Grass Like)
	Poaceae	*Hyparrhenia hirta*	Coolatai Grass	High Threat Weed
	Poaceae	*Imperata cylindrica*	Blady Grass	Grass (Grass Like)
	Poaceae	*Megathyrsus maximus*	-	Exotic
	Poaceae	*Microlaena stipoides var. stipoides*	Weeping Grass	Grass (Grass Like)
	Poaceae	*Paspalum dilatatum*	Paspalum	High Threat Weed
	Poaceae	*Poa annua*	Winter Grass	Exotic
	Poaceae	*Setaria pumila*	Pale Pigeon Grass	Exotic
	Poaceae	*Sporobolus africanus*	Parramatta Grass	Exotic
	Poaceae	*Sporobolus virginicus*	-	Grass (Grass Like)
	Portulacaceae	*Portulaca oleracea*	Pigweed	Forb
	Primulaceae	*Lysimachia arvensis*	Scarlet Pimpernel	Exotic
	Proteaceae	*Banksia oblongifolia*	Fern-leaved Banksia	Shrub
	Ranunculaceae	*Ranunculus inundatus*	River Buttercup	Forb

No.	Family	Scientific Name	Common Name	Form
	Restionaceae	*Lepyrodia scariosa*	-	Grass (Grass Like)
	Rosaceae	*Rubus anglocandicans*	Blackberry	High Threat Weed
	Rubiaceae	*Opercularia diphylla*	Stinkweed	Forb
	Rubiaceae	*Opercularia varia*	Variable Stinkweed	Forb
	Rubiaceae	*Richardia humistrata*	-	Exotic
	Sapindaceae	*Dodonaea triquetra*	Large-leaf Hop-bush	Shrub
	Selaginellaceae	*Sellaginella uliginosa*	Swamp Selaginella	Fern
	Stylidiaceae	*Stylidium gramineum*	-	Forb
	Thymelaeaceae	*Pimelea linifolia*	Slender Rice Flower	Shrub
	Verbenaceae	*Lantana camara*	Lantana	High Threat Weed
	Verbenaceae	*Verbena bonariensis*	Purpletop	Exotic
	Violaceae	*Viola hederacea*	Ivy-leaved Violet	Forb
	Xanthorrhoeaceae	*Xanthorrhoea fulva*	-	Other
	Xanthorrhoeaceae	*Xanthorrhoea latifolia*	-	Other
	Xanthorrhoeaceae	*Xanthorrhoea media*	-	Other
	Xyridaceae	*Xyris gracilis*	-	Forb

APPENDIX 2. RECOMMENDED PLANTING LISTS

Table B1: Conservation Areas Recommended Planting List

Stratum	Scientific Name	Common Name	Management Zone 3	Management Zone 4	Recommended Planting Densities
Canopy	*Angophora costata*	Sydney Red Gum		✓*	1 / 50 m^2
	Corymbia gummifera	Red Bloodwood		✓*	1 / 50 m^2
	Eucalyptus resinifera	Red Mahogany	✓		1 / 50 m^2
	Eucalyptus robusta	Swamp Mahogany	✓		1 / 50 m^2
	Melaleuca quinquenervia	Broad-leaved Paperbark	✓		1 / 50 m^2
Shrubs	*Allocasuarina littoralis*	Black She-oak		✓*	1 / 50 m^2
	Leptospermum trinervium	Flaky-barked Tea-tree	✓	✓*	1 / 50 m^2
	Acacia myrtifolia	Myrtle wattle		✓*	1 / 25 m^2
	Persoonia levis	Broad-leaved geebung		✓*	1 / 25 m^2
	Lambertia formosa	Mountain Devil		✓*	1 / 25 m^2
	Livistona australis	Cabbage-tree Palm	✓		1 / 50 m^2
	Pimelea linifolia	Slender Rice Flower		✓*	1 / 25 m^2
	Melaleuca sieberi		✓		1 / 50 m^2
	Melaleuca nodosa	Prickly-leaved Paperbark	✓		1 / 50 m^2
	Leptospermum polygalifolium	Tantoon	✓		1 / 50 m^2
	Pultenaea paleacea	Chaffy Bush-pea	✓		1 / 25 m^2
Ground	*Themeda australis*	Kangaroo Grass	✓	✓*	1 / 1 m^2
	Lomandra obliqua	-		✓*	1 / 1 m^2
	Panicum simile	Colour Panic	✓		1 / 1 m^2
	Entolasia stricta	Wiry Panic	✓	✓*	1 / 1 m^2
	Gahnia clarkei	Tall Saw-sedge	✓		1 / 4 m^2

*Supplementary Plantings if required based on adaptive management monitoring

Table B2: Management Zone 2 Recommended Planting List

Stratum	Scientific Name	Common Name	
Ground (where suitable)	*Cladium procerum*	-	1 / 1 m^2
	Persicaria strigosa	Spotted Knotweed	1 / 1 m^2
	Typha orientalis	Broad-leaved Cumbungi	1 / 1 m^2

Table B3: Landscaping Recommended Planting List

Stratum	Scientific Name	Common Name
Canopy	*Angophora costata*	Smooth Bark Apple
	Corymbia gummifera	Red Bloodwood
	Eucalyptus robusta	Swamp Mahogany
Shrubs	*Acacia myrtifolia*	Myrtle wattle
	Persoonia levis	Broad-leaved Geebung
	Lambertia formosa	Mountain Devil
	Pimelea linifolia	Slender Rice Flower
Ground (If Suitable)	*Themeda australis*	Kangaroo Grass
	Lomandra obliqua	-
	Panicum simile	Colour Panic
	Entolasia stricta	Wiry Panic

APPENDIX 3. STAFF CONTRIBUTIONS

The following staff were involved in the project:

Name	Qualifications	Title	Contribution
Mark Dean	BEnvSc & Mgt	Ecologist	Report Author
David Martin	Master of Science BEnvSc & Mgt Accredited BAM Assessor	Senior Ecologist	Report Review
Samara Schulz	BEnvSc & Mgt (Hons)	Principal Botanist	GIS and figure preparation
Kane Blundell	BEnvSc & Mgt	Ecologist	GIS and figure preparation

APPENDIX 4. SCIENTIFIC LICENCING AND PERMITS

Wedgetail employees involved in the current study are licensed or approved under the *Biodiversity Conservation Act 2016* (License Number: SL102506, Expiry: 28 May 2025) and the *Animal Research Act 1985* to harm/trap/release protected native fauna and to pick for identification purposes native flora and to undertake fauna surveys.