Biodiversity Development Assessment Report

Telegraph Road, Young NSW 2594

December 2020

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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

EI Australia has been contracted to provide a **Biodiversity Development Assessment Report** for a proposal at Telegraph Road, Young NSW 2594 within the Hilltops Council Local Government Area (LGA).

Trigger for a formal BDAR under the BC Act 2016:

The Biodiversity Offsets Scheme is triggered as the proposal impacts an area identified on the Biodiversity Values map. An accredited assessor has used the Appendix D: Streamlined assessment module – Planted native vegetation module (BAM, 2020).

Stage 1: Biodiversity Assessment

- On-ground survey took place in December 2020 by Senior Ecologist Geraldene Dalby-Ball.
- Data was gathered across a BAM plot located on site.
- 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 survey revealed that vegetation on site has been significantly modified such that ecologist were unable to assign a PCT for the development area based on the vegetation survey.
- Existing data was used to determine the original PCT (277) which have occurred on site.
- The accredited assessor has concluded that the Kurrajong Trees (*Brachychiton populneus)* do not constitute the original vegetation community – as listed on Bionet.
- In accordance with *BAM 2020,* section 4.2 (*2c*), the accredited assessor has concluded that the planted native vegetation is eligible to be assessed in accordance with Appendix D: Streamlined assessment module – Planted native vegetation as per BAM 2020.
- Vegetation is structurally and functionally poor due to previous clearing on site. Thus, the proposed development assessed in this BDAR is not expected to significantly contribute to loss of a TEC.
- The removal of planted vegetation is unlikely to impact threatened species.
- No threatened species were recorded during the site surveys.

Stage 3: Improving Biodiversity values

- Delineation of work areas, Native species landscaping, Weed Management and removal, Native seed collection, Preservation of habitat, Nest box installation, Sediment and erosion controls

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

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Stage 1: Biodiversity Assessment

1 Introduction

EI Australia has been contracted to provide a **Biodiversity Development Assessment Report** for a proposal at Telegraph Road, Young NSW 2594 within the Hilltops 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.

Table 1 - Site Administrative Information

Category	Details
Title Reference (Lot/DP)	1/-/DP736225 2/-/DP736225 3/-/DP845187 4/-/DP845187 1171/-/DP754611 1154/-/DP754611 1199/-/DP754611 3/-/DP374948 11/-/DP1138027 12/-/DP1138027
Area (ha)	3.4Ha
Street Address	2, 4, 10, 12 & 20 Telegraph Road, young NSW 2594
LGA	Hilltops Council
Land Zoning	R1: General Residential RU4: Primary Production Small Lots RE1: Public Recreation

Figure 1.1. Site of the proposed development. Source: SixMaps 2020.

1.2 Site history

The site was previously a residential housing. Houses have since been demolished.

1.3 Proposed actions

The proposed actions involve conversion of residential, public recreation and rural zones into industrial, to build a factory.

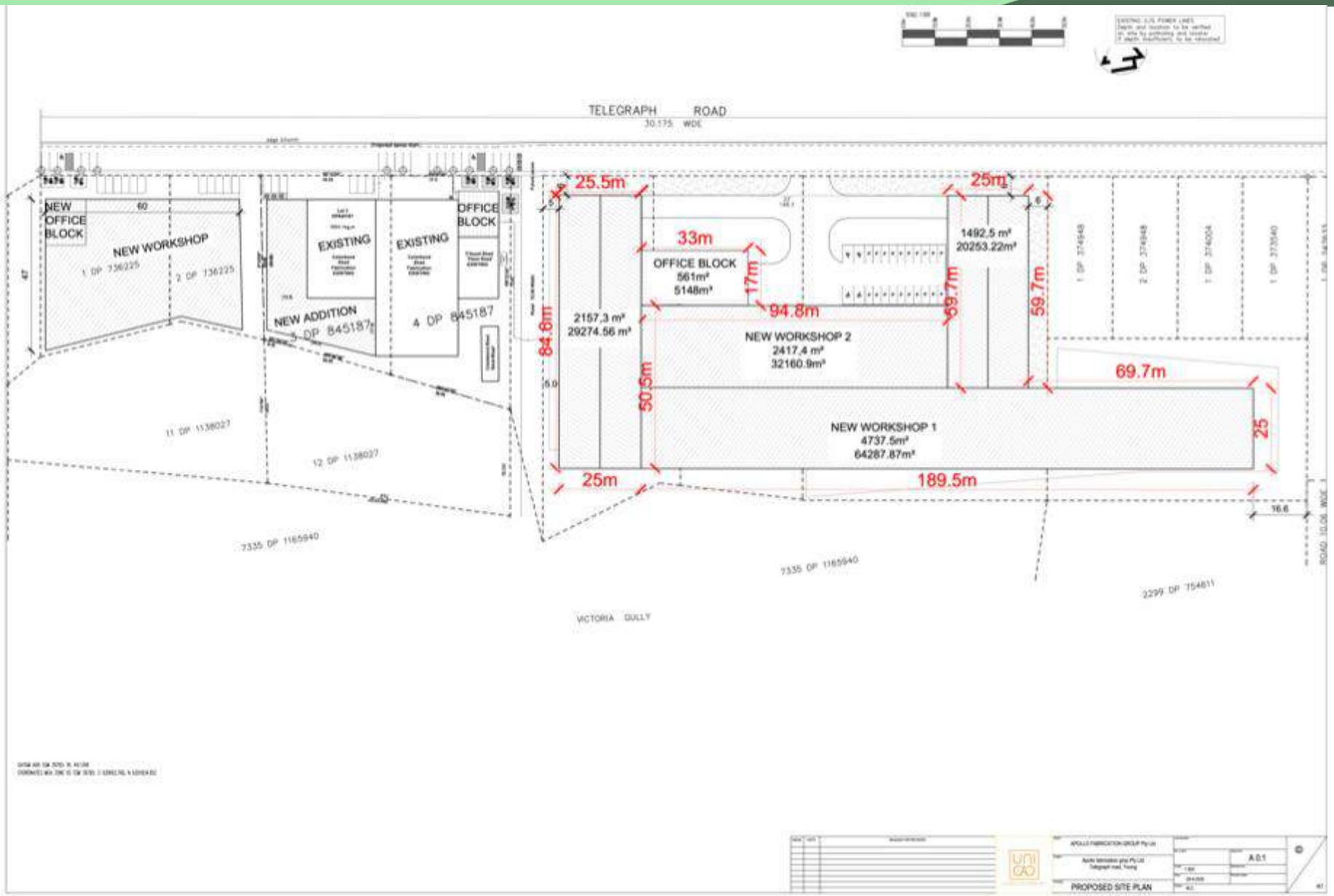


Figure 1.2. Proposed site plan at Telegraph Road, Young. Source – Unique CAD Experience, 28.9.2020.

1.4 Sources of information used in the assessment

The following sources of information were used for this assessment:

- SeedMaps 2020
- Central_West_Lachlan OEH (2020)
- BioNet DPIE (2020)
- Proposed Site Plan. Unique CAD Experience, 28.9.2020
- 18424-20-09-2017-verD. C.P.C. Land Development Consultants P/L. Updated 20.09.2017

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 Biodiversity Offsets Scheme is triggered as the proposal impacts an area identified on the Biodiversity Values map. An accredited assessor has used the Appendix D: Streamlined assessment module – Planted native vegetation module (BAM, 2020).

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 Biodiversity Values Map

The Biodiversity Offsets Scheme is triggered as the proposal impacts an area identified on the Biodiversity Values map. An accredited assessor has used the Appendix D: Streamlined assessment module – Planted native vegetation module (BAM, 2020).

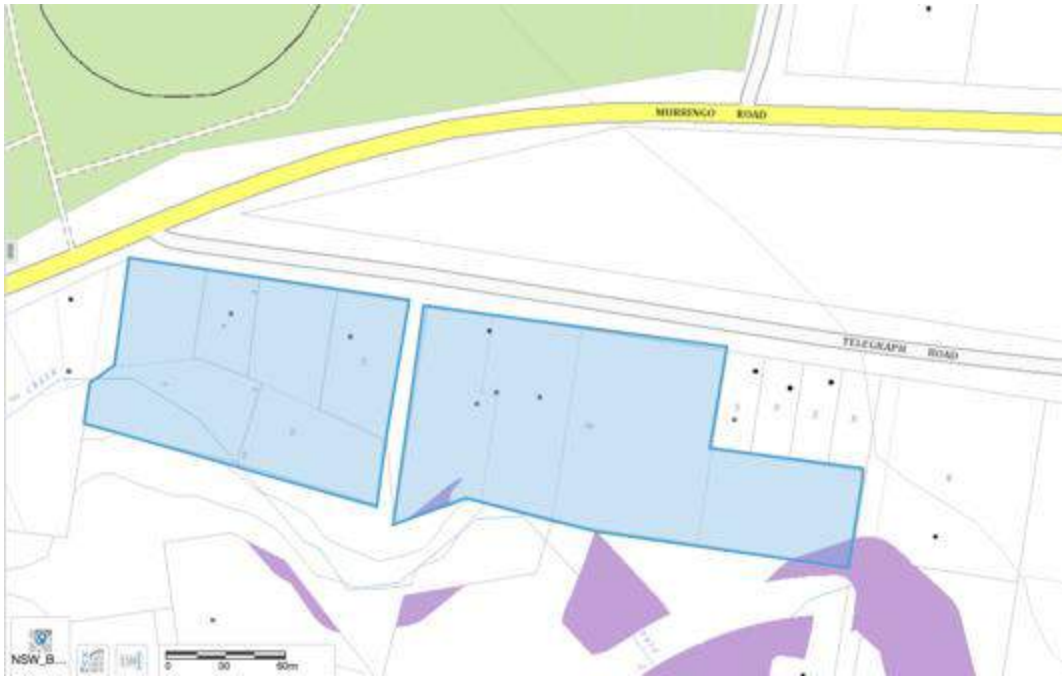
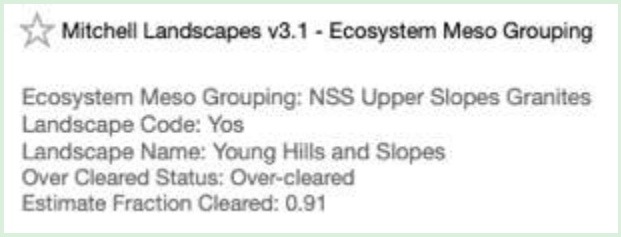


Figure 1.3. Biodiversity Map – Site in blue. Source: https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BOSETMap. **December 2020.**

2 Landscape features and site context

The site is located within agricultural/rural/light industrial setting. The surrounding properties are made up of agricultural (Cropping) rural (grazing and pasture paddocks) and patches of native bushland.

Table 2 - Site Biodiversity Information

Category	Details
Interim Biogeographic Regionalisation for Australia (IBRA)	NSW South Western Slopes
IBRA Sub Region	Inland Slopes
NSW Landscape 	Young Hills and Slopes 
% Native vegetation cover	10% in the 1500m radius circle See Figure 2.1

Landscape features	
Rivers and streams	N/A Victoria creek runs adjacent to the site.
Wetlands	N/A
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

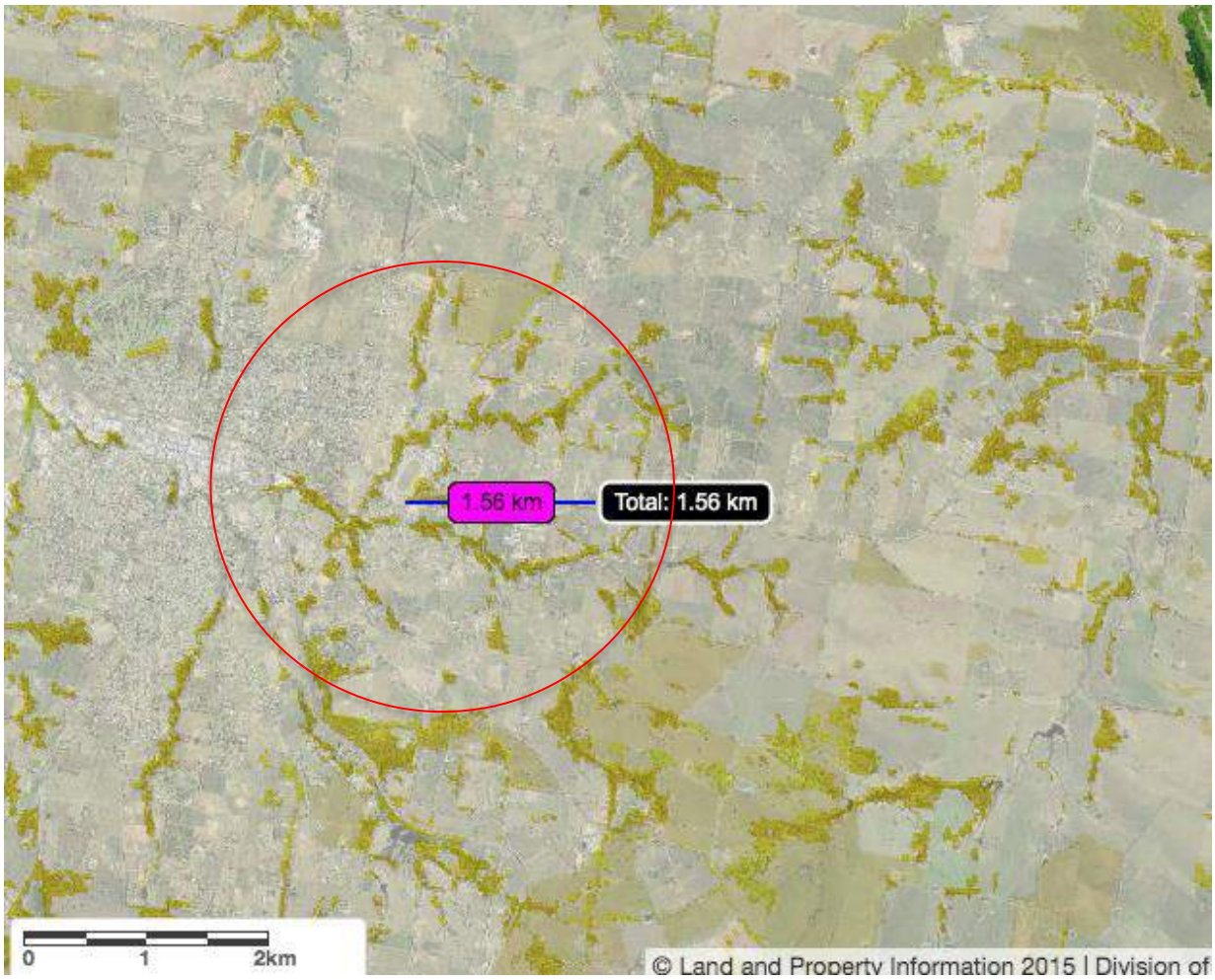


Figure 2.1. Red circle showing the 1500m buffer around the site.

3 Native vegetation

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

A review of the most up-to-date vegetation mapping, Central_West_Lachlan (2020), identified two (2) plant community types (PCT) within site. The PCT is identified as; *Blakelys Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion* (PCT277); and *Blakelys Red Gum - White Box - Yellow Box - Black Cypress Pine box grass/shrub woodland on clay loam soils on undulating hills of central NSW South Western Slopes Bioregion* (PCT282).

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
277	Blakelys Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	White Box Yellow Box Blakely's Red Gum Woodland State Conservation: Endangered Ecological Community (EEC)	White Box Yellow Box Blakely's Red Gum Woodland Commonwealth Conservation: Critically Endangered (CE)
282	Blakelys Red Gum - White Box - Yellow Box - Black Cypress Pine box grass/shrub woodland on clay loam soils on undulating hills of central NSW South Western Slopes Bioregion	White Box Yellow Box Blakely's Red Gum Woodland State Conservation: Endangered Ecological Community (EEC)	White Box Yellow Box Blakely's Red Gum Woodland Commonwealth Conservation: Critically Endangered (CE)

3.1.1 Field Survey

The field survey assisted in verifying the distribution and quality of vegetation at the site. The survey revealed that vegetation on site has been significantly modified such that ecologist were unable to assign a PCT for the development area.

On site, the condition of vegetation was poor due to current use of the site I.e. Livestock grazing. The ground stratum was either bare ground (as depicted in photos) or a mixture of exotic pasture species (Rye grass – *L. Rigidum*, Kikuyu – *P. clandestinum*, Wild Oat – *A. fatua*) in the lower depressions on site.

It is likely that PCT 277 (*Blakelys Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion*) may have occupied the site pre-European settlement. This is based on a survey of the adjoining riparian zone, output results of the Bionet Vegetation Classification and PCT mapping for the site.

Trees and shrubs are scattered across the site, all of which are believed to be planted. Trees and shrubs are either exotic or not identified as a species which represents the most likely PCT 277. Tree trees on site do

not host optimal habitat features for native fauna and unlikely that threatened species would utilise trees on site.

Trees on site include - Five (5) **Native** - Kurrajong Trees (*Brachychiton populneus*), **Exotic -** One (1) Peppercorn Tree *(Schinus areira),* Cherry tree *(Prunus* spp) and an Oak Tree *(Quercus* spp*).* – locations identified below Figure 3.1.

Figure 3.1. Subject site (red box) within mapped vegetation surrounding the property Central_West_Lachlan. Source: SEED 2020.

3.1.2 Site Photos

Photos depict condition of the site during the December 2020 inspection.

Plate 3.1. Next to the existing factory

Plate 3.2. Near factory looking towards the group of houses

Plate 3.3. Back to factory (looking West).

Plate 3.4. Ground.

Plate 3.5. Oak tree. Diameter at BH 40cm.

Plate 3.6. Kurrajong Tree (*Brachychiton populneus)*

Plate 3.7. Kurrajong Tree (*Brachychiton populneus)*

Plate 3.8. Location of Cherry Tree

Plate 3.9. Location of Peppercorn tree.

3.1.3 Site Photos – Off site

The following photos were taken outside of the sit boundaries. Ecologists traversed the adjoining riparian zone to verify PCT classification and identify vegetation condition of adjacent vegetation.

Plate 4.0. Victoria Creek in marginal condition with high abundance of exotic aquatic plants.

Plate 4.1. *Casuarina cunninghamiana* may provide foraging habitat for native fauna.

Plate 4.2. *Eucalyptus blakelyi,* known as Blakely's red gum.

Plate 4.3.- *Acacia dealbata* - Silver Wattle.

4 Threatened Species

4.1 Flora and Flora Field Survey

No threatened flora or fauna species were identified during December 2020 field surveys. This development is assessed as per the streamlined assessment module 'Plant native vegetation'. A dedicated effort was made to traverse the site to understand habitat suitability for threatened flora and fauna.

No species listed in the BAM-C as threatened and requiring survey during December were observed. Similarly, other threatened species are unlikely to use the site or planted native vegetation for habitat – see appendix IV for the BAM-C species list.

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 onsite were recorded. Surveys were general and opportunistic in nature and were performed by traversing the site.

4.1.2 Diurnal Bird Surveys

Diurnal bird surveys occurred during mid-afternoon. Opportunistic observations of birds were made during vegetation surveys. Several species which are known to nest in hollows were candidate species in the BAM Calculator (appendix IV). A dedicated effort was made to traverse the impact area to understand if hollows are present and if they are suitable for predicted bird species.

It was concluded that the impact area hosts potential foraging habitat for all birds species listed in the BAM calculator. Therefore, all bird species identified in the BAM calculator were retained in the assessment for foraging purposes.

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

4.1.3 Microbats

The impact area hosts marginal foraging habitat (canopy vegetation) for threatened microbat species which are identified in the BAM calculator for the site. All microbat species have been retained in the BAM calculator for foraging purposes. 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 while microbat species may use the site for foraging purposes, they are unlikely to use the site for breeding purposes due to lack of optimal breeding opportunities within the impact area. Therefore, impact assessment on microbat breeding habitat has been excluded from the BAM assessment.

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 onsite. Habitat requirements for all threatened amphibian species identified in the BAM calculator are marginal within the impact area.

4.1.6 Reptile and Snail surveys

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

- Leaf litter
- Rocks
- Rubbish

No threatened Reptile or Snail species were identified during site investigations.

4.2 Threatened Flora - Desktop

No threatened flora species have been recorded within 10km of the study site according to BioNet records.

4.3 Threatened Fauna - Desktop

A total of 5 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 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 fauna observed in previous ecological surveys within a 10km radius of the study site. NSW DPIE Bionet 2020.

Class	Scientific Name	Common Name	NSW Status	Comth. Status	No. of records
Aves	*Anthochaera phrygia*	Regent Honeyeater	E4A,P	CE	1
Aves	*Artamus cyanopterus cyanopterus*	Dusky Woodswallow	V,P		1
Aves	*Polytelis swainsonii*	Superb Parrot	V,P,3	V	10
Mammalia	*Petaurus norfolcensis*	Squirrel Glider	V,P		5
Mammalia	*Pteropus poliocephalus*	Grey-headed Flying-fox	V,P	V	5

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

Likelihood of occurrence

See Appendix I for a 'Rationale for Likelihood of Occurrence', which outlines why species have been retained or omitted from BAM calculations. Reasons for inclusion or removal are based on species habitat preferences, site investigations, species survey, Bionet records and expert opinion. During the survey, none of the above threatened species were observed on-site.

Stage 2: Impact Assessment

5 Streamlined assessment module – Planted native vegetation

The site is identified as a single vegetation zone. The site has been significantly modified such that ecologists are unable to assign a PCT for the development area based on the survey results alone. Using *BAM 2020* section 4, it is concluded that the most likely original PCT for the site is PCT 277. This is based on existing information (Bionet, SEED Mapping) and results of the survey on the adjoin riparian land.

In accordance with *BAM 2020,* section 4.2 (*2c*), the accredited assessor has concluded that the planted native vegetation is eligible to be assessed in accordance with Appendix D. Below in an extract of Appendix D: Streamlined assessment module – Planted native vegetation as per BAM 2020.

Appendix D: Streamlined assessment module – Planted native vegetation

The decision-making key below provides a framework for the assessment of planted native vegetation using the BAM.

Where only part of the subject land contains planted native vegetation, this module may be used to assess that part of the development, activity, clearing or biodiversity certification proposal. The standard BAM is then used to assess the remaining areas.

D.1 Decision-making key

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

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

ii. No..... Go to 2.

2. *Is the planted native vegetation:*

A. *planted for the purpose of environmental rehabilitation or restoration under an existing conservation obligation listed in BAM Section 11.9(2.), and*

B. *the primary objective was to replace or regenerate a plant community type or a threatened plant species population or its habitat?*

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

ii. No..... Go to 3.

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

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

ii. No..... Go to 4.

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

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

ii. No..... Go to 5.

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

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

ii. No..... Go to 6.

As such, the accredited assessor has assessed the suitability of the planted native vegetation for threatened species. It has been concluded that threatened species are unlikely to use the planted native vegetation for habitat and impacts on threatened species are expected to be negligible. Mitigation measures as per 8.4 of the BAM are recommended during all phases of works on site – see section 9 below.

See appendix I for the assessment of eligible threatened species which were predicted by the BAM-C for PCT 277. Appendix I also includes species which may occur on site, this is based on Bionet records and expert option.

6 Direct Impacts

6.1.1 Vegetation disturbance and Loss

It is anticipated that planted native vegetation (Kurrajong Trees) will be removed to accommodate for the proposed development. However, the development site is substantially degraded such that the original vegetation community is unlikely to recover.

Native species landscaping post construction is recommended and may increase the habitat values of the site and adjoining land.

7 Indirect Impacts

7.1.1 Weed growth and invasion

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

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. The soil appears to be sodic thus erosion can occur at a faster rate. Soil compaction could occur from machinery use. It is recommended that soil compaction in non-built upon areas 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

The proposed actions may result in transport of sediment from the work zones because of increased storm water runoff to areas downstream. This may impact water quality, riparian vegetation and aquatic fauna. Recommendations to maintain and improve water quality on site have been listed in section 9 below.

Stage 3: Improving Biodiversity Values

8 Avoid and minimise impacts

The development will not significantly impact features outlined in table 8 below.

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	Scattered throughout	Negligible	N/A	N/A

9 Recommendations

9.1.1 Native species landscaping

It is recommended that locally native species selected from PCT 277 species list be used in the landscaping schedule and planted throughout the site where practical. Species plantings should aim to restore maximum diversity at the site. This will provide greater foraging and nesting habitat for native species and will deliver greater biodiversity gain outcomes. These species should be selected in consultation with an ecologist for the greatest ecological outcome.

Such measures will also increase habitat connectivity of the surrounding landscape. Shrub and ground covers will also increase the habitat area for other wildlife including small insectivorous and insectivorous birds. PCT 277 species list is included in appendix v below.

9.1.2 Weed management

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.

9.1.3 Sediment and erosion controls

During the construction stage, sediment controls will be required. Silt fences are recommended and should be erected by the building contractor around the works zone. 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.

Soil stabilisation may be required after primary weed removal works. Sediment and erosion control measures must ensure that no settlement of sediment or silt is to occur within areas of vegetation to be retained.

All sediment fences should be retained for as long as practical. If removed then monitoring is required to ensure flows do not concentrate and cause further erosion. If concentrated flows do occur and /or erosion gullies develop then coir logs are required across slope and placed such that they create sheet, rather than a concentrated flow.

9.1.4 Relocation of habitat

Existing habitat features (e.g. fallen timber, hollow logs, large rocks) must be removed from the development site and placed in the adjoining retained vegetation.

9.1.5 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.

The is important particularly for the riparian zone which run adjacent to the site.

9.1.6 Weed management

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.

9.1.7 Tree Protection

The main trees to be managed are trees within close proximity to building works. These trees may be beyond the site boundaries (with riparian zones) although should be protected to ensure they are not damaged during construction.

9.1.8 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.

9.1.9 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

9.1.10 Pathogen prevention

To prevent the introduction of pathogens, Bushland Hygiene Protocols outlined in Appendix II 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.

10 Appendices

10.1 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. As discussed in Sections 2 and 3, much of the vegetation within the subject land and 1,500 m buffer has been previously cleared, fragmented and is subject to ongoing disturbance.

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.

Table 10. 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	Habitat suitability of the planted native vegetation – see appendix D – BAM 2020.
Acacia ausfeldii	Ausfeld's Wattle	Established plants are likely to be killed by fire, as mature and juvenile plants have a single-stemmed growth form. Associated species include *Eucalyptus albens*, *E. blakelyi* and *Callitris* spp., with an understorey dominated by *Cassinia* spp. and grasses. *Acacia ausfeldii* is likely to have a dormant soil seedbank from which germination is stimulated by fire; a small number of seeds have been observed to germinate in the absence of fire. When stimulated by fire, germination	Site too disturbed in cleared areas to have viable habitat. Areas with vegetation (exotic and native) was searched and no plants were observed.

		appears to be reduced at depth, and by low fire temperature. Laboratory experiments show strong germination only at the highest temperature treatment of 100ºC (Brown *et al.* 2003). Flowers from August to October.	
Euphrasia arguta	Euphrasia arguta	Historic records of the species noted the following habitats: 'in the open forest country around Bathurst in sub humid places', 'on the grassy country near Bathurst', and 'in meadows near rivers'. Plants from the Nundle area have been reported from eucalypt forest with a mixed grass and shrub understorey; here, plants were most dense in an open disturbed area and along the roadside, indicating the species had regenerated following disturbance. The number of plants at a given site may vary over time depending on the season and disturbance history. *Euphrasia arguta* has an annual habit and has been observed to die off over the winter months, with active growth and flowering occurring between January and April. As with other species of *Euphrasia*, this species is semi-parasitic and attaches to the roots of other associated plants.	Site too disturbed in cleared areas to have viable habitat. Areas with vegetation (exotic and native) was searched and no plants were observed.
Zieria obcordata	Granite Zieria	Grows in eucalypt woodland or shrubland dominated by species of *Acacia* on rocky hillsides. Also occurs in *Eucalyptus* and *Callitris* dominated woodland with an open, low shrub understorey, on moderately steep, mainly west to north-facing slopes in sandy loam amongst granite boulders. Associated vegetation includes *Eucalyptus blakelyi, Brachychiton populneus* and *Acacia implexa* woodland with pockets of low shrub understorey. Also in *E. goniocalyx, E. blakelyi, E. macrorhyncha, A. doratoxylon, A. vestita* and *Callitris glaucophylla* woodland with a shrubby understorey. Main flowering period is in spring (September-October), but plants tend to have flowers present throughout the year. In wild populations, plants tend to grow in crevices between granite boulders, often in lines running downslope. Best growth has been achieved with plants in a very sandy well-drained soil. Extremely sensitive to grazing and	Site too disturbed in cleared areas to have viable habitat. Areas with vegetation (exotic and native) was searched and no plants were observed.

		browsing disturbances by domestic stock and native herbivores. Heavily browsed plants and vigorous regrowth (following severe browsing by wallabies) have been recorded at sites. Plants are tolerant of prolonged moderate drought conditions but highly susceptible to extreme summer heatwaves that occur over more than five consecutive days.	
Swainsona sericea	Silky Swainson-pea	Found in Natural Temperate Grassland and Snow Gum *Eucalyptus pauciflora* Woodland on the Monaro. Found in Box-Gum Woodland in the Southern Tablelands and South West Slopes. Sometimes found in association with cypress-pines *Callitris* spp. Habitat on plains unknown. Regenerates from seed after fire.	Site too disturbed in cleared areas to have viable habitat. Areas with vegetation (exotic and native) was searched and no plants were observed..
Swainsona recta	Small Purple-pea	Before European settlement Small Purple-pea occurred in the grassy understorey of woodlands and open-forests dominated by Blakely's Red Gum *Eucalyptus blakelyi*, Yellow Box *E. melliodora*, Candlebark Gum *E. rubida* and Long-leaf Box *E. goniocalyx*. Grows in association with understorey dominants that include Kangaroo Grass *Themeda australis*, poa tussocks *Poa* spp. and spear-grasses *Austrostipa* spp. Plants die back in summer, surviving as a rootstocks until they shoot again in autumn. Flowers throughout spring, with a peak in October. Seeds ripen at the end of the year. Individual plants have been known to live for up to 20 years. Generally tolerant of fire, which also enhances germination by breaking the seed coat and reduces competition from other species.	Site too disturbed in cleared areas to have viable habitat. Areas with vegetation (exotic and native) was searched and no plants were observed..
Cullen parvum	Small Scurf-pea	In known populations in Victoria and NSW, plants are found in grassland, River Red Gum (*Eucalyptus camaldulensis*) Woodland or Box-Gum Woodland, sometimes on grazed land and usually on table drains or adjacent to drainage lines or watercourses, in areas with rainfall of between 450 and 700 mm. Plants tend to die back in dry seasons and re-sprout with rain in winter or spring; in dry years, plants apparently do not	Site too disturbed in cleared areas to have viable habitat. Areas with vegetation (exotic and native) was searched and no plants were observed.

		always produce shoots but survive below the ground. Flooding has been suggested as a mechanism for seed dispersal. Reproduction has been found to result largely from self-fertilisation, which has produced substantial differences between populations.	
Prasophyllum petilum	Tarengo Leek Orchid	Grows in open sites within Natural Temperate Grassland at the Boorowa and Delegate sites. Also grows in grassy woodland in association with River Tussock *Poa labillardieri*, Black Gum *Eucalyptus aggregata* and tea-trees *Leptospermum* spp. near Queanbeyan and within the grassy groundlayer dominated by Kanagroo Grass under Box-Gum Woodland at Ilford (and Hall, ACT). Apparently highly susceptible to grazing, being retained only at little-grazed travelling stock reserves (Boorowa & Delegate) and in cemeteries (near Queanbeyan, Ilford and Hall). Flowers in October at Boorowa and Ilford, and December at sites near Queanbeyan and Delegate. Population density at the Boorowa site is higher in the open grassland dominated by wallaby grasses *Austrodanthonia* spp., compared to that within the denser stands of Kangaroo Grass *Themeda australis*. Highly colonial, with very large numbers present and very conspicuous at the Boorowa site, but cryptic at the Queanbeyan, Ilford and Delegate sites where low numbers are recorded. The population near Muswellbrook is also small. Flowers are followed by fleshy seed capsules in summer.	Site too disturbed in cleared areas to have viable habitat. Areas with vegetation (exotic and native) was searched and no plants were observed..
Ammobium craspedioides	Yass Daisy	Found in moist or dry forest communities, Box-Gum Woodland and secondary grassland derived from clearing of these communities. Grows in association with a large range of eucalypts (*Eucalyptus blakelyi*, *E. bridgesiana*, *E. dives*, *E. goniocalyx*, *E. macrorhyncha*, *E. mannifera*, *E. melliodora*, *E. polyanthemos*, *E. rubida*). Apparently unaffected by light grazing, as populations persist in some grazed sites. Found in a number of TSRs, Crown reserves, cemeteries and roadside reserves within the region.	Site too disturbed in cleared areas to have viable habitat. Areas with vegetation (exotic and native) was searched and no plants were observed.

Scientific Name	Common Name	Habitat/ Geographic Constraints	Habitat suitability of the planted native vegetation – see appendix D – BAM 2020.
Litoria booroolongensis	Booroolong Frog	The Booroolong Frog is restricted to NSW and north-eastern Victoria, predominantly along the western-flowing streams of the Great Dividing Range. It has disappeared from much of the Northern Tablelands, however several populations have recently been recorded in the Namoi catchment. The species is rare throughout most of the remainder of its range. Live along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses. Adults occur on or near cobble banks and other rock structures within stream margins. Shelter under rocks or amongst vegetation near the ground on the stream edge. Sometimes bask in the sun on exposed rocks near flowing water during summer. Breeding occurs in spring and early summer and tadpoles metamorphose in late summer to early autumn. Eggs are laid in submerged rock crevices and tadpoles grow in slow-flowing connected or isolated pools. Forage on stream banks or vegetation and timber within 100m of stream. May shelter on stream banks or vegetation and fallen timber within 100m of stream. Best detected from December to February.	Likelihood of occurrence for the species is low. Additionally, habitat suitability and dependence on the planted native vegetation is also low. Habitat is substantially degraded such that the species is unlikely to utilise area. The site has been significantly altered and degraded from its natural state. It has a long history of clearing, fragmentation and on-going disturbance. It is unlikely that the site or planted vegetation offer habitat for the species.
Phascogale tapoatafa	Brush-tailed Phascogale	Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest. Occurs primarily where the annual rainfall exceeds 500mm. Agile climber foraging preferentially in rough barked trees of 25 cm DBH or greater. Feeds mostly on arthropods but will also eat other invertebrates, nectar and sometimes small vertebrates. Females have exclusive territories of approximately 20 - 60 ha, while males have overlapping territories of up to 100 ha. Nest and shelter in tree hollows with entrances 2.5 - 4 cm wide and use many different hollows over a short time span. Also shelter in globular nests or possum drays. Mating occurs May - July; males die soon after the mating season whereas females can live for up to three years but generally only produce one litter.	Likelihood of occurrence for the species is none to extremely low. Additionally, habitat suitability and dependence on the planted native vegetation is also low. Habitat is substantially degraded such that the species is very unlikely to utilise areas with vegetation and there is no habitat in cleared areas. The site has been significantly altered and degraded from its natural state. It has a long history of clearing, fragmentation and on-going disturbance.

Petrogale penicillata	Brush-tailed Rock-wallaby	The range of the Brush-tailed Rock-wallaby extends from south-east Queensland to the Grampians in western Victoria, roughly following the line of the Great Dividing Range. The species' range is now fragmented, particularly in the south where they are now mostly found as small isolated populations dotted across their former range. In NSW they occur from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. Throughout their range, Brush-tailed Rock-wallabies feed on a wide variety of grasses and shrubs, and have flexible dietary requirements. Shelter or bask during the day in rock crevices, caves and overhangs and are most active at night. Highly territorial and have strong site fidelity with an average home range size of about 15 ha. Live in family groups of 2 – 5 adults and usually one or two juvenile and sub-adult individuals. Dominant males associate and breed with up to four females. Breeding is likely to be continuous, at least in the southern populations, with no apparent seasonal trends in births.	Likelihood of occurrence for the species is none to extremely low. Additionally, habitat suitability and dependence on the planted native vegetation is also low. Habitat is substantially degraded such that the species is very unlikely to utilise areas with vegetation and there is no habitat in cleared areas. The site has been significantly altered and degraded from its natural state. It has a long history of clearing, fragmentation and on-going disturbance. It is unlikely that the site or planted vegetation offer habitat for the species.
Burhinus grallarius	Bush Stone-curlew	The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and in the south-east it is either rare or extinct throughout its former range. Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Largely nocturnal, being especially active on moonlit nights. Feed on insects and small vertebrates, such as frogs, lizards and snakes. Nest on the ground in a scrape or small bare patch. Two eggs are laid in spring and early summer.	Likelihood of occurrence for the species is very low. Habitat is substantially degraded such that the species is unlikely to utilise area. The site has been significantly altered and degraded from its natural state. It has a long history of clearing, fragmentation and on-going disturbance Fallen wood in open flat areas is not present.
Cercartetus nanus	Eastern Pygmy-possum	Found in rainforests communities to sclerophyll (including Box-Ironbark) forests, woodland and heath. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes, soft fruits are eaten when flowers are unavailable and insects.	Likelihood of occurrence for the species is extremely low. Habitat is substantially

			degraded such that the species is highly unlikely to utilise area. The site has been significantly altered and degraded from its natural state. It has a long history of clearing, fragmentation and on-going disturbance.
Synemon plana	Golden Sun Moth	Occurs in Natural Temperate Grasslands and grassy Box-Gum Woodlands in which groundlayer is dominated by wallaby grasses *Austrodanthonia* spp. Grasslands dominated by wallaby grasses are typically low and open - the bare ground between the tussocks is thought to be an important microhabitat feature for the Golden Sun Moth, as it is typically these areas on which the females are observed displaying to attract males. Habitat may contain several wallaby grass species, which are typically associated with other grasses particularly spear-grasses *Austrostipa* spp. or Kangaroo Grass *Themeda australis*. Adults are short-lived (one to four days) and do not feed - having no functional mouthparts; the larvae are thought to feed exclusively on the roots of wallaby grasses. Males spend their entire adult life patrolling the grassland in search of females; once mated, the females spend their time laying eggs at the bases of wallaby grass tussocks. Larvae feed on the roots of the wallaby grass plant. The larval development time (and thus generation time) is unknown - it possibly varies between one and three years.	Likelihood of occurrence for the species is low. Additionally, habitat suitability and dependence on the planted native vegetation is also low. Habitat is substantially degraded such that the species is unlikely to utilise area. Native grasses are degraded and damaged by on-going grazing. It is unlikely that the site or planted vegetation offer habitat for the species.
Callocephalon fimbriatum	Gang-gang Cockatoo	In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas. Favours old growth forest and woodland attributes for nesting and roosting. Nests are located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts.	Likelihood of occurrence for the species is low. Occasional use of canopy while moving between territories is possible. She-oaks may be fed on however these are outside the proposed building area and will be retained so there is no impact.

Pteropus poliocephalus	Grey-headed Flying-fox	Occurs within tall sclerophyll forests and woodlands, heath, swamp subtropical and temperate rainforests, and urban areas. Occurs within 20km of a significant food source. May be found close to gullies and water within vegetation with a dense canopy.	GHFF may fly-over and occuassionally feed on blossoms of Eucalypts along the creek-line. The planted vegetation may offer marginal foraging habitat in the form of canopy vegetation. However, the species is highly mobile and may only use the site occasionally. Impacts on the species are expected to be negligible.
Phascolarctos cinereus	Koala	Inhabit eucalypt woodlands and forests. Feeds on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	The site has been significantly altered and degraded from its natural state. It has a long history of clearing, fragmentation and on-going disturbance. It is unlikely that the site or planted vegetation offer habitat for the species.
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.	BWB may feed in the area and utilize hollows or crevices in dead trees / branches. None will be impacted by prosed works. The planted vegetation may offer marginal foraging habitat in the form of canopy vegetation. However, the species is highly mobile and may only use the site occasionally. Impacts on the species are expected to be negligible.
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*	Likelihood of occurrence for the species is low. Additionally, habitat suitability and

		ariel), frequenting low to mid-elevation dry open forest and woodland close to these features.	dependence on the planted native vegetation is also low. The planted vegetation may offer marginal foraging habitat in the form of canopy vegetation. However, the species is highly mobile and may only use the site occasionally. Impacts on the species are expected to be negligible.
Hieraaetus morphnoides	Little Eagle	Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. Lays two or three eggs during spring, and young fledge in early summer. Preys on birds, reptiles and mammals, occasionally adding large insects and carrion.	Likelihood of occurrence for the species is low. Additionally, habitat suitability and dependence on the planted native vegetation is also low. Habitat is substantially degraded such that the species is unlikely to utilise area.
Tyto novaehollandiae	Masked Owl	The species prefers dry eucalypt forests and woodlands and hunts along the edges and forests and roadsides. Mainly preys upon arboreal and ground mammals, primarily rats. Requires tree hollows in moist gullies for breeding.	Likelihood of occurrence for the species is low. No large hollows in tree trunks and low prey abundance. The site has been significantly altered and degraded from its natural state. It has a long history of clearing, fragmentation and on-going disturbance. It is unlikely that the site or planted vegetation offer habitat for the species.
Aprasia parapulchella	Pink-tailed Legless Lizard	Only known from the Central and Southern Tablelands, and the South Western Slopes. There is a concentration of populations in the Canberra/Queanbeyan Region. Other populations have been recorded near Cooma, Yass, Bathurst, Albury and West Wyalong. This species is also found in the Australian Capital Territory. Inhabits sloping, open	Likelihood of occurrence for the species is low. Additionally, habitat suitability and dependence on the planted native vegetation

		woodland areas with predominantly native grassy groundlayers, particularly those dominated by Kangaroo Grass (*Themeda australis*). Sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks. Commonly found beneath small, partially-embedded rocks and appear to spend considerable time in burrows below these rocks; the burrows have been constructed by and are often still inhabited by small black ants and termites. Feeds on the larvae and eggs of the ants with which it shares its burrows. It is thought that this species lays 2 eggs inside the ant nests during summer; the young first appear in March. Best detected from September to February	is also low. Habitat is substantially degraded such that the species is unlikely to utilise area. The site has been significantly altered and degraded from its natural state. It has a long history of clearing, fragmentation and on-going disturbance. It is unlikely that the site or planted vegetation offer habitat for the species.
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.	Likelihood of occurrence for the species is low. Trees in creek may be a food source when in flower. The site has been significantly altered and degraded from its natural state. It has a long history of clearing, fragmentation and on-going disturbance. It is unlikely that the site or planted vegetation offer habitat for the species.
Lophoictinia isura	Square-tailed Kite	The Square-tailed Kite ranges along coastal and subcoastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. In arid north-western NSW, has been observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland. Is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects	Likelihood of occurrence for the species is low. Additionally, habitat suitability and dependence on the planted native vegetation is also low. Habitat is substantially degraded such that the species is unlikely to utilise area. The site has been significantly altered and degraded from its natural state.

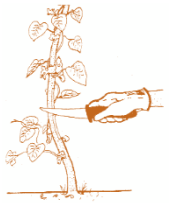
		in the tree canopy, picking most prey items from the outer foliage. Appears to occupy large hunting ranges of more than 100km2. Breeding is from July to February, with nest sites generally located along or near watercourses, in a fork or on large horizontal limbs.	
Petaurus norfolcensis	Squirrel Glider	Inhabits mature or old growth Blackbutt-Bloodwood forests with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia mid-storey. Requires abundant tree hollows for refuge and nest sites. Diet varies seasonally and consists of Acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein.	Likelihood of occurrence for the species is extremely low. Additionally, habitat suitability and dependence on the planted native vegetation is also low. Habitat is substantially degraded such that the species is unlikely to utilise area. It is unlikely that the site or planted vegetation offer habitat for the species.
Delma impar	Striped Legless Lizard	Found mainly in Natural Temperate Grassland but has also been captured in grasslands that have a high exotic component. Also found in secondary grassland near Natural Temperate Grassland and occasionally in open Box-Gum Woodland. Habitat is where grassland is dominated by perennial, tussock-forming grasses such as Kangaroo Grass *Themeda australis*, spear-grasses *Austrostipa* spp. and poa tussocks *Poa* spp., and occasionally wallaby grasses *Austrodanthonia* spp. Sometimes present in modified grasslands with a significant content of exotic grasses. Sometimes found in grasslands with significant amounts of surface rocks, which are used for shelter. Sometimes utilises dried cowpats for shelter. Actively hunts for spiders, crickets, moth larvae and cockroaches. Two papery eggs are laid in early summer. Goes below ground or under rocks or logs over winter.	Likelihood of occurrence for the species is low. Additionally, habitat suitability and dependence on the planted native vegetation is also low. Habitat is substantially degraded such that the species is unlikely to utilise area. The site has been significantly altered and degraded from its natural state. It has a long history of clearing, fragmentation and on-going disturbance. It is unlikely that the site or planted vegetation offer habitat for the species.
Polytelis swainsonii	Superb Parrot	Inhabit Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. In the Riverina the birds nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland. On the South West Slopes nest trees can be in open Box-Gum Woodland or isolated paddock trees. Species known to be used are	Likelihood of occurrence for the species is low. Trees in creek may be a food source when in flower.

		Blakely's Red Gum, Yellow Box, Apple Box and Red Box. Nest in small colonies, often with more than one nest in a single tree. Breed between September and January. May forage up to 10 km from nesting sites, primarily in grassy box woodland. Feed in trees and understorey shrubs and on the ground and their diet consists mainly of grass seeds and herbaceous plants. Also eaten are fruits, berries, nectar, buds, flowers, insects and grain.	Likelihood of occurrence for the species is low. It is unlikely that the site or planted vegetation offer habitat for the species.
Lathamus discolor	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 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. pilulari*s. Return to home foraging sites on a cyclic basis depending on food availability.	Likelihood of occurrence for the species is low. Trees in creek may be a food source when in flower. Likelihood of occurrence for the species is low. It is unlikely that the site or planted vegetation offer habitat for the species.
Haliaeetus leucogaster	White-bellied Sea-Eagle	Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Occurs at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves; and at, or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarsh. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest). Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as 'guard roosts'. Nests are large structures built from sticks and lined with leaves or grass. Feed mainly on fish and freshwater turtles, but also waterbirds, reptiles, mammals and carrion. White-bellied Sea-Eagles build a large stick nest, which is used for many seasons in succession. The nest can be located in a tree up to 30m above the ground, but may also be placed on the ground or on rocks, where there are no suitable trees. At the start of the breeding season, the nest is lined with fresh green leaves and twigs.	Likelihood of occurrence for the species is low. Additionally, habitat suitability and dependence on the planted native vegetation is also low. Habitat is substantially degraded such that the species is unlikely to utilise area. The site has been significantly altered and degraded from its natural state. It has a long history of clearing, fragmentation and on-going disturbance. It is unlikely that the site or planted vegetation offer habitat for the species.

10.2 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.

10.3 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.

10.4 Appendix IV– BAM –C; Candidate species report

NSW GOVERNMENT

BAM Candidate Species Report

Proposal Details

Assessment Id 00023250/BAAS19008/20/00023252	Proposal Name Telegraph Rd Young	BAM data last updated * 07/12/2020
Assessor Name Geraldene Susan Dalby-Ball	Report Created 07/12/2020	BAM Data version * 34
Assessor Number BAAS19008	Assessment Type Part 4 Developments (General)	BAM Case Status Open
Assessment Revision 0	Date Finalised To be finalised	BOS entry trigger BOS Threshold: Biodiversity Values Map

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

List of Species Requiring Survey

Name	Presence	Survey Months
Acacia ausfeldii Ausfeld's Wattle		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ **Aug** ☐ **Sep** ☐ **Oct** ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Litoria booroolongensis Booroolong Frog		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ **Oct** ☐ **Nov** ☐ **Dec** ☐ Survey month outside the specified months?
Phascogale tapoatafa Brush-tailed Phascogale		☐ **Jan** ☐ **Feb** ☐ **Mar** ☐ **Apr** ☐ **May** ☐ **Jun** ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ **Dec** ☐ Survey month outside the specified months?

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Petrogale penicillata Brush-tailed Rock-wallaby		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Burhinus grallarius Bush Stone-curlew		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Cercartetus nanus Eastern Pygmy-possum		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Euphrasia arguta Euphrasia arguta		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Callocephalon fimbriatum Gang-gang Cockatoo		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Synemon plana Golden Sun Moth		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

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Zieria obcordata Granite Zieria		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Pteropus poliocephalus Grey-headed Flying-fox		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Phascolarctos cinereus Koala		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Miniopterus orianae oceanensis Large Bent-winged Bat		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Chalinolobus dwyeri Large-eared Pied Bat		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Hieraaetus morphnoides Little Eagle		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

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Tyto novaehollandiae Masked Owl		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Aprasia parapulchella Pink-tailed Legless Lizard		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Anthochaera phrygia Regent Honeyeater		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Swainsona sericea Silky Swainson-pea		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Swainsona recta Small Purple-pea		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Cullen parvum Small Scurf-pea		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

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Lophoictinia isura Square-tailed Kite		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Petaurus norfolcensis Squirrel Glider		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Delma impar Striped Legless Lizard		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Polytelis swainsonii Superb Parrot		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Lathamus discolor Swift Parrot		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Prasophyllum petilum Tarengo Leek Orchid		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

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Haliaeetus leucogaster White-bellied Sea-Eagle		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Ammobium craspedioides Yass Daisy		☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

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10.5 Appendix V– PCT 277 Species list.

Scientific Name	Common Name
Upper Stratum	
Eucalyptus blakelyi	Blakely's Red Gum
Eucalyptus melliodora	Yellow Box
Eucalyptus bridgesiana	Apple Box
Eucalyptus albens	White Box
Eucalyptus microcarpa	Grey Box
Eucalyptus conica	Fuzzy Box
Callitris glaucophylla	White Cypress Pine
Eucalyptus goniocalyx	Long-leaved Box
Eucalyptus polyanthemos subsp. *polyanthemos*	Red Box
Mid Stratum	
Acacia dealbata	Silver Wattle
Hibbertia obtusifolia	Hoary Guinea-flower
Ground Stratum	
Themeda australis	Kangaroo Grass
Poa sieberiana	Grey Tussock-grass
Bothriochloa macra	Red Grass
Aristida ramosa	Purple Wiregrass
Panicum effusum	Hairy Panic
Austrostipa verticillata	Slender Bamboo Grass
Austrostipa scabra subsp. *scabra*	Rough Speargrass
Austrostipa bigeniculata	Kneed Speargrass
Austrodanthonia auriculata	Lobed Wallaby Grass

Austrodanthonia setacea	Bristly Wallaby-grass
Cymbopogon refractus	Barbed Wire Grass
Elymus scaber var. *scaber*	Common Wheatgrass
Juncus usitatus	Pin Rush
Lomandra filiformis subsp. *Coriacea*	Wattle Mat-rush
Alternanthera nana	Downy Pigweed
Geranium solanderi var. *solanderi*	Native Geranium
Chrysocephalum apiculatum	Common Everlasting
Sida corrugata	Corrugated Sida
Carex inversa	Knob Sedge
Wahlenbergia luteola	Yellowish Bluebell
Chloris truncata	Australian Windmill Grass
Cheilanthes sieberi subsp. *Sieberi*	Mulga Fern
Vittadinia cuneata	Fuzzweed
Enteropogon acicularis	Curly Windmill Grass
Convolvulus graminetinus	-
Bulbine bulbosa	Bulbine Lily
Dianella revoluta var. *revoluta*	Black-anther Flax-lily
Calotis scabiosifolia var. *scabiosifolia*	Rough Burr-Daisy

11 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 worked with various stakeholders across both the public and private sectors to deliver sustainable environmental outcomes. He has worked on projects with major construction contractors and has been able to deliver tailored environmental solutions on time and within budget.

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.

He has advanced communication skills and can deliver professional ecological assessments. He has a thorough understanding of current NSW and Commonwealth environmental legislation. He is also competent in the practical application of flora and fauna surveying and monitoring techniques.

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

Key Projects Include:

- Monitoring of Endangered Species, various locations
- Environmental consultant for many civil developments throughout the Sydney region
- Researching the On-farm costs of revegetation in the Richmond River Catchment
- Sustainable business transformation proposal for a retail store.

SPECIALISATIONS

- Urban and landscape ecology – design and re-creation
- Environmental Impact Assessments (EIA)
- Review of Environmental Factors for development applications
- Flora and Fauna management plans
- Habitat tree assessment, marking and mapping
- GIS mapping
- Sound understanding and practical application of experimental design
- Grant writing and grant assessment

CAREER SUMMARY

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

QUALIFICATIONS AND MEMBERSHIPS

- **Bachelor of Environmental Science, Southern Cross University.**
- **Certificate II Agriculture.**
- **WHS General Induction of Construction Industry NSW White Card.**