Biodiversity Development Assessment Report

64-70 Clark Road, Londonderry

By Ecological Consultants Australia Pty Ltd TA

Kingfisher Urban Ecology and Wetlands

March 2021

About this document

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Statement of Authorship

This study and report was undertaken by Ecological Consultants Australia at Studio 1/33 Avalon Parade, Avalon. The author of the report is Geraldene Dalby-Ball with qualifications BSc. majoring in Ecology and Botany with over 20 years' experience in this field and Jack Hastings with qualifications B EnvSc.

Limitations Statement

Information presented in this report is based on an objective study undertaken in response to the brief provided by the client. Any opinions expressed in this report are the professional, objective opinions of the authors and are not intended to advocate any particular proposal or pre-determined position.

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Signed: Geraldene Dalby-Ball – Director of Ecological Consultants Australia

Executive Summary

Introduction

Ecological Consultants Australia (ECA) has been contracted by The Planning Hub to provide a **Biodiversity Development Assessment Report** for a proposal at 64-70 Clark Road, Londonderry within the Penrith City Council Local Government Area (LGA).

Trigger for a formal BDAR under the BC Act 2016:

Although the proposal doesn't trigger the area clearing threshold, it does trigger the BV map threshold. Therefore, a BDAR is required.

Stage 1: Biodiversity Assessment

- On-ground survey took place in March 2021 by Senior Ecologist Geraldene Dalby-Ball and Ecologist Luke Johnson.
- Data was gathered across one BAM plot located within the proposed impact area.
- Flora and fauna observations were recorded on-site using binoculars and physical examination. Notes, photos and samples of flora species were taken to assess ecological health and value of the site.
- Bionet searches were performed for flora, fauna and endangered populations to identify if there were previous records of threatened species occurring within the local area using a 10km radius around the site.

Results

Stage 2: Impact Assessment

- The impact calculations were made based on there being direct impacts to vegetation from the proposed development. The impact area and/or areas of modification has been calculated as 0.09ha within the site.
- PCT 725 is mapped (via *Cumberland Plain West_VIS__4207 OEH (2016*) in the proposed development area. It is antipcated that this threatened community also corresponds with the Biodiversity Values map layer, which triggered the BOS.
- A single vegetation zone covers the impact area (proposed development area). Vegetation within this zone is identified as PCT 725 for the purposes of the BAM-C. Based on desktop and field assessments, PCT 725 is likely to be the remnant PCT for this zone and as such, was selected in the BAM-C.
- The field survey has concluded that the area proposed for modification is currently maintained as a lawn area. Vegetation in this area consists of primarily exotic grass species. No critical habitat for native species can be found on the maintained lawn area. There is no native canopy or mid-storey cover in the area proposed for modification.
- Desktop vegetation mapping via *Cumberland Plain West_VIS__4207 OEH (2016*) does not accurately reflect vegetation exent within the proposed development area.
- The southern portion of the block, beyong the area proposed modification exhibits discontinuous canopy and mid-storey cover. This area hosts remnant bushland with the diversity of species in

moderate to low condition. The mid-storey and canopy are predominantly native and the understory is dominated by African Lovegrass.

- No threatened species were recorded during the site surveys.

Stage 3: Improving Biodiversity values

- Delineation of work areas
- Weed Management and removal
- Native seed collection
- Nest boxes
- Erosion and sediment controls
- Native species landscaping

See recommendations section for a detailed explanation as to how these recommendations improve biodiversity values.

Conclusions and Recommendations

The proposed development will have an approximate impact area of 0.09ha on an area which is primarily exotic grass species. The grand total cost to offset both ecosystem credits and species credits generated by this development is $0.00. The site did not achive the minimum Vegetation Intregty (V.I) score for the EEC to generate Species or Ecosystem offset credits. BAM-C output reports suggest to contact the BCT for pricing information.

It is recommended that the planting schedule should be selected from locally native PCT species lists. It is recommended that seeds are collected from the site. Seedlings can then be propagated and planted once established. Landscaping across the site should be selected from locally native ground and shrub species.

The removal of this tree should be offset using a 10:1 offset ratio (replanted:removed). Locally native canopy species are recommended for planting to compensate for the removal of the tree. This compensatory measure should ensure that the site will continue to provide foraging and possible breeding habitat for native fauna into the future.

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Stage 1: Biodiversity Assessment

1 Introduction

Ecological Consultants Australia (ECA) has been contracted by The Planning Hub to provide a **Biodiversity Development Assessment Report** for a proposal at 64-70 Clark Road, Londonderry within the Penrith City Council Local Government Area (LGA).

1.1 Site information and general description

The Subject Site (the "Site") is the area of direct and likely indirect impacts and is defined as the whole of the property.

This area has been assessed in the Biodiversity Assessment Method Calculator (BAM-C) from which offset credits have been generated.

Table 1 - Site Administrative Information

Category	Details
Title Reference (Lot/DP)	2/-/DP512998
Area (ha)	2.02Ha
Street Address	64-70 Clark Road, Londonderry NSW 2753
LGA	Penrith City Council
Land Zoning	RU4: Primary Production Small Lots

Figure 1.1. Site of the proposed development. Source: SixMaps 2021.

1.2 Site history

Hisotricaly, the site may have been managed for agricultural and horticultural purposes. During the late 20th century the site was likley subdivided to provide what is now the rural / residential housing area.

Native vegetation would have once covered the area although due to modification and disturbance, the site has lost many natural attributes. The site has been significantly altered and degraded from its natural state due to a long history of vegetation clearing, habitat fragmentation and on-going disturbance.

1.3 Proposed actions

The proposed project involves staged development application for the demolition of an existing dwelling and associated structures and construction of a detached dual occupancy with associated on-site waste water management system.

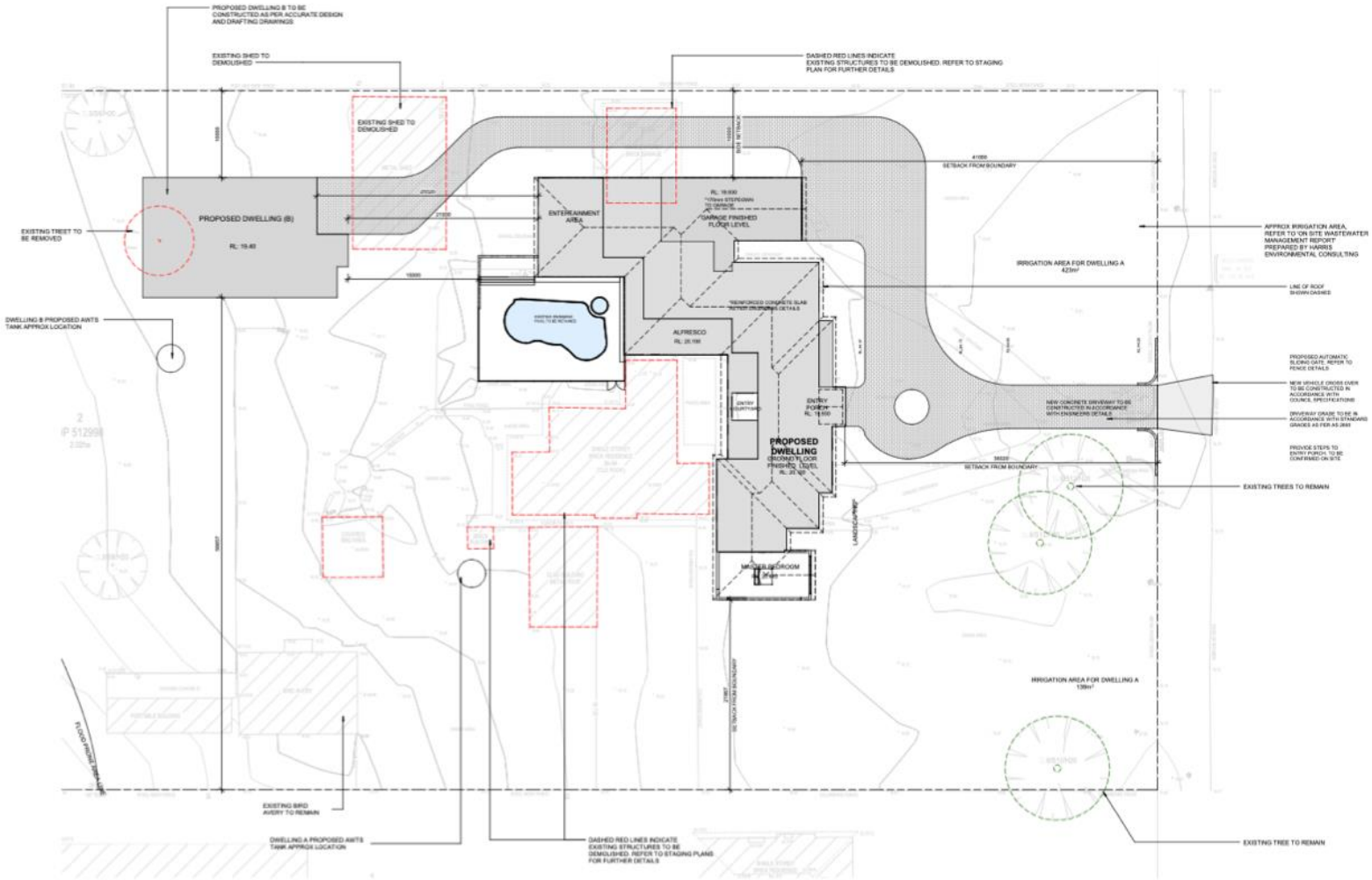


Figure 1.2. Site Plan for the proposal at 64-70 Clark Road, Londonderry. Source J Mammone Architecture (JMA) 8/02/21 Issue F.

1.4 Sources of information used in the assessment

The following sources of information were used for this assessment:

- SeedMaps 2021
- CumberlandPlainWest_VIS__4207 OEH (2016)
- BioNet DPIE (2021)
- Planning for Bush Fire Protection (PBP) NSW RFS 2019.
- Architectural Plans - 64-70 Clark Road, Londonderry. J Mammone Architecture 2021.
- Soil and Site Assessment - 64-70 Clark Road, Londonderry. Harris Environmental Consulting. 6/11/20.

1.5 Legislative context and statutory requirements

1.5.1 NSW Environmental Planning and Assessment Act 1979

The NSW *Environmental Planning and Assessment Act 1979* and the *Environmental Planning and Assessment Regulation 2000* institutes and sets out a system for environmental planning and assessment in NSW, and includes Part 4 which deals with development applications on private land.

This proposal falls under a Part 4 development and requires development consent, and associated environmental assessment.

1.5.2 NSW Biodiversity Conservation Act 2016 and associated documents

The *Biodiversity Conservation Act 2016* (BC Act 2016) is the key legislation that enables the conservation of biodiversity within the state of New South Wales. The BC Act 2016 facilitates the assessment and on-going protection of flora and fauna, including threatened species and ecological communities. The BC Act 2016 outlines assessment and offsetting requirements for activities with the potential to impact on threatened species and ecological communities in NSW, and the clearing of native vegetation which exceeds the threshold.

The BC Act also:

- Outlines the licences required under the BC Act to harm protected flora and fauna;
- Lists Threatened species and ecological communities in Schedules 1 and 2;
- Sets out monetary and imprisonment penalties for offences relating to the harming of protected flora and fauna;
- Under Part 7 (s7.4), introduces a list of activities/proposal that exceeds the biodiversity offsets scheme threshold.

The NSW *Biodiversity Conservation Regulation 2017* sets out the Biodiversity Offsets Scheme entry threshold for Part 4 developments under the EP&A Act 1979. If the development triggers as least one (1) entry threshold, the development must be assessment under The BC Act using the Biodiversity Assessment Method (BAM) (OEH 2017). See also https://www.environment.nsw.gov.au/biodiversity/entryrequirements.htm

The development triggers the Biodiversity Offsets Scheme entry threshold. The assessment type used in the BAM-C is Part 4 Developments (Small Area). Vegetation zones have annexed the appropriate areas of native vegetation which will be modified or removed. Thus, an adequate BDAR has is provided to the consent authority.

1.5.3 Commonwealth Environmental Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is applicable if it was considered that an impact on a 'matter of National Environmental Significance (NES)' were likely, thus providing a trigger for referral of the proposal to the Department of Environment and Heritage.

Matters of national environmental significance identified in the Act are:

- world heritage properties;
- national heritage places;
- Ramsar wetlands;
- nationally threatened species and communities;
- migratory species protected under international agreements;
- the Commonwealth marine environment; and
- nuclear actions.

The Commonwealth Government has published Significant Impact Guidelines (DE 2013) to assist in the determination of whether an action is likely to have a significant impact on a matter of NES. The proposal is not expected to significantly impact any MNES.

1.6 Biodiversity Offsets Scheme threshold

The Biodiversity Offsets Scheme applies to:

local development (assessed under Part 4 of the Environmental Planning and Assessment Act 1979) that triggers the Biodiversity Offsets Scheme threshold (see section 1.6) or is likely to significantly affect threatened species based on the test of significance in section 7.3 of the Biodiversity Conservation Act 2016.

1.6.1 BOS Area Clearing Threshold

The proposal does not trigger the area clearing threshold as per the BOS entry requirements. Area clearing thresholds are determined by minimum lot size and guidelines outlined in BAM (DPIE 2020) (figure 1.2a).

Table 1.1. Minimum lot size and threshold which the development exceeds.

Minimum lot size	**2Ha**
Threshold for clearing, above which the BAM and offsets scheme apply	**0.5ha**
Impact area	**0.09ha**

Area clearing threshold

The area threshold varies depending on the minimum lot size (shown in the Lot Size Maps made under the relevant Local Environmental Plan (LEP)), or actual lot size (where there is no minimum lot size provided for the relevant land under the LEP).

Minimum lot size associated with the property	Threshold for clearing, above which the BAM and offsets scheme apply
Less than 1 ha	0.25 ha or more
1 ha to less than 40 ha	0.5 ha or more
40 ha to less than 1000 ha	1 ha or more
1000 ha or more	2 ha or more

Figure 1.2a The area clearing threshold as per the BOS entry requirements.

1.6.2 Biodiversity Values Map

The proposed development area does impact areas identified by the Biodiversity Values map published by the Chief Executive of the NSW Office of Environment and Heritage.

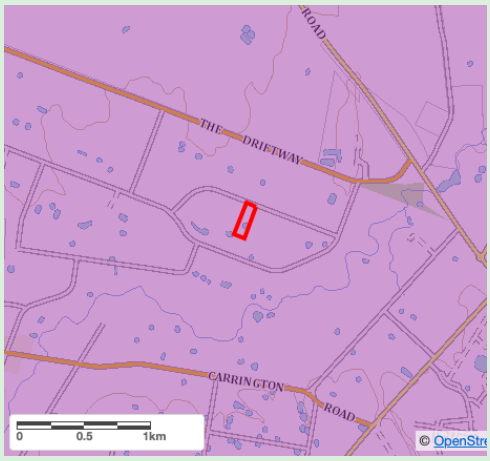
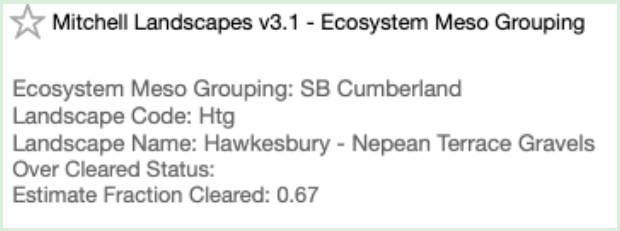
Biodiversity Values

BV Land Status: Biodiversity Values
Date added to BV Map: 11/27/2020
BV Map Criteria: Threatened species or communities with potential for serious and irreversible impacts

Figure 1.3. Biodiversity Map – Site in yellow. Source: https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BOSETMap **2021**

2 Landscape features and site context

Table 2 - Site Biodiversity Information

Category	Details
Interim Biogeographic Regionalisation for Australia (IBRA)	Sydney Basin
IBRA Sub Region	Cumberland
NSW Landscape 	Hawkesbury – Nepean Terrace Gravels Htg - Below 
% Native vegetation cover	80% in the 1500m radius circle See Figure 1.4b
Landscape features	
Rivers and streams	No Rivers or streams on site
Wetlands	N/A A dam does exist in the southern portion of the site. This feature will not be directly impacted, it is >60m south of the proposed development area.
Connectivity features	Vegetation on site is connected to adjoining bushland via paddock trees and inconsistent structural layers.
Areas of geological significance and soil hazard features	No
Areas of Outstanding Biodiversity Value identified under the BC Act	No
Geology and Soil	Sedimentary rocks (undifferentiated consolidated Cenozoic sedimentary rocks; sandstone, limestone,

	conglomerate, siltstone, duricrust; commonly ferruginised or silicified; may be poorly consolidated, highly weathered, and dissected by present day drainage). Berkshire Park Soil Landscape. (Harris Environmental Consulting. 2020).

Figure 1.4a. Idenifies the native vegetation extent on site, as per CumberlandPlainWest_VIS__4207 (OEH 2016) and the dam in the southern portion of the property.

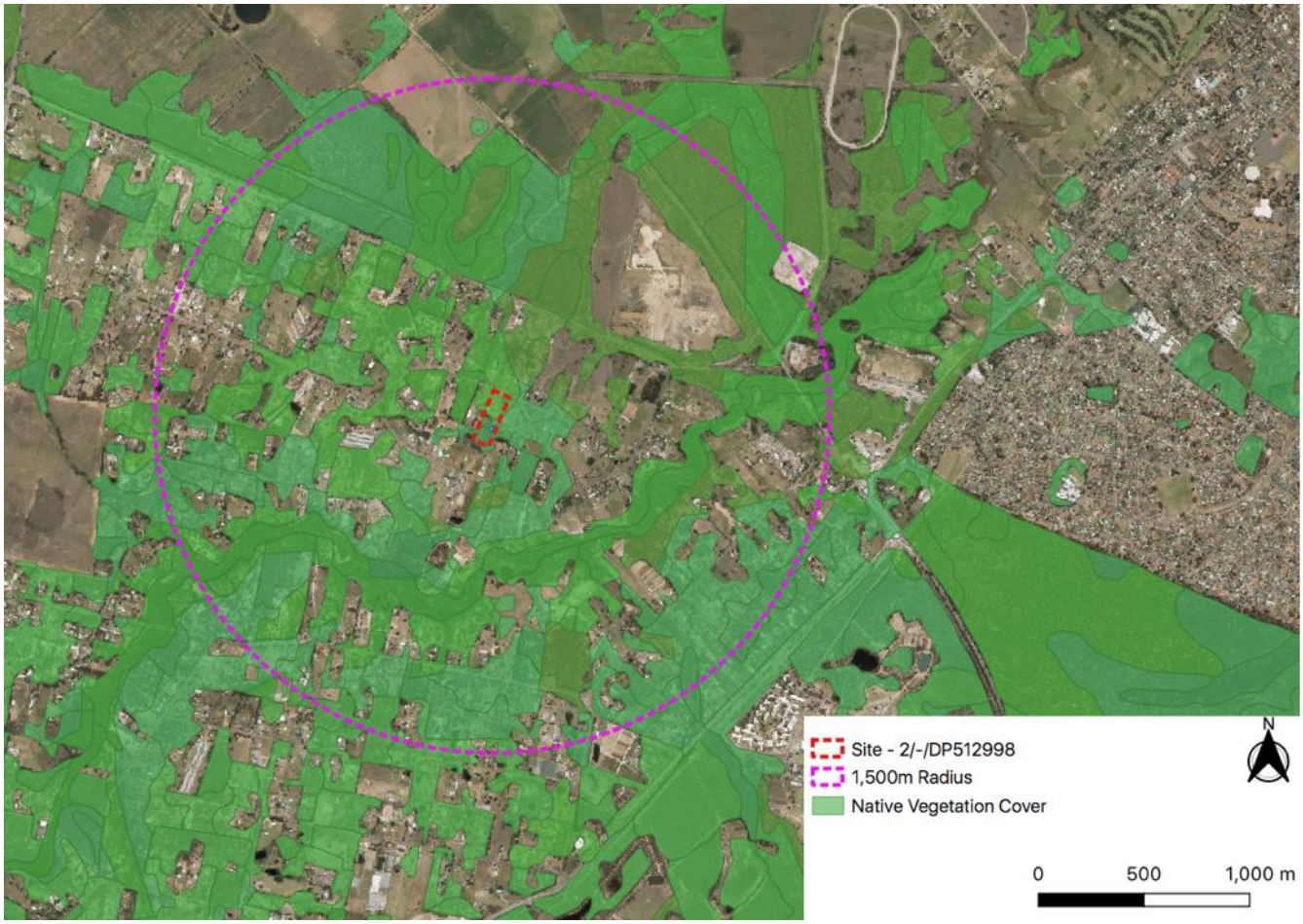


Figure 1.4b. Purple circle showing the 1500m buffer around the site, displays connectivity form the site and native vegetation extent.

3 Native vegetation

3.1 Desktop and Survey results – Plant Community Types (PCTs)

A review of the most up-to-date vegetation mapping, *Cumberland Plain West_VIS__4207 OEH (2016)* identified three plant community types (PCT) within site. The PCT are identified as;

I. *Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion (PCT 724);*

II. *Broad-leaved Ironbark - Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion (PCT 725), and;*

III. *Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin Bioregion (PCT 1067).*

Table 3 – Table of vegetation community synonyms as per NSW and Commonwealth legislation.

NSW PCT Code	NSW PCT Name	BC Act 2016	EPBC Act 1999
724	Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion	Shale Gravel Transition Forest in the Sydney Basin Bioregion State Conservation: Endangered Ecological Community (EEC)	Shale Gravel Transition Forest in the Sydney Basin Bioregion Commonwealth Conservation: Critically Endangered (CE)
725	Broad-leaved Ironbark - Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion	Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion State Conservation: Endangered Ecological Community (EEC)	Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion Commonwealth Conservation: Critically Endangered (CE)
1067	Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin Bioregion	Castlereagh Swamp Woodland Community State Conservation: Endangered Ecological Community (EEC)	N/A

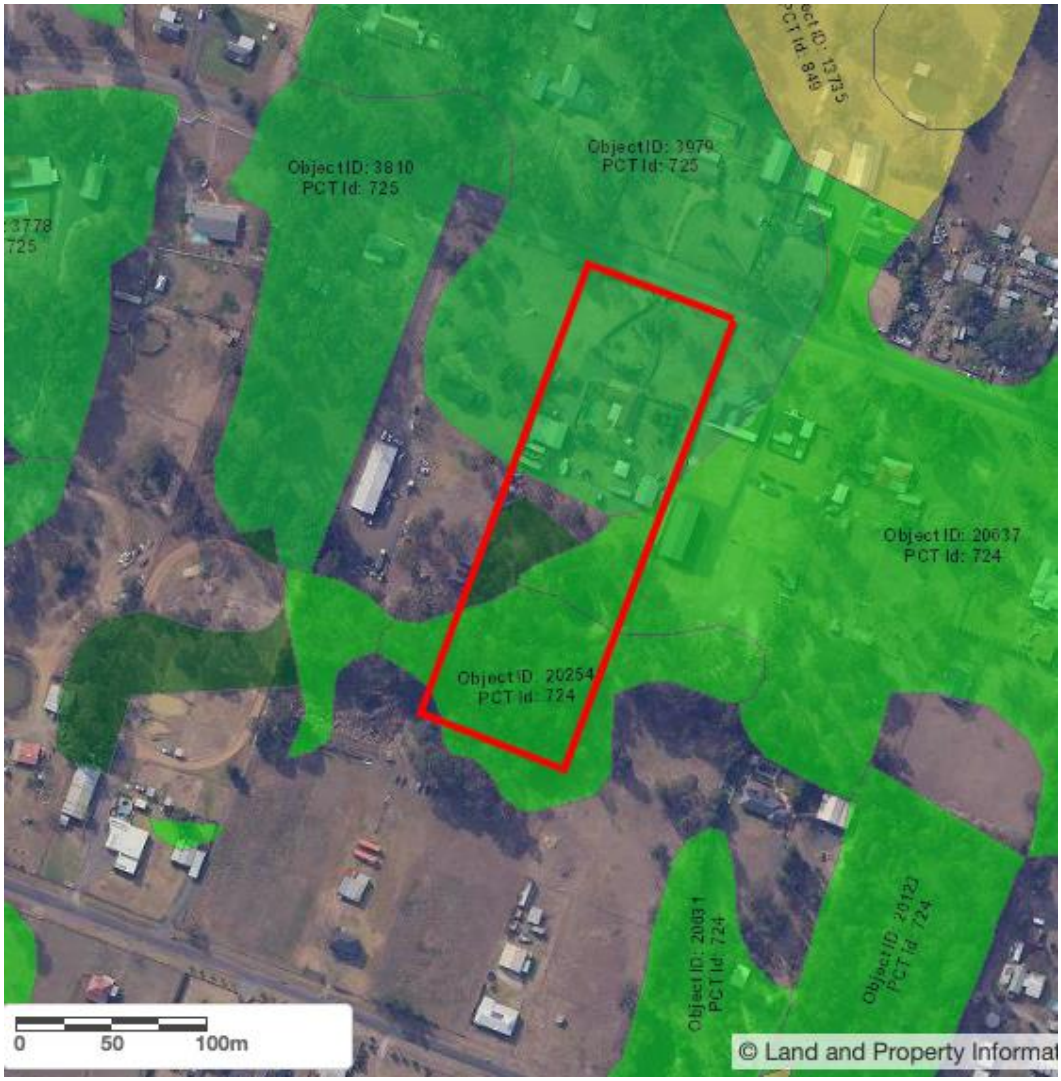


Figure 1.5. Subject site within mapped vegetation surrounding the property CumberlandPlainWest_VIS__4207 OEH (2016) . Source: SEED Maps, 2021.

3.1.1 Field Survey

The field survey assisted in verifying the distribution and quality of vegetation at the site.

PCT 725 - *Broad-leaved Ironbark - Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion,* is mapped (via *Cumberland Plain West_VIS__4207 OEH (2016*) in the proposed development area. It is antipcated that this threatened community also corresponds with the Biodiversity Values map layer, which triggered the BOS.

The field survey has concluded that the area proposed for modification is currently maintained as a lawn area. Vegetation in this area consists of primarily exotic grass species (I.e. Buffalograss (*Bouteloua dactyloides)* and Phoenix Plams (*Phoenix canariensis*).

No critical habitat for native species can be found on the maintained lawn area. There is no native canopy or mid-storey cover in the area proposed for modification. Desktop vegetation mapping via *Cumberland Plain West_VIS__4207 OEH (2016*) does not accurately reflect vegetation exent within the proposed development area.

The southern portion of the block, beyong the area proposed modification exhibits discontinuous canopy and mid-storey cover. This area hosts remnant bushland with the diversity of species in moderate to low condition. The mid-storey and canopy are predominantly native and the understory is dominated by African Lovegrass.

Stratification and plot dimensions

The BAM plot was as per the BAM Method with 20x20 plots (400m^2) for assessing structure and composition with a center line extending 50m to great a 20 x 50 plot (1000m^2) to assess function. See Biodiversity Assessment Method Operational Manual – Stage 1 (OEH 2018) page 26-28 for methods used.

https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Biodiversity/biodiversity-assessment-method-operational-manual-stage-1-180276.pdf

3.1.2 Site Photos

Included are photos of the BAM vegetation zone (proposed development are) and the general condition of vegetation at the site.

Plate 1. Garden and proposed redevelopment area.

Plate 2. BAM plot within the proposed development zone.

Plate 3. Within the proposed building area the ground layer is exotic.

Plate 4. Trees in the area south of house (outside of development footprint).

4 Threatened Species

4.1 Flora and Flora Field Survey

No threatened flora or fauna species were identified during Kingfisher 2021 field surveys.

4.1.1 Opportunistic Flora and Fauna survey methods

During opportunistic surveys, notes and photos were taken of the vegetation types and flora and fauna present on site were recorded. Surveys were general and opportunistic in nature and were performed by traversing the site.

4.1.2 Diurnal Bird Surveys

It is unlikely that threatened avifauna would use the impact area for foraging or breeding purposes, due to lack of optimal breeding habitat (suitable hollows, suitable waterways). Justification for species exclusion in the BAM-C can be found in appendix I.

4.1.3 Microbats

The site survey for microbats primarily focused on their breeding habitat requirements such as caves, outcrops, hollows and other features which microbat species may use for breeding purposes. It has been concluded that microbats are unlikey to be significant impacted by this development. The proposal will not result in the loss or disturbance of significant breeding or forgaing habitat.

4.1.4 Mammal Surveys

Mammal surveys occurred during the mid-afternoon. The proposed development is not expected to significantly impact upon breeding or foraging purposes for any mammal species identified in the BAM Calculator as there are no optional habitat features within the development area.

4.1.5 Amphibian Surveys

Amphibian surveys occurred during the mid-afternoon. Opportunistic observations of amphibians were made during vegetation surveys. Any potential habitat features were investigated however no threatened amphibian species identified in the BAM calculator were identified on site.

4.1.6 Reptile and Snail surveys

Reptile and Snail surveys were undertaken by thorough investigation of potential habitat including:

- Leaf litter
- Bark litter
- Stick piles
- Native ground cover vegetation
- Rocks
- Rubbish

Although no threatened Reptile or Snail species were identified during site investigations.

4.2 Threatened Flora - Desktop

A total of 10 threatened flora species have been recorded within 10km of the study site according to BioNet records. These species are currently listed as vulnerable or endangered under state and/or commonwealth legislation (see Table 4). The vulnerable and endangered species to focus on site searches for can be seen in Table 4 below highlighted in bold. This is based on likelihood of occurrence.

Table 4. Threatened flora observed in previous ecological surveys within a 10km radius of the study site. NSW DPIE Bionet 2021.

Family	Scientific Name	Common Name	NSW status	Comm. status	Records
Fabaceae (Mimosoideae)	*Acacia bynoeana*	Bynoe's Wattle	E1	V	42
Fabaceae (Mimosoideae)	*Acacia pubescens*	Downy Wattle	V	V	3
Casuarinaceae	*Allocasuarina glareicola*		E1	E	89
Fabaceae (Faboideae)	*Dillwynia tenuifolia*		V		1852
Proteaceae	*Grevillea juniperina* subsp. *juniperina*	Juniper-leaved Grevillea	V		1166
Myrtaceae	*Micromyrtus minutiflora*		E1	V	214
Proteaceae	*Persoonia hirsuta*	Hairy Geebung	E1,P,3	E	7
Proteaceae	*Persoonia nutans*	Nodding Geebung	E1,P	E	709
Thymelaeaceae	*Pimelea curviflora* var. *curviflora*		V	V	16
Fabaceae (Faboideae)	*Pultenaea parviflora*		E1	V	291

Note: E = Endangered, V = Vulnerable, P = Protected.

4.3 Threatened Fauna - Desktop

A total of 36 threatened fauna species have been recorded within 10km of the study site according to BioNet records. These species are currently listed as vulnerable or endangered under state and/or commonwealth legislation (see Table 5). The vulnerable and endangered species to focus on-site searches for can be seen in Table 5 below highlighted in bold. This is based on likelihood of occurrence.

Table 5. Threatened fauna observed in previous ecological surveys within a 10km radius of the study site. NSW DPIE Bionet 2021.

Class	Scientific Name	Common Name	NSW Status	Comth. Status	No. of records
Amphibia	*Litoria aurea*	Green and Golden Bell Frog	E1,P	V	1
Aves	*Anthochaera phrygia*	Regent Honeyeater	E4A,P	CE	12
Aves	*Artamus cyanopterus cyanopterus*	Dusky Woodswallow	V,P		14
Aves	*Botaurus poiciloptilus*	Australasian Bittern	E1,P	E	1
Aves	*Calidris ferruginea*	Curlew Sandpiper	E1,P	CE,C,J,K	1
Aves	*Chthonicola sagittata*	Speckled Warbler	V,P		10
Aves	*Circus assimilis*	Spotted Harrier	V,P		2
Aves	*Daphoenositta chrysoptera*	Varied Sittella	V,P		27
Aves	*Ephippiorhynchus asiaticus*	Black-necked Stork	E1,P		2
Aves	*Epthianura albifrons*	White-fronted Chat	V,P		1
Aves	*Falco subniger*	Black Falcon	V,P		3
Aves	*Glossopsitta pusilla*	Little Lorikeet	V,P		9
Aves	*Grantiella picta*	Painted Honeyeater	V,P	V	2
Aves	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	V,P		3
Aves	*Hieraaetus morphnoides*	Little Eagle	V,P		6
Aves	*Hirundapus caudacutus*	White-throated Needletail	P	V,C,J,K	3
Aves	*Lathamus discolor*	Swift Parrot	E1,P,3	CE	21
Aves	*Lophoictinia isura*	Square-tailed Kite	V,P,3		4

Class	Scientific Name	Common Name	NSW Status	Comth. Status	No. of records
Aves	*Melithreptus gularis gularis*	Black-chinned Honeyeater (eastern subspecies)	V,P		4
Aves	*Neophema pulchella*	Turquoise Parrot	V,P,3		1
Aves	*Ninox connivens*	Barking Owl	V,P,3		4
Aves	*Ninox strenua*	Powerful Owl	V,P,3		2
Aves	*Petroica boodang*	Scarlet Robin	V,P		8
Aves	*Petroica phoenicea*	Flame Robin	V,P		21
Aves	*Polytelis swainsonii*	Superb Parrot	V,P,3	V	1
Aves	*Rostratula australis*	Australian Painted Snipe	E1,P	E	3
Gastropod	*Meridolum corneovirens*	Cumberland Plain Land Snail	E1		57
Mammalia	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V,P		5
Mammalia	*Micronomus norfolkensis*	Eastern Coastal Free-tailed Bat	V,P		9
Mammalia	*Miniopterus orianae oceanensis*	Large Bent-winged Bat	V,P		7
Mammalia	*Myotis macropus*	Southern Myotis	V,P		9
Mammalia	*Petaurus australis*	Yellow-bellied Glider	V,P		2
Mammalia	*Petaurus norfolcensis*	Squirrel Glider	V,P		1
Mammalia	*Phascolarctos cinereus*	Koala	V,P	V	4
Mammalia	*Pteropus poliocephalus*	Grey-headed Flying-fox	V,P	V	49
Mammalia	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V,P		9

Note: E = Endangered, V = Vulnerable, P = Protected.

Stage 2: Impact Assessment

5 BAM Calculator

5.1 Vegetation Zones and Integrity Scores

A single vegetation zone covers the impact area (proposed development area). Vegetation within this zone is identified as PCT 725 for the purposes of the BAM-C. Based on desktop and field assessments, PCT 725 is likely to remnant PCT for this zone and as such, was selected in the BAM-C.

Table 6. Table of current vegetation integrity scores for vegetation zones on site.

PCT	Vegetation Zone	Area (Ha)	Vegetation Integrity Score
PCT 725	One (Development)	0.09	0

Figure 1.6. Vegetation zone (I.e Impact area) and BAM plot locations on site - BAM plot idenifed in yellow.

5.2 Species and Ecosystem Credits

The grand total cost to offset both ecosystem credits and species credits generated by this development is $0.00. The site did not achive the minimum Vegetation Intregty (V.I) score for the EEC to generate Species or Ecosystem offset credits. BAM-C output reports suggest to contact the BCT for pricing information.

6 Direct Impacts

6.1.1 Vegetation disturbance and Loss

One tree is proposed for removal to accommodate for the proposed development. The removal of this tree should be offset using a 10:1 offset ratio (replanted:removed). Locally native canopy species are recommended for planting to compensate for the removal of the tree. This compensatory measure should ensure that the site will continue to provide foraging and possible breeding habitat for native fauna into the future.

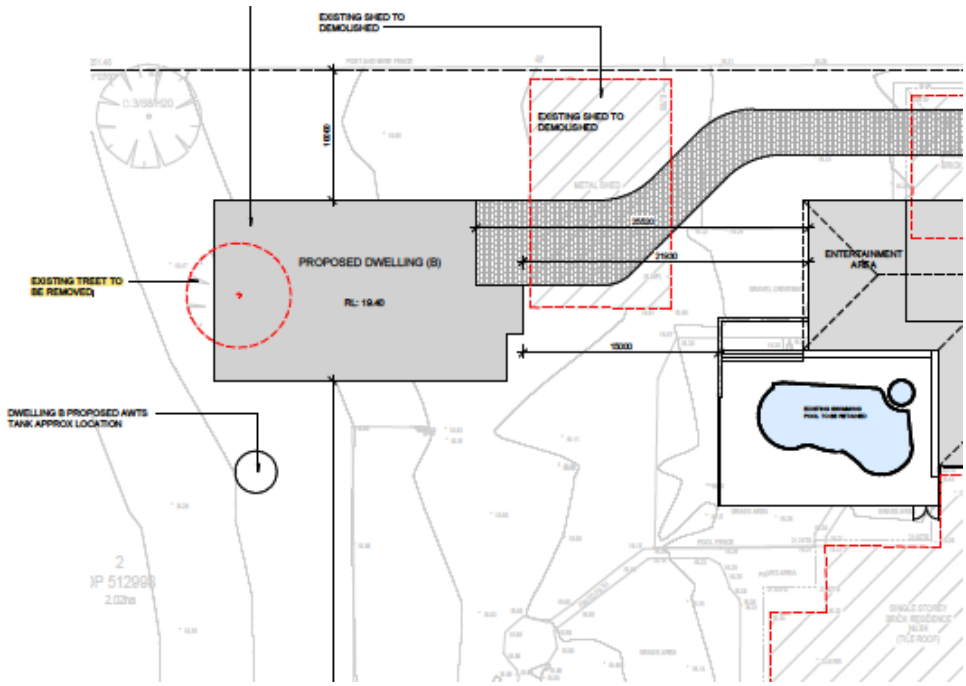


Figure 1.7. Tree proposed for removal.

7 Indirect Impacts

7.1.1 Weed growth and invasion

Weed species are present and must be properly managed so they do not spread.

At the direct works zone weeds are to be managed by stopping seed spread on machinery, tools, equipment and worker clothes (e.g. boots). Additionally, after weed removal around the perimeter area of the construction, there must be continuous maintenance of the site otherwise it may result in increased weed growth, exacerbated by the high abundance of weeds present pre-works.

Weeds will colonize and pioneer on any cleared grounds so must be managed throughout the duration of the project as well as on-going post woks

7.1.2 Introduction of pathogens

The introduction of pathogens may occur into the site, and surrounding remnant bushland, via machinery, tools, equipment and worker clothing (e.g. boots). Diseases to watch out for include Phytophthora (also

known as Root Rot – type of water mold) and Myrtle Rust (*Puccinia psidii* – type of fungus). See Appendix for Bushland Hygiene Protocols for Phytophora.

7.1.3 Soil disturbance and erosion

The removal of vegetation and trees can result in soil disturbance. Soil compaction could occur from machinery use. It is recommended that soil compaction is to be avoided and not to occur within the trees to be retained. Replacement of woody debris and a covering of organic matter over the cleared site will prevent erosion and thus is highly recommended.

7.1.4 Water Quality

There are no streams present onsite however the proposed actions may result in transport of sediment from the work zones because of increased storm water runoff to areas downstream. Which may impact water quality, riparian vegetation and aquatic fauna. Recommendations to maintain and improve water quality on site have been listed in section 10 below.

7.1.5 On site Wastewater Disposal

As idenifed on the site plans, the on site wastewater disposal system will be locted in the northern portion of the property. The system is unlikey to affect the hydrology of the site or have significant implactions for the remnant bushland in the southern portion of the property. Please refer to the - *Soil and Site Assessment - 64-70 Clark Road, Londonderry. Harris Environmental Consulting. 6/11/20,* which found that the “on-site wastewater management can be undertaken for the proposed dwellings.”

8 Serious and Irreversible Impact Assessment (SAII)

The following section provides details which address section 10.2 of the Biodiversity Assessment Method (BAM) and thus has referenced the guiding document *Guidance to assist a decision-maker to determine a serious and irreversible impact* in order to satisfy BAM requirements.

The document *Guidance to assist a decision-maker to determine a serious and irreversible impact* outlines the steps taken determine serious and irreversible impacts in section 3.2. The steps are as follows;

1. Step one: Identify relevant entities at risk of a SAII
2. Step two: Evaluate the extinction risk of the entity to be impacted
3. Step three: Detail measures taken to avoid, minimise and mitigate impacts on the entity
4. Step four: Evaluate a serious and irreversible impact
5. Step five decision making

8.1.1 Step one - Identify relevant entities at risk of a SAII

Following 3.2.1 in *Guidance to assist a decision-maker to determine a serious and irreversible impact;*

> *The Biodiversity Assessment Report (BAR) will identify species or ecological communities at risk of a SAII that are likely to be affected by the proposal. These entities are identified in the BAM Calculator (BAM-C). The front page of the credit report provided by the BAM-C will also identify all the entities that are considered to be at risk of a SAII and are impacted on by the proposal.*

The BAM-C Credit report can be found in appendix IV. The following section identifies SAII entities recognised by the BAM Calculator as being at risk of a serious and irreversible impact. Description of the principles for the Listed entities are available in the *Guidance to assist a decision-maker to determine a serious and irreversible impact.* The list of SAII entities identified by the document was accessed via;

https://www.environment.nsw.gov.au/topics/animals-and plants/biodiversity/biodiversity-offsets-scheme/serious-and-irreversible-impacts

Table 7. All SAII entity recognised by the BAM Calculator for the site.

Scientific Name	Common Name	Principles			
		1	2	3	4
Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion (PCT 725)	Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion (PCT 725)	X	X		

8.1.2 Step two - Evaluate the extinction risk of the entity to be impacted

- Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion

The community satisfies Principle 1 and 2 of SAII criteria;

- Principle 1 – species or ecological community currently in a rapid rate of decline
- Principle 2 – species or ecological communities with a very small population size

The proposed development will have an approximate impact area of 0.09ha on an area which is primarily exotic grass species. The field survey has concluded that the area proposed for modification is currently maintained as a lawn area. Vegetation in this area consists of primarily exotic grass species. No critical habitat for native species can be found on the maintained lawn area. There is no native canopy or mid-storey cover in the area proposed for modification. Desktop vegetation mapping via *Cumberland Plain West_VIS__4207 OEH (2016*) does not accurately reflect vegetation exent within the proposed development area.

The proposed development is not expected to significantly contribute to loss of Castlereagh Ironbark Forest in the Sydney Basin Bioregion due to the degraded nature of the proposed impact area.

8.1.3 Step three - Detail measures taken to avoid, minimise and mitigate impacts on the entity

- Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion

The proposal is expected to have a negligible impact upon the EEC as core habitat for the community will not be removed. The vegetation proposed for removal is in poor condition and it is unlikely that the original vegetation community would recover without assistance.

The removal of this tree should be offset using a 10:1 offset ratio (replanted:removed). Locally native canopy species are recommended for planting to compensate for the removal of the tree. This compensatory measure should ensure that the site will continue to provide foraging and possible breeding habitat for native fauna into the future.

Delineation of works areas and exclusion zones for all vegetation to remain has been recommended.

8.1.4 Step four - Evaluate a serious and irreversible impact

- Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion

The proposed development assessed in this BDAR is not expected to significantly contribute to loss of Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion due to the poor condition of vegetation within the impact area and the proposed mitigation measures. Vegetation is both structurally and functionally poor due to historical actions on site. It is unlikely that this proposal would place the EEC at risk of extinction or cause a serious or irreversible impact.

Stage 3: Improving Biodiversity Values

9 Avoid and minimise impacts

The development will not significantly impact features outlined in table 8 below. The proposed actions will not affect water quality as there will be erosion and silt management controls on site to prevent runoff. Below is a table showing the potential impact the development would have on features that threatened species or communities can be dependent on.

Table 8. Expected impact on potential habitat onsite.

Feature	Present	Description of feature characteristics and location	Potential Impact	Threatened species or community using or dependent on feature	Section of the BAR where prescribed impact is addressed.
Karst, caves, crevices, cliffs or other geologically significant feature	No	N/A	N/A	N/A	N/A
Rocks	No	N/A	N/A	N/A	N/A
Human made structure	Yes	House within the development site	Negligible	N/A	N/A
Non-native vegetation	Yes	N/A	N/A	N/A	N/A

10 Recommendations

10.1.1 Native species landscaping

The planting schedule should be selected from locally native PCT species lists. It is recommended that seeds are collected from the site. Seedlings can then be propagated and planted once established. Landscaping across the site should be selected from locally native ground and shrub species.

The inclusion of canopy tree planting and planting of locally native mid and understory species would benefit the endangered ecological community. The vegetation integrity on site and the viability of the vegetation corridor, would likely improve.

10.1.2 Weed management

Low impact bushland regeneration methods should be utilised to meet weed control performance criteria in all areas of remnant native vegetation, to prevent unnecessary impacts to native vegetation and disturbance to soil. Low impact bush regeneration methods include the manual removal of herbaceous weeds and their propagules by hand and with hand tools. All bush regeneration activities requiring the use of chemicals must be performed in accordance with the NSW *Pesticides Act 1999.* Herbicides must not be applied whilst exotic plants are setting seeds.

10.1.3 Delineation of work areas

During construction, impacts to the site and adjacent vegetation should be minimised by the delineation of works zones. Access to the site would be best restricted to the development footprint only. An environmental exclusion zone is proposed for vegetation outside work areas.

10.1.4 Tree Protection

All trees in close proximity to building works should be managed via a tree survey.

10.1.5 Erosion and sediment controls

Sediment and erosion controls should continue to be implemented. Immediate measures to stabilise soil and reduce erosion risk are recommended. Immediate measures to stabilise soil and reduce erosion risk may include; Jute matting, coir logs and silt fencing. Thick jute mesh will be applied to areas requiring soil stabilisation with the added benefit of suppressing weed growth

10.1.6 Weed Removal Techniques

Weed removal proposed for the site will consist of hand removal techniques, manual/mechanical removal using bush regenerator tools and winter thermal (flame) weeding. This approach will reduce the amount of herbicide used and reduce the amount of off-target damage through spot on application.

Woody perennial weeds less than 2 metres in height will require cut and paint or scrape and paint bush regenerator techniques based on the germinating/epicormic behaviour of the plant (especially plants that tend to coppice or sucker).

It is recommended that seed heads are removed prior to commencement of primary works. This would be best performed carefully by hand with secateurs with the aim of avoiding the spread flowers or seeds into planting zones.

See Appendix III for further details. For key weed photo guide see Appendix VIII.

10.1.7 Native Seed Collection

Any native trees or shrubs being removed for the construction works should be checked for seeds during removal works. If seeds are present, they should be collected and used off-site, location to be determined with council.

10.1.8 Nest boxes

Installation of a 2 nest boxes designed for microbats should be added to the site to increase roosting opportunities in the area.

Image from: nestboxes.com.au

10.1.9 Pathogen prevention

To prevent the introduction of pathogens, Bushland Hygiene Protocols outlined in Appendix V should be followed. The site is considered to be an area which may promote the spread of Phytophthora (a group of fungus-like diseases affecting plants) due to its moist soil and proximity to water. It is recommended that Bushland Hygiene Protocols be followed closely.

11 Conclusions

The proposed development will have an approximate impact area of 0.09ha on an area which is primarily exotic grass species. The grand total cost to offset both ecosystem credits and species credits generated by this development is $0.00. The site did not achive the minimum Vegetation Intregty (V.I) score for the EEC to generate Species or Ecosystem offset credits. BAM-C output reports suggest to contact the BCT for pricing information.

It is recommended that the planting schedule should be selected from locally native PCT species lists. It is recommended that seeds are collected from the site. Seedlings can then be propagated and planted once established. Landscaping across the site should be selected from locally native ground and shrub species.

One tree is proposed for removal to accommodate for the proposed development. However, the development site is substantially degraded such that the original vegetation community is unlikely to recover. The removal of this tree should be offset using a 10:1 offset ratio (replanted:removed). Locally native canopy species are recommended for planting to compensate for the removal of the tree. This compensatory measure should ensure that the site will continue to provide foraging and possible breeding habitat for native fauna into the future.

12 Appendices

12.1 Appendix I – Rationale for Likelihood of Occurrence

Rationale for Likelihood of Occurrence all Species Credit Species (candidate species) predicted by the BAM Calculator (BAM-C) and details whether the species have been retained or omitted from the calculator.

Where a species has a specific habitat constraint, which is not present within the subject land, or if the species is a vagrant within the IBRA subregion, the species is considered unlikely to occur and no further assessment is required. Additionally. in accordance with section 6.4.1.17 of the BAM, a candidate species credit species can be considered unlikely to occur within the subject land (or specific vegetation zones) where habitat is substantially degraded such that the species is unlikely to utilise area.

A predicted candidate species credit species that is not considered to have suitable habitat on the subject land (or specific vegetation zones) in accordance with section 6.4.1.17 of the BAM does not require further assessment on the subject land (or specific vegetation zones). The reasons for determining that a predicted species credit species is unlikely to have suitable habitat on the subject land (or specific vegetation zones) has been included below for each Candidate Species for the BDAR.

Note - All BAM-C Predicated species (Ecosystem Credit Species) were retained.

Table 6. Potential Species Credit Species generated by the BAM-C, all the following species were candidate threatened species for the site. All BAM-C predicated species were retained.

Scientific Name	Common Name	Habitat/ Geographic Constraints	Retained in BAM Calculator	Reason for Inclusion or Removal
Flora				
Allocasuarina glareicola		Grows in Castlereagh woodland on lateritic soil. Found in open woodland with Eucalyptus parramattensis, Eucalyptus fibrosa, Angophora bakeri, Eucalyptus sclerophylla and Melaleuca decora.	No	Likelihood of occurrence for the species is low. Habitat is substantially degraded such that the species is unlikely to utilise area. The proposed impact area has been significantly altered and degraded from its

		Common associated understorey species include Melaleuca nodosa, Hakea dactyloides, Hakea sericea, Dillwynia tenuifolia, Micromyrtus minutiflora, Acacia elongata, Acacia brownei, Themeda australis and Xanthorrhoea minor.		natural state. It has a long history of clearing, fragmentation and on-going disturbance.
Gyrostemon thesioides	*Gyrostemon thesioides*	Grows on hillsides and riverbanks and may be restricted to fine sandy soils. A fire-opportunist, with recruitment occurring from a soil stored seed bank following fire. Adult plants are killed by fire. Plants reach maturity in less than a year and plants are presumably short-lived.	No	Likelihood of occurrence for the species is low. Habitat is substantially degraded such that the species is unlikely to utilise area. The proposed impact area has been significantly altered and degraded from its natural state. It has a long history of clearing, fragmentation and on-going disturbance. Additionally, the species was not recorded during site surveys and no recording on Bionet within 10 Km radius. Species is not present and is unlikely to be present on the subject land. No further assessment required.
Hibbertia fumana		Species is known to occur in a long intergrade between Castlereagh Scribbly Gum Woodland and Castlereagh Ironbark Forest. Also recently found associated with aeolian sand deposits. Species has been found to occur in a variety of structural habitats including open areas, disturbed	No	Likelihood of occurrence for the species is low. Habitat is substantially degraded such that the species is unlikely to utilise area. The proposed impact area has been significantly altered and degraded from its natural state. It has a long history of

		sites and also within thick ground cover dominated by a heavy cover of sedges, rushes and grasses. Has the potential to occur in similar intergrade alluvial habitats rich in sands and laterite in other parts of western Sydney.		clearing, fragmentation and on-going disturbance. Additionally, the species was not recorded during site surveys and no recording on Bionet within 10 Km radius. Species is not present and is unlikely to be present on the subject land. No further assessment required.
Hibbertia sp. Bankstown		This species is endemic to New South Wales and is currently known to occur in only one population at Bankstown Airport in Sydney's southern suburbs, in the Bankstown local government area.	No	Likelihood of occurrence for the species is low. Habitat is substantially degraded such that the species is unlikely to utilise area. The proposed impact area has been significantly altered and degraded from its natural state. It has a long history of clearing, fragmentation and on-going disturbance. Additionally, the species was not recorded during site surveys and no recording on Bionet within 10 Km radius. Species is not present and is unlikely to be present on the subject land. No further assessment required.
Micromyrtus minutiflora		Restricted to the general area between Richmond and Penrith, western Sydney. Habitat and ecology	No	Likelihood of occurrence for the species is low. Habitat is substantially degraded such that the species is unlikely to utilise area.

		Grows in Castlereagh Scribbly Gum Woodland, Ironbark Forest, Shale/Gravel Transition Forest, open forest on tertiary alluvium and consolidated river sediments. Sporadic flowering, June to March Response to fire and mechanical disturbance is uncertain. Regeneration may be due to resprouting or germination of soil-stored seed.		The proposed impact area has been significantly altered and degraded from its natural state. It has a long history of clearing, fragmentation and on-going disturbance. Additionally, the species was not recorded during site surveys and no recording on Bionet within 10 Km radius. Species is not present and is unlikely to be present on the subject land. No further assessment required.
Thick Lip Spider Orchid		The Thick Lip Spider Orchid is known from the Sydney area (old records), Wyong, Ulladulla and Braidwood in NSW. Populations in Kiama and Queanbeyan are presumed extinct. It was also recorded in the Huskisson area in the 1930s. The species occurs on the coast in Victoria from east of Melbourne to almost the NSW border. Habitat and ecology Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil. The single leaf regrows each year.	No	Likelihood of occurrence for the species is low. Habitat is substantially degraded such that the species is unlikely to utilise area. The proposed impact area has been significantly altered and degraded from its natural state. It has a long history of clearing, fragmentation and on-going disturbance. Additionally, the species was not recorded during site surveys and no recording on Bionet within 10 Km radius. Species is not present and is unlikely to be present on the subject land. No further assessment required.

		Flowers appear between September and November (but apparently generally late September or early October in extant southern populations).		

Scientific Name	Common Name	Habitat/ Geographic Constraints	Retained in BAM Calculator	Reason for Inclusion or Removal
Fauna				
Chalinolobus dwyeri	Large-eared Pied Bat	Large-eared Pied Bat roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features.	No	There is a low likelihood of occurrence within the proposed development area. Breeding and foraging habitat within this area is substantially degraded such that the species is unlikely to utilise area. The proposed development area does not present marginal foraging habitat for the species in the form of canopy vegetation. The development site would not be considered breeding habitat for the species. The impact area lacks key Habitat constraints including; Caves, tunnels, mines, culverts or other structures known or suspected to be used for breeding, as per the BAM-C. No further assessment or consideration is required.

Miniopterus australis	Little Bent-winged Bat	Moist eucalypt forest, rainforest or dense coastal banksia scrub. Little Bentwing-bats roost in caves, tunnels and sometimes tree hollows during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. They often share roosting sites with the Common Bentwing-bat and, in winter, the two species may form mixed clusters. In NSW the largest maternity colony is in close association with a large maternity colony of Common Bentwing-bats (*M. schreibersii*) and appears to depend on the large colony to provide the high temperatures needed to rear its young.	No	There is a low likelihood of occurrence within the proposed development area. Breeding and foraging habitat within this area is substantially degraded such that the species is unlikely to utilise area. The proposed development area does not present marginal foraging habitat for the species in the form of canopy vegetation. The development site would not be considered breeding habitat for the species. The impact area lacks key Habitat constraints including; Caves, tunnels, mines, culverts or other structures known or suspected to be used for breeding, as per the BAM-C. No further assessment or consideration is required.
Miniopterus orianae oceanensis	Large Bent-winged Bat	Primarily roosts in caves but will utilise mine shafts, storm-water tunnels, buildings and other man-made structures. Forms colonies within a maternity cave and disperse within a 300km range. Forage in forested areas in the tree canopy.	No	There is a low likelihood of occurrence within the proposed development area. Breeding and foraging habitat within this area is substantially degraded such that the species is unlikely to utilise area. The proposed development area does not present marginal foraging habitat for the species in the form of canopy vegetation. The development site would not be considered breeding habitat for the species.

				The impact area lacks key Habitat constraints including; Caves, tunnels, mines, culverts or other structures known or suspected to be used for breeding, as per the BAM-C. No further assessment or consideration is required.
Anthochaera phrygia	Regent Honeyeater	The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. This species has been seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests.	No	There is a low likelihood of occurrence within the proposed development area. Breeding and foraging habitat within this area is substantially degraded such that the species is unlikely to utilise area. The proposed development area does not present marginal foraging habitat for the species in the form of canopy vegetation. The development site does not contain areas of important breeding habitat for the species, as per the DPIE BV map. Species not recorded during site survey. No further assessment or consideration is required.
Swift Parrot		On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red	No	There is a low likelihood of occurrence within the proposed development area. Breeding and foraging habitat within this area is substantially degraded such that the species is unlikely to utilise area.

		Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Commonly used lerp infested trees include Grey Box *E. microcarpa*, Grey Box *E. moluccana* and Blackbutt *E. pilularis*. Return to home foraging sites on a cyclic basis depending on food availability.		The proposed development area does not present marginal foraging habitat for the species in the form of canopy vegetation. The development site does not contain areas of important breeding habitat for the species, as per the DPIE BV map. Species not recorded during site survey. No further assessment or consideration is required.

12.2 Appendix II– Key Weed Removal Methods

Physical removal

Technique	Method	Equipment
Hand Removal 	Seedlings and smaller weed species where appropriate will be pulled out by hand, without risk of injury to workers. The size that this can occur varies throughout the treatment area. Generally, it ranges from post seed to approximately 300mm in height. Rolling and raking is suitable for larger infestations of Wandering Jew. The weed can be raked and stems and plants parts rolled. The clump of weed material can then be bagged and removed from site.	Tools: Gloves, Rakes, Knife and Weed Bags
Crowning 	Plants that possess rhizomes or bulbs might not respond to various removal techniques and may need to be treated with crowning. A knife, mattock or trowel is to be driven into the soil surrounding the bulb or rhizome at an angle of approximately 45 degrees with surrounding soil, so as to cut any roots that may be running off. This is to occur in 360 degrees around the bulb/rhizome. The rhizome or bulb is to be bagged and removed from the site and disposed of at an appropriate waste recycling facility Soil disturbance is to be kept to a minimum when using this technique.	Tools: Knife, mattock, trowel, impervious gloves, and all other required P.P.E.
Cut and Paint Stems 	Weed species deemed unsuitable for hand removal shall be cut. Those that have persistent of vigorous growth will be cut and painted with Roundup® Biactive Herbicide or equivalent. Juvenile and smaller weed species will be cut with secateurs at base of plant, and herbicide applied via applicator bottle. Stem to be cut horizontally as close to the ground as possible, using secateurs, loppers or a pruning saw. Horizontal cuts to be made on top of stem to prevent the herbicide running off the stump. Apply herbicide to the cut stem immediately, within 10-20 seconds, before the plant cells close and the translocation of the herbicide is limited. Herbicide is not to reach sediment or surrounding non-targeting plants.	Tools: loppers, secateurs, pruning saw, herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide and all other required P.P.E.

Technique	Method	Equipment
Scrape and Painting 	More resilient weed species, where other techniques are less reliable are to be scraped with a knife or chisel and painted with undiluted Roundup® Biactive Herbicide. Works to be carried out by a contractor with a current herbicide license. Weed species will be scraped with a knife or chisel up the length of the trunk, and herbicide applied via applicator bottle. Scrape the trunk from as close to the ground as possible to approximately ¾ of the plants height. Where trunk diameters exceed approximately 5 cm a second scrape shall be made on the other side of the trunk. Apply undiluted herbicide to the cut trunk immediately, within 10-20 seconds, before the plant cells close and the translocation of the herbicide is limited. All care must be taken by the contractor not to spill herbicide onto sediment or surrounding non-targeting plants. Follow up treatment may be required. If plants resprout, scrape and paint the shoots using the same method after sufficient regrowth has occurred.	Tools: knife, chisel, protective clothing, safety glasses herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide, and all other required P.P.E.
Cut with a Chainsaw and Paint 	Larger size weed species, too large for cutting with hand tools, shall be cut with a chainsaw and painted with undiluted Roundup® Biactive Herbicide. Works to be carried out by a contractor with a current chainsaw and herbicide license. Larger weed species will be cut with a chainsaw at base of plant, and herbicide applied via applicator bottle. Cut the stem horizontally as close to the ground as possible, using the chainsaw. Remove upper branches to reduce bulk of plant. If cutting at the base is impractical, cut higher to get rid of the bulk of the weed, then cut again at the base and apply herbicide. Make cuts horizontal to prevent the herbicide running off the stump. Apply undiluted herbicide to the cut trunk immediately, within 10-20 seconds, before the plant cells close and the translocation of the herbicide is limited. Ensure there is no runoff of poison. All care must be taken by the contractor not to spill herbicide into water, onto sediment, or surrounding non-targeting plants. Follow up treatment will be required. If plants resprout, cut and paint the shoots using the same method.	Tools: chainsaw, ear muffs, protective clothing, safety glasses herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide, and all other required P.P.E.

Technique	Method	Equipment
Spot Spraying	Spot spraying involves spraying non-seeding annuals and grasses, and for regrowth of weeds once an area has been cleared or brushcut. Works to be carried out by a contractor with a current herbicide license. Herbicide will be mixed up according to the manufacturer's directions for the particular weed species being targeted. Mixed herbicide shall be applied to the targeted weed species with a backpack sprayer. All care must be taken by the contractor not to spill herbicide onto sediment or surrounding non-targeting plants.	Tools: protective clothing, safety glasses, herbicide sprayer, impervious gloves, Herbicide, and all other required P.P.E.

Flame Weeding

Thermal (flame) weeding is a method where high temperatures are applied to weeds, causing the plant to die. Thermal weeding is particularly useful in situations where conservation or health considerations are high and weed density is low such as waterways where herbicide use is not permitted.
While flame weeding is not suited to most streetscapes due to the fire hazard nor can it be used on materials such as soft fall and similar playground equipment it is noted that 'flame' weeding in waterways allows weed management in areas where herbicides are not permitted.
Also for native vegetation areas thermal weeding, with a flame weeder, has been shown to stimulate germination of native plants while killing the seeds of annual weeds such as Devils Pitchfork, *Bidens pilosa*. Flame weeding is also effective in killing persistent weeds like
Mother of Millions.
Best results are obtained when follow up weed control is undertaken 4-6 weeks after treatment. In addition, weed control should be conducted periodically after that for example to control weeds over a period of a year it is likely that between 3-5 applications will be necessary, depending on rainfall and the extent of the weed seed bank. This method is most effective on young annual weeds and least effective on older perennial weeds. In some cases, control of perennial weeds will be ineffective however this depends on the species present and its age.

Images provided by Dragonfly Environmental

Flame weeding should be undertaken outside of the fire seasons. Flame weeding allows for the mimicking of a burn in areas where a control burn could not be undertaken. See native plants regenerating after flame weeding.

12.3 Appendix III– Bushland Hygiene Protocols for Phytophthora (Hornsby Council Recommendations)

- Always assume that the area you are about to work in is free of the disease and therefore needs to be protected against infection.
- And, always assume that the activity you are about to undertake has the potential to introduce the disease.
- Arrive at site with clean shoes, i.e.: no dirt encrusted on them.
- If you arrive with shoes that are encrusted with dirt, they will have to be completely soaked in metho or disinfectant and allow a few minutes to completely soak in. NEVER scrape untreated dirt off your shoes onto the ground.
- Before you move onto the site spray the bottom of your shoes with 70 % metho. Bleach solution (1% strength) or household/commercial disinfectant (as per label) are also suitable.
- Check all tools and equipment that comes in contact with soil are clean before entering the area (they should have been cleaned on site at the end of the previous work session). If there is any dirt on them, spray them with 70% metho.
- Clean all tools at the end of each work session while still on site ensuring this is done away from drainage lines and adjacent work areas. Knock or brush off encrusted dirt and completely spray with 70 % metho. Replace in storage/transport containers.
- Preferably compost all weed material on site.
- Never drag vegetation with exposed roots and soil through bushland.
- When removing weeds from site, remove as much soil as possible from them in the immediate work area and carefully place vegetative material into plastic bags.
- Try not to get the bag itself dirty; don't put it on/in a muddy area.
- Always work from the lower part of a slope to the upper part.
- Always work in areas known to be free of the pathogen before working in infected areas.
- Minimise activities wherever possible when the soil is very wet.
- Vehicles should not be driven off track or into reserves (unless vehicle decontamination is carried out before and after entering a single work site)
- Only accredited supplies of plants/mulch to be used.

Kit should contain: 1 bucket, 1 scrubbing brush, 1 spray bottle (metho 70% solution), 1 bottle tap water, 1 bottle methylated spirits.

Contact Hornsby Bushcare if you require any refills or replacements of your Phytophthora Kits on 9484 3677 or bushcare@hornsby.nsw.gov.au

Facts about Phytophthora

Phytophthora cinnamomi (Phytophthora) is a microscopic, soil borne, water-mould that has been implicated in the death of remnant trees and other plants in Australian bushland. Phytophthora is not native to Australia. It is believed to have been introduced sometime after European settlement. Phytophthora is a national problem and is listed as a key threatening process under the Commonwealth's Environmental Protection and Biodiversity Conservation Act 1999.

Symptoms including Dieback

"Dieback" simply means dying or dead plants. There are many causes of dieback; Phytophthora is just one of them. Often dieback is the result of a combination of factors such as; changed drainage patterns and nutrient loads (e.g.: increased stormwater run-off) or changed soil conditions (e.g.: dumped fill or excavation of/near root zone). Plants that are stressed are more vulnerable to Phytophthora.

Initial symptoms of Phytophthora include; wilting, yellowing and retention of dried foliage, loss of canopy and dieback. Infected roots blacken and rot and are therefore unable to take-up water and nutrients. Severely infected plants will eventually die. Symptoms can be more obvious in summer when plants may be stressed by drought. If you suspect that Phytophthora is on your site, please contact the Bushcare team to collect a soil sample to be lab tested. This is usually done in the warmer months where conditions are optimum for the disease.

Infection

There is no way of visually telling if Phytophthora is present in the soil as its structures and spores are microscopic (invisible to the naked eye). Phytophthora requires moist soil conditions and warm temperatures for infection, growth and reproduction. Spores travel through moist soil and attach to plant roots. Once Phytophthora has infected a host plant it can grow inside plant root tissue independent of external soil moisture conditions. After infection, Phytophthora grows through the root destroying the tissue which is then unable to absorb water and nutrients.

12.4 Appendix IV– BAM –C; Reports and Data

12.4.1 Payment Report.

Biodiversity payment summary report

Assessment Id	Payment data version	Assessment Revision	Report created
00024761/BAAS19008/21/00024762		0	26/03/2021

Assessor Name	Assessor Number	Proposal Name	BAM Case Status
Geraldene Susan Dalby-Ball	BAAS19008	64-70 Clark Road Londonderry	Finalised

Assessment Type	Date Finalised	BOS entry trigger
Part 4 Developments (Small Area)	26/03/2021	BOS Threshold: Biodiversity Values Map

PCT list

Price calculated	PCT common name	Credits
Yes	725 - Castlereagh Ironbark forest	0

Species list

Price calculated	Species	Credits

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

Biodiversity payment summary report

IBRA sub region	PCT common name	Threat status	Offset trading group	Risk premium	Administrative cost	Methodology adjustment factor	Price per credit	No. of ecosystem credits	Final credits price
Cumberland	**725** - Castlereagh Ironbark forest	Yes	Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	18.83%	$ 1,263.88	1.7766	$ 38,810.63	0	$0.00

Subtotal (excl. GST)	**$0.00**
GST	**$0.00**
Total ecosystem credits (incl. GST)	**$0.00**

Species credits for threatened species

Species profile ID	Species	Threat status	Price per credit	Risk premium	Administrative cost	No. of species credits	Final credits price

No species available

Assessment Id: 00024761/BAAS19008/21/00024762

Proposal Name: 64-70 Clark Road Londonderry

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Biodiversity payment summary report

Grand total **Contact BCT for pricing**

Assessment Id	Proposal Name	Page 3 of 3
00024761/BAAS19008/21/00024762	64-70 Clark Road Londonderry	

12.4.2 Predicted species report.

BAM Predicted Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00024761/BAAS19008/21/00024762	64-70 Clark Road Londonderry	22/02/2021
Assessor Name	Report Created	BAM Data version *
Geraldene Susan Dalby-Ball	26/03/2021	37
Assessor Number	Assessment Type	BAM Case Status
BAAS19008	Part 4 Developments (Small Area)	Finalised
Assessment Revision	BOS entry trigger	Date Finalised
0	BOS Threshold: Biodiversity Values Map	26/03/2021

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

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

Common Name	Scientific Name	Vegetation Types(s)
Barking Owl	Ninox connivens	725-Castlereagh Ironbark forest
Black-chinned Honeyeater (eastern subspecies)	Melithreptus gularis gularis	725-Castlereagh Ironbark forest
Brown Treecreeper (eastern subspecies)	Climacteris picumnus victoriae	725-Castlereagh Ironbark forest
Diamond Firetail	Stagonopleura guttata	725-Castlereagh Ironbark forest
Dusky Woodswallow	Artamus cyanopterus cyanopterus	725-Castlereagh Ironbark forest
Eastern Coastal Free-tailed Bat	Micronomus norfolkensis	725-Castlereagh Ironbark forest
Eastern False Pipistrelle	Falsistrellus tasmaniensis	725-Castlereagh Ironbark forest
Flame Robin	Petroica phoenicea	725-Castlereagh Ironbark forest
Gang-gang Cockatoo	Callocephalon fimbriatum	725-Castlereagh Ironbark forest
Greater Broad-nosed Bat	Scoteanax rueppellii	725-Castlereagh Ironbark forest

NSW GOVERNMENT

BAM Predicted Species Report

Grey-headed Flying-fox	Pteropus poliocephalus	725-Castlereagh Ironbark forest
Hooded Robin (south-eastern form)	Melanodryas cucullata cucullata	725-Castlereagh Ironbark forest
Koala	Phascolarctos cinereus	725-Castlereagh Ironbark forest
Large Bent-winged Bat	Miniopterus orianae oceanensis	725-Castlereagh Ironbark forest
Little Bent-winged Bat	Miniopterus australis	725-Castlereagh Ironbark forest
Little Eagle	Hieraaetus morphnoides	725-Castlereagh Ironbark forest
Little Lorikeet	Glossopsitta pusilla	725-Castlereagh Ironbark forest
Masked Owl	Tyto novaehollandiae	725-Castlereagh Ironbark forest
Painted Honeyeater	Grantiella picta	725-Castlereagh Ironbark forest
Powerful Owl	Ninox strenua	725-Castlereagh Ironbark forest
Regent Honeyeater	Anthochaera phrygia	725-Castlereagh Ironbark forest
Rosenberg's Goanna	Varanus rosenbergi	725-Castlereagh Ironbark forest
Scarlet Robin	Petroica boodang	725-Castlereagh Ironbark forest
Speckled Warbler	Chthonicola sagittata	725-Castlereagh Ironbark forest
Spotted-tailed Quoll	Dasyurus maculatus	725-Castlereagh Ironbark forest
Square-tailed Kite	Lophoictinia isura	725-Castlereagh Ironbark forest
Swift Parrot	Lathamus discolor	725-Castlereagh Ironbark forest
Turquoise Parrot	Neophema pulchella	725-Castlereagh Ironbark forest
Varied Sittella	Daphoenositta chrysoptera	725-Castlereagh Ironbark forest
White-bellied Sea-Eagle	Haliaeetus leucogaster	725-Castlereagh Ironbark forest
Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris	725-Castlereagh Ironbark forest

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

Refer to BAR for detailed justification

Common Name	Scientific Name	Justification in the BAM-C

Assessment Id: 00024761/BAAS19008/21/00024762

Proposal Name: 64-70 Clark Road Londonderry

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12.4.3 Candidate species report

BAM Candidate Species Report

Proposal Details

Assessment Id 00024761/BAAS19008/21/00024762	Proposal Name 64-70 Clark Road Londonderry	BAM data last updated * 22/02/2021
Assessor Name Geraldene Susan Dalby-Ball	Report Created 26/03/2021	BAM Data version * 37
Assessor Number BAAS19008	Assessment Type Part 4 Developments (Small Area)	BAM Case Status Finalised
Assessment Revision 0	Date Finalised 26/03/2021	BOS entry trigger BOS Threshold: Biodiversity Values Map

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

List of Species Requiring Survey

Name	Presence	Survey Months

Threatened species assessed as not on site

Refer to BAR for detailed justification

Common name	Scientific name	Justification in the BAM-C
Allocasuarina glareicola	Allocasuarina glareicola	Habitat degraded
Gyrostemon thesioides	Gyrostemon thesioides	Habitat degraded
Hibbertia fumana	Hibbertia fumana	Habitat degraded
Hibbertia sp. Bankstown	Hibbertia sp. Bankstown	Habitat degraded
Large Bent-winged Bat	Miniopterus orianae oceanensis	Habitat degraded
Large-eared Pied Bat	Chalinolobus dwyeri	Habitat degraded
Little Bent-winged Bat	Miniopterus australis	Habitat degraded
Micromyrtus minutiflora	Micromyrtus minutiflora	Habitat degraded
Regent Honeyeater	Anthochaera phrygia	Habitat degraded
Swift Parrot	Lathamus discolor	Habitat degraded

NSW GOVERNMENT

BAM Candidate Species Report

Thick Lip Spider Orchid	Caladenia tessellata	Habitat degraded

12.4.4 Biodiversity Credit Report (Like for Like)

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id 00024761/BAAS19008/21/00024762	Proposal Name 64-70 Clark Road Londonderry	BAM data last updated * 22/02/2021
Assessor Name Geraldene Susan Dalby-Ball	Assessor Number BAAS19008	BAM Data version * 37
Proponent Names Matt Teuma	Report Created 26/03/2021	BAM Case Status Finalised
Assessment Revision 0	Assessment Type Part 4 Developments (Small Area)	Date Finalised 26/03/2021
BOS entry trigger BOS Threshold: Biodiversity Values Map	* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.	

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	Endangered Ecological Community	725-Castlereagh Ironbark forest

Species
Nil

Additional Information for Approval

BAM Biodiversity Credit Report (Like for like)

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

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

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
725-Castlereagh Ironbark forest	Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	0.1	0	0	0

BAM Biodiversity Credit Report (Like for like)

725-Castlereagh Ironbark forest

Like-for-like credit retirement options

Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion This includes PCT's: 725, 808	-	725_725	No	0	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

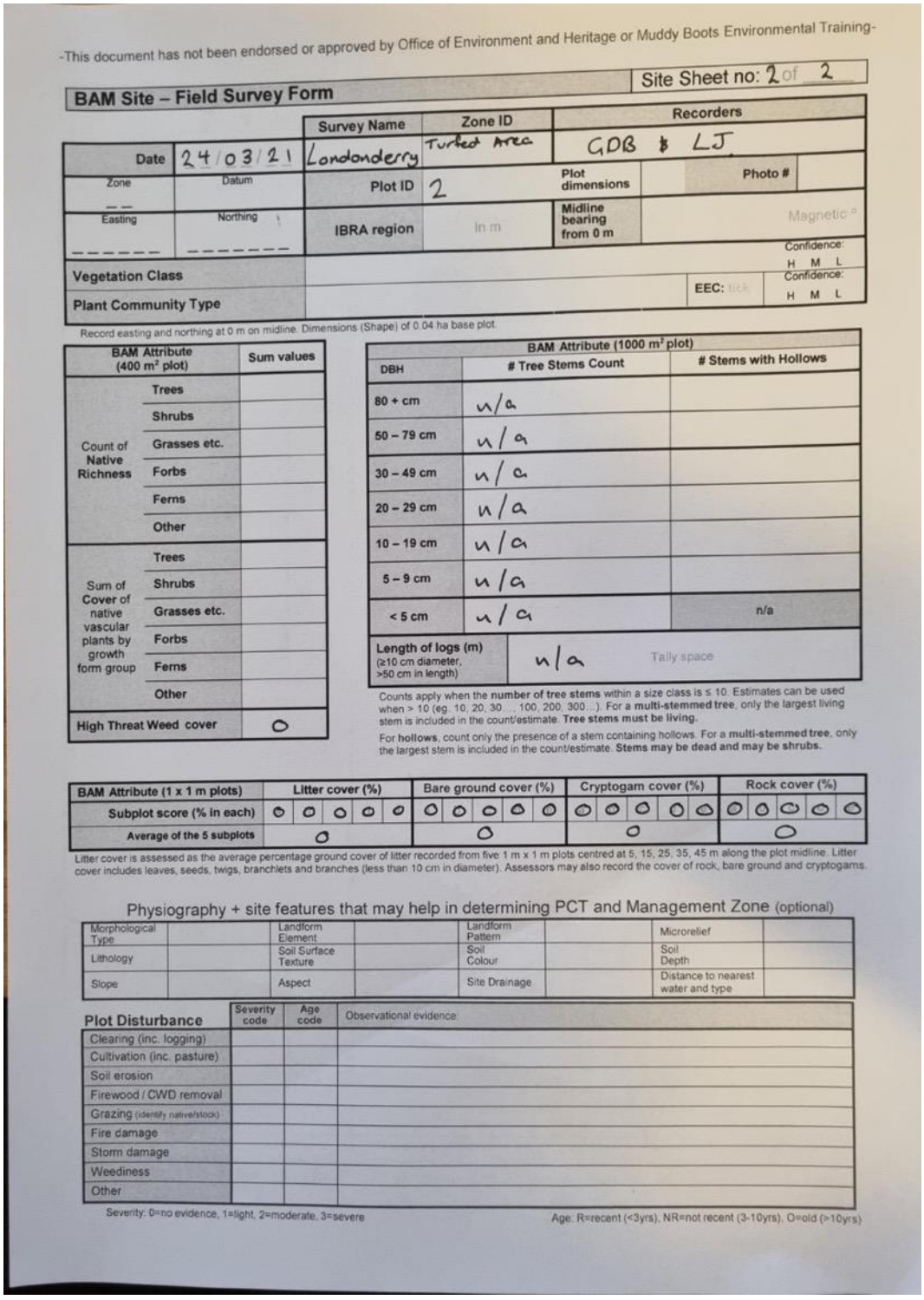
Species Credit Summary

No Species Credit Data

Credit Retirement Options

Like-for-like credit retirement options

12.5 Appendix V – BAM Field Data Sheets



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BAM Site – Field Survey Form Site Sheet no: 2 of 2

Survey Name	Zone ID	Recorders
Londonderry	Turfed Area	GDB & LJ

Date: 24/03/21		Plot ID: 2	Plot dimensions:	Photo #:	
Zone: __	Datum:	IBRA region:	In m	Midline bearing from 0 m:	Magnetic °
Easting: _____	Northing: _____				

Vegetation Class — Confidence: H M L
Plant Community Type — EEC: tick — Confidence: H M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed cover		0

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	n/a	
50 – 79 cm	n/a	
30 – 49 cm	n/a	
20 – 29 cm	n/a	
10 – 19 cm	n/a	
5 – 9 cm	n/a	
< 5 cm	n/a	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	n/a	Tally space

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30…, 100, 200, 300…). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

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

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

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

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

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

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

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

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400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 24/03/21	Londonderry	Turfed Area	CDB & LJ

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
	1					
	2 Buffalo grass (Stenotaphrum sp)	E	100%.			
	3					
	4					
	5					
	6					
	7					
	8					
	9					
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	39					
	40					

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

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

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

13 Expertise of authors

Geraldene Dalby-Ball
DIRECTOR

With over 20 years wetland and urban ecology experience, a great passion for what she does, and extensive technical and on-ground knowledge make Geraldene a valuable contribution to any project.

Geraldene has over 8 years local government experience as manager of environment and education for Pittwater Council. Geraldene presented papers on the topic at the NSW Coastal Conference, Sydney CMA and Hawkesbury Nepean forums. Geraldene is a Technical Advisor Sydney Olympic Park Wetland Education and Training (WET) panel.

Geraldene has up to date knowledge of environmental policies and frequently provides input to such works. Geraldene was a key contributor to the recent set of Guidelines commissioned by South East Queensland Healthy Waterways Water Sensitive Urban Design Guidelines. Geraldene's role included significant contributions and review of the Guideline for Maintaining WSUD Assets and the Guideline for Rectifying WSUD Assets.

Geraldene is a frequent contributor to many community and professional workshops on ecological matters particularly relating to environmental management. She is an excellent Project Manager.

Geraldene is a joint author on the popular book Burnum Burnum's Wildthings published by Sainty and Associates. Author of the Saltmarsh Restoration Chapter Estuary Plants of East Coast Australia published by Sainty and Associates (2013). Geraldene's early work included 5 years with Wetland Expert Geoff Sainty of Sainty and Associates. Geraldene is an expert in creating and enhancing urban biodiversity habitat and linking People with Place.

SPECIALISATIONS

- Urban Ecology – and habitat rehabilitation and re-creation.
- Urban waterway management – assessing, designing and supervising rehabilitation works
- Saltmarsh and Wetland re-creation and restoration – assessment, design and monitoring
- Engaging others in the area of environmental care and connection
- Technical Advisor – environmental design, guidelines and policies
- Sound knowledge and practical application of experimental design and statistics
- Project management and supervision
- Grant writing and grant assessment
- Budget estimates and tender selection
- Expert witness in the Land and Environment Court

CAREER SUMMARY

- **Director and Ecologist**, Ecological Consultants Australia. 2014-*present*
- **Director and Ecologist**, Dragonfly Environmental. 1998-*present*
- **Manager** Natural Resources and Education, Pittwater Council 2002-2010
- **Wetland Ecologist** Sainty and Associates 1995-2002

QUALIFICATIONS AND MEMBERSHIPS

- **Bachelor of Science with 1st Class Honors**, Sydney University
- WorkCover WHS General Induction of Construction Industry NSW White Card.
- Senior First Aid Certificate.
- **Practicing member and vice president** Ecological Consultants Association of NSW

Jack Hastings

ECOLOGIST

Jack is a passionate ecologist who has demonstrated technical knowledge and the ability to provide specialist ecological advice across a variety of projects, in both the private and public sector. He is responsible for providing practical ecological interpretation, research and advice to a diverse range of clients. These attributes would make Jack a valued partner to any project.

Growing up in Northern NSW, Jack developed a keen interest in the natural environment. This passion lead Jack to graduate with a Bachelor of Environmental Science (SCU) in 2018.

As an undergraduate student, he published a study that examined the cost of revegetation across the Richmond River Catchment in NSW. This study provided Jack with a deep understanding of urban and landscape ecology and the environmental factors associated with habitat restoration.

Diverse industry experience has enabled Jack to deliver a range of ecological reports and management plans. He also has considerable knowledge in applying the Biodiversity Assessment Method (BAM). He has completed a range of significant projects, working as the project ecologist on local developments through to state significant infrastructure.

As a result, Jack has valuable on-ground experience to complement his wide-ranging knowledge regarding state and federal legislation.

Jack would be a valuable addition to any project as he is committed to achieving the best possible outcome for both the client and the environment.

SPECIALISATIONS

- Reporting - Biodiversity Assessment Reports (BDAR), Ecological Assessments, REFs, CEMP, PoM, VMP, Flora & Fauna, Certification Certificates.
- Providing specialist ecological advice across a variety of projects, private and public sector, to identify environmental constraints and opportunities.
- Demonstrated project management skills in relation to leading small teams to achieve milestones within project budget and time frames.
- Demonstrated capacity to coordinate and undertake field work – including: vegetation surveys, species monitoring, fauna survey.
- Mapping and geographic information system (GIS) skills using QGIS Mapping Software.
- High level communication and interpersonal skills to engage effectively with organisations in the public or private sector.
- Botanical skills including the identification of native and introduced flora and vegetation structural class and community types.
- Educating and engaging with the public about ecology, environmental issues and conservation biology.

CAREER SUMMARY

- **Ecologist**, Ecological Consultants Australia, *2019-present.*
- **Environmental Consultant**, BBN Consulting. *2018-2019.*

QUALIFICATIONS AND MEMBERSHIPS

- Bachelor of Environmental Science, Southern Cross University (2018).
- Practicing member - Ecological Consultants Association of NSW.
- Certificate II Agriculture.
- WHS General Induction of Construction Industry NSW White Card

Luke Johnson

ECOLOGIST

Luke is a passionate ecologist who has experience across both the government and private sectors to deliver sustainable environmental outcomes. He has contributed to projects with major construction contractors and has been able to deliver creative environmental solutions on time and within budget.

As an undergraduate student, he interned with the Bureau of meteorology for a research project identifying traditional ecological knowledge of severe weather events in communities in the Pacific.

He has exceptional customer communication skills and builds long lasting professional relationships with his clients. He has a working knowledge of current NSW and Commonwealth environmental legislation. He is also competent in the practical application of flora and fauna surveying and monitoring techniques.

Key Projects Include:

- Monitoring of Endangered Species, various locations of NSW and VIC
- Environmental consultant for an array services including occupational hygiene and hazardous materials
- Conducted environmental impact assessments for state infrastructure projects and Department of Defence
- Passion for traditional ecological knowledge including researching for the Bureau of Meteorology's COSPAC program

SPECIALISATIONS

- Urban and landscape ecology
- Environmental Impact Assessments (EIA)
- Flora and Fauna Assessments
- Habitat tree assessment, marking and mapping
- GIS mapping

CAREER SUMMARY

- **Ecologist**, Ecological Consultants Australia. *2020-present*
- **Environmental Consultant,** Hibbs & Associates. *2019-2020*
- **Field Ecologist,** Biosis 2018-2019

QUALIFICATIONS AND MEMBERSHIPS

- **Bachelor of Environmental Management and Ecology, Victoria University**
- **First aid certificate**
- **Asbestos awareness training**
- **WHS General Induction of Construction Industry NSW White Card**