Ecological Assessment

Masterplan 614-626 Old Northern Rd, Dural NSW 2158

By Ecological Consultants Australia Pty Ltd TA

Kingfisher Urban Ecology and Wetlands

August 2022

FINAL

About this document

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Statement of Authorship

This study and report was undertaken by Ecological Consultants Australia at 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, Luke Johnston with qualifications BSc. Majoring in Ecology.

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

- This report was prepared to support a Planning Proposal request by Legacy Property to The Hills Shire Council (Council) to rezone land at Old Northern Road and Derriwong Road, Dural.
- The site has an area of 12.879 hectares and comprises five existing lots.
- The Planning Proposal request seeks to rezone the site from RU6 Rural Transition to R2 Low Density Residential and SP2 Infrastructure (Local Road), facilitating the delivery of 110 residential lots and a new local park. The proposal also seeks to amend the maximum height of buildings standard from 10 metres to 9 metres. The Planning Proposal request is accompanied by a site-specific development control plan and offer to enter into a Voluntary Planning Agreement to secure public benefits associated with the proposal.
- The indicative subdivision layout submitted with the Planning Proposal request provides a mix of larger residential lots ranging from 600sqm to 3,400sqm. This will contribute additional housing supply, diversity, and choice in the local area, and support the viability of the Dural village centre.
- Recommendations have been provided to reduce the likelihood of impact and mitigate impacts if the proposal is approved.

Methods

- On-ground survey took place on 1st of August 2022 by Ecologist Luke Johnson.
- Flora and fauna observations were recorded on-site using binoculars. 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.
- Review of proposed development was evaluated for potential environmental impacts.

Results

- No threatened flora or fauna species were recorded on- site during survey. *Epacris purpurescens* has a record on the site for 2017 recorded via Bionet. No habitat currently.
- No significant habitat features, values or landscape corridors will be impacted by the Masterplan – subdivision.
- The proposal does not trigger entry into the BOS (not on BV map, area threshold – clearing native species area) is not reached.
- A thorough assessment of likelihood was conducted for Threatened species. Results from that are the Test of Significance was conducted for Microbats (not significant impact). While is resulted in a 'not significant' impact for this community recommendations have been made to assists the long-term sustainability of this community.

Mitigation Measures

If the proposal is approved there will be another stage to detail potential works. This report provides detailed assessment of Ecological considerations of the Masterplan. Mitigation works will be required.

Before works:

- Removal of weeds to prevent spread of seed/pieces.
- Effective site management to minimise sediment runoff
- Update search for Threatened species searches and native vegetation if there is a long duration between assessment and application.
- Bush hygiene protocols are to be followed to prevent the spread of pathogens including *Phytophthora*.

Legislation: Various pieces of legislation apply to this location and the proposed works are in keeping with the objective of the Acts. Key acts are listed below.

- *Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).*
- *Environmental Planning and Assessment Act 1979 (EP&A Act).*
- *Biodiversity Conservation Act 2016 (BC Act).*
- *Fisheries Management Act 1994 (FM Act).*
- *National Parks & Wildlife Act 1974 (NP&W Act).*
- *Biosecurity Act (superseding the Noxious Weed Act 1993) (NW Act).* • *Biodiversity SEPP (2021)*

Table of Contents

1 Introduction

1.1 Scope of works

Ecological Consultants Australia (ECA) trading as Kingfisher Urban Ecology & Wetlands has been contracted by Legacy Property to provide advice in the form of an "Ecological Assessment" to consider ecological components of the site and surrounds. Legacy Property requested this report to support a Planning Proposal to The Hills Shire Council (Council) to rezone land at Old Northern Road and Derriwong Road, Dural. The Planning Proposal request seeks to rezone the site from RU6 Rural Transition to R2 Low Density Residential and SP2 Infrastructure (Local Road), facilitating the delivery of 110 residential lots and a new local park. The proposal also seeks to amend the maximum height of buildings standard from 10 metres to 9 metres. The Planning Proposal request is accompanied by a site-specific development control plan and offer to enter into a Voluntary Planning Agreement to secure public benefits associated with the proposal.

This report also presents the findings of the assessment and it not triggering entry into the Biodiversity Offset Scheme. This report will assess potential direct and indirect impacts on any threatened species, populations, and communities as per section 5A of the Environmental Planning & Assessment Act 1979. The 'test of significance' has been undertaken in accordance with the NSW Legislation 'threatened species test of significance'. The test of significance is set out in s. 7.3 of the Biodiversity Conservation Act 2016 (BC Act).

1.1 Limitations of the Study

Limitations of the study may arise where certain cryptic species of plants may occur as soil-stored seed or as subterranean vegetative structures. Some species are identifiable above-ground only after environmental circumstances related to factors such as periodic fire frequency, intensity or seasonality, soil moisture regime, biological life-cycle patterns as in the case of small plants such as species of orchids etc. No specific invertebrate surveys were conducted.

Surveys at one time of the year cannot be expected to detect the presence of all species occurring, or likely to occur, in the study area. This is because some species may (a) occur seasonally, (b) utilise different areas periodically (as a component of a more extensive home range), or (c) become dormant during specific periods of the year. Rather, the survey provides the opportunity to sample the area, search specifically for species likely to be encountered within the available time frame and assess the suitability of habitat for species.

Considering the site and habitat availability Kingfisher are confident that this survey is representative of the likely species and vegetation community and that future studies at other times would not change the conclusions in this report.

1.2 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. The Study Area includes the Subject Site, as well as any additional surrounding land traversed during the field survey. The Subject Site (the "Site") is identified as 2/DP567995, X/DP501233, 9/DP237576, 2/DP541329, and Y2/DP91652 in the local government area of the Hills Shire Council.

The combined sites have an area of 12.879 ha and comprises five existing lots. The sites currently have exotic mown grass that has been under management for an extended period as can be seen in the aerial imagery included in this report.

Table 1.1. Site Administrative Information

Category	Details
Title Reference (Lot/DP)	2/DP567995, X/DP501233, 9/DP237576, 2/DP541329, Y2/DP91653

Category	Details
Area (ha)	12.879 ha
Street Address	614-626 Old Northern Rd, Dural NSW 2158
LGA	The Hills Shire Council
Land Zoning	RU6: Transition SP2: Infrastructure

Figure 1.1. Site location. Source: SixMaps 2022.

Figure 1.2. Current Masterplan. Source: Legacy Property, 2022.

1.3 The Proposal

The proposal is a residential subdivision. The masterplan below shows the proposed lot layout and the site. The subdivision is shown in more detail in Figure 1.3. The area of public open space on the North side of the school and along Old Northern Road may facilitate tree retention in this location.

Figure 1.3. Residential Masterplan.

1.4 Sources of information used in the assessment

The following sources of information were used for this assessment:

Bionet, previous studies and the author's knowledge of the local area, were used to determine the possible occurrence of endangered ecological communities and threatened plant species on-site. The Bionet records accessed cover a 10km^2 area extending from the site and include recordings from 1993 to the present day.

Records from the following databases were collated and reviewed:

- Atlas of NSW Wildlife (Bionet). New South Wales, Office of Environment and Heritage (OEH).
- NSW Threatened Species Information (DPIE).
- NSW State Vegetation Type Map: Plant Community Types (2022).
- PlantNET (The Royal Botanic Gardens and Domain Trust 2014).
- Protected Matters Search Tool of the Australian Government Department of the Environment (DoE) for matters protected by the Cwlth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

Plans and drawings specific to this development;

- Dural revised layout – Masterplan 2022.
- Ecological Assessment. Eco Logical Australia, 23 March 2016.

1.5 Legislative context and statutory requirements

The implications for the proposal were assessed in relation to key biodiversity legislation and policy including:

- *Cwlth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).*

  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 does not impact on a 'matter of National Environmental Significance' and therefore is compliant with the EPBC Act.

- *Environmental Planning and Assessment Act 1979 (EP&A Act).*

The EPA Act requires that the assessing body, in this case local government, consider the impact of the development on the surroundings – with respect to this ecology report the impacts on the environment are assessed. The area of the proposed subdivision has few remaining native ecology values (native species). No significant impact on threatened species, populations, or communities.

- *Biodiversity Conservation Act 2016 (BC Act).*

Recently replacing the Threatened Species Conservation Act this includes the test of significance for impacts on threated species, communities. The test of significance has been conducted and the proposal was found to not have a significant impact on the current ecology of the site. The proposed development is compliant with the BC Act.

- *National Parks & Wildlife Act 1974 (NP&W Act).*

The proposed development is complaint with the NP&W Act.

- *Biosecurity Act (superseding the Noxious Weed Act 1993) (NW Act).*

The Biosecurity Act replaced the Noxious Weeds Act, and the objectives of this Act are to manage, and eradicate and Weeds that cause a high level of environmental, economic, or social harm. With the removal of and management of weeds the sites work with be complaint with the objectives of this Act.

1.5.1 Biodiversity Offsets Scheme Threshold

The Biodiversity Offsets Scheme (BOS) is a test used to determine when it is necessary to engage an accredited assessor to apply the Biodiversity Assessment Method (the BAM) and thus evaluate the impacts of a proposal.

It has been concluded that the development does not trigger the BOS area clearing threshold nor is the site located on the BV map. The area clearing threshold trigger is based on the minimum or actual lot size associated with the property (1Ha – 40Ha) and the thresholds for clearing which triggers BOS (0.5Ha or more). The lot layout does not remove more than 0.5Ha (not more than the lowest trigger of 0.25ha) of native vegetation therefore the development does not trigger the BOS.

Careful searches were made through each lot to determine if any native grasses/forbs or any other species was growing there. Our aim was first to see if there was any native species, then if over 5% then over 15% native species. A detailed search through 45 1x1m plots in grass indicated a dominance of exotic species (over 99%) in most quadrats. *Juncus* sp was present as scattered individual in a few locations and not enough to be over 1% of any 20x20 or any Lot overall.

Area clearing threshold

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

Minimum lot size associated with site is 1Ha – 40Ha and the development will not clear >0.5Ha of vegetation.

Thus, the BOS area clearing threshold does not apply.

Biodiversity Values Map threshold

The Biodiversity Values (BV) Map identifies land of high biodiversity value, as defined by clause 7.3(3) of the Biodiversity Conservation Regulation 2017. The Biodiversity Offsets Scheme applies to clearing of native vegetation and other biodiversity impacts prescribed by clause 6.1 of the Biodiversity Regulation 2017 on land identified on the map.

Figure 1.3. The site (red mark) located on the BV map

The site (red mark) is not located on high biodiversity value land as identified on the Biodiversity Values Map.

Therefore, the development does not trigger the BOS as per the Biodiversity Values Map threshold.

3 Methods

3.1 Site Inspections

Ecologist Luke Johnson assessed the site in early August 2022. Weather was fine and sunny during daytime then cooler in the evening survey. Geraldene Dalby-Ball inspected the site in late August and the weather was mostly sunny with overcast and period of light rain.

During site visits, notes and photos were taken of the vegetation types, flora, and fauna present. Due to the small area of proposed impacts, detailed or systematic surveys were not performed. Surveys were general and opportunistic in nature and were performed by traversing the site. Surveys included one diurnal bird and fauna survey, a single vegetation survey and a general habitat survey in which fauna habitat resources were identified.

A detailed search through the grass areas with 45 1x1m plots in the grass was done to focus the search for native species and determine approximate % of native species cover. This was to see if a BDAR was triggered, and it was not at this time.

The area was stratified based on condition and vegetation cover as well as lot size. The following show types of vegetation condition. The paddock grass has the highest cover.

3.1 Site Photos

Exotic grasses

Understory is weed dominated

Native and exotic trees

Area proposed to have no works.

Common Couch present though not likely a remnant. Part of a grass mix. It was however assumed native in our count of native cover.

Weeds dominating around buildings

Weeds dominant – no native ground plants found here.

Areas with native *Juncus* sp. Likely *J.usitatus*

4 Native vegetation

4.1 Desktop results – Plant Community Types (PCTs) and Vegetation Zones

A review of the most up-to-date vegetation mapping, NSW State Vegetation Type Map: Plant Community types (2022), identified two (2) plant community types (PCT) within site. The PCT are identified as, PCT 3250 - *Northern Foothills Blackbutt Grassy Forest*; and PCT 3262 - *Sydney Turpentine Ironbark Forest*.

Table 2 – Table of vegetation community synonyms as per NSW and Commonwealth legislation.

PCT	TEC Name	BC Act 2016	EPBC Act 1999
325	Northern Foothills Blackbutt Grassy Forest	Endangered Ecological Community (EEC)	Not listed
3262	Sydney Turpentine Ironbark Forest	Endangered Ecological Community (EEC)	Critically Endangered

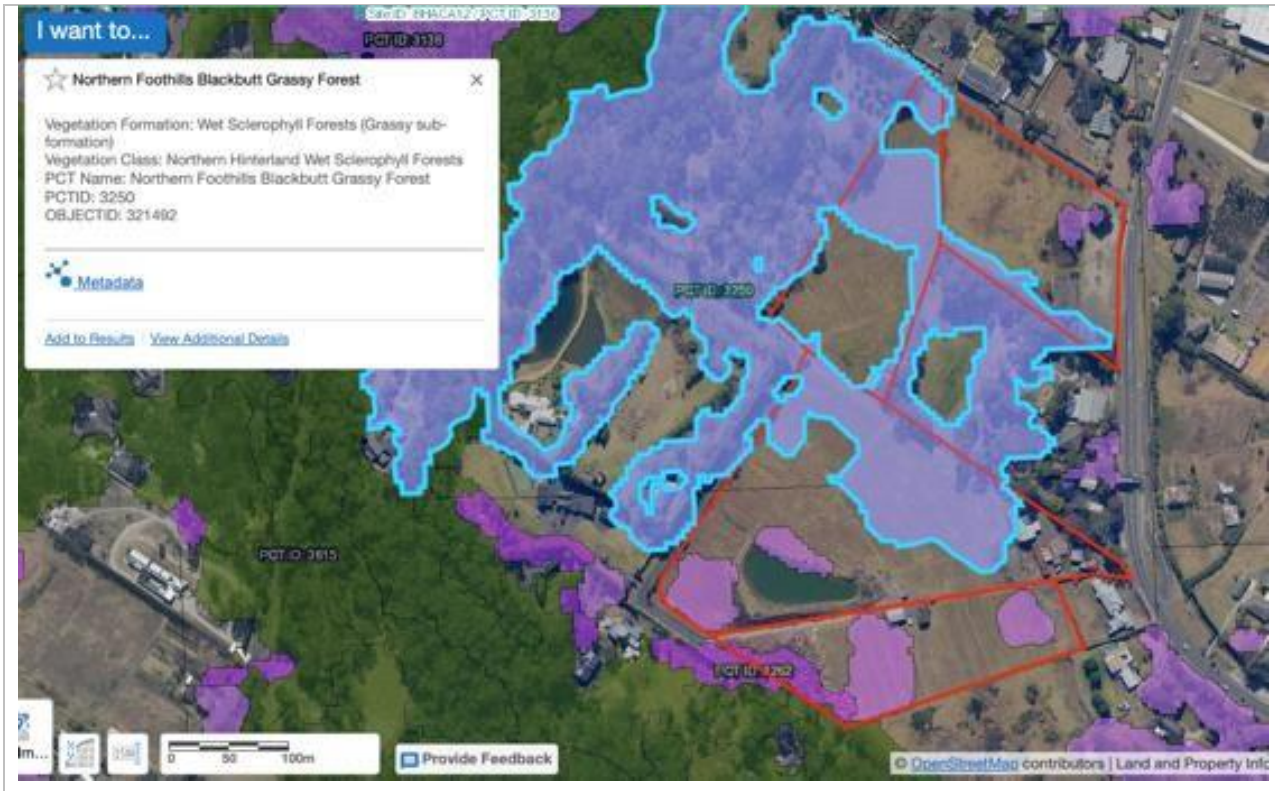


Figure 3.1a. PCT 3250 Northern Foothills Blackbutt Grassy Forest. Source: SEED NSW SVTM 2022.

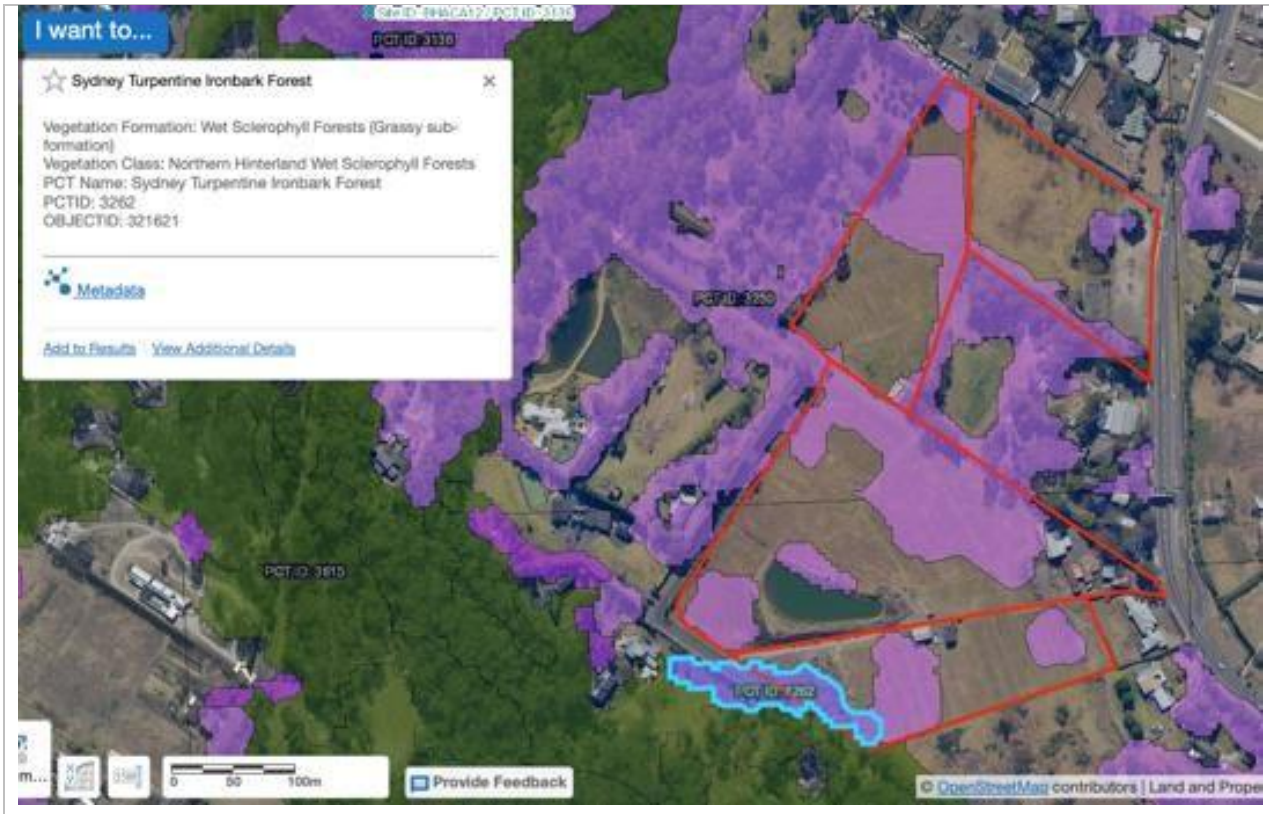


Figure 3.1b. PCT 3262 Sydney Turpentine Ironbark Forest. Source: SEED NSW SVTM 2022.

4.2 Field survey method – PCTs and Vegetation Zones

4.2.1 Field Survey

Ecologist Luke Johnson assessed the site in August 2022. See methods section. BAM plots were undertaken with one in each lot then later Geraldene did 42 1x1m plots in grass areas to focus the search for native species and see if over 15% (or any present).

Near Map imagery was also assessed and has been included below.

Site inspection indicated that vegetation of the southernmost Lot has mature trees present only on the road reserve and boundary with Derriwong Road. While from an aerial photo the centre looks like trees are present - they are not. High resolution aerial imagery has been included to show the rear of this southernmost Lot.

The proposed Masterplan, if implemented does not removed more than the threshold of native vegetation. At the time of the development a BDAR may be required for this site if there is at that time sufficient native vegetation on the boundary with Derriwong Road or native grasses/forbs etc take grow through the paddock areas and resulting in over 0.25ha of clearing of native vegetation. Currently this area is not on the biodiversity's mapping. If clearing does not exceed that threshold, then an update to the Flora Fauna report is expected to be sufficient.

4.2.2 Near Map Imagery

Image from Six maps -accessed August 2022

Image for Near Map June 2022

The following aerial images from Nearmap show the site since 2009. While it was not under the heavy cultivation of the neighbouring blocks it is a mix of exotic species and low areas have native Juncus.

2022

2021

2018

2014

2009

The vegetated long-grass area will be examined again near the time of a DA to see if there is a change in cover.


163.88 m
24.42 m
21.26 m
14.57 m
12333.67 m²
134.96 m
190.39 m
Derriwong Rd
Derriwong Rd
Derriwong Rd
Vertical
Sat Jun 4 2022

5 Threatened Species

5.1 Threatened flora

BioNet results were compared with the list from the BAM calculator to ensure all possible species were considered.

BioNet records within 10km of the study site had 28 species currently listed as vulnerable or endangered under state and/or commonwealth legislation, out of a total of 1,767 species. The vulnerable and endangered species to focus on-site searches for can be seen in Table 4.1 below. This is based on likelihood of occurrence.

Table 4.1. **Threatened Flora recorded within a 10km radius since 1993. NSW OEH BioNet 2022.**

Family	Scientific Name	Common Name	NSW status	Cwealth status	Records
Fabaceae	**Acacia bynoeana**	**Bynoe's Wattle**	E1	V	8
Fabaceae	Acacia pubescens	Downy Wattle	V	V	14
Myrtaceae	**Darwinia biflora**		V	V	114
Myrtaceae	**Darwinia peduncularis**		V		3
Ericaceae	**Epacris purpurascens var. purpurascens**		V		189
Myrtaceae	Eucalyptus camfieldii	Camfield's Stringybark	V	V	8
Myrtaceae	Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	V	3
Myrtaceae	**Eucalyptus scoparia**	**Wallangarra White Gum**	E1	V	3
Myrtaceae	**Eucalyptus sp. Cattai**		E4A	CE	7
Rubiaceae	Galium australe	Tangled Bedstraw	E1		3
Orchidaceae	Genoplesium baueri	Bauer's Midge Orchid	E1,P,2	E	2

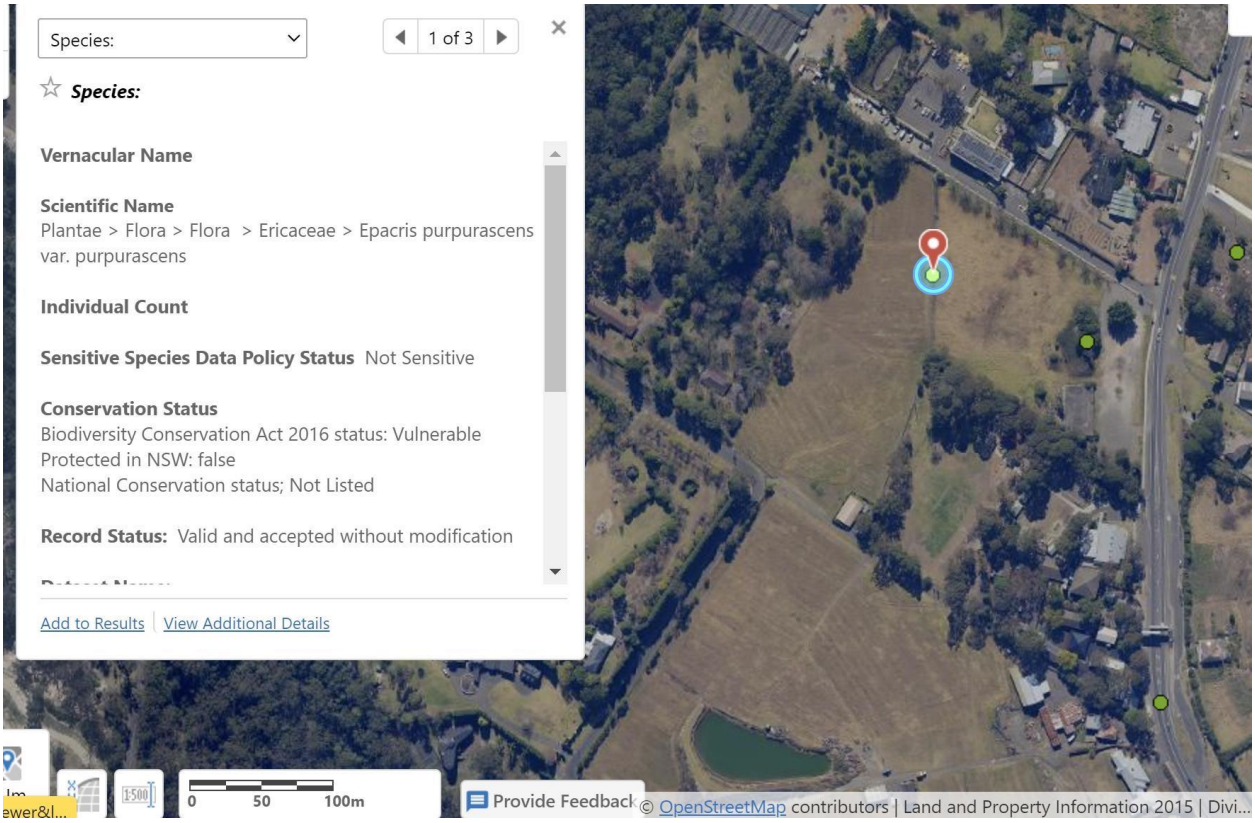
Grammitidaceae	**Grammitis stenophylla**	**Narrow-leaf Finger Fern**	E1,3		2
	Hibbertia superans		E1		33
Myrtaceae	Kunzea rupestris		V	V	1
Myrtaceae	Lasiopetalum joyceae		V	V	8

Family	Scientific Name	Common Name	NSW status	Cwealth status	Records
	Leptospermum deanei		V	V	1
	Leucopogon fletcheri subsp. fletcheri		E1		14
	Macadamia integrifolia	Macadamia Nut		V	8
Myrtaceae	Melaleuca biconvexa	Biconvex Paperbark	V	V	1
Myrtaceae	**Melaleuca deanei**	**Deane's Paperbark**	V	V	26
Proteaceae	Persoonia hirsuta	Hairy Geebung	E1,P,3	E	16
Proteaceae	**Persoonia mollis subsp. maxima**		E1,P	E	78
Thymelaeaceae	**Pimelea curviflora var. curviflora**		V	V	32
Rhamnaceae	Pomaderris brunnea	Brown Pomaderris	E1	V	1
	Pterostylis nigricans	Dark Greenhood	V,P,2		1

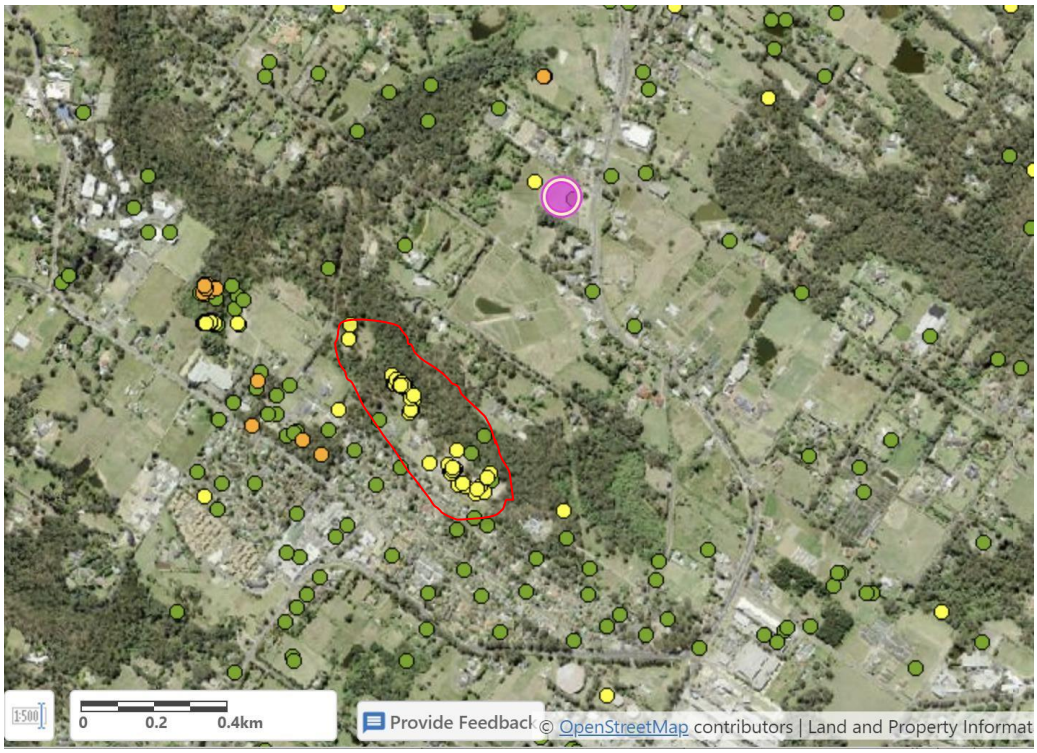
Myrtaceae	Rhodamnia rubescens	Scrub Turpentine	E4A	CE	2
Myrtaceae	Syzygium paniculatum	Magenta Lilly Pilly	E1	V	8
Elaeocarpaceae	**Tetratheca glandulosa**		V		109

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

Those recorded close by historically include:



Event Date 2001 SEED mapping



Red outline area also *Epacris purpurascens* SEED mapping

5.2 Threatened fauna

A total of 343 fauna species have been recorded within 10km of the study site according to BioNet records since 1993. Of these, 40 species are currently listed as vulnerable or endangered under state and/or commonwealth legislation. The vulnerable and endangered species to focus on-site searches for can be seen in Table 4.2 below, this is based on likelihood of occurrence.

NB: species whose habitat doesn't occur on site have been omitted from this list – those with marginal habitat have been retained on the list.

Table 4.2. **Threatened fauna recorded within a 10km radius since 1993. NSW OEH Bionet 2022.**

Class	Scientific Name	Common Name	NSW status	Cwealth status	Records
Amphibia	*Litoria aurea*	Green and Golden Bell Frog	E1,P	V	1
Amphibia	***Pseudophryne australis***	**Red-crowned Toadlet**	V,P		36
Aves	*Artamus cyanopterus*	Dusky Woodswallow	V,P		1

Aves	***Callocephalon fimbriatum***	**Gang-gang Cockatoo**	V,P,3	E	7
Aves	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V,P,2		8
Aves	*Daphoenositta chrysoptera*	Varied Sittella	V,P		4
Aves	*Falco hypoleucos*	Grey Falcon	E1,P,2		1
Aves	***Glossopsitta pusilla***	**Little Lorikeet**	V,P		4
Aves	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	V,P		2
Aves	***Hieraaetus morphnoides***	**Little Eagle**	V,P		2
Aves	***Hirundapus caudacutus***	**White-throated Needletail**	P	V,C,J,K	18
Aves	*Ixobrychus flavicollis*	Black Bittern	V,P		3
Aves	***Lathamus discolor***	**Swift Parrot**	E1,P,3	CE	4
Aves	*Lophoictinia isura*	Square-tailed Kite	V,P,3		2

Class	Scientific Name	Common Name	NSW status	Cwealth status	Records
Aves	*Melithreptus gularis*	Black-chinned Honeyeater (eastern subspecies)	V,P		1
Aves	*Ninox connivens*	Barking Owl	V,P,3		3
Aves	***Ninox strenua***	**Powerful Owl**	V,P,3		157

Aves	*Petroica boodang*	Scarlet Robin	V,P		3
Aves	*Petroica phoenicea*	Flame Robin	V,P		1
Aves	*Petroica rodinogaster*	Pink Robin	V,P		1
Aves	*Polytelis swainsonii*	Superb Parrot	V,P,3	V	1
Aves	*Ptilinopus superbus*	Superb Fruit-Dove	V,P		1
Aves	***Stagonopleura guttata***	**Diamond Firetail**	V,P		1
Aves	***Tyto novaehollandiae***	**Masked Owl**	V,P,3		3
Aves	*Tyto tenebricosa*	Sooty Owl	V,P,3		1
Gastropoda	*Meridolum corneovirens*	Cumberland Plain Land Snail	E1		1
Gastropoda	***Pommerhelix duralensis***	**Dural Land Snail**	E1	E	62
Mammalia	*Cercartetus nanus*	Eastern Pygmy-possum	V,P		1
Mammalia	*Dasyurus maculatus*	Spotted-tailed Quoll	V,P	E	4
Mammalia	***Falsistrellus tasmaniensis***	**Eastern False Pipistrelle**	V,P		11
Mammalia	***Micronomus norfolkensis***	**Eastern Coastal Free-tailed Bat**	V,P		19
Mammalia	***Miniopterus australis***	**Little Bent-winged Bat**	V,P		16
Mammalia	***Miniopterus orianae oceanensis***	**Large Bent-winged Bat**	V,P		53

Mammalia	***Myotis macropus***	**Southern Myotis**	V,P		10
Class	Scientific Name	Common Name	NSW status	Cwealth status	Records
Mammalia	*Petaurus norfolcensis*	Squirrel Glider	V,P		1
Mammalia	*Phascolarctos cinereus*	Koala	E1,P	E	5
Mammalia	***Pteropus poliocephalus***	**Grey-headed Flying-fox**	V,P	V	123
Mammalia	***Saccolaimus flaviventris***	**Yellow-bellied Sheathtailbat**	V,P		14
Mammalia	***Scoteanax rueppellii***	**Greater Broad-nosed Bat**	V,P		14
Mammalia	***Vespadelus troughtoni***	**Eastern Cave Bat**	V,P		1

Bionet was examined for threatened species sightings. Each dot was investigated on-line to see species and date of sighting then suitability on-site for that species.

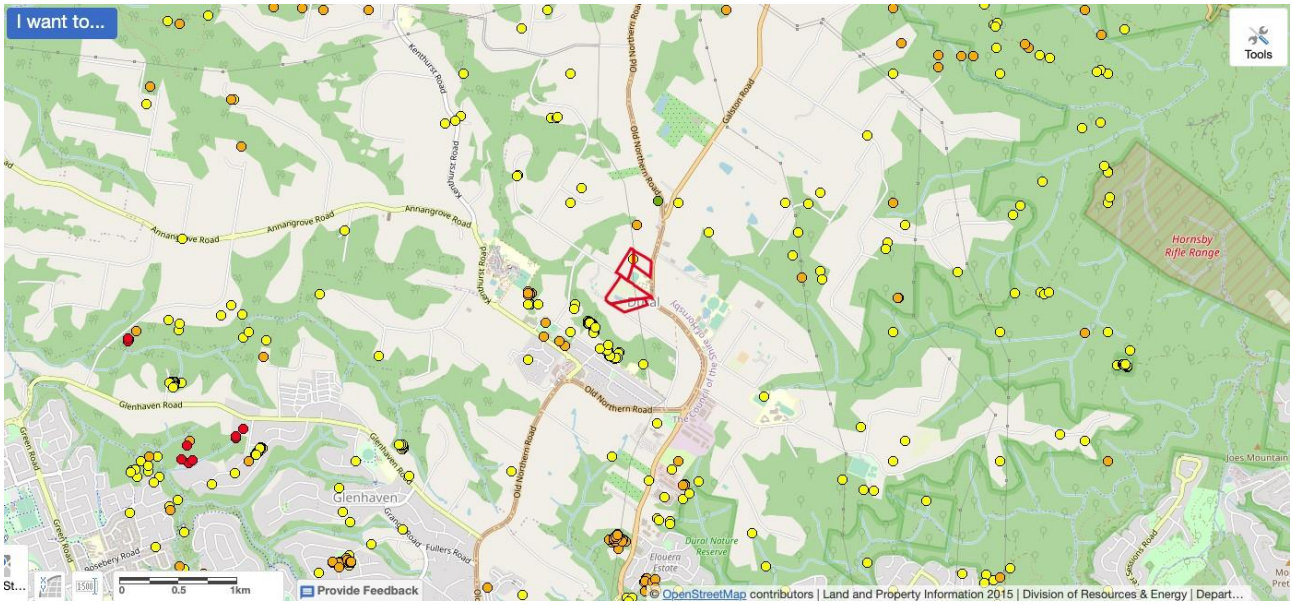
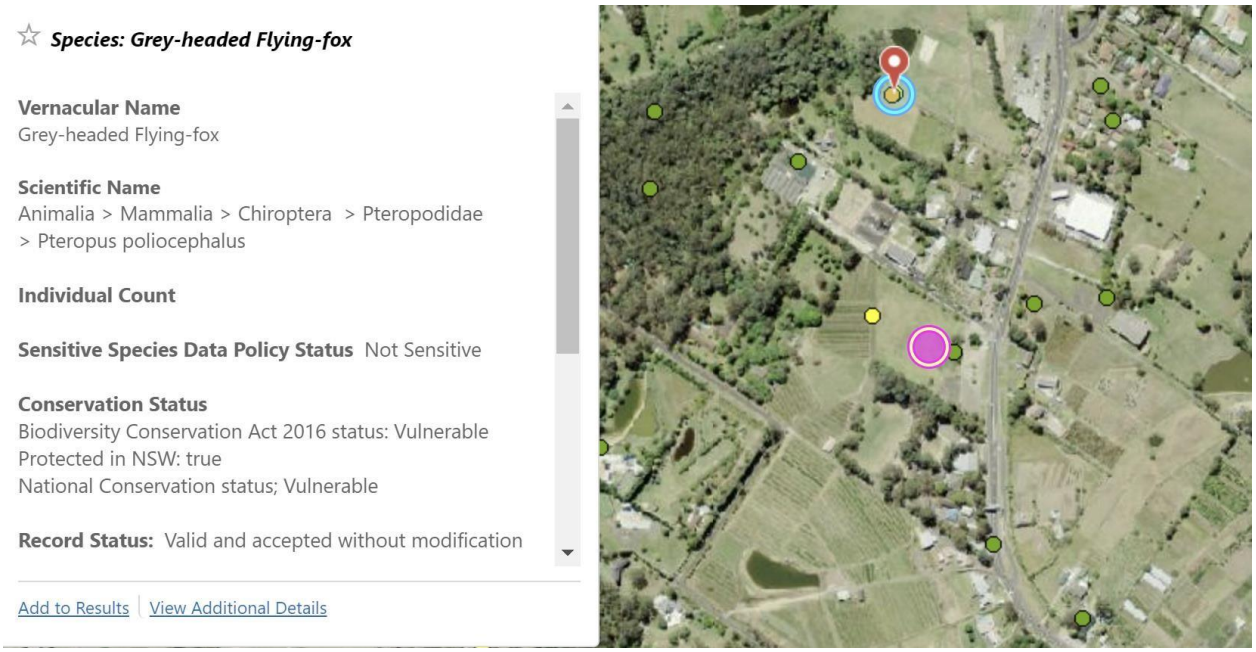
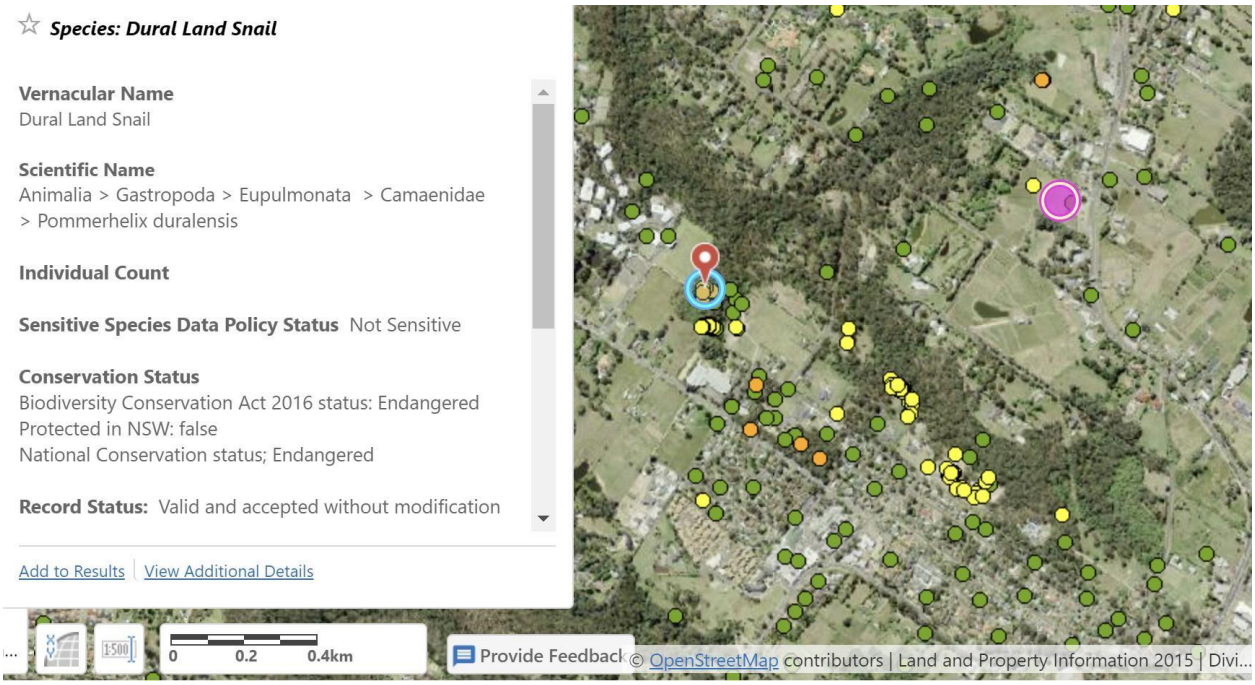


Figure 4.0 **Bionet threatened species sighted around site. Source: SEED 2022.**



Event Date 1991 SEED mapping (NB More sightings since this time)

Event Date 2017 SEED mapping



Dural Land Snail Event Date 2019 SEED mapping

5.3 Endangered Populations

One (1) endangered population have been recorded to occur within 10km of the site. Table 4.3 identifies the populations.

The endangered populations are unlikely to be within the study site or a corridor linking populations to those communities. No further assessment is required for these communities.

Table 4.3. Endangered Populations within 10km of site.

Scientific Name	Endangered Population	NSW status	Cwealth status	Records
Callocephalon fimbriatum	Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai Local Government Areas	E2,V,P,3	E	5

The likelihood of occurrence is a broad categorisation used by Kingfisher to indicate the potential for a species to occur within the study area. It is based on expert opinion and implies the relative value of a study area for a species. See Appendix III for rationale of likelihood of occurrence.

5.4 Waterways

First order waterways run both sides of the Site however none are marked as starting on it.

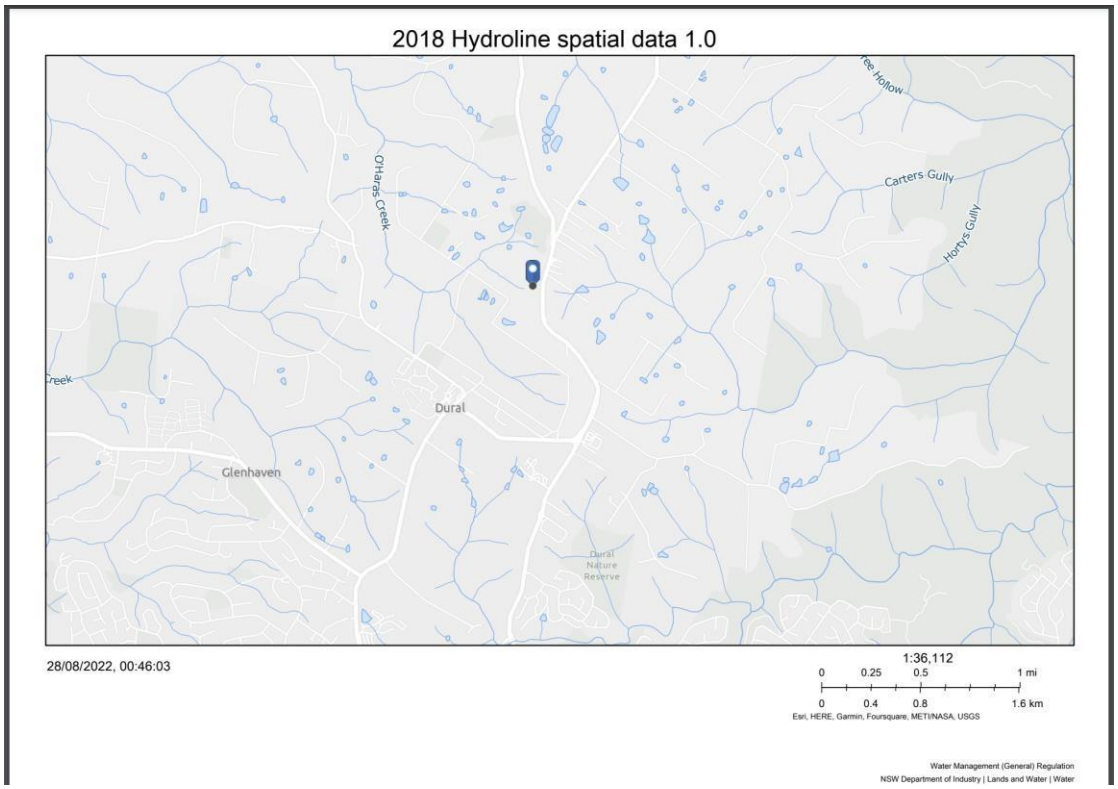


Figure 5.1 Hydroline. Source: Water Management (General) Regulation 2018 Hydroline spatial data 1.

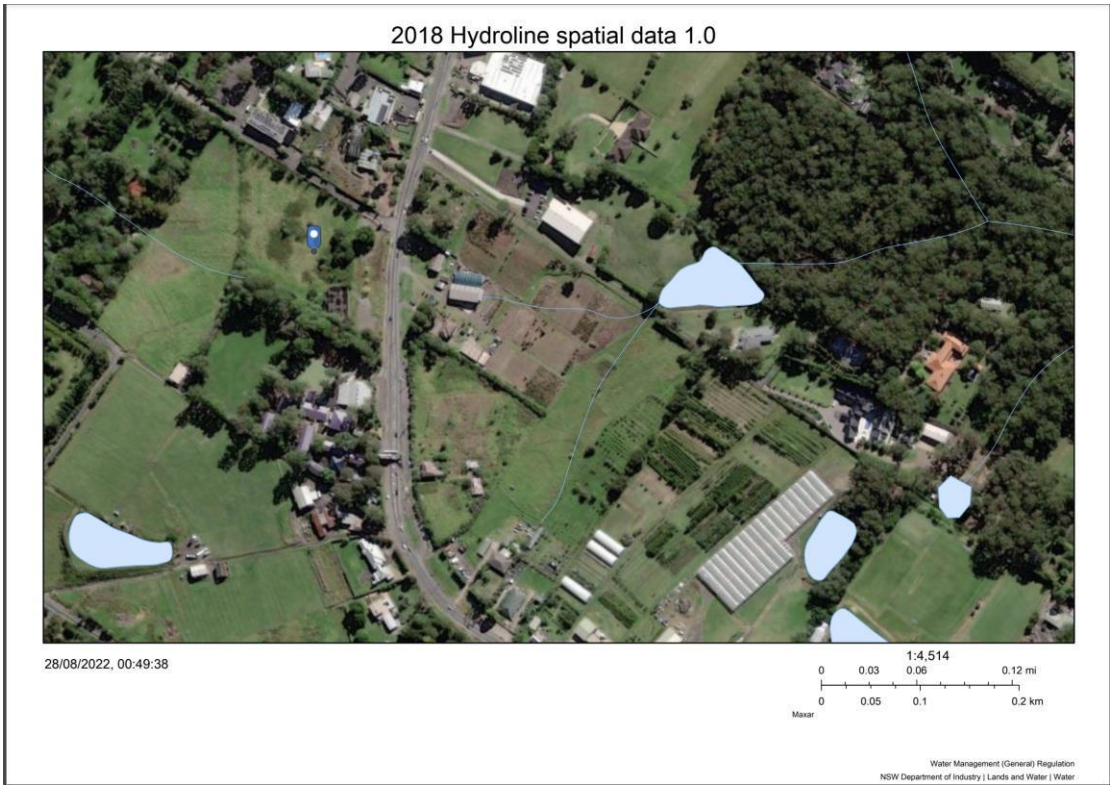


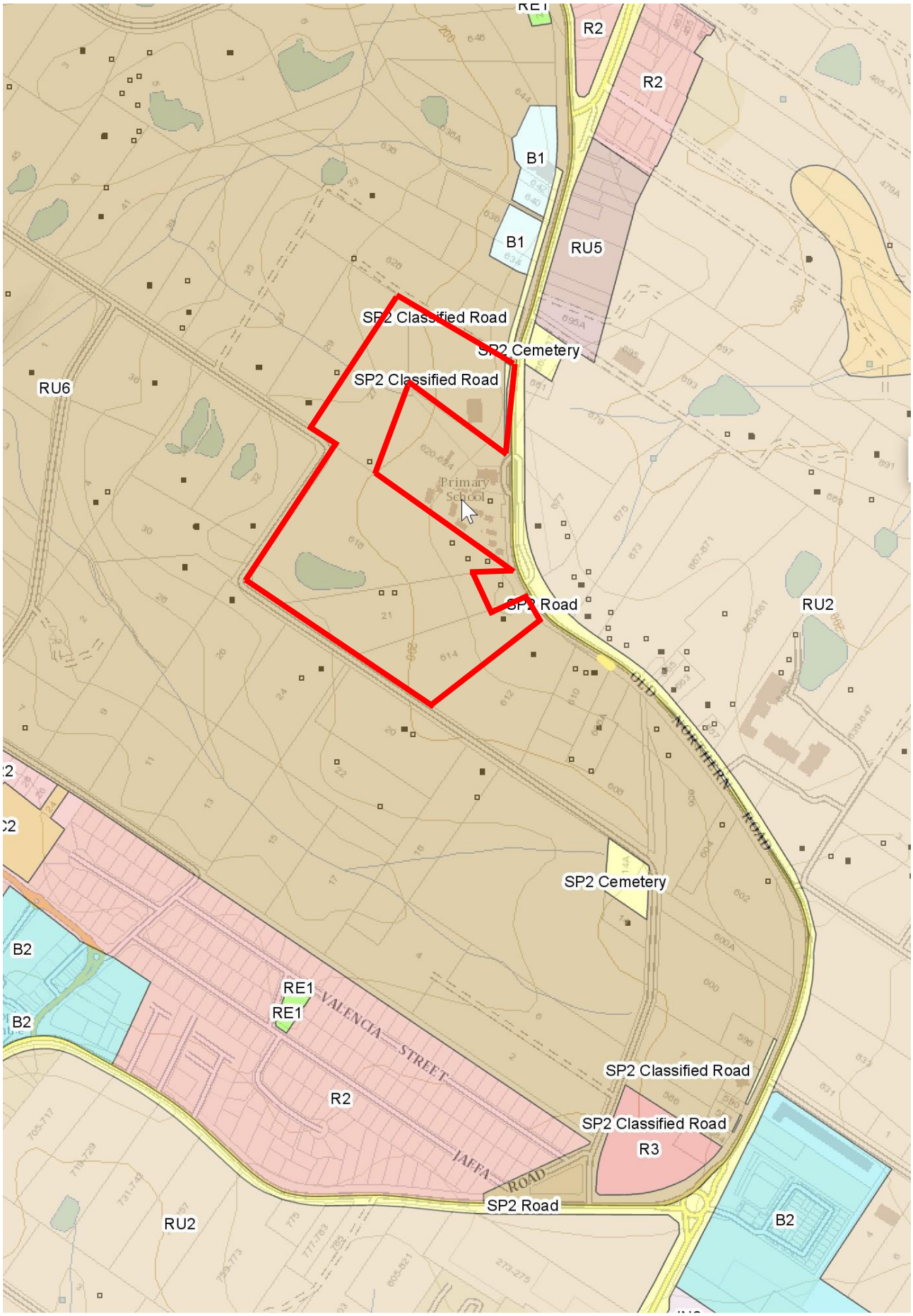
Figure 5.1 Hydroline. Source: Water Management (General) Regulation 2018 Hydroline spatial data 1.

SEPP State Environmental Planning Policy (Biodiversity and Conservation) 2021 applies to this land.

https://legislation.nsw.gov.au/view/html/inforce/current/epi-2021-0722 with the aim:

(a) to protect the biodiversity values of trees and other vegetation in non-rural areas of the State, and

(b) to preserve the amenity of non-rural areas of the State through the preservation of trees and other vegetation.


RE1
R2
R2
B1
B1
RU5
SP2 Classified Road
SP2 Cemetery
SP2 Classified Road
RU6
Primary School
SP2 Road
RU2
OLD NORTHERN ROAD
SP2 Cemetery
B2
RE1
RE1
VALENCIA STREET
B2
SP2 Classified Road
R2
SP2 Classified Road
R3
JAFFA ROAD
SP2 Road
RU2
B2

6 Impacts

6.1 Direct Impacts that may occur under this planning proposal

6.1.1 Vegetation removal

Grass is exotic (under 15% native grass as trigger). On site findings for all lots, other than the southernmost was 100% exotic grass. The Southern lot has a low abundance of native ground species, Juncus sp and grasses (*Microlaena stipoides* <5% and on the edge near trees).

An attempt will be made for trees and vegetation along Derriwong Road to be retained. This can be worked with at the time of DA submission.

Removal will be restricted to include only the trees which are affected by the development footprint. Trees are typical of the community PCT 3250 and PCT 3262 and thus part of the Endangered Community. As part of the moving forward from the planning proposal to an official development application the potential impact on these trees would be assessed under a biodiversity assessment report. That report may either follow the lines of a scattered tree assessment or the assessment of the patch of trees and land under the standard biodiversity assessment method.

Whatever is approved it is recommended that offset planting occur on site post development. Plantings should aim to replace the canopy structure which may be impacted by vegetation removal. Species should be selected from the local PCTs. A vegetation management plan would accompany the development application.

6.2 Indirect Impacts

The proposed actions may result in a range of indirect impacts affecting species or communities.

6.2.1 Introduction of pathogens

The introduction of pathogens may occur into the site, , 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 methods to control selected pathogens.

6.2.2 Runoff

The proposed actions may result in transport of sediment from the work zones as a result of increased storm water runoff.

7 Recommendations

7.1 Mitigation Measures

The following mitigation measures have been suggested if planning proposal is approved.

7.1.1 Up to date assessment

BDAR for the area with canopy trees.

7.1.2 Delineation of work areas

During construction, impacts on the site and adjacent vegetation should be minimized by the delineation of works zones. Access to the site would be best restricted to small passageways avoiding native vegetation to prevent soil disturbance in general and in particular, damage to native vegetation. Access will be restricted to disturbed open areas and in accordance with the Arborist report in a line with tree protection measures.

7.1.3 Tree Protection

Tree protection will be consistent with the Arborist report (AURA 2020). Main trees to be managed are trees within proximity to building works. NB: see final arborist report for details of works and tree numbers.

7.1.4 Native species planting

Low impact bushland regeneration methods should also be utilised to meet weed control performance targets. The bushland on site displaying signs of resilience.

Plantings are one of several best practice measures, to retain and support the long-term survival of the vegetation on site. 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.

7.1.5 Erosion and runoff

Where required, sediment controls will be put in place. These will include, but not be limited to sediment fences, jute matting and crushed sandstone. Sediment controls will be reviewed during site inspections and/or after significant rainfall (more than 10mm in 24hrs resulting in site runoff).

7.1.6 Weed management

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

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 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/scrape and poison regenerator techniques based on the germinating/epicormic behaviour of the plant (especially plants that tend to coppice or sucker). See Appendix II for further details. For key weed photo guide see Appendix I.

7.1.7 Nest boxes

Eight nest boxes designed for microbats would be conditioned at DA stage and be added to the site to replace potential loss of roosting habitat. Image from: nestboxes.com.au

7.1.8 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.

Phytophthora infected vegetation. (Image by Rasbak, licensed under the Creative Commons Attribution-Share Alike 3.0 Unported, 2.5 Generic, 2.0 Generic and 1.0 Generic license.)

Myrtle Rust generally infects new leaf growth. (Image by John Tann, licensed under the Creative Commons Attribution 2.0 Generic license.)

8 Appendices

8.1 Appendix I– 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, 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.

Technique	Method	Equipment

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.
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 plant's 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.
Technique	**Method**	**Equipment**

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, earmuffs, protective clothing, safety glasses herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide, and all other required P.P.E.
Spot Spraying	Spot spraying involves spraying non-seeding annuals and grasses, and for regrowth of weeds once an area has been cleared or brush cut. 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 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.

8.2 Appendix II– Bushland Hygiene Protocols for Phytophthora

- 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.

8.3 Appendix III – Threatened species likelihood of occurrence

Appendix III is based on BioNet records within 10km of the study site. The following flora and fauna species are currently listed as vulnerable or endangered under state and/or commonwealth legislation. The likelihood of occurrence for the flora and fauna species is listed below.

Table 7.1 – Threatened flora species likelihood of occurrence

Scientific Name	Common Name	Habitat Requirements	Site Suitability
Acacia bynoeana	Bynoe's Wattle	Occurs in heath or dry sclerophyll forest on sandy clay soils, often containing ironstone gravels. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches.	Searches done and none of these plants seen. Also nonevident on previous aerial as most of this area has been intensively used agriculturally.
Acacia pubescens	Downy Wattle	Occurs on alluviums, shales and at the intergrade between shales and sandstones. The soils are characteristically gravely soils, often with ironstone. Occurs in open woodland and forest, in a variety of plant communities, including Cooks River/ Castlereagh Ironbark Forest, Shale/ Gravel Transition Forest and Cumberland Plain Woodland. The topography of the habitat of the species is flat to gently undulating, a characteristic of the Cumberland Plain region.	

Darwinia biflora		Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone. In addition, the species appears to occur frequently on sheet rock which often contains moss beds. The species occurs in Sandstone Ridgetop Woodland, which is equivalent to Sydney Sandstone Ridge-top Woodland/ Open Forest and Sydney Sandstone Scrub-heath complex.	

Scientific Name	Common Name	Habitat Requirements	Site Suitability
Darwinia peduncularis		Occurs as local disjunct populations in coastal NSW with a couple of isolated populations in the Blue Mountains. Usually grows on or near rocky outcrops on sandy, well drained, low nutrient soil over sandstone.	

Epacris purpurascens var. purpurascens		Found in a range of habitat types, most of which have a strong shale soil influence. These include ridgetop drainage depressions supporting wet heath within or adjoining shale cap communities e.g., Stringybark and Ironbark woodlands, various shale/sandstone transition forest associations including Turpentine Ironbark Margin Forest, Stringybark/Scribbly Gum Woodland and Scribbly Gum/ Grey Gum/ Red Bloodwood Woodland. The species also occurs in riparian zones draining into Sydney Sandstone Gully Forest, shale lenses within sandstone habitats and colluvial areas overlying or adjoining sandstone or tertiary alluvium.	Records are close and include one on the site. The habitat is not currently on the site.
Eucalyptus camfieldii	Camfield's Stringybark	Restricted distribution at Norah Head, Peats Ridge, Mt Colah, Elvina Bay Trail (West Head), Terrey Hills, Killara, North Head, Menai, Wattamolla and a few other sites in Royal National Park. Recorded in poor coastal country in shallow sandy soils overlying Hawkesbury sandstone. Coastal heath mostly on exposed sandy ridges. Occurs mostly in small, scattered stands near the boundary of tall coastal heaths and low open woodland of the slightly more fertile inland areas. Associated species frequently include stunted species of *E. oblonga* Narrow-leaved Stringybark, *E.*	Not present

Scientific Name	Common Name	Habitat Requirements	Site Suitability
		capitellata Brown Stringybark and *E. haemastoma* Scribbly Gum.	
Eucalyptus nicholii	Narrow-leaved Black Peppermint	It occurs in grassy or sclerophyll woodland in association with many other eucalypts that grow in the area, including *E. andrewsii* and many of the stringybarks, such as *E. caliginosa*. Grows on shallow relatively infertile soils on shales and slates; Niangala to Glen Innes. The distribution of this species overlaps with the following EPBC Act-listed threatened ecological communities: White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland, and Upland Wetlands of the New England Tablelands and the Monaro Plateau.	Not present
Eucalyptus scoparia	Wallangarra White Gum	Found in open eucalypt forest and woodland on well drained granite hilltops, slopes, and rocky outcrops. Most populations occur at altitudes to 1300 m, mostly as individuals or small groups. At lower altitudes, individuals mainly occur on podsolics in damp situations. The distribution of this species overlaps with the "White BoxYellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland" EPBC Act-listed threatened ecological community.	Not present

Eucalyptus sp. Cattai		Occurs as a rare emergent tree in scrub, heath and low woodland on sandy soils, usually as isolated individuals or occasionally in small, clustered groups. The sites at which it occurs are generally flat and on ridge tops. Associated soils	Not present Closest individuals over 300m and in reserve in different habitat.

Scientific Name	Common Name	Habitat Requirements	Site Suitability
		are laterised clays overlying sandstone. There are no known populations that occur in conservation reserves.	
Galium australe	Tangled Bedstraw	Most flowering collections have been made in late spring to early autumn. In NSW (and ACT Territory in Jervis Bay), Tangled Bedstraw has been recorded in Turpentine forest and coastal Acacia shrubland. In other States the species is found in a range of near-coastal habitats, including sand dunes, sand spits, shrubland and woodland.	Unlikely
Genoplesium baueri	Bauer's Midge Orchid	Grows in dry sclerophyll forest and moss gardens over sandstone.	Unlikely
Grammitis stenophylla	Narrow-leaf Finger Fern	Moist places, usually near streams, on rocks or in trees, in rainforest and moist eucalypt forest.	Unlikely

Hibbertia superans		The species occurs on sandstone ridgetops often near the shale/sandstone boundary. Occurs in both open woodland and heathland, and appears to prefer open disturbed areas, such as tracksides. Most occurrences are in or near Shale/Sandstone Transition Forest and are often associated with other threatened flora including *Pimelea curviflora* var. *curviflora, Darwinia biflora, Epacris purpurascens* var. *purpurascens, Leucopogon fletcheri* subsp. *fletcheri, Acacia bynoeana, Eucalyptus* sp. *Cattai* and *Persoonia hirsuta*. These plants tend to be very strongly associated due to their habitat requirements and restricted distribution.	Unlikely

Scientific Name	Common Name	Habitat Requirements	Site Suitability
Kunzea rupestris		Grows in shallow depressions on large flat sandstone rock outcrops. Characteristically found in short to tall shrubland or heathland. Flowering occurs in spring. It has indehiscent fruits which resist soil entrapment and so may disperse many metres per week. Resprouts from the base after fire or mechanical damage. Seedlings have also been observed after fire.	Not seen

Lasiopetalum joyceae		Grows in heath on sandstone. Flowers in spring. The distribution of this species overlaps with the following EPBC Act-listed threatened ecological communities: Shale/Sandstone Transition Forest, White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland, and Turpentine-Ironbark Forest in the Sydney Basin Bioregion.	Unlikely
Leptospermum deanei		Woodland on lower hill slopes or near creeks. Sandy alluvial soil or sand over sandstone. Occurs in Riparian Scrub - e.g., Tristaniopsis laurina, Baechea myrtifolia; Woodland - e.g., Eucalyptus haemstoma; and Open Forest - e.g., Angophora costata, Leptospermum trinervium, Banksia ericifolia. Flowers October-November.	Unlikely
Leucopogon fletcheri subsp. fletcheri		Occurs in dry eucalypt woodland or in shrubland on clayey lateritic soils, generally on flat to gently sloping terrain along ridges and spurs. Associated with the Mittagong Formation	Too degraded

Scientific Name	Common Name	Habitat Requirements	Site Suitability
		between the Wianamatta Shale and the Hawkesbury Sandstone.	

Macadamia integrifolia	Macadamia Nut	Grows in remnant rainforest, preferring partially open areas such as rainforest edges. Found on high nutrient alluvial and volcanic soils predominate often with considerable exposure of rock fragments or substrate, mostly basalt and diorite. The surface soils are uniformly dark, slightly acid and varying in texture from clayey-sand through various loams to silty-clay. Vegetation communities in which the Macadamia Nut is found range from complex notophyll mixed forest, extremely tall closed forest, simple notophyll mixed very tall closed forest to simple microphyll-notophyll mixed mid-high closed forest.	Not habitat
Melaleuca biconvexa	Biconvex Paperbark	Grows in sandy or light clay soils over thin shales. Sydney region occurrences are usually on Tertiary sands and alluvium, and soils derived from the Mittagong Formation. Occurs in a range of vegetation types from heath and shrubby woodland to open forest. In the Shale Sandstone Transition Forest associated species include *Eucalyptus fibrosa, E. punctata, Corymbia gummifera, Pultenaea scabra* var*. biloba, Kunzea ambigua, Allocasuarina littoralis* and *Themeda australis*. At sites with a stronger sandstone influence *Eucalytpus sclerophylla, E. piperita, E. oblonga, Grevillea diffusa, G. mucronulata, Acacia suaveolens* and *Persoonia pinifoliaare*. Often occurs in open, slightly	Not habitat

Scientific Name	Common Name	Habitat Requirements	Site Suitability
		disturbed sites such as along tracks. Flowers between July to December as well as April-May.	
Melaleuca deanei	Deane's Paperbark	The species grows in heath on sandstone. Mostly occupies broad flat ridgetops, dry ridges, and slopes. In southern Sydney, the species is most often found on flat broad ridge tops more than 100 metres wide. The altitudinal range of *M. deanei* is between 20 and 410 metres above sea level. Strongly associated with sandy loam soils that are low in nutrients, sometimes with ironstone present. Is most often found in Coastal Sandstone Ridgetop Woodland. Flowers appear in summer.	Potential near trees in undisturbed area – southernmost lot if waterlogged – needs to be checked pre-DA. Unlikely
Persoonia hirsuta	Hairy Geebung	Usually found in sandy soils in dry sclerophyll open forest, woodland, and heath on sandstone. Usually present as isolated individuals or very small populations. Habitat Preferences: It also favours disturbed heath, shrubby thickets, and sandstone scrubs	No

Persoonia mollis subsp. maxima		Occurs in sheltered aspects of deep gullies or on the steep upper hillsides of narrow gullies on Hawkesbury Sandstone. This habitat is characterised by steep side slopes, rocky benches, and broken scarps, with creeks fed by small streams and intermittent drainage depressions. These habitats also support relatively moist, tall forest vegetation communities, often with warm temperate rainforest influences.	Potential near trees in undisturbed area.

Scientific Name	Common Name	Habitat Requirements	Site Suitability
Pimelea curviflora var. curviflora		Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Also recorded in Illawarra Lowland Grassy Woodland habitat at Albion Park on the Illawarra coastal plain. Flowers October to May. Has an inconspicuous cryptic habit as it is fine and scraggly and often grows amongst dense grasses and sedges. It may not always be visible at a site as it appears to survive for some time without any foliage after fire or grazing, relying on energy reserves in its tuberous roots.	

Pomaderris brunnea	Brown Pomaderris	Grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines. In the Sydney region this species is found typically near the coast, on Sydney Sandstones. In this area it grows in woodland and semi cleared scrub, on clay and alluvial soils of floodplains and creek lines.	Habitat too degraded
Pterostylis nigricans	Dark Greenhood	Coastal heathland with Heath Banksia (*Banksia ericifolia*), and lower-growing heath with lichen-encrusted and relatively undisturbed soil surfaces, on sandy soils.	Habitat too degraded and not suitable
Rhodamnia rubescens	Scrub Turpentine	Found in littoral, warm temperate and subtropical rainforest, and wet sclerophyll forest usually on volcanic and sedimentary soils. This species is characterised as highly to extremely susceptible to infection by Myrtle Rust. Myrtle Rust affects all plant parts.	Not seen – not present
Scientific Name	Common Name	Habitat Requirements	Site Suitability
Syzygium paniculatum	Magenta Lilly Pilly	Found in rainforest on sandy soils or stabilised Quaternary sand dunes at low altitudes in coastal areas. Rainforests are often remnant stands of littoral or gallery rainforest. Is thought to tolerate wet and dry conditions on sands.	Not seen – not present

Tetratheca glandulosa		Occurs on shale/sandstone transition geology particularly in areas where shale caps occur over sandstone. Associated with Lucas heights, Gymea, Lambert and Faulconbridge soil landscapes. Generally, occurs on ridgetops, upper slopes, and occasionally mid-slope benches. Prefers shallow soils consisting of yellow clayey/sandy loams.	Potentially where trees are still present along the road on southernmost block.

Table 7.2 – Threatened fauna species likelihood of occurrence

Please note – Marine species including Turtles (*Cheloniidae*), Marine Birds *(Diomedeidae, Procellariidae) and Whales (Otariidae, Balaenidae, Balaenopteridae, Physeteridae) have been omitted from this list.*

Scientific Name	Common Name	Habitat Requirements	Site Suitability
Litoria aurea	Green and Golden Bell Frog	Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (Gambusia holbrooki), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas. The species is active by day and usually breeds in summer when conditions are warm and wet	Habitat too degraded

Scientific Name	Common Name	Habitat Requirements	Site Suitability

Pseudophryne australis	Red-crowned Toadlet	Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings. Shelters under rocks and amongst masses of dense vegetation or thick piles of leaf litter. Breeding congregations occur in dense vegetation and debris beside ephemeral creeks and gutters. Eggs are laid in moist leaf litter, from where they are washed by heavy rain; a large proportion of the development of the tadpoles takes place in the egg. Disperses outside the breeding period, when they are found under rocks and logs on sandstone ridges and forage amongst leaf-litter.	Habitat too degraded
Artamus cyanopterus	Dusky Woodswallow	Woodlands and dry open forests with preference for those dominated by eucalypts with mallee associations. May also be found in shrublands, heaths and occasionally in modified habitats and wet forests.	May fly over and on power line s- no roosting on-site.

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	Habitat too degraded

Scientific Name	Common Name	Habitat Requirements	Site Suitability
		located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts.	
Calyptorhynchus lathami	Glossy Black-Cockatoo	Lives in coastal woodlands and drier forest areas, open inland woodlands, or timbered watercourses where casuarinas (or she-oaks), its main food trees, are common. Glossy black-cockatoos occasionally eat seeds from eucalypts, angophoras, acacias, and hakeas, as well as eating insect larvae. Prefers to nest in the hollows of large, old eucalypt trees, alive or dead. The typical nest site will be around 3 to 30 metres above the ground.	Habitat too degraded

Daphoenositta chrysoptera	Varied Sittella	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth barked gums with dead branches, mallee, and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy.	Habitat too degraded
Falco hypoleucos	Grey Falcon	Occasionally found near the coast in open woodland, but usually in grassland, shrubland and wooded water courses in more arid regions. Uses nest of old birds, including ravens and other birds of prey, normally high in a eucalypt, which is close to water.	Could fly over and forage over the site. No trees to breed or roost will be impacted if the subdivision was approved. Loss of open feeding habitat would occur though.
Glossopsitta pusilla	Little Lorikeet	Prefers open Eucalypt forest and woodlands. Primarily feeds within the canopy of Eucalyptus, Angophora and Melaleuca	Habitat too degraded

Scientific Name	Common Name	Habitat Requirements	Site Suitability
		trees. Prefers riparian areas but may visit isolated trees in open or cleared land.	

Haliaeetus leucogaster	White-bellied Sea-Eagle	Occurs at sites near the sea or sea-shore and in the vicinity of freshwater swamps, lakes, reservoirs, billabongs, and saltmarsh. Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. 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.	Unlikely No breeding areas
Hieraaetus morphnoides	Little Eagle	Occupies open eucalypt forest, woodland, or open woodland. She-oak 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.	Could fly over and forage over the site. No trees to breed or roost will be impacted if the subdivision was approved. Loss of open feeding habitat would occur though.
Hirundapus caudacutus	White-throated Needletail	Almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. Recorded most often above wooded areas, including open forest and	Flying high – not breeding

Scientific Name	Common Name	Habitat Requirements	Site Suitability
		rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland. Recorded roosting in trees in forests and woodlands, both among dense foliage in the canopy or in hollows.	
Ixobrychus flavicollis	Black Bittern	Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest, and mangroves. Feeds on frogs, reptiles, fish, and invertebrates, including snails, dragonflies, shrimps, and crayfish, with most feeding done at dusk and at night. During the day, roosts in trees or on the ground amongst dense reeds.	No habitat

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. pilularis. Return to home foraging sites on a cyclic basis depending on food availability.	Habitat too degraded – no trees in most of site. Roadside trees may be visited.
Lophoictinia isura	Square-tailed Kite	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference	Could fly over and forage over the site. No trees to breed or roost will be

Scientific Name	Common Name	Habitat Requirements	Site Suitability
		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 in the tree canopy, picking most prey items from the outer foliage.	impacted if the subdivision was approved. Loss of open feeding habitat would occur though.

Melithreptus gularis	Black-chinned Honeyeater (eastern subspecies)	Primarily found in the upper levels of dry open forests and woodlands. Prefers vegetation dominated by box and ironbark Eucalypts but may be found in areas of smooth barked gums, stringybarks, river she-oaks (nesting) and teatrees.	Habitat too degraded
Ninox connivens	Barking Owl	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. Flexible in its habitat use. Hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats due to the higher density of prey on these fertile soils. Nesting occurs during mid-winter and spring but is variable between pairs and across years.	Could fly over – no good roosts to watch and find prey.
Ninox strenua	Powerful Owl	Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. Breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. Roosts by day in dense vegetation comprising	Said not to take food off ground – but in trees. So, no habitat.

Scientific Name	Common Name	Habitat Requirements	Site Suitability

		species such as *Syncarpia glomulifera, Allocasuarina littoralis, Acacia melanoxylon, Angophora floribunda, Exocarpus cupressiformis* and several Eucalypt species. Nests in large tree hollows (at least 0.5 m deep), in large Eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old.	
Petroica boodang	Scarlet Robin	Ideal habitat includes eucalypt forests and woodlands with an open and grassy understorey with few shrubs. Can occur in mature or regrowth vegetation. Sometimes seen in mallee, wet forests, wetlands, and tea-tree swamps. Habitat generally contains many logs and fallen timber.	Habitat too degraded
Petroica phoenicea	Flame Robin	Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys. Occasionally occurs in temperate rainforest, and in herb fields, heathlands, shrublands and sedgelands at high altitudes. Winters in dry forests, open woodlands and in pastures and native grasslands, with or without scattered trees. Breeds in spring to late summer. Nests are often near the ground and are built in sheltered sites, such as shallow cavities in trees, stumps, or banks. Builds an open cup nest made of plant materials and spider webs.	Habitat too degraded

Petroica rodinogaster	Pink Robin	Inhabits rainforest and tall, open eucalypt forest, particularly in densely vegetated gullies. Nest is a deep, spherical cup made of green moss bound with cobweb and	Habitat too degraded

Scientific Name	Common Name	Habitat Requirements	Site Suitability
		adorned with camouflaging lichen and is lined with fur and plant down. It is situated in an upright or oblique fork, from 30 cm to 6 m above the ground, in deep undergrowth.	
Polytelis swainsonii	Superb Parrot	Found in River Red Gum Forest or Box-Gum, Box-Cypresspine and Boree Woodlands. Nests in large tree hollows in forest, woodland, and paddocks. Known to use Apple Box, Red Box, Yellow Box and Blakely's Red Gum.	Habitat too degraded
Ptilinopus superbus	Superb Fruit-Dove	The species is found in rainforests, rainforest margins, mangroves, wooded stream-margins, and even isolated figs, lilly pilies and pittosporums. The Superb Fruit-Dove may migrate to New Guinea in winter, but little is known of its movements, or the reasons for its sometimes-southerly flights as far as Tasmania. Feeds almost exclusively on fruit, mainly in large trees.	Habitat too degraded

Stagonopleura guttata	Diamond Firetail	Found in grassy eucalypt woodland areas, such as Snow Gum Eucalypts and Box-Gum Woodlands. Also in mallee, open forest, natural temperate grassland, and grassland derived from other communities including riparian areas, and lighted wooded farmland. May use hawk or raven nests.	Habitat too degraded
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.	Record – 300m however no habitat on site atm. Habitat too degraded

Scientific Name	Common Name	Habitat Requirements	Site Suitability
Tyto tenebricosa	Sooty Owl	Occurs in a variety of rainforest, including dry, subtropical, and warm temperate variants, and moist eucalypt forest. Roosts during the day in tall forest tree hollows or in heavy vegetation. Large tree hollows are used for nesting.	Habitat too degraded
Meridolum corneovirens	Cumberland Plain Land Snail	Primarily found in Cumberland Plain Woodland. Cumberland Plain Woodland is an open woodland community with a grassy understory with patches of dense shrubs. Requires bark and leaf litter, logs, and grass clumps for shelter. May shelter in rubbish. The species is a fungus specialist.	Habitat is degraded – could be potential (low) near tree line along the road

Pommerhelix duralensis	Dural Land Snail	Specialises in shale-sandstone transition geology-based habitats. Prefers forested habitats with a native ground cover and abundant woody debris. Shelters under rocks, leaf litter and bark and has been observed in exposed areas. Population density is noted as being extremely low across its range.	Habitat is degraded – could be potential (low) near tree line along the road. Not in open grass areas without habitat features.
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.	Habitat too degraded
Dasyurus maculatus	Spotted-tailed Quoll	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath, and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs,	Habitat too degraded

Scientific Name	Common Name	Habitat Requirements	Site Suitability
		small caves, rock outcrops and rocky-cliff faces as den sites. Mostly nocturnal animal feeding on medium-sized (500g5kg) mammals.	

Falsistrellus tasmaniensis	Eastern False Pipistrelle	The Eastern False Pipistrelle is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania. Prefers moist habitats, with trees taller than 20 m. Generally, roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. Hunts beetles, moths, weevils, and other flying insects above or just below the tree canopy. Hibernates in winter. Females are pregnant in late spring to early summer.	Microbats could fly over and forage over the site. Loss of open feeding habitat would occur though.
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures. Usually solitary but also recorded roosting communally, probably insectivorous.	Microbats could fly over and forage over the site. Loss of open feeding habitat would occur though.
Miniopterus australis	Little Bentwinged Bat	Moist eucalypt forest, rainforest, or dense coastal banksia scrub. Little Bent wing-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	Microbats could fly over and forage over the site. Loss of open feeding habitat would occur though.

Scientific Name	Common Name	Habitat Requirements	Site Suitability
		Bentwing-bats (*M. schreibersii*) and appears to depend on the large colony to provide the high temperatures needed to rear its young.	
Miniopterus orianae oceanensis	Large Bentwinged Bat	Primarily roosts in caves but will utilise mine shafts, stormwater 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.	Microbats could fly over and forage over the site. Loss of open feeding habitat would occur though.
Myotis macropus	Southern Myotis	Roosts in groups of 10-15 in areas close to water. Will utilise caves, mine shafts, tree hollows, storm water drains, buildings, bridges, and dense foliage. Forages over water bodies catching insects and small fish.	
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.	No

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.	No
Scientific Name	Common Name	Habitat Requirements	Site Suitability
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.	Could fly over and forage over the site. No trees to breed or roost will be impacted if the subdivision was approved. Loss of open feeding habitat would occur though.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. Breeding has been recorded from December to mid-March when a single young is born. Seasonal movements are unknown; there is speculation about a migration to southern Australia in late summer and autumn.	Microbats could fly over and forage over the site. No trees to breed or roost will be impacted if the subdivision was approved. Loss of open feeding habitat would occur though.

Scoteanax rueppellii	Greater Broadnosed Bat	Roosts in tree hollows but may be found in buildings. Primarily found in gullies and river systems that drain the Great Dividing Range. Occurs in a range of habitats including woodlands to moist or dry eucalypt forest, rainforest with greatest preference for tall wet forests. Forages along creeks and river corridors.	Microbats could fly over and forage over the site. No trees to breed or roost will be impacted if the subdivision was approved. Loss of open feeding habitat would occur though.
Vespadelus troughtoni	Eastern Cave Bat	Roosts in caves, mine shafts. Generally found in dry open forest and woodlands. Prefers areas near cliffs and rocky overhangs.	Microbats could fly over and forage over the site. Loss of open feeding habitat would occur though.

Likelihood – Endangered Population

Scientific Name	Common Name	Habitat Requirements	Site Suitability

Callocephalon fimbriatum	Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai Local Government Areas	Occurs within a variety of forest and woodland types. Usually frequents forested areas with old growth attributes required for nesting and roosting purposes. Also utilises less heavily timbered woodlands and urban fringe areas to forage but appears to favour well-timbered country through which it habitually flies as it moves about. Individuals of this population are likely to move outside the 'defined' population boundary in the general area and should still be considered of this population. Significant as it is the last known breeding population in the Sydney Metropolitan area. Has a small population size, estimated to be between 18 - 40 pairs.	Could fly over and forage nearby. No trees to breed or roost. Low habitat potential.

8.1 Appendix IV – Test of Significance (5 Part Test).

8.1.1 Microbats

Six species of microbat were assessed as having the potential to occur within the study area based on Bionet records. The following species have the potential to occur in the site or surrounding bushland:

- Eastern Freetail-bat (*Mormopterus norfolkensis)*
- Large Bentwing-bat (*Miniopterus schreibersii oceanensis)*
- Little Bentwing-bat (*Miniopterus australis)*
- Large-eared Pied Bat (*Chalinolobus dwyeri)*
- Greater Broad-nosed Bat (*Scoteanax rueppellii)*
- Southern Myotis (*Myotis macropus)* – not likely unless dams are full

All the recorded species are considered to be highly mobile and would be likely to be accessing the site occasionally or opportunistically as foraging habitat across a landscape of fragmented habitat. Although these species have differing habitat requirements, they have been assessed together as the trees to be removed would be considered marginal habitats for all five species.

(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

The proposed work is not expected to remove vegetation which would be considered optimal or significant foraging/breeding habitat for the species. Marginal foraging habitat for microbat species may be removed (in the form of three trees) however this is not expected to place any microbat species at risk of extinction.

(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

Not an EEC

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

(c) in relation to the habitat of a threatened species or ecological community:

Currently no roosting/ breeding habitat and no trees to forage over. – this would be an insignificant impact area within the home range of microbat species. Microbat species are highly mobile and would be likely to be accessing the site occasionally or opportunistically as foraging habitat. It is unlikely that individuals would be exclusively reliant upon the trees being removed for foraging purposes.

(i) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

No core habitat will be removed or modified as a result of the proposed development. No areas of habitat will become fragmented or isolated from other areas of habitat as a result of the proposed action.

(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly), No areas of outstanding biodiversity value yet listed for this area.

(e) whether the proposed development or activity is, or is part of, a key threatening process or is likely to increase the impact of a key threatening process.

Yes, tree removal is part of the KTP of habitat loss – direct and indirect through loss of prey habitat.

Recommendations

Micro-bat boxes will be installed on-site x 2 (in trees on road edge). Boxes to be marine ply or equivalent and installed so that there is no nailing into the tree (see best practice – hanging of boxes and using coil springs to keep in place). Boxes to be at least 4m above the ground.

9 Expertise of authors

Geraldene Dalby-Ball
DIRECTOR

With over 30 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