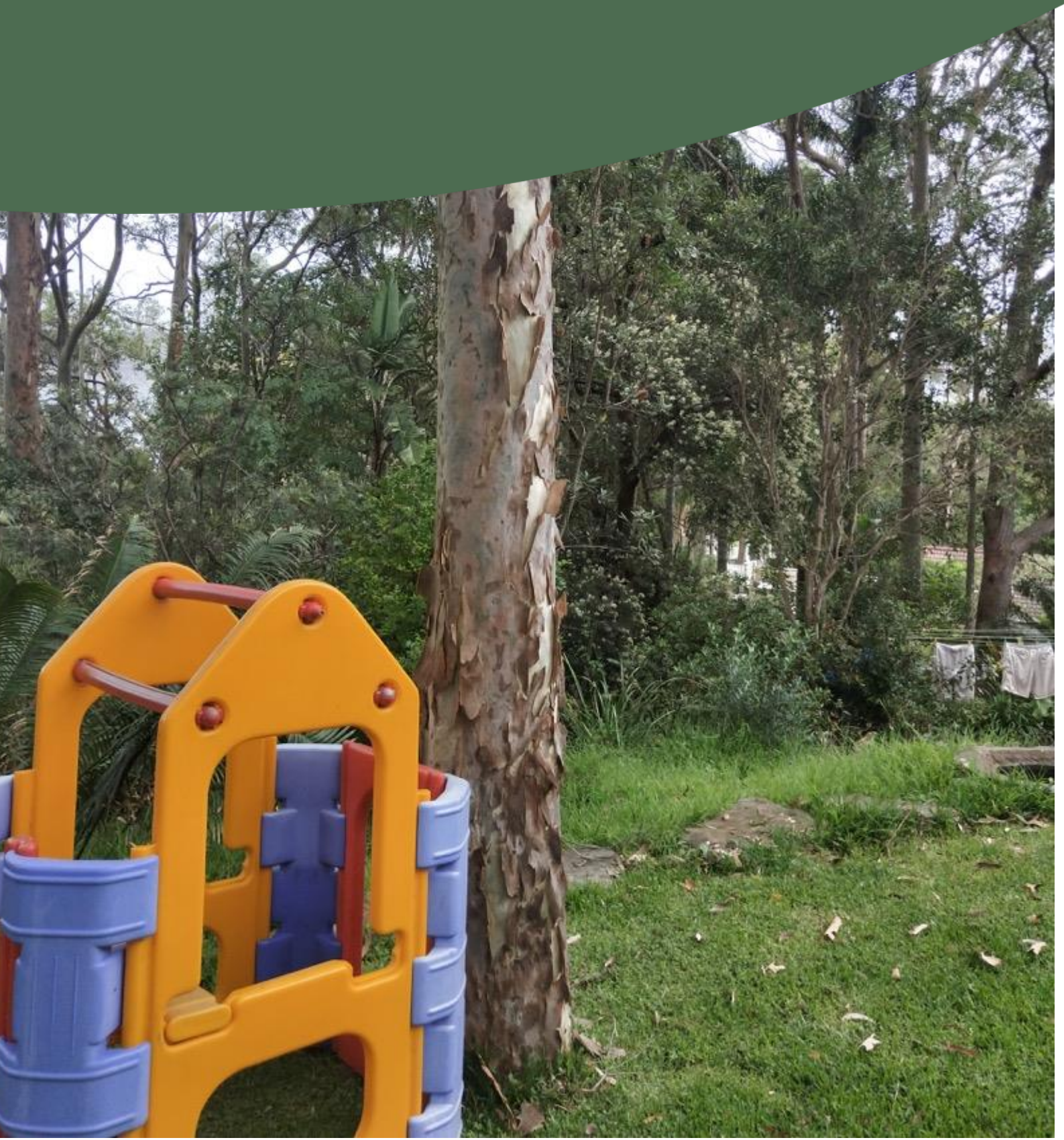
Flora and Fauna Assessment

29 Wandeen Road, Clareville NSW 2107

By Ecological Consultants Australia Pty Ltd TA

Kingfisher Urban Ecology and Wetlands

November, 2020



About this document

Copyright Statement©

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, Jack Hastings *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.

Document Control Sheet	
Title:	Flora and Fauna Assessment Report 29 Wandeen Road, Clareville NSW 2107
Version:	Final
Author:	Geraldene Dalby-Ball and Jack Hastings
Date:	November 2020
File location:	C:\Users\Geraldene\Dropbox\ECA 4 Projects\2 Projects\2020-2021\Flora Fauna BAM BDAR\29 Wandeen Road, Clareville
Distribution:	Patricia Quirk needpc73@gmail.com

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

Executive Summary

Introduction

- This Flora and Fauna was prepared for the land owner and applicant (Patricia Quirk) for the proposed development at 29 Wandeen Road, Clareville, NSW 2107 (Lot 89 in DP 13760), in the Northern Beaches Council LGA.
- The proposed development involves the alterations and additions to the existing dwelling.
- 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 18th of November 2020 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 or previously recorded via Bionet.
- No significant habitat features, values or landscape corridors will be impacted by the proposed development.
- The proposal does not trigger entry into the BOS.
- Tree protection will be consistent with the Arborist report (Growing My Way, 2020). Main trees to be managed are trees within close proximity to building works. NB: see final arborist report for details of works and tree numbers.
- The site is within the PWSGF EEC however the community is not in benchmark condition, site is landscaped.
- The building area is small and the design has considered the trees and maximises their retention.
- It is preferred that five (5) trees be removed as the development encroaches on the SRZ. The trees are in marginal condition and native landscaping post development will offset their removal from the site.
- Test of significance has been conducted for PWSG Forest – while is resulted in a 'not significant' impact for this community recommendations have been made to assists the long-term sustainability of this community. Appendix V contains 5-part tests.

Mitigation Measures

If the development is approved mitigation works will be required.

Before works:

- Tree Protection as per Arborist report.
- Removal of weeds to prevent spread of seed.
- Effective site management to minimise sediment runoff

During works:

- Tree Protection as per Arborist report.
- Effective site management to minimise sediment runoff
- Bush hygiene protocols are to be followed to prevent the spread of pathogens including *Phytophthora*.

After completion of works:

- Landscaping works will be conducted, native species recommended.

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.

- *Cwlth 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).*

Table of Contents

1 Introduction

1.1 Scope of works

Ecological Consultants Australia (ECA) trading as Kingfisher Urban Ecology & Wetlands has been contracted by the land owner and applicant (Patricia Quirk) to provide a "Flora and Fauna Assessment" to 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 Department of Planning, Industry and Environment (DPIE) '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 particular 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 Lot 89 in DP 13760, in the local government area of Northern Beaches Council.

The site has an area of 836.1 m^2, and currently contains native bushland.

Table 1 - Site Administrative Information

Category	Details
Title Reference (Lot/DP)	89/DP13760
Area (m^2)	836.1 m^2
Street Address	29 Wandeen Road, Clareville NSW 2107

LGA	Northern Beaches Council
Land Zoning	E4 – Environmental Living

Figure 1.0. Site location. Source: SixMaps 2020.

1.3 The Proposal

The proposed development is for the alterations and additions of an existing dwelling. The site is within the PWSGF EEC however the community is not in benchmark condition. It is anticipated that five (5) trees will be removed as the development encroaches on their SRZ.

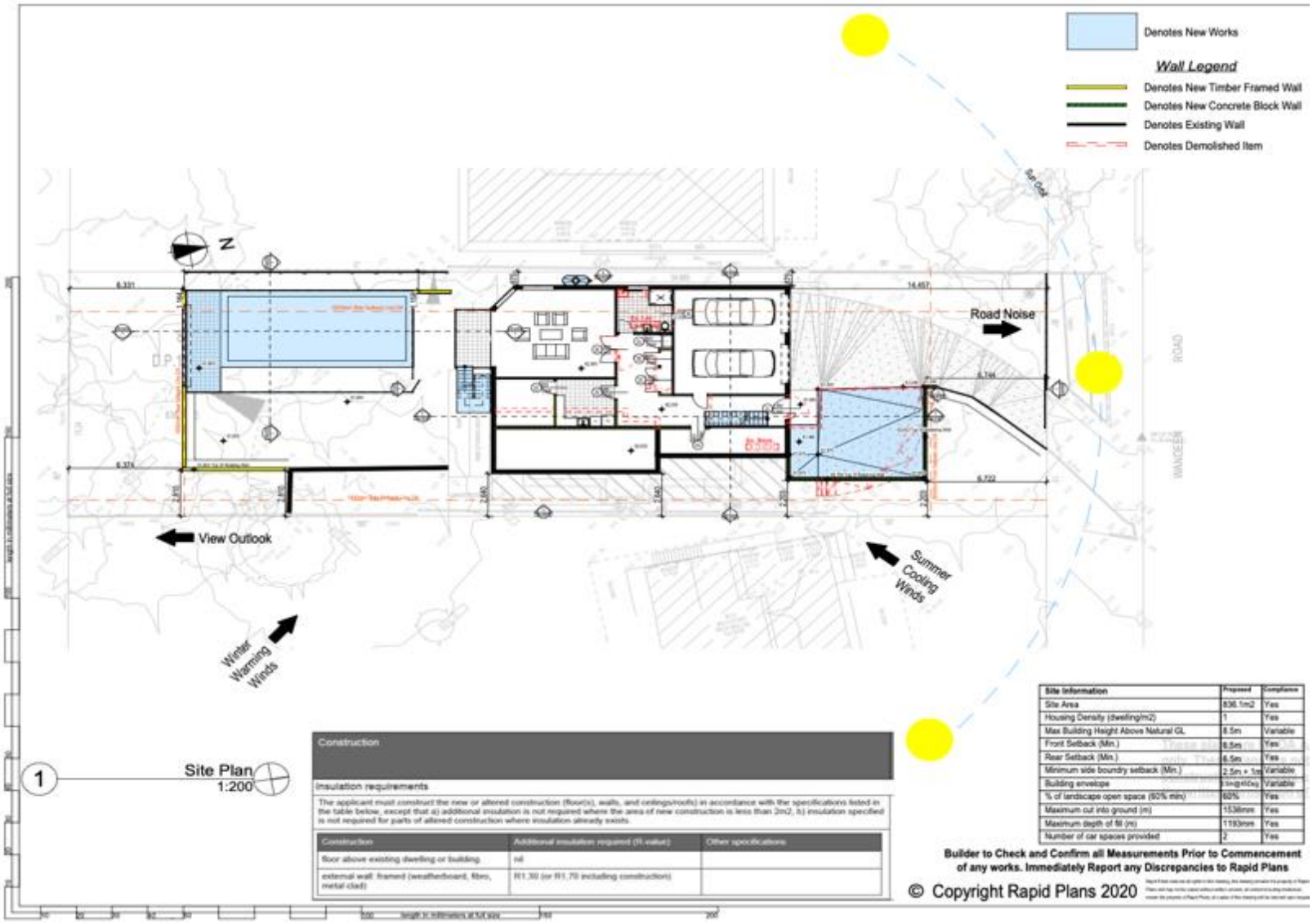


Figure 2 – Site Plan. Source: Rapid Plans Building Design and Architectural Drafting, 10/02/20.

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).
- The Native Vegetation of the Sydney Metropolitan Area - Version 3.1 (OEH, 2016) VIS_ID 4489.
- 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;

- Construction Impact & Management Statement. 'Growing My Way' Tree Consultancy. June 2020 (Arborist Report)
- QUIRK - DA Final. Rapid Plans Building Design and Architectural Drafting. October 2020

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 proposal indicates 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 have been conducted and the proposal was found to not have a significant impact on the current ecology of the site. The proposed development is complaint 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.

- Northern Beach Council DCP.

The proposal satisfies provisions outlined in the Pittwater Development Control Plan 21 - DCP - B4.7 (Pittwater Spotted Gum Forest).

B4.7 Pittwater Spotted Gum Forest - Endangered Ecological Community

Outcomes

- Conservation of intact Pittwater Spotted Gum Forest EEC. (En)
- Regeneration and/or restoration of fragmented and / or degraded Pittwater Spotted Gum Forest EEC. (En)
- Reinstatement of Pittwater Spotted Gum Forest to link remnants. (En)
- Long-term viability of locally native flora and fauna and their habitats through conservation, enhancement and/or creation of habitats and wildlife corridors. (En)

Controls

- Development shall not have an adverse impact on Pittwater Spotted Gum Endangered Ecological Community.
- Development shall restore and/or regenerate Pittwater Spotted Gum Endangered Ecological Community and provide links between remnants.
- Development shall be in accordance with any Pittwater Spotted Gum Forest Recovery Plan.

- Development shall result in no significant onsite loss of canopy cover or a net loss in native canopy trees.
- Development shall retain and enhance habitat and wildlife corridors for locally native species, threatened species and endangered populations.
- Caretakers of domestic animals shall prevent them from entering wildlife habitat.
- Fencing shall allow the safe passage of native wildlife.
- Development shall ensure that at least 80% of any new planting incorporates native vegetation (as per species found on the site or listed in Pittwater Spotted Gum Endangered Ecological Community).
- Development shall ensure any landscaping works are outside areas of existing Pittwater Spotted Gum Endangered Ecological Community and do not include Environmental Weeds.

The proposal will not significantly impact a remnant patch of PWSGF as the ground and mid-storey at the site has been significantly modified from a natural state. Five canopy of trees will be removed; however, this will not significantly fragment or isolate the existing wildlife corridor. The Long-term viability of native flora and fauna on site will be secured via native species landscaping.

It is recommended that locally native canopy species be incorporated into the landscaping schedule. See appendices IV for PWSGF species list. Impacts on native vegetation and the environment are expected to be negligible. Appropriate weed management during construction, followed by locally native plants would be expected to result in a net environmental benefit, when compared with current features on site. Installation of two nest boxes is recommended to increase habitat for microbats and forest owls.

2.1.1 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) and the thresholds for clearing which triggers BOS (0.25Ha or more). The building footprint will not remove more than 0.25Ha of native vegetation therefore the development does not trigger the BOS.

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 and the development will not clear >0.25Ha 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 2.2. The site (yellow box) located on the BV map

The site (yellow box) 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.

2 Methods

2.1 Site Inspections

On-ground survey took place on 18th of November 2020 by Ecologist Luke Johnson. . Weather was fine and sunny during day-time then cooler in the evening survey.

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.

2.1 Site Photos

Figure. 3.0. Existing gardens adjoining Wandeen Rd.

Figure. 3.1. Indication of current canopy cover on site.

Figure 3.2. Existing gardens on site – poor habitat value

Figure 3.3. Existing gardens on site – poor habitat value

Figure 3.4 Trees #1 and #2 *Corymbia maculata* to be removed.

Figure 3.5. Trees #4, #5, #6 *Corymbia maculata* to be removed – as extracted from Growing My Way, Arborist Report (2020)

3 Native vegetation

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

A review of the most up-to-date vegetation mapping, Sydney Metropolitan Area Vegetation Mapping - Version 3.1 (OEH, 2016) VIS_ID 4489), identified one plant community type (PCT) within site. The PCT is identified as, PCT 1214- Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion.

Threatened Ecological Community (TEC) Synonym- Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion (PWSGF). PWSGF is listed as an Endangered Ecological Community (EEC) under the NSW BC Act (2016).

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

NSW PCT Code	TEC Name	BC Act 2016	EPBC Act 1999
1214	Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion	Pittwater Spotted Gum forest State Conservation: Endangered Ecological Community (EEC)	Not listed

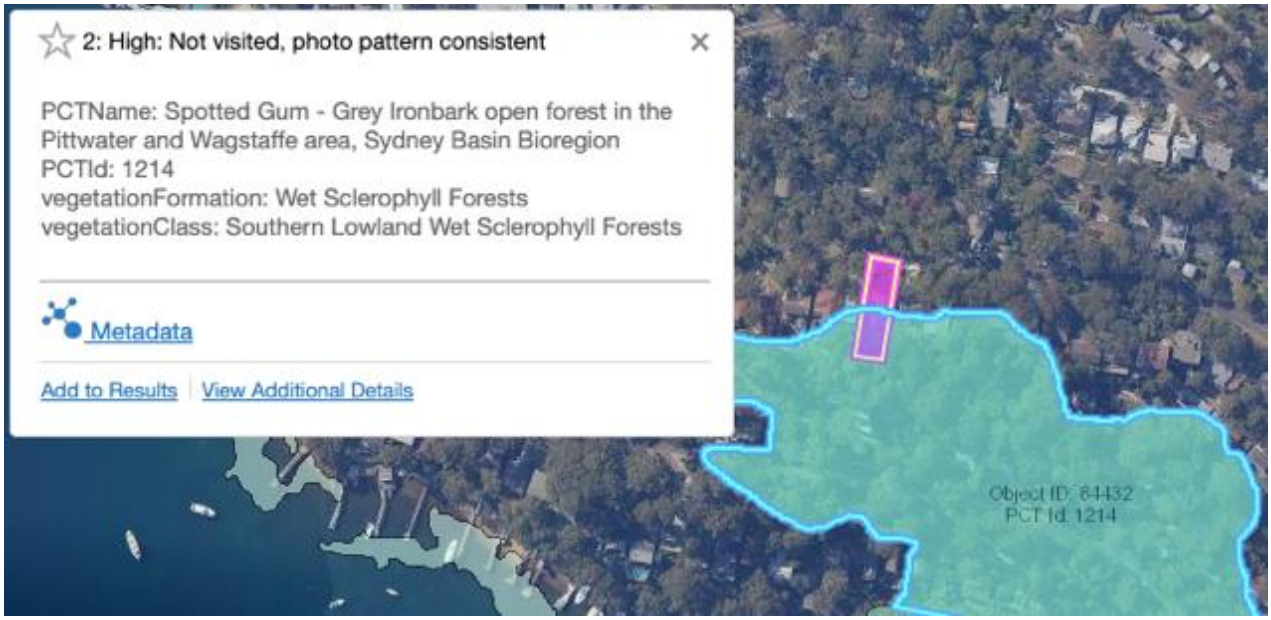


Figure 4 - Current PCT and Vegetation Zones Source: SEED 2020.

3.2 Field survey method – PCTs and Vegetation Zones

3.2.1 Field Survey

On-ground survey took place on 18th of November 2020 by Ecologist Luke Johnson. . Weather was fine and sunny during day-time then cooler in the evening survey. No threatened species (flora or fauna) were identified during. Nor were hollows observed in tree to be removed.

4 Threatened Species

4.1 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 17 species currently listed as vulnerable or endangered under state and/or commonwealth legislation, out of a total of 1,609 species. The vulnerable and endangered species to focus on-site searches for can be seen in **Table 3** below. This is based on likelihood of occurrence.

Table 3. Threatened flora recorded within a 10km radius since 1993. NSW OEH Bionet 2020.

Family	Scientific Name	Common Name	NSW status	Cwealth status	Records
Rutaceae	*Asterolasia elegans*		E1	E	1
Rutaceae	*Boronia umbellata*	Orara Boronia	V,P	V	1
Myrtaceae	*Callistemon linearifolius*	Netted Bottle Brush	V,3		4
Euphorbiaceae	*Chamaesyce psammogeton*	Sand Spurge	E1		7
Orchidaceae	*Cryptostylis hunteriana*	Leafless Tongue Orchid	V,P,2	V	1
Myrtaceae	*Eucalyptus camfieldii*	Camfield's Stringybark	V	V	7
Myrtaceae	*Eucalyptus nicholii*	Narrow-leaved Black Peppermint	V	V	4
Orchidaceae	*Genoplesium baueri*	Bauer's Midge Orchid	E1,P,2	E	1
Proteaceae	*Grevillea caleyi*	Caley's Grevillea	E4A,3	CE	51
Myrtaceae	*Kunzea rupestris*		V	V	1
Malvaceae	*Lasiopetalum joyceae*		V	V	1
Orchidaceae	*Microtis angusii*	Angus's Onion Orchid	E1,P,2	E	2
Proteaceae	*Persoonia hirsuta*	Hairy Geebung	E1,P,3	E	5

Family	Scientific Name	Common Name	NSW status	Cwealth status	Records
Thymelaeaceae	*Pimelea curviflora* var. *curviflora*		V	V	1
Myrtaceae	*Rhodamnia rubescens*	Scrub Turpentine	E4A		31
Myrtaceae	*Syzygium paniculatum*	Magenta Lilly Pilly	E1	V	16
Elaeocarpaceae	*Tetratheca glandulosa*		V		17

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

4.2 Threatened fauna

A total of 441 fauna species have been recorded within 10km of the study site according to BioNet records since 1993. Of these, 56 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** 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 Threatened fauna recorded within a 10km radius since 1993. NSW OEH Bionet 2020.

Class	Scientific Name	Common Name	NSW status	Cwealth status	Records
Amphibia	*Heleioporus australiacus*	Giant Burrowing Frog	V,P	V	25
Amphibia	*Litoria aurea*	Green and Golden Bell Frog	E1,P	V	2
Amphibia	*Pseudophryne australis*	Red-crowned Toadlet	V,P		45
Aves	*Anthochaera phrygia*	Regent Honeyeater	E4A,P	CE	37
Aves	*Ardenna carneipes*	Flesh-footed Shearwater	V,P	J,K	1
Aves	*Artamus cyanopterus cyanopterus*	Dusky Woodswallow	V,P		2
Aves	*Burhinus grallarius*	Bush Stone-curlew	E1,P		54
Aves	*Callocephalon fimbriatum*	Gang-gang Cockatoo	V,P,3		1
Aves	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V,P,2		74
Aves	*Dasyornis brachypterus*	Eastern Bristlebird	E1,P,2	E	1
Aves	*Diomedea exulans*	Wandering Albatross	E1,P	E	2
Aves	*Diomedea gibsoni*	Gibson's Albatross	V,P	V	1
Aves	*Esacus magnirostris*	Beach Stone-curlew	E4A,P		1

Class	Scientific Name	Common Name	NSW status	Cwealth status	Records
Aves	*Glossopsitta pusilla*	Little Lorikeet	V,P		8
Aves	*Haematopus fuliginosus*	Sooty Oystercatcher	V,P		7
Aves	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	V,P		42
Aves	*Hieraaetus morphnoides*	Little Eagle	V,P		4
Aves	*Hirundapus caudacutus*	White-throated Needletail	P	V,C,J,K	8
Aves	*Ixobrychus flavicollis*	Black Bittern	V,P		1
Aves	*Lathamus discolor*	Swift Parrot	E1,P,3	CE	15
Aves	*Lophoictinia isura*	Square-tailed Kite	V,P,3		3
Aves	*Macronectes giganteus*	Southern Giant Petrel	E1,P	E	1
Aves	*Melithreptus gularis gularis*	Black-chinned Honeyeater (eastern subspecies)	V,P		1
Aves	*Neophema pulchella*	Turquoise Parrot	V,P,3		1
Aves	*Ninox connivens*	Barking Owl	V,P,3		21
Aves	*Ninox strenua*	Powerful Owl	V,P,3		262
Aves	*Numenius madagascariensis*	Eastern Curlew	P	CE,C,J,K	8
Aves	*Pandion cristatus*	Eastern Osprey	V,P,3		5
Aves	*Petroica boodang*	Scarlet Robin	V,P		1
Aves	*Ptilinopus regina*	Rose-crowned Fruit-Dove	V,P		3
Aves	*Ptilinopus superbus*	Superb Fruit-Dove	V,P		2
Aves	*Thalassarche cauta*	Shy Albatross	V,P	V	3
Aves	*Thalassarche chrysostoma*	Grey-headed Albatross	P	E	1
Aves	*Thalassarche melanophris*	Black-browed Albatross	V,P	V	1
Aves	*Tyto novaehollandiae*	Masked Owl	V,P,3		4
Mammalia	*Cercartetus nanus*	Eastern Pygmy-possum	V,P		279
Mammalia	*Chalinolobus dwyeri*	Large-eared Pied Bat	V,P	V	16
Mammalia	*Dasyurus maculatus*	Spotted-tailed Quoll	V,P	E	5
Mammalia	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V,P		2

Class	Scientific Name	Common Name	NSW status	Cwealth status	Records
Mammalia	*Isoodon obesulus obesulus*	Southern Brown Bandicoot (eastern)	E1,P	E	31
Mammalia	*Micronomus norfolkensis*	Eastern Coastal Free-tailed Bat	V,P		12
Mammalia	*Miniopterus australis*	Little Bent-winged Bat	V,P		43
Mammalia	*Miniopterus orianae oceanensis*	Large Bent-winged Bat	V,P		71
Mammalia	*Myotis macropus*	Southern Myotis	V,P		17
Mammalia	*Petauroides volans*	Greater Glider	P	V	1
Mammalia	*Petaurus norfolcensis*	Squirrel Glider	V,P		5
Mammalia	*Phascolarctos cinereus*	Koala	V,P	V	76
Mammalia	*Pseudomys novaehollandiae*	New Holland Mouse	P	V	9
Mammalia	*Pteropus poliocephalus*	Grey-headed Flying-fox	V,P	V	138
Mammalia	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V,P		1
Mammalia	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V,P		7
Mammalia	*Vespadelus troughtoni*	Eastern Cave Bat	V,P		1
Reptilia	*Caretta caretta*	Loggerhead Turtle	E1,P	E	4
Reptilia	*Chelonia mydas*	Green Turtle	V,P	V	8
Reptilia	*Eretmochelys imbricata*	Hawksbill Turtle	P	V	1
Reptilia	*Varanus rosenbergi*	Rosenberg's Goanna	V,P		23

4.3 Endangered Populations

Two (2) **endangered populations** have been recorded to occur within 10km of the site. Table 5 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 5. Endangered Populations within 10km of site.

Family	Scientific Name	Common Name	NSW status	Cwealth status	Records
Mammalia	*Petaurus norfolcensis*	Squirrel Glider on Barrenjoey Peninsula, north of Bushrangers Hill	E2,V,P		1
Mammalia	*Phascolarctos cinereus*	Koala in the Pittwater Local Government Area	E2,V,P	V	76

Likelihood of occurrence

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 Impacts

5.1 Direct Impacts

5.1.1 Vegetation removal

Tree removal will be restricted to include only the trees which are affected by the development footprint. Trees proposed for removal are in good condition as identified in the Growing My Way, Arborist Report (2020) (page 23). Please refer to figures 3.4 -3.5 above for the trees to be removed.

. Trees proposed for removal according to arborist assessment include;

- Tree #1 – *Corymbia maculata* (Spotted Gum)
- Tree #2 – *Corymbia maculata* (Spotted Gum)
- Tree #3 – *Corymbia maculata* (Spotted Gum)
- Tree #4 – *Corymbia maculata* (Spotted Gum)
- Tree #5 - *Corymbia maculata* (Spotted Gum)

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 PWSGF species list, see appendix IV.

5.2 Indirect Impacts

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

5.2.1 Loss of Breeding Opportunities

Works on site may result in temporary-reduced breeding opportunities for locally occurring native species including amphibians, reptiles, birds, mammals and invertebrates through the production of construction noise and vegetation removal.

5.2.2 Weed growth and invasion

Weed species may arise within the direct works zone and surrounding landscaped areas through soil disturbance or by being brought in as seed on work machinery, tools, equipment and worker clothes (e.g. boots). Soil disturbance combined with the elevated nutrients and increased light exposure may result in increased weed growth, aggravated by the high abundance of weeds present pre-works.

5.2.3 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.

5.2.4 Noise

The proposed actions may result in noise which may result in minor disturbance to sensitive fauna in the local canopy.

5.2.5 Runoff

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

6 Recommendations

6.1 Mitigation Measures

The following mitigation measures have been suggested if the development is approved.

6.1.1 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 to Arborist report in a line with tree protection measures.

6.1.2 Tree Protection

Tree protection will be consistent with the Growing My Way, Arborist Report (2020). NB: see final arborist report for details of works and tree numbers. Please refer to figures 3.4 - 3.5 above for the trees to be removed. Figure 5 below is an extract form the Growing My Way, Arborist Report (2020) regarding tree protection.

"Site Specific Tree Plan of Management"

TREE # & IDENTIFICATION	RETAIN MANAGE PROTECT	Replacement Required	MANUAL EXCAVATION (for footings)	Install TPZ Fencing Install Tree Trunk Guard	CC Signoff	OC Signoff (confirming new trees to have been planted)
1 *Corymbia maculata* (Spotted Gum)	No	Yes (40cm container diameter is specified)	No	No No	No	Yes (confirming specified trees as being planted)
2 *Corymbia maculata* (Spotted Gum)	No	Yes (40cm	No	No	No	Yes (confirming

29 Wandeen Road, Clareville, NSW Page 24 of 28

Growing My Way Tree Services June 2020

		container diameter is specified)		No		specified trees as being planted)
3 *Corymbia maculata* (Spotted Gum)	No	Yes (40cm container diameter is specified)	No	No No	No	Yes (confirming specified trees as being planted)
4 *Corymbia maculata* (Spotted Gum)	No	Yes (40cm container diameter is specified)	No	No No	No	Yes (confirming specified trees as being planted)
5 *Corymbia maculata* (Spotted Gum)	No	Yes (40cm container diameter is specified)	No	No No	No	Yes (confirming specified trees as being planted)

Figure 5. Site Specific Tree Plan of Management as per the Growing My Way, Arborist Report (2020).

6.1.3 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).

6.1.4 Weed management

Weed species are present and must be appropriately managed so they do not spread. There must be continuous maintenance of the native vegetation onsite otherwise it may result in increased weed growth, exacerbated by the high abundance of weeds present pre-works.

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

6.1.5 Weed Removal Techniques

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

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

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

See Appendix II for further details. For key weed photo guide see Appendix I.

6.1.6 Nest boxes

Although it is not critical, installation of a single nest box designed for microbats should be added to the site to replace potential loss of roosting habitat.

Image from: nestboxes.com.au

6.1.7 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.)

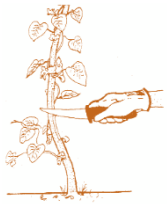
Myrtle Rust generally infects new leaf growth. (Image by John Tann, licensed under the Creative Commons Attribution 2.0 Generic license.)

7 Appendices

7.1 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, 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.

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 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.

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, ear muffs, 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 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.

7.2 Appendix II– 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.

7.3 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 8 – Threatened flora species likelihood of occurrence

Family	Scientific Name	Common Name	Habitat Preferences	Site Suitability
Rutaceae	*Asterolasia elegans*		Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby local government areas. Found in sheltered forests on mid-to lower slope sand valleys, e.g. in or adjacent to gullies which support sheltered forest.	No flora bearing the key identifying features of this species was seen within the site. No potential habitat within the site boundaries. No further assessment required. Low likelihood of occurrence
Rutaceae	*Boronia umbellata*	Orara Boronia	This Boronia grows as an understorey shrub in and around gullies in wet open forest. It appears to regenerate well after disturbance, but it is not known whether prolonged or repeated disturbance affects long-term persistence.	No flora bearing the key identifying features of this species was seen within the site. No potential habitat within the site boundaries. No further assessment required. Low likelihood of occurrence
Myrtaceae	*Callistemon linearifolius*	Netted Bottle Brush	For the Sydney area, recent records are limited to the Hornsby Plateau area near the Hawkesbury River. The species was more widespread in the past, and there are currently only 5-6 populations remaining from the 22 populations historically recorded in the Sydney area. Three of the remaining populations are reserved in Ku-ring-gai Chase National Park, Lion Island Nature Reserve and Spectacle Island Nature Reserve. The species has also been recorded from Yengo National Park. Grows in dry sclerophyll forest on the coast and adjacent ranges. Flowers in spring to summer.	No flora bearing the key identifying features of this species was seen within the site. No potential habitat within the site boundaries. No further assessment required. Low likelihood of occurrence

Family	Scientific Name	Common Name	Habitat Preferences	Site Suitability
Euphorbiaceae	*Chamaesyce psammogeton*	Sand Spurge	Grows on fore-dunes, pebbly strandlines and exposed headlands, often with Spinifex (*Spinifex sericeus*) and Prickly Couch (*Zoysia macrantha*). Flowering recorded in spring and summer. Sand Spurge seeds float, so some dispersal between beaches may occur. Longevity of the species is approximately 5–30 years with a primary juvenile period of less than 1 year. Plant growth occurs in spring and summer.	No flora bearing the key identifying features of this species was seen within the site. No potential habitat within the site boundaries. No further assessment required. Low likelihood of occurrence
Orchidaceae	*Cryptostylis hunteriana*	Leafless Tongue Orchid	Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. It appears to prefer open areas in the understorey and is often found in association with the Large Tongue Orchid and the Tartan Tongue Orchid.	No flora bearing the key identifying features of this species was seen within the site. No potential habitat within the site boundaries. No further assessment required. Low likelihood of occurrence
Myrtaceae	*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. capitellata* Brown Stringybark and *E. haemastoma* Scribbly Gum.	No flora bearing the key identifying features of this species was seen within the site. No potential habitat within the site boundaries. No further assessment required. Low likelihood of occurrence
Myrtaceae	*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	No flora bearing the key identifying features of this species was seen within the site. No potential habitat within the site boundaries. No further

Family	Scientific Name	Common Name	Habitat Preferences	Site Suitability
			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.	assessment required. Low likelihood of occurrence
Orchidaceae	*Genoplesium baueri*	Bauer's Midge Orchid	Grows in dry sclerophyll forest and moss gardens over sandstone.	No flora bearing the key identifying features of this species was seen within the site. No potential habitat within the site boundaries. No further assessment required. Low likelihood of occurrence
Proteaceae	*Grevillea caleyi*	Caley's Grevillea	Restricted to an 8 km square area around Terrey Hills, approximately 20 km north of Sydney. Occurs in three major areas of suitable habitat, namely Belrose, Ingleside and Terrey Hills/Duffys Forest within the Ku-ring-gai, Pittwater and Warringah Local Government Areas. Recorded existing on the ridgetop between elevations of 170 to 240m asl, in association with laterite soils and a vegetation community of open forest, generally dominated by *Eucalyptus sieberi* and *E. gummifera*.	No flora bearing the key identifying features of this species was seen within the site. No potential habitat within the site boundaries. No further assessment required. Low likelihood of occurrence
Myrtaceae	*Kunzea rupestris*		Restricted, with most locations in the Maroota - Sackville - Glenorie area and one outlier in Ku-ring-gai Chase National Park, all within the Central Coast botanical subdivision of NSW. Currently known to exist in 20 populations, 6 of which are reserved. 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	No flora bearing the key identifying features of this species was seen within the site. No potential habitat within the site boundaries. No further assessment required. Low likelihood of occurrence

Family	Scientific Name	Common Name	Habitat Preferences	Site Suitability
			week. Resprouts from the base after fire or mechanical damage. Seedlings have also been observed after fire.	
Malvaceae	*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.	No flora bearing the key identifying features of this species was seen within the site. No potential habitat within the site boundaries. No further assessment required. Low likelihood of occurrence
Orchidaceae	*Microtis angusii*	Angus's Onion Orchid	Currently known from only one site at Ingleside, north of Sydney. The Ingleside population occurs on soils that have been modified but were originally those of the restricted ridgetop lateritic soils in the Duffys Forest - Terrey Hills - Ingleside and Belrose areas.	No flora bearing the key identifying features of this species was seen within the site. No potential habitat within the site boundaries. No further assessment required. Low likelihood of occurrence
Proteaceae	*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 flora bearing the key identifying features of this species was seen within the site. No potential habitat within the site boundaries. No further assessment required. Low likelihood of occurrence
Thymelaeaceae	*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 Illawaraa coastal plain. Flowers October to May. Has an inconspicuous cryptic habit as it is fine and scraggly and	No flora bearing the key identifying features of this species was seen within the site. No potential habitat within the site boundaries. No further

Family	Scientific Name	Common Name	Habitat Preferences	Site Suitability
			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.	assessment required. Low likelihood of occurrence
Myrtaceae	*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.	No flora bearing the key identifying features of this species was seen within the site. No potential habitat within the site boundaries. No further assessment required. Low likelihood of occurrence
Myrtaceae	*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.	No flora bearing the key identifying features of this species was seen within the site. No potential habitat within the site boundaries. No further assessment required. Low likelihood of occurrence
Elaeocarpaceae	*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.	No flora bearing the key identifying features of this species was seen within the site. No potential habitat within the site boundaries. No further assessment required. Low likelihood of occurrence

Table 9 – **Threatened fauna species likelihood of occurrence**

Fauna

Scientific Name	Common Name	Habitat Preferences	Site Suitability
Heleioporus australiacus	Giant Burrowing Frog	Sites must have native vegetation. The species has not been found on cleared land. Occurs in hanging swamps on sandstone shelves and along perennial creeks. The species is not restricted to watercourses.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
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	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
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.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
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.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
Ardenna carneipes	Flesh-footed Shearwater	Nest on Lord Howe Island in forests on sandy soils from Ned's Beach to Clear Place, with smaller colonies below Transit Hill and at Old Settlement Beach. Eggs are laid at the end of a burrow 1 - 2 metres in length.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or

Scientific Name	Common Name	Habitat Preferences	Site Suitability
			consideration is required. Low likelihood of occurrence
Artamus cyanopterus 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.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
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.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
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.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
Calyptorhynchus lathami	Glossy Black-Cockatoo	Lives in coastal woodlands and drier forest areas, open inland woodlands or timbered watercourses where casuarinas (or sheoaks), 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.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence

Scientific Name	Common Name	Habitat Preferences	Site Suitability
Dasyornis brachypterus	Eastern Bristlebird	Habitat for central and southern populations is characterised by dense, low vegetation including heath and open woodland with a heathy understorey. In northern NSW the habitat occurs in open forest with dense tussocky grass understorey and sparse mid-storey near rainforest ecotone; all of these vegetation types are fire prone.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
Diomedea exulans	Wandering Albatross	The Wandering Albatross visits Australian waters extending from Fremantle, Western Australia, across the southern water to the Whitsunday Islands in Queensland between June and Spetember. It has been recorded along the length of the NSW coast. At other times birds roam the southern oceans and commonly follow fishing vessels for several days. Wandering albatross spend the majority of their time in flight, soaring over the southern oceans. They breed on a number of islands just north of the Antarctic Circle: South Georgia Island (belonging to the UK), Prince Edward and Marion Islands (South Africa), Crozet and Kerguelen Islands (French Southern Territories) and Macquarie Island (Australia). Breeding takes place on exposed ridges and hillocks, amongst open and patchy vegetation. Wandering albatross pairs mate for life; these long-lived birds do not reach sexual maturity until 9-11 years of age. Wandering Albatross breed bienially in small, loose colonies among grass tussocks, using a large mud nest. A single egg is laid; both parents incubate the egg (that hatches after two months) and feed the growing chick, which remains on the nest for around 9 months. They feed in pelagic, offshore and inshore waters, often at night, taking fish and cephalopods such as squid, crustaceans and carrion, and will often follow ships feeding on the refuse they trail.	
Diomedea gibsoni	Gibson's Albatross	Essentially endemic to the Auckland Islands of New Zealand. The non-breeding range is poorly known however the species probably disperses across the southern Pacific. The species is regularly encountered on trans-Tasman shippping routes and at seas off Sydney, and regularly occurs off the NSW coast usually between Green Cape and Newcastle. This species is known only to breed on the Adams, Disappointment and Auckland Islands in the subantarctic Auckland Island group. Breeds bienially in colonies	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence

Scientific Name	Common Name	Habitat Preferences	Site Suitability
		among grass tussocks on isolated subantarctis islands, using the wind to travel great distances both during and between breeding seasons. Most eggs are laid in December and January, with chicks fledging the following year in January and February. The annual breeding population is relatively small and has been estimated at 6,077 pairs. This species regularly occurs off the NSW coast from Green Cape to Newcastle. Although representing a small proportion on its total foraging area, potential forage in NSW waters during the winter is nonetheless considered significant for the species. Forage for Gibson's Albatross is extremely patchy, both spatially and temporally, and individuals traverse great distances in search of food. This species feeds pelagically on squid, fish and crustaceans. Satellite tracking studies have shown that foraging areas used by males and females are mutually exclusive; females frequent the Tasman Sea, whereas males disperse to lower latitudes or move north-east into the mid-Pacific Ocean.	
Esacus magnirostris	Beach Stone-curlew	The Beach Stone-curlew has been recorded around the north coast of Australia, mainly between mid-north Western Australia and north-east NSW. The species has largely disappeared from the south-east of its former range and is now rarely recorded on ocean beaches in NSW. Occurs on open, undisturbed beaches, islands, reefs, and estuarine intertidal sandflats and mudflats; beaches with estuaries or mangroves nearby are preferred; may also frequent river mouths, offshore sandbars and rock platforms. Individuals forage with slow deliberate heron-like actions. The diet consists of crabs and other marine invertebrates. Less strictly nocturnal than the Bush Stone-curlew. Breeding occurs from September to November, with nests being located on sandbanks, spits or islands in estuaries, among mangroves, or in sand surrounded by short grasses and scattered casuarinas. One egg is laid, and both parents care for the young until independence is reached at seven to twelve months.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
Glossopsitta pusilla	Little Lorikeet	Prefers open Eucalypt forest and woodlands. Primarily feeds within the canopy of Eucalyptus, Angophora and Melaleuca trees. Prefers riparian areas but may visit isolated trees in open or cleared land.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or

Scientific Name	Common Name	Habitat Preferences	Site Suitability
			consideration is required. Low likelihood of occurrence
Haematopus fuliginosus	Sooty Oystercatcher	Inhabits rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries. Forages on exposed rock or coral at low tide for foods such as limpets and mussels. Breeds in spring and summer, almost exclusively on offshore islands, and occasionally on isolated promontories.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
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.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
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.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence

Scientific Name	Common Name	Habitat Preferences	Site Suitability
Hirundapus caudacutus	White-throated Needletail	White-throated Needletails often occur in large numbers over eastern and northern Australia. They arrive in Australia from their breeding grounds in the northern hemisphere in about October each year and leave somewhere between May and August. They are aerial birds and for a time it was commonly believed that they did not land while in Australia. It has now been observed that birds will roost in trees, and radio-tracking has since confirmed that this is a regular activity. The White-throated Needletail feeds on flying insects, such as termites, ants, beetles and flies. They catch the insects in flight in their wide gaping beaks. Birds usually feed in rising thermal currents associated with storm fronts and bushfires and they are commonly seen moving with wind fronts. White-throated Needletails are non-breeding migrants in Australia.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
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.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
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.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
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	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence

Scientific Name	Common Name	Habitat Preferences	Site Suitability
		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 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.	
Macronectes giganteus	Southern Giant Petrel	The Southern Giant Petrel has a circumpolar pelagic range from Antarctica to approximately 20° S and is a common visitor off the coast of NSW. Over summer, the species nests in small colonies amongst open vegetation on Antarctic and subantarctic islands, including Macquarie and Heard Islands and in Australian Antarctic territory. A single chick is raised and although breeding occurs annually, approximately 30% of the potential breeding population does not nest. It is an opportunistic scavenger and predator, and scavenges from fishing vessels and animal carcasses on land. It is also an active predator of cephalopods and euphausiids, as well as smaller birds (particularly penguins) both at land and at sea. Birds will desert their nests if disturbed at the breeding colony.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
Melithreptus gularis 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 sheoaks (nesting) and tea-trees.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
Neophema pulchella	Turquoise Parrot	Occurs on edges of eucalypt woodlands, ridges through forests and creeks. Prefers shading for ground foraging.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence

Scientific Name	Common Name	Habitat Preferences	Site Suitability
Ninox connivens	Barking Owl	Inhabits eucalypt woodland, open forest, swamp woodlands and, especially in inland areas, timber along watercourses. Denser vegetation is used occasionally for roosting. During the day they roost along creek lines, usually in tall understorey trees with dense foliage such as Acacia and Casuarina species, or the dense clumps of canopy leaves in large Eucalypts. Feeds on a variety of prey, with invertebrates predominant for most of the year, and birds and mammals such as smaller gliders, possums, rodents and rabbits becoming important during breeding. Live alone or in pairs. Territories range from 30 to 200 hectares and birds are present all year. Three eggs are laid in nests in hollows of large, old eucalypts including River Red Gum (*Eucalyptus camaldulensis*), White Box (*Eucalyptus albens*), (Red Box) *Eucalyptus polyanthemos* and Blakely's Red Gum (*Eucalyptus blakelyi*). Breeding occurs during late winter and early spring.	Marginal potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
Ninox strenua	Powerful Owl	The species requires large tracts of forest or woodland, however fragmented landscapes can contribute to their range. Breeds in forests and woodlands but may forage in open areas. Mainly preys upon medium sized arboreal mammals. Requires tree hollows for breeding.	Potential habitat occurs within the site and in the surrounding areas. The species would be expected to utilize the remnant vegetation within the site as foraging habitat. Specifically, the species would be expected to utilise the vegetation canopy for invertebrate foraging resources.
Numenius madagascariensis	Eastern Curlew	The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. The Eastern Curlew mainly forages on soft sheltered intertidal sandflats or mudflats, open and without vegetation or covered with seagrass, often near mangroves, on saltflats and in saltmarsh, rockpools and among rubble on coral reefs, and on ocean beaches near the tideline. The Eastern Curlew roosts on sandy spits and islets, especially on dry beach sand near the high-water mark, and among coastal vegetation including low saltmarsh or mangroves. It occasionally roosts on reef-flats, in the shallow water of lagoons and other near-coastal wetlands.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence

Scientific Name	Common Name	Habitat Preferences	Site Suitability
Pandion cristatus	Eastern Osprey	Inhabits coastal areas, especially the mouths of large rivers, lagoons and lakes. Feeds on fish over clear, open water. Breed from July to September in NSW. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
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.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
Ptilinopus regina	Rose-crowned Fruit-Dove	Coast and ranges of eastern NSW and Queensland, from Newcastle to Cape York. Vagrants are occasionally found further south to Victoria. Rose-crowned Fruit-doves occur mainly in sub-tropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest, where fruit is plentiful. They are shy pigeons, not easy to see amongst the foliage, and are more often heard than seen. They feed entirely on fruit from vines, shrubs, large trees and palms, and are thought to be locally nomadic as they follow the ripening of fruits. Some populations are migratory in response to food availability - numbers in north-east NSW increase during spring and summer then decline in April or May.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
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.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
Thalassarche cauta	Shy Albatross	This species is circumpolar in distribution, occurring widely in the southern oceans. Islands off Australia and New Zealand provide breeding habitat. In Australian waters, the Shy Albatross occurs along the east coast from Stradbroke Island in Queensland along the entire south coast of the continent to Carnarvon in Western Australia. Although uncommon north of Sydney, the species is commonly recorded off southeast NSW,	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence

Scientific Name	Common Name	Habitat Preferences	Site Suitability
		particularly between July and November, and has been recorded in Ben Boyd National Park. This pelagic or ocean-going species inhabits subantarctic and subtropical marine waters, spending the majority of its time at sea. While at sea, it soars on strong winds and when calm, individuals may rest on the ocean, in groups during the breeding season or as individuals at other times. Occasionally the species occurs in continental shelf waters, in bays and harbours. The species feeds on fish, crustaceans, offal and squid and may forage in mixed-species flocks. Food may be caught by seizing prey from the water's surface while swimming, by landing on top of prey, diving for prey beneath the water and by scavenging behind fishing vessels. Known breeding locations include Albatross Island off Tasmania, Auckland Island, Bounty Island and The Snares, off New Zealand, where nesting colonies of 6-500 nests occur and may contain other species such as the Australian Gannet. Located on sheltered sides of islands, on cliffs and ledges, in crevices and slopes, nests are used annually and consist of a mound of mud, bones, plant matter and rocks. Parents are territorial while nesting, having both defensive and mating displays. Breeding occurs September-December, when a single egg is laid and incubated for 72 days. Both parents feed and guard the young for approximately 5 months before they fledge and become independent.	
Thalassarche melanophris	Black-browed Albatross	The Black-browed Albatross has a circumpolar range over the southern oceans, and are seen off the southern Australian coast mainly during winter. This species migrates to waters off the continental shelf from approximately May to November and is regularly recorded off the NSW coast during this period. The species has also been recorded in Botany Bay National Park. Inhabits antarctic, subantarctic, subtropical marine and coastal waters over upwellings and boundaries of currents. Can tolerate water temperatures between 0oC and 24oC. Spends most of its time at sea, breeding on small isolated islands. When at sea, individuals soar on strong winds and rest on the ocean, when calm, often in groups. This species feeds on fish, crustaceans, offal and squid and often forages in flocks with other seabirds. Individuals seize prey from the surface while swimming or landing, sometimes submerging their head and body to	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence

Scientific Name	Common Name	Habitat Preferences	Site Suitability
		capture prey underwater, and they scavenge in large flocks behind fishing vessels. This species nests annually on a mound of soil and vegetation, on the cliffs or steep slopes of vegetated antarctic and subantarctic islands. Colonies of up to 100,000 nests are formed, occasionally containing other species such as the Grey-headed Albatross, during which time the birds are territorial while nesting. Breeding occurs September-December, when a single egg is laid and incubated for 65-72 days by both parents. Both parents feed and guard the young for 4-5 months before they fledge and become independent. After breeding, the fledgling and adults leave the breeding colony, with the young reaching breeding age at approximately 11 years of age.	
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.	Potential habitat occurs within the site and in the surrounding areas. The species would be expected to utilize the remnant vegetation within the site as foraging habitat. Specifically, the species would be expected to utilise the vegetation canopy for invertebrate foraging resources.
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.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
Chalinolobus dwyeri	Large-eared Pied Bat	Large-eared Pied Bat roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features.	Potential habitat occurs within the site and in the surrounding areas. The species would be expected to utilize the remnant vegetation within the site as foraging habitat. Specifically, the species would be expected to utilise the vegetation canopy for invertebrate foraging resources.

Scientific Name	Common Name	Habitat Preferences	Site Suitability
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, small caves, rock outcrops and rocky-cliff faces as den sites. Mostly nocturnal animal feeding on medium-sized (500g-5kg) mammals.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
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.	Potential habitat occurs within the site and in the surrounding areas. The species would be expected to utilize the remnant vegetation within the site as foraging habitat. Specifically, the species would be expected to utilise the vegetation canopy for invertebrate foraging resources.
Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)	Species found in heath or open forest with a heathy understorey on sandy or friable soils. They feed on a variety of ground-dwelling invertebrates and the fruit-bodies of hypogenous (underground-fruiting) fungi.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
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 maily in tree hollows but will also roost under bark or in man-made structures. Usually solitary but also recorded roosting communally, probably insectivorous.	Potential habitat occurs within the site and in the surrounding areas. The species would be expected to utilize the remnant vegetation within the site as foraging habitat. Specifically, the species would be expected to utilise the vegetation canopy for invertebrate foraging resources.
Miniopterus australis	Little Bent-winged Bat	Moist eucalypt forest, rainforest or dense coastal banksia scrub. Little Bentwing-bats roost in caves, tunnels and sometimes tree hollows during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. They often share roosting sites with the Common Bentwing-bat and, in winter, the two species may form mixed clusters. In NSW the largest maternity colony is in close association with a large maternity colony of Common Bentwing-bats (*M. schreibersii*) and	Potential habitat occurs within the site and in the surrounding areas. The species would be expected to utilize the remnant vegetation within the site as foraging habitat. Specifically, the species would be expected to utilise the vegetation canopy for invertebrate foraging resources.

Scientific Name	Common Name	Habitat Preferences	Site Suitability
		appears to depend on the large colony to provide the high temperatures needed to rear its young.	
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.	Potential habitat occurs within the site and in the surrounding areas. The species would be expected to utilize the remnant vegetation within the site as foraging habitat. Specifically, the species would be expected to utilise the vegetation canopy for invertebrate foraging resources.
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.	Potential habitat occurs within the site and in the surrounding areas. The species would be expected to utilize the remnant vegetation within the site as foraging habitat. Specifically, the species would be expected to utilise the vegetation canopy for invertebrate foraging resources.
Petauroides volans	Greater Glider	Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Inactive for most of the day, feeding and moving mostly at night. Spend most of their time in trees, but will descend and traverse open ground to move between trees. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
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.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence

Scientific Name	Common Name	Habitat Preferences	Site Suitability
Petaurus norfolcensis	Squirrel Glider on Barrenjoey Peninsula, north of Bushrangers Hill	NSW: Occurs on the coast in a range of habitats including low scrubby eucalypt woodlands and banksia thickets to tall, wet eucalypt forests bordering on rainforest. The availability of a year-round supply of carbohydrates (nectar, sap, gum, and honeydew) appears to be an important habitat feature. In NSW, this corresponds to a high diversity of tree and shrub species, including a high nectar producing species and one or more winter flowering species. In Pittwater, important food sources are likely to be the winter flowering Coast Banksia (*Banksia integrifolia*) and Spotted Gum (*Corymbia maculata*) and the summer flowering Old Man Banksia (*B. serrata*) and Grey Ironbark (*Eucalyptus paniculata*). Other likely food sources include *Angophora costata, Banksia spinulosa, Corymbia gummifera, Eucalyptus botryoides, E. punctata, E. robusta, Melaleuca quinquernervia,* mistletoes and *Xanthorrhoea* species. This animal will gouge and lick incisions on the trunks and main branches of *Eucalyptus*, *Corymbia* and *Angophora* trees to feed on sap and on Acacia trees and shrubs to feed on gum, especially when nectar is in short supply. Tree hollows are an important habitat feature providing den sites for raising young. Hollows can be found in trees of the following genera *Eucalyptus*, *Corymbia* and *Angophora*. Other species such as *Melaleuca quinquenervia* can also provide suitable hollows.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
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.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
Phascolarctos cinereus	Koala in the Pittwater Local Government Area	Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Inactive for most of the day, feeding and moving mostly at night. Spend most of their time in trees, but will descend and traverse open ground to move between trees. Home range size varies	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence

Scientific Name	Common Name	Habitat Preferences	Site Suitability
		with quality of habitat, ranging from less than two ha to several hundred hectares in size.	
Pseudomys novaehollandiae	New Holland Mouse	The New Holland Mouse has a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Known to inhabit open heathlands, open woodlands with a heathland understorey and vegetated sand dunes. Lives predominantly in burrows shared with other individuals	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
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.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
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.	Potential habitat occurs within the site and in the surrounding areas. The species would be expected to utilize the remnant vegetation within the site as foraging habitat. Specifically, the species would be expected to utilise the vegetation canopy for invertebrate foraging resources.
Scoteanax rueppellii	Greater Broad-nosed 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.	Potential habitat occurs within the site and in the surrounding areas. The species would be expected to utilize the remnant vegetation within the site as foraging habitat. Specifically, the species would be expected to utilise the vegetation canopy for invertebrate foraging resources.
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.	Potential habitat occurs within the site and in the surrounding areas. The species would be expected to utilize the remnant vegetation within the site as foraging

Scientific Name	Common Name	Habitat Preferences	Site Suitability
			habitat. Specifically, the species would be expected to utilise the vegetation canopy for invertebrate foraging resources.
Caretta caretta	Loggerhead Turtle	Loggerhead Turtles are ocean-dwellers, foraging in deeper water for fish, jellyfish and bottom-dwelling animals. The female comes ashore to lay her eggs in a hole dug on the beach in tropical regions during the warmer months.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
Chelonia mydas	Green Turtle	Ocean-dwelling species spending most of its life at sea. Carnivorous when young but as adults they feed only on marine plant material. Eggs laid in holes dug in beaches throughout their range. Scattered nesting records along the NSW coast.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence
Varanus rosenbergi	Rosenberg's Goanna	Found in heath, open forest and woodland. Associated with termites, the mounds of which this species nests in; termite mounds are a critical habitat component. Individuals require large areas of habitat. Feeds on carrion, birds, eggs, reptiles and small mammals. Shelters in hollow logs, rock crevices and in burrows, which they may dig for themselves, or they may use other species' burrows, such as rabbit warrens.	Low potential for the species to occur within the site due to low habitat quality of the site. No further assessment or consideration is required. Low likelihood of occurrence

7.4 Appendix IV – PWSGF Species List.

Table 10. PCT 1214 - Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion species list. Source- Bionet Vegetation Classification 2020.

Scientific Name	Common Name
Upper Stratum	
Corymbia maculata	Spotted Gum
Allocasuarina torulosa	Forest Oak
Elaeocarpus reticulatus	Blueberry Ash
Eucalyptus paniculata	Grey Ironbark
Eucalyptus umbra	Broad-leaved White Mahogany
Glochidion ferdinandii	Cheese Tree
Corymbia gummifera	Red Bloodwood
Eucalyptus botryoides	Southern Mahogany
Mid Stratum	
Podolobium ilicifolium	Prickly Shaggy-pea
Macrozamia communis	Burrawang
Notelaea longifolia	Large-leaved Olive
Synoum glandulosum subsp. *glandulosum*	Scentless Rosewood
Ground Stratum	
Billardiera scandens	Apple Berry
Dianella caerulea	Blue Flax-lily
Entolasia stricta	Wiry Panic
Lomandra longifolia	Spiky-headed Mat-rush
Xanthorrhoea macronema	Bottlebrush Grass Tree
Microlaena stipoides var. *stipoides*	Weeping Grass
Schelhammera undulata	Lilac Lily
Themeda australis	Kangaroo Grass

7.1 Appendix V – Test of Significance (5 Part Test).

7.1.1 Pittwater Wagstaff Spotted Gum Forest EEC (PWSGF)

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,

Not a Threatened Species

In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

(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

The local occurrence of PWSGF is already at risk of extinction. The proposal is unlikely to place the community at a greater risk of extinction. The building area is small and the design has taken into account the PWSGF community. Overall impacts on the community are expected to be negligible and as such unlikely to place the community at a greater risk of extinction.

(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,

It is unlikely that the proposal will substantially and adversely modify the composition of the ecological community. Five trees are proposed for removal. The inclusion of canopy tree planting and planting of locally native mid and understory species is recommended as it will be a benefit to the community.

The small impact area is unlikely to substantially and adversely modify the composition of the ecological community. Appropriate mitigation measures will be introduced to restore and improve the condition of the EEC if the development is approved.

b) In relation to the habitat of a threatened species or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

The proposal does not significantly reduce the habitat area or potential habitat area for PWSGF EEC. The proposal will remove five trees, although the area of habitat is in poor condition.

Appropriate mitigation measures will be introduced to restore and improve the condition of the EEC if the development is approved.

(ii) 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

The proposal will not increase fragmentation of the community nor will areas of PWSGF become isolated. The understory has been modified with the existing structures and gardens.

the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

Habitat will be removed in the areas of the building footprint. Habitat in the areas proposed for modification is already highly disturbed and in poor conditions. Native species landscaping is expected to support habitat for native species.

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),

Declared areas of outstanding biodiversity value have not yet been declared in this area.

c) 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.

Land clearing is a key threatening process. Although the area of impact is small and does not significantly alter or impact the PWSGF EEC. The proposal will not cause an increase in any KTP.

Conclusion

Ecologists have concluded that there will be no significant impact upon Pittwater Wagstaff Spotted Gum Forest EEC as a result of this development. The inclusion of canopy tree planting and planting of locally native mid and understory species is recommended.

7.1.2 Large Forest Owls Populations Barking, Powerful, Eastern Grass and Sooty, (*Ninox connivens, Ninox strenua, Tyto longimembris, Tyto tenebricosa*).

(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 tree removals would not however, alone, be expected to adversely affect the life cycle of Large Forest Owls such that a local population would become extinct. Potential impacts from the removal of trees and thus prey species. Tree proposed for removal do not host suitable breeding habitat features for Large Forest Owls. The proposal is unlikely to affect the life cycle of a local population of Large Forest Owls.

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

Not 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:

(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

Habitat for Large Forest Owls will not be removed because of this development. Marginal foraging habitat for owl prey species may be removed (in the form of five trees) however this is not expected to cause a significant impact for Large Forest Owls.

(ii) 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

The removal of trees from the site will include three trees and thus the prey species that use these trees preferentially. This is not expected to fragment or isolate the general habitat of Large Forest Owls.

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.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

No essential habitat being removed. Habitat to be removed is not known breeding or roosting habitat.

(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.

Conclusion:

This proposal is not likely to significantly affect Populations of Large Forest Owls (*Ninox connivens, Ninox strenua, Tyto longimembris, Tyto tenebricosa*) and will not be likely to put the local population at risk of extinction.

7.1.3 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)*

All of 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 habitat 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 five 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:

Five trees will be removed– 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. 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.

8 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 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.

Jack Hastings

ECOLOGIST

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.**