



NARLA
environmental

Flora and Fauna Assessment

41 Marine Parade, Avalon

Report prepared for Casey Brown Architecture Pty Ltd

May 2016





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environmental

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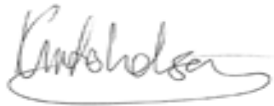
Report Certification

Works for this report were undertaken by:

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I, Kurtis Lindsay, certify that:

- this Flora and Fauna Assessment has been prepared in accordance with the brief provided by the client.
- the information presented in this report is a true and accurate record of the study findings in the opinion of the authors.



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1. Introduction

1.1 Background and Project Proposal

Narla Environmental Pty Ltd (Narla) was engaged by Casey Brown Architecture Pty Ltd on behalf of Ms Jane Rowe (the proponent) to undertake an Ecological Impact Assessment in association with the Development Application (DA) for the knockdown and rebuild of the residence at 41 Marine Parade, Avalon Beach ('the subject site') (**Figure 1**).

The proposed development is considered an 'Ecologically Sustainable Development'. Defined as such, *on the basis that the development maintains the ecological processes on which life depends while meeting the needs and improving the total quality of life of the present generation, without compromising the ability of future generations to do the same.*

Ecologically sustainable development is the primary objective of the Environmental Living (E4) zoning specified by the Pittwater Local Environmental Plan, 2014 (LEP) and is fundamental to the environmental, social and economic objectives of the Pittwater 21 Development Control Plan (DCP).

Environmental Objectives

This development will satisfy the zone objectives of the LEP, which are to:

- Provide for low-impact residential development in areas with special ecological, scientific or aesthetic values
- Ensure that residential development does not have an adverse effect on those values
- Provide for residential development of a low density and scale integrated with the landform and landscape
- Encourage development that retains and enhances riparian and foreshore vegetation and wildlife corridors

This development will abide by the environmental objectives of the Pittwater 21 DCP, which are to:

- conserve and enhance the ecological integrity, biodiversity, wildlife corridors, aquatic habitats, water quality, environmental heritage and environmental significance of Pittwater
- maintain the natural beauty of the area by retaining natural landforms, minimising land excavation and fill, and by minimising erosion, pollution and other forces that may impact on the landscape
- prescribe limits to urban development to control potential impacts on the natural environment, natural hazards, and the provision, capacity and management of infrastructure

- plan design and site development to achieve the principles of ecologically sustainable development

1.2 Scope of assessment

The objectives of this flora and fauna assessment were to:

- Undertake background research to determine the likelihood for NSW and/or Commonwealth threatened biota to utilise the occur within or use the subject site during a point in their lifecycles
- Establish the likelihood of occurrence of migratory species, threatened species, endangered populations and threatened ecological communities as listed under the New South Wales Threatened Species Conservation Act 1995 (TSC Act) and/or the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)
- Assess any potential impacts to species and/ or communities listed under the TSC Act and EPBC Act
- Identification of Pittwater Council regionally and locally significant species (Pittwater Council 2014) that may be impacted by the proposed works
- Identify and map the distribution of vegetation communities in the subject area and discuss patch size and condition
- Record presence and the extent of any noxious weeds
- Determine ecological impacts or risks that may result due to the proposed works
- Recommendation of any controls or additional actions to be taken to protect or improve environmental outcomes of the proposed works

1.3 Relevant Legislation and Policies

Legislation/ Policy	Relevant Ecological Feature On Site	Triggered	Action Required
Environmental Planning and Assessment Act 1979 (EP&A Act)	All features	Yes	This Ecological Impact Assessment Report and all subsequent recommendations relevant to the DA (the planning process).
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	Littoral Rainforest found on the western boundary of the subject site is an EPBC listed CEEC however identified patch was <1 hectare	No	None
Threatened Species Conservation Act 1995 (TSC Act)	Littoral Rainforest found on the western boundary of the subject site is a TSC listed EEC	Yes	Follow recommended controls to protect the areas containing Littoral Rainforest as further described in this report
Native Vegetation Act 1993 (NV Act)	This Act does not apply to vegetation the Pittwater LGA.	No	This Act does not apply to vegetation the Pittwater LGA.
Noxious Weeds Act 1993 (NW Act)	Noxious weeds class 4 identified on site.	Yes	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed
Coastal Protection Act 1979 NSW (CP Act)	Works are also deemed unlikely to adversely affect adjacent Avalon Beach, ocean, foreshore or other listed coastal features in the coastal zone.	No	Prevent erosion and control storm water releases.
State Environmental Planning Policy No. 14 - Coastal Wetlands (SEPP 14)	No SEPP 14 Coastal Wetlands on site, nor in the vicinity or storm water discharge areas.	No	None
State Environmental Planning Policy No 19 - Bushland in Urban Areas (SEPP 19)	Subject site is boarded by zoned North Avalon Bushland.	Yes	Erect controls to ensure work does not impact surrounding bushland. These include ensuring work zones stay within subject site and minimising erosion/ soil transport, control stormwater flow, potential for weed dispersal.
State Environmental Planning Policy No. 26 - Littoral Rainforest (SEPP 26)	Littoral Rainforest EEC occurs on the subject site, but there is no SEPP26 mapped Littoral Rainforest present on the subject site therefore SEPP26 does not apply	No	None

Legislation/ Policy	Relevant Ecological Feature On Site	Triggered	Action Required
State Environmental Planning Policy No. 44 - Koala Habitat Protection (SEPP 44)	Diagnostic flora species of Koala Habitat were not found to occur within the subject site. Subject site <1 hectare	No	None
State Environmental Planning Policy No. 71 - Coastal Protection (SEPP 71)	Footprint of residence will not be significantly changed. No increase to coastal shadowing. Not directly relevant so long as works are managed in accordance with principles of ecologically sustainable development.	No	None
Fisheries Management Plan	No stream, lacustrine or marine environments occur within the subject site therefore this legislation does not apply to the subject site. Nor did a search for species listed under the FM Act reveal any threatened species occurring within the catchment of the subject site.	No	None

1.4 Site Description

The subject site is situated within the suburb of Avalon Beach, in the Northern Beaches Local Government Area (LGA). It is important to note that during the preparation of this report, the LGA has changed from 'Pittwater' to 'Northern Beaches'. This report is based upon Pittwater LGA requirements for Ecological Impact assessment.

The subject site is located on the headland which over-looks Avalon Beach from the north. It consists of a 1,515m² battle axe block containing a single residence dwelling at the end of a long driveway. The structure sits back from the surrounding houses in the block. Aspects to the East, South and West are surrounded by bushland of North Avalon Headland Reserve.

Topography, geology and soils

The subject site is located on a prominent south-east facing headland. The slope from driveway to dwelling is 9°.

The surface geology is dominated by lithic-quartz sandstone of the Narrabeen Group (Herbert 1983) which outcrops throughout the subject site. The Western edge of the property contains a lens of interbedded shale or laminite, also of the Narrabeen Group.

A large exposed outcrop of Narrabeen sandstone dissects the Western third of the subject site in a North-south orientation (roughly). The outcrop predominantly faces South-west and covers approximately 260 m² (17 %) of the subject site.

The soils on the subject site all belong to the Watagan Soil Landscape. The soils derived from the shale lenses are Brown Podzolic Soils, they are deeper and contain higher clay content than the adjacent sandstone ridgetops which produce Yellow Podzolic Soils (Chapman & Murphy 1989). The deeper Brown Podzols in the south-west of the subject site were restricted by the outcropping sandstone that extended over the majority of the site.

1.5 Study Limitations

This study was not intended to provide a complete inventory of all species with potential to occur on the subject site; rather it was to provide an assessment into the likelihood of occurrence of any significant ecological features (migratory species, threatened species, communities and populations) on the subject site, and the potential for impacts from the proposed works on any of those ecological features.

The species inventory provided for the site was restricted to what was observed during the singly day field visit by Narla Ecologists on 10th May 2016.

The timing of the survey may not have coincided with emergence times of some species of flora and fauna, such as seasonally flowering ground orchids, seasonal migratory fauna or nocturnal fauna.

To account for those species that could not be identified during the field survey, detailed habitat assessments were combined with desktop research and local ecological knowledge to establish an accurate prediction of the potential for such species to occur on or adjacent the subject site.

2. Methodology

2.1 Desktop Assessment and Literature Review

A thorough literature review of local information relevant to the Pittwater Council area was undertaken. Online databases were utilised to gain an appreciation of the site and its surrounds to an area of approximately 10km².

Searches utilising NSW Wildlife Atlas (Bionet) and the Commonwealth Protected Matters Search Tool were conducted to identify all current threatened and migratory flora and fauna records within a 10km² search area centred on the subject site. This data was used to assist in establishing the presence or likelihood of any such ecological values as occurring on or adjacent the subject site, and helped inform our Ecologist on what to look for during the site assessment.

Soil landscape and geological mapping was examined to gain an understanding of the environment on the subject site and assist in determining whether any threatened flora or ecological communities may occur there (Herbert 1983, Chapman & Murphy 1989).

2.2 Ecological Site Assessment

A site assessment was performed by Narla Environmental Senior Ecologist Kurtis Lindsay on Tuesday the 10th of May 2016.

The following processes were undertaken during the site assessment:

- Recording the identification and extent of vegetation communities on the subject site, with a particular focus on the presence of any endangered ecological communities (EEC)
- Recording a detailed list of flora species encountered on the subject site, with a focus on indigenous species including threatened species, species diagnostic of threatened ecological communities and noxious weeds.
- Recording opportunistic sightings of any fauna species seen or heard on or within the immediate surrounds of the subject site
- Assessment of the connectivity and quality of the vegetation within the subject site and surrounding area
- Identifying and recording the locations of notable fauna habitat such as important nesting, roosting or foraging microhabitats.
- Targeting the habitat of any threatened and regionally significant fauna including:
 - tree hollows (habitat for threatened large forest owls, parrots, cockatoos and arboreal mammals)
 - caves and crevices (habitat for threatened reptiles, small mammals and microbats)
 - termite mounds (habitat for threatened reptiles and the echidna)
 - soaks (habitat for threatened frogs and dragonflies)
 - wetlands (habitat for threatened fish, frogs and water birds)
 - drainage lines (habitat for threatened fish and frogs)
 - fruiting trees (food for threatened frugivorous birds and mammals)
 - flowering trees (food for threatened nectarivorous mammals and birds)

- trees and shrubs supporting nest structures (habitat for threatened birds and arboreal mammals), and
- any other habitat features that may support fauna (particularly threatened) species.

3. Results and Discussion

Following the Ecological desktop and site assessment, Narla were satisfied that the proposed development had been appropriately located entirely within the area identified as having least ecological impact. If the appropriate recommendations in this report are followed, the project will see no net ecological loss and may even see ecological gain.

In situations where the habitat on or around the subject was deemed potentially suitable for certain species that could not have been surveyed for during the field assessment, the precautionary principle applies and those species were assumed present. A 7-part test assessment of significance was applied to such species to determine any impacts from the proposed works.

3.1 Biodiversity Corridors

Wildlife Corridors

The subject site is not mapped as occurring within a designated Pittwater Council Biodiversity Corridor as per *Pittwater 21 DCP – Wildlife Corridor Map (Figure 4)*. The adjacent land in North Avalon Headland Reserve is mapped as 'CO1 - Those areas though disturbed are likely to be of habitat value due to good crown cover and/or understory'. This classification is an accurate representation of the site and the adjacent public lands.

Despite the lack of designated wildlife corridor status, the subject site is likely to still act as part of a wildlife corridor owing to the presence of remnant vegetation and its contiguity with surrounding remnant vegetation.

The vegetation on the edges of the subject site and across the adjoining reserve to the east of the subject site were in good condition, however, there were two areas of council-managed public land to the east and south of the subject site that were acting as sources for noxious weed spread and recolonisation back into the subject site and the surrounding properties. These areas contained dense growth of all the noxious weeds identified in the subject site along with many more environmental weeds.

3.2 State Legislative Requirements

Critical Habitat

No Critical Habitat as declared under the TSC Act occurs on the study site.

Proximal National Parks

The nearest National Park to the subject site is Ku-ring-gai Chase National Park, which lies 3.5 km to the East of the subject site and is separated from the subject site by suburbs and Pittwater Estuary.

State Environmental Planning Policy 19 (SEPP 19) - Bushland in Urban Areas

This SEPP applies to land adjoining bushland zoned or reserved for public open space. The subject site is applicable as it connects with urban bushland reserves at North Avalon Headland and Bangalley Headland. Both are protected under SEPP19. This State policy sets aims and objectives to conserve and where necessary, regenerate the vegetation, its fauna and any cultural heritage items (such as any Aboriginal sites), to encourage appropriate and sympathetic use by the public. As is the case with all areas of Pittwater, the Tree Preservation and Management Order applies to all areas of bushland and open space covered in this Plan (Pittwater Council 2002).

SEPP 26 - Littoral Rainforest

The site is not mapped in the official SEPP26 - Littoral Rainforest mapping, however, this does not mean that Littoral Rainforest does not occur on the subject site. The areas mapped as Littoral Rainforest in SEPP 26 are examples of the Littoral Rainforest ecological communities, but the mapping for SEPP 26 is not exhaustive, and stands of the Littoral Rainforest ecological community occur at locations not mapped under SEPP 26. Some stands of Littoral Rainforest may have been too small to be mapped at the same resolution as SEPP 26, other stands may have existed as regrowth or were in the process of regenerating. Such stands are all still classified as Littoral Rainforest under the TSC Act.

SEPP 44 - Koala Habitat Protection

SEPP 44 - Koala Habitat Protection only applies to land which:

- (i) has an area of more than 1 hectare, or
- (ii) has, together with any adjoining land in the same ownership, an area of more than 1 hectare whether or not the development application applies to the whole, or only part, of the land.

SEPP 44 does not apply to the proposed DA, because it is taking place on a property that covers substantially less than 1 hectare in area.

Need for Assessment of Significance and/or Species Impact Statement (TSC Act)

No threatened flora or fauna species have been recorded to occur in the subject site.

One threatened flora species, Netted Bottlebrush (*Callistemon linearifolius*) (Vulnerable under the TSC Act) may occur on the subject site but identification confirmation is required. If this species is confirmed, it is expected that there will be no impact as a result of the proposed development because the individual plant occurred entirely outside the development footprint.

Three threatened fauna species were deemed as having potential to utilise habitat on the subject site during part of their lifecycle. These species were all microbats (small insectivorous bats) that nest in caves and crevices and forage by night over and around heathlands. They were the, Large-eared Pied Bat (*Chalinolobus dwyeri*), Little Bent-wing Bat (*Miniopterus australis*) and Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*). These microbats are all listed as Vulnerable under the TSC Act.

One Endangered Ecological Community (EEC) occurred on the subject site, *Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions*. It is expected that there will be no impact on this community as a result of the proposed development because the community occurs entirely outside the proposed development footprint.

It is considered unlikely that any threatened flora species may occur on the site in dormancy (e.g. in seed bank). This opinion is based on a lack of any proximal local records of species that display such life histories.

Taking the precautionary principle, Narla conducted Assessments of Significance (7-part test) to assess the potential for impact upon the Netted Bottlebrush, Cave-roosting Microbats and *Littoral rainforest in the NSW North Coast, Sydney Basin and South East Corner bioregions - Endangered Ecological Community*. It was deemed that the proposed works will have no significant impact on the EEC or threatened species, therefore a Species Impact Statement (SIS) is not required.

Commonwealth legislation (EPBC Act)

Despite desktop and field searches, no EPBC Act matters of National Environmental Significance (MNES) were confirmed to occur on the subject site.

The cave-roosting, Large-eared Pied Bat was considered to have potential to roost (on occasion) in the sandstone caves and crevices present on the subject site. This species is listed as Vulnerable under the EPBC Act.

Potential for any impact upon this species was assessed against under the 'EPBC Act Significant Guidelines'. It was deemed that the proposed works will have no significant impact on the Large-eared Pied Bat. Therefore an *EPBC Act Referral to Commonwealth* is not required.

3.3 Flora and Vegetation

Existing Vegetation Communities

Vegetation on the subject site is contiguous with the native vegetation of adjacent North Avalon Headland Reserve.

Two remnant vegetation communities were identified and mapped as occurring on the subject site (**Figure 2**). The official Pittwater Council and OEH vegetation community classifications are listed **Table 1**.

Areas dominated by exotic flora species were mapped as 'Ornamental Gardens'.

i. Littoral Rainforest



Plate 1. Littoral Rainforest on the Subject Site

The more significant of the two vegetation communities identified on the subject site was a type of *Littoral Rainforest* which was found to correspond to the TSC Act Endangered Ecological Community *Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions*.

This vegetation community occupied a small area of approximately 110m² of the south-western side of the subject site. Average canopy cover (Specht Classification) was 70%.

The condition of this remnant was moderate but slightly degraded. There were signs of past infestation of noxious weeds including Japanese Honeysuckle (*Lonicera japonica*), Lantana (*Lantana camara*), Mother of Millions (*Bryophyllum delagoense*) and African olive (*Olea europaea* subsp. *cuspidata*) however evidence revealed that attempts have been made by the property owner to remove such weed infestation. Active weed removal by the property owner had opened up growing space for native rainforest species, and natural regeneration was noted in several of the canopy species.

The canopy (up to four metres tall) was dominated by Cheese Tree (*Glochidion ferdinandi*), Large Mock-olive (*Notelaea longifolia* f. *longifolia*), Ovate Mock-olive (*Notelaea ovata*) and Muttonwood (*Myrsine variabilis*) with occasional emergent Coastal Tea Tree (*Leptospermum laevigatum*), Coastal Banksia (*Banksia ericifolia*) and Hillock Bush (*Melaleuca hypericifolia*). A single, unidentified mature Bottlebrush (*Callistemon* sp.) was observed in this area. Port Jackson Fig (*Ficus rubiginosa*) and Coastal Acacia (*Acacia longifolia* subsp. *sophorae*) grew in sandstone crevices. Ground cover was sparse but contained Commelina (*Commelina cyanea*), Scrambling Lily (*Geitonoplesium cymosum*) and Sweet Sarsparilla (*Smilax glycyphylla*).

ii. Coastal Scrub



Plate 2. Coastal Scrub on the Subject Site

The dominant community across the subject site was a tall Coastal Scrub.

This was dominated by a canopy of Coastal Banksia and Coastal Tea Tree (up to four metres tall) with abundant White Correa (*Correa alba*), Coastal Rosemary (*Westringia fruticosa*) and Coastal Acacia (*Acacia longifolia* subsp. *sophoreae*) in the shrub layer and Honey Rush (*Lomandra longifolia*), Sandfly (*Zieria smithii*), Flannel Flower (*Actinotus helianthi*), Knobby Club Rush (*Ficinia (Isolepis) nodosa*), Dusky Coral Pea (*Kennedia rubicunda*), Wiry Panic (*Entolasia stricta*), Weeping Rice Grass (*Microlaena stipoides*), Blue Flax Lily (*Dianella caerulea*) and Native Violet (*Viola hederacea*) in the ground layer.

Large areas of this community were significantly influenced by historical garden plant introductions including *Agapanthus* sp., Wild Iris (*Dietes grandiflora*) and Lilyturf (*Liriope muscari*). This was particularly prevalent in the areas closest to the existing dwelling. T

This area of the subject site supported four large, mature Norfolk Island Pines which were likely to have been planted over 50 years ago. Little native vegetation was growing under these Norfolk Island Pines.

In order to best present the conservation significance of this vegetation community on the subject site, we have mapped it according to two condition classes:

1. Coastal Scrub - good condition.
2. Coastal Scrub – degraded

Areas of 'good condition' Coastal Scrub on the subject site were dominated by 50% - 100% of the native species assemblage expected from this ecological community, as identified from comparison with remnant vegetation in the adjacent reserve. Areas of 'degraded' Coastal Scrub were dominated by less than 50% native species assemblage, had broken or disturbed canopy cover (owing to historical clearing), and contained abundant exotic garden plants or weeds (>10% weed cover).

Flora Species

A total of 80 plant species were identified within the subject site, of which 38 were native and 42 classified as exotic (**Table 2**). Nomenclature follows PlantNet (2016). Many of the exotic plants were unmaintained garden ornamentals and some were environmental weeds.

Despite thorough in-field searches, no flora species of conservation significance listed under either "Rare or Threatened Australian Plants" (RoTAP) (Briggs and Leigh 1996), TSC Act or EPBC Act were confirmed on or immediately adjacent the subject site. This does not rule out the potential for some threatened species to still exist on the subject site in the seedbank or in dormancy (e.g. terrestrial orchids which only emerge after suitable rainfall and warmer temperatures).

A single mature Bottlebrush (*Callistemon* sp.) tree (approximate three metres tall) was observed on the north-western edge of the Littoral Rainforest (at 56H 6277261, 345840). It was not in flower at the time of survey. The leaves appeared broader and longer than the locally common Stiff Bottlebrush (*C. rigidus*) and broader than the Narrow-leaved Bottlebrush (*C. linearis*). It is possible that the tree was planted or was a self-sown garden escapee however the possibility of it being the Vulnerable listed (TSC Act) Netted Bottlebrush (*C. linearifolius*) cannot be confirmed or ruled out at this stage, at least until flowers are analysed by an expert at the New South Wales Herbarium.

Eight noxious weeds were identified within the subject site. They are listed in **Table 2**. This issue is discussed further in **section 3.3**.

3.1 Environmental Loss Summary

The knockdown and rebuild process is not expected to require the removal of any locally indigenous vegetation or living trees other than one non-indigenous, planted Norfolk Pine Tree (*Araucaria hererophylla*). This tree is 15m tall with a diameter at breast height (dbh) of 67 cm (**Figure 1**).

The single Norfolk Pine has been previously approved for removal by Pittwater Council. It had limited habitat potential for fauna, other than to common large, bird species which may choose the site to nest in. The likelihood of any nesting occurring is low and in the event such species chose to nest in the area, they would have the option to nest in any of the other three suitably positioned, large Norfolk Pines which will be retained.

The Norfolk Pine due for removal will be replaced with an advanced, locally indigenous native tree (Growing my way 2016; Selena Hannan Landscape Design 2016).

All proposed construction works will predominantly occur within the footprint of the existing dwelling (due to be demolished) and this is separated from sensitive vegetation communities by a buffer of ornamental gardens. The ornamental gardens are going to be removed and

revegetated with locally indigenous native plants (a decision by the owner), on conclusion of the proposed dwelling construction.

A small proportion of the south-west corner of the proposed dwelling will encroach into a small section of the natural sandstone outcropping on the subject site. Works in this area will be kept to a minimum. The proponent will take precautionary measures to ensure least potential impact to any fauna inhabiting this sandstone habitat, including any potential roosting microbats.



Figure 1. Subject Site and Norfolk Pine Tree due for removal (previously approved by Council)

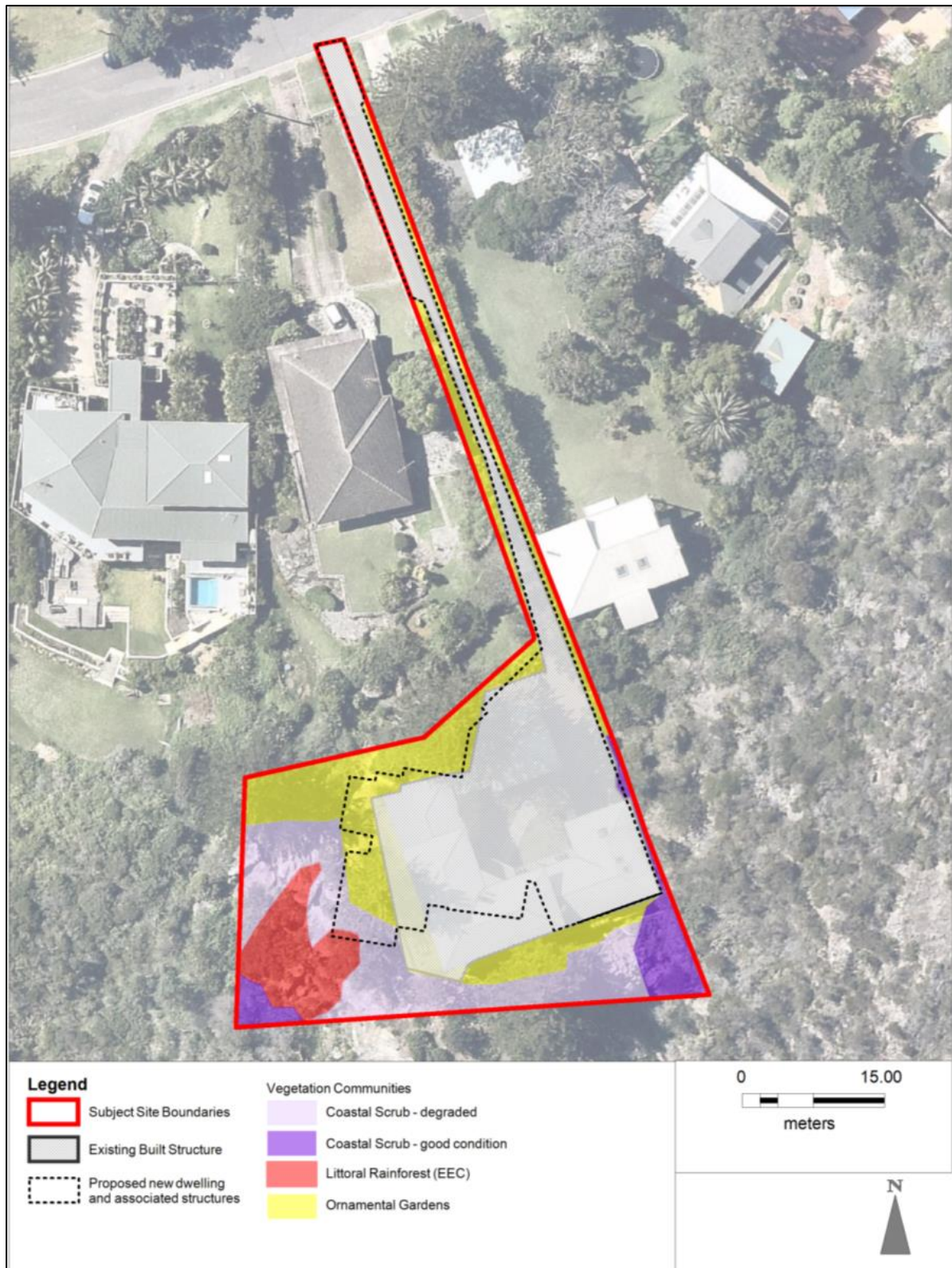


Figure 2. Vegetation Mapped on the Subject Site

Table 1. Vegetation Communities Recorded on the Subject Site

Community	Area of Coverage on Subject Site (m²)	Average Canopy Cover (Specht)	Description of Community on Subject Site	TSC Act	Pittwater Council Native Vegetation Classification 2012	OEH Plant Community Type (PCT)	Sydney Metropolitan CMA Unit
Coastal Scrubland	Good condition		A dense scrub with a canopy of Coastal Tea-tree (<i>Leptospermum laevigatum</i>) and Coastal Banksia (<i>Banksia integrifolia</i> subsp. <i>integrifolia</i>). Shrub layer of Coastal Rosemary (<i>Westringia fruticosa</i>), Coastal Wattle (<i>Acacia longifolia</i> subsp. <i>sophorae</i>), White Correa (<i>Correa alba</i>) Sweet Pittosporum(<i>Pittosporum undulatum</i>), Cheese Tree (<i>Glochidion ferdinandi</i>) and Coffee Bush (<i>Breynia oblongifolia</i>). Ground cover dominated by <i>Lomandra longifolia</i> , <i>Zieria smithii</i> , <i>Actinotus helianthi</i> , <i>Isolepis nodosa</i> with <i>Pelargonium australe</i> and other less common shrubs. Ground dominated by <i>Kennedia rubicunda</i> , <i>Entolasia stricta</i> , <i>Microlaena stipoides</i> , <i>Dianella caerulea</i> and <i>Viola hederacea</i> .	Not Listed	Coastal Tea-tree – Banksia Scrub (S_HL02)	Coast Banksia - Coast Tea-tree low moist forest on coastal sands and headlands, Sydney Basin Bioregion and South East Corner Bioregion(PCT 771)	Coastal Tea-tree – Banksia Scrub (S_HL02)
	90m²	>60%					
	Degraded						
	284 m²	5% - 60%					
Littoral Rainforest	110 m²	75%	A small patch of littoral rainforest in a sheltered south-west facing slope. Dominated by Cheese Tree , Muttonwood (<i>Myrsine variabilis</i>), <i>Notalaea longifolia</i> , <i>Notalaea ovata</i> , <i>Ficus rubiginosa</i> (Port Jackson Fig) . Emergent Coastal Banksia and Coastal Tea-tree. Sparse ground layer of <i>Geitonoplesium cymosum</i> , <i>Smilax glycyphylla</i> , <i>Dianella caerulea</i> , <i>Lomandra longifolia</i> and <i>Kennedia rubicunda</i> . Sheltered by aspect and sandstone outcropping.	Littoral rainforest in the NSW North Coast, Sydney Basin and South East Corner bioregions - Endangered Ecological Community	Coastal Headland Littoral Thicket (S_RF08)	Lilly Pilly littoral rainforest of the southern Sydney Basin Bioregion and South East Corner Bioregion (PCT 910)	Coastal Headland Littoral Thicket (S_RF08)

3.2 Fauna

Fauna

Sixteen fauna species were encountered on the day of the field survey. All fauna species encountered were listed as 'protected' under the *NSW National Parks and Wildlife Act 1974* and none were listed as threatened under either the TSC Act or EPBC Act.

Birds were the most commonly encountered fauna group, and reptiles and mammals were recorded with lower species richness (**Table 3**).

The list of fauna recorded during the site visit was produced opportunistically and thus only represents a subset of the species that may occur on the subject site at any one time. For this reason, a thorough assessment of fauna habitat availability conducted during the site visit was conducted as a priority. The habitat assessment provided a better understanding of the fauna species that may potentially occur on the subject site during some part of their lifecycle.

Fauna Habitat

The subject site provided some potential foraging, nesting and roosting habitat for a suite of fauna, however most of the subject site was considered suboptimal for providing fauna habitat. This was owing to historical disturbance and clearing. Much of the fauna habitat contained weeds and garden exotics including those encroaching from the adjoining bushland reserve.

The most significant fauna habitat occurred in the east and south-west corners of the subject site where good condition Coastal Scrubland remnant vegetation provided habitat structure, shelter, foraging and nesting resources for a suite of native fauna including small birds (e.g. fairy-wrens, scrubwren and honeyeaters) and mammals such as Ring-tailed Possum (*Pseudochirus peregrinus*) and Long-nosed Bandicoot (*Perameles nasuta*). It is predicted that these species will continue to occur on the subject site during and post construction works.

Four recently used Ring-tailed Possum dreys (nests) were found in a stand of Coastal Tea Tree and Cheese Tree in the south-west of the subject site.

Evidence of long-nose bandicoot foraging was apparent in furrows in leaf litter and soil in the west of the subject site.

Extensive outcropping of Narrabeen Sandstone across the west of the subject site provided cracks and crevices which were used for shelter and foraging by small reptiles such as the Elegant Snake-eyed Skink (*Cryptoblepharus pulcher*) and may provide temporary roosting habitat for microbats and small terrestrial mammals.

Abundant fruit and nectar-bearing plants were present within the area which is likely to attract additional species into the area with changes in seasonal fruit/nectar availability. This included the fruit-bearing native Mutton Wood and Mock Olive, as well as the exotic Lantana, Ochna and African Olive.

Little Wattlebird (*Anthochaera chrysoptera*) and New Holland Honeyeater (*Phylidonyris novaehollandiae*) were observed foraging on flowers of Coastal Banksia during the site visit.

This foraging resource may also be utilised by nectarivorous mammal species such as Grey-headed Flying Fox (*Pteropus poliocephalus*) and Eastern Pygmy Possum (*Cercartetus nanus*) which may occur on or adjacent the subject site.

3.3 Threats

Key Threatening Processes

The proposed development will not introduce or exacerbate any Key Threatening Processes (KTP) (as listed under the TSC Act). The following five KTP are already in action within the subject site:

1. Invasion and establishment of exotic vines and scramblers
2. Invasion of native plant communities by African Olive (*Olea europaea* L. subsp. *cuspidata*)
3. Invasion, establishment and spread of *Lantana camara*
4. Invasion of native plant communities by exotic perennial grasses
5. Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants

Bushland restoration (weed removal and revegetation) efforts made prior, during and post construction works on the subject site will aim to control these KTP and restore native vegetation communities as effectively as possible.

Noxious Weeds

Eight noxious weeds were identified within the subject site. They are listed in **Table 2**. All of these weeds are listed as 'Class 4 Noxious Weeds' in the Pittwater Local Government Area under the *NSW Noxious Weeds Act 1993* (NW Act).

Class 4 status requires that "the growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed".

The noxious weeds recorded on the subject site were:

- African Olive (*Olea europaea* subsp. *cuspidata*)
- Ground Asparagus Fern (*Asparagus aethiopicus*)
- Mother of Millions (*Bryophyllum delagoense*)
- Turkey Rhubarb (*Acetosa sagittata*)
- Japanese Honeysuckle (*Lonicera japonica*)
- Lantana (*Lantana camara*)
- Indian Hawthorn (*Rhaphiolepis indica*)
- Ochna (*Ochna serrulata*)

Noxious weeds occurred in low density throughout the subject site. The proponent has been actively controlling noxious and assisting in the control of weed infestations and prevention of spread.

Council-managed land to the immediate south of the subject site is severely weed infested and provides a source for infestation of the surrounding properties (**Figure 4**).

Landscaping

Seperate to this report, a Landscape Plan was produced for the subject site (Selena Hannan 2016). The Landscape Plan provides a comprehensive design and species list for the proposed landscaping to be conducted around the proposed dwelling. The proposed landscape garden will contain only local flora species arranged in a manner that reflects local bushland conditions and meets Council requirements and local ecological considerations. Additionally, communications with the property owner have confirmed a personal interest in further enhancing native regeneration.

Pittwater Council DCP 21 Natural Environment Controls require that any plantings planned in an Endangered Ecological Community, such as the Littoral Rainforest on the subject site, must consist of at least 80% flora species native to that community.

Bushfire Mitigation Measures

The Bushfire Hazard Assessment Report (Building Code & Bushfire Hazard Solutions 2016) recommended that the entire property is managed as an Inner Protection Area (IPA) which is described in Appendix 2 of *Planning for Bush Fire Protection 2006*:

"An IPA should provide a tree canopy cover of less than 15% and should be located greater than 2 metres from any part of the roofline of a dwelling. Garden beds of flammable shrubs are not to be located under trees and should be no closer than 10 metres from an exposed window or door. Trees should have lower limbs removed up to a height of 2 metres above the ground."

Landscaping will be designed to reflect the requirements of an IPA; however, the removal of existing native trees and shrubbery is not required or expected to take place.

Sewerage

The proposed development is to be connected to the sewerage system. This will mean it is unlikely there will be any adverse effects to local ecology from the sewerage system.

Storm-water

A spreader pipe system may be used to moderate the release of stormwater off the proposed dwelling. Stormwater flow from the spreader pipe will be directed to existing paths of natural runoff. Prior to any release, all stormwater is to be piped through any tanks that may be required by the regulating authorities (White Geotechnical Group 2016). The proposed development is unlikely to result in significant changes to storm-water runoff so it is expected there will be no exacerbated impact on native species of plants or animals.

Domestic Animals

The proponent has always kept domestic animals on the subject site. Surrounding properties currently keep domestic pets, including free roaming cats, and will in all likelihood continue to do so.

The keeping of domestic pets can be continued without fear of adverse ecological effect.

Feral Pests

No feral fauna were recorded on the subject site, but the habitat is likely to support Black Rat (*Rattus rattus*), House Mouse (*Mus musculus*), Rabbit (*Oryctolagus cuniculus*), Feral Cat (*Felis catus*) and Fox (*Vulpes vulpes*) for all or part of their lifecycles.

Feral Cat and Fox are the biggest threat as they actively hunt and kill wildlife, including sensitive and uncommon species recorded on the subject site, like Variegated Fairy-wren (*Malurus lamberti*) and Ring-tailed Possum.

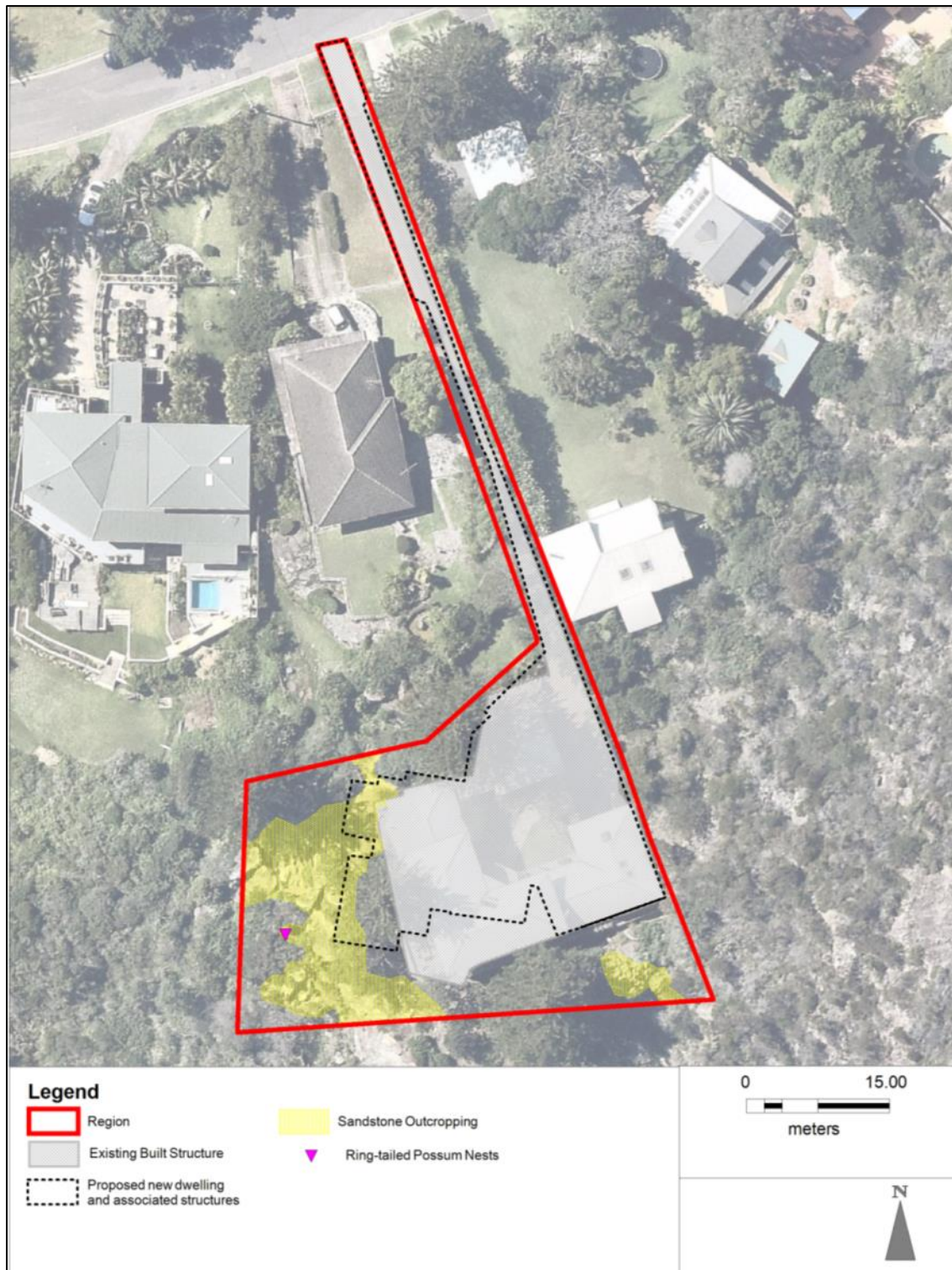


Figure 3. Significant fauna habitat features

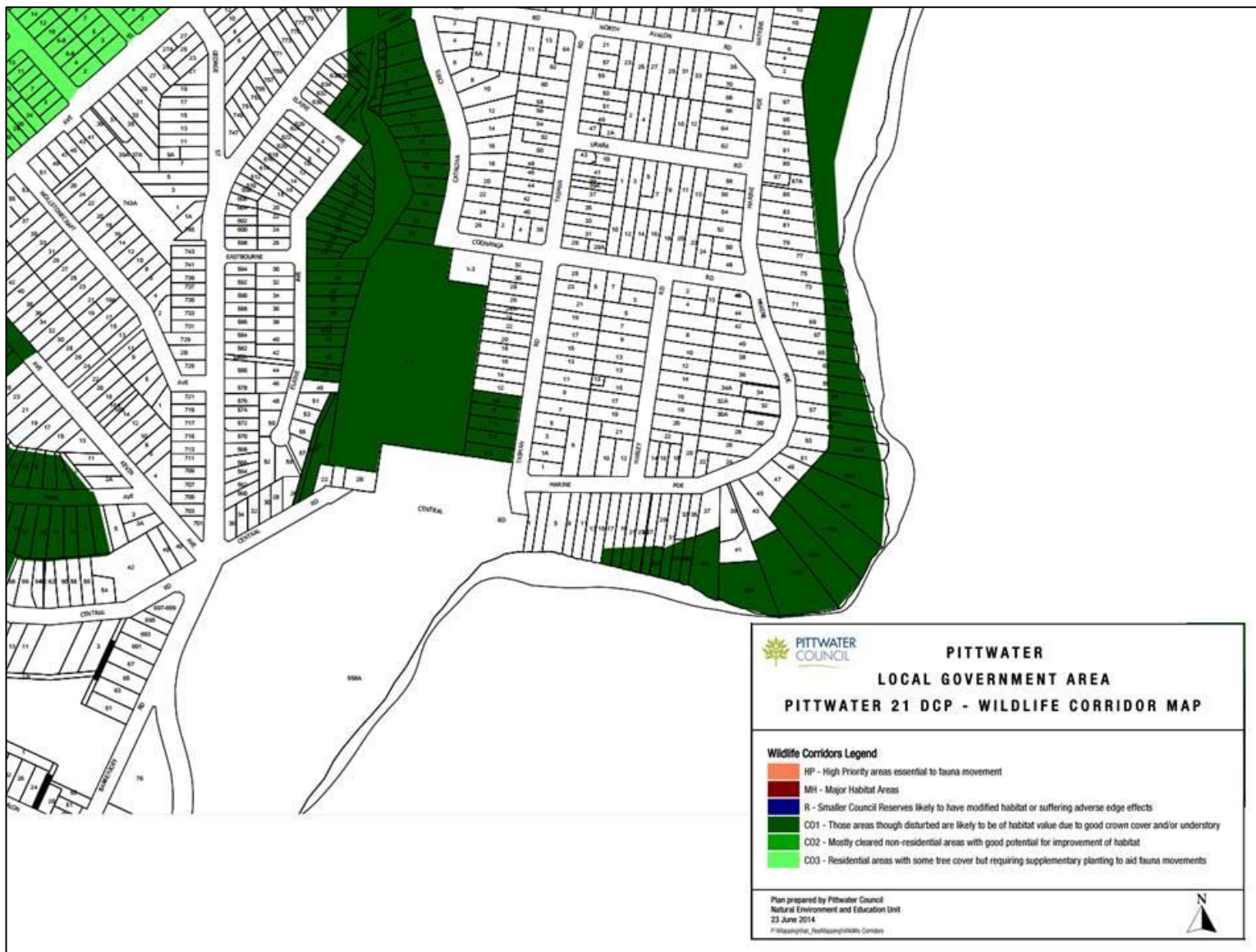


Figure 4. Pittwater Council 21 DCP - Wildlife Corridor Map



Figure 5. Area of intense weed infestation on public lands adjacent the subject site

4.Recommendations

4.1 Ecological Sustainability Plan/Bushland Management Plan

Owing to the presence of an Endangered Ecological Community on the subject site (i.e. the small area of Littoral Rainforest on the south-western side of the site) and the zoning of the land, Council will require the site to have an Ecological Sustainability Plan/Bushland Management Plan implemented.

An Ecological Sustainability Plan/Bushland Management Plan is a map-based report written for the property owner and those living on the site to aid them in maximising the long-term sustainability of the sites ecological processes (in bushland areas). The plans are particularly important for ensuring long-term sustainability of Endangered Ecological Communities - such as Littoral Rainforest.

Development in the Northern Beaches is on-going. Application of Ecological Sustainability Plans/Bushland Management Plans to sites as they are developed (or re-developed) will result in multiple environmental sustainability outcomes including:

- Retention/creation of habitat areas for native wildlife including corridors for small birds such as fairy-wrens - this is essential to keep the reserve areas as viable core habitat for many small native birds.
- Appropriate management of Noxious and Environmental Weeds on private property.
- Effective management of Bushfire asset protection zones (APZ) are properly managed.
- Protection of Endangered Ecological Communities

The Ecological Sustainability Plan/Bushland Management Plan is required by Council as it enables developments to comply with the strategic aims of the Pittwater Community (as per Council's 20-year plan) and comply with environmental legislation. It is relied on when writing conditions of consent as it covers requirements pre-works, during construction and after completion of works. The Plan applies to the site for the life of the development.

The Plan should address the following KTP within the subject site:

1. Invasion and establishment of exotic vines and scramblers
2. Invasion of native plant communities by African Olive *Olea europaea L. subsp. cuspidata*
3. Invasion, establishment and spread of *Lantana camara*
4. Invasion of native plant communities by exotic perennial grasses
5. Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants

Bushland restoration (weed removal and revegetation) efforts made prior, during and post construction works on the subject site will aim to control these KTP and restore native vegetation communities as effectively as possible.

It may be appropriate for Pittwater Council to commission part of the Plan, owing to the fact that its adjacent bushland reserve is directly influenced by, and in turn directly influences the vegetation on the subject site.

4.2 Recommendations - Construction Phase

Clearing of Vegetation

The single Norfolk Island Pine due for removal should be replaced by an advanced indigenous native tree as soon as possible.

Suitable tree species should only include those that may naturally occur in the Coastal Scrub vegetation community. This may include:

- Coastal Banksia (*Banksia integrifolia*)
- Common Lillypilly (*Acmena smithii*)
- Coastal Tea Tree (*Leptospermum laevigatum*)
- Black She-oak (*Allocasuarina littoralis*)
- Olive Plum (*Elaeodendron australe*)
- Cheese Tree (*Glochidion ferdinandi*)
- Blueberry Ash (*Elaeocarpus reticulatus*)
- Broad-leaved Mahogany (*Eucalyptus umbra*)

Removal of any locally indigenous tree, shrub and ground cover must be avoided. In the event of accidental impact or removal, the proponent should notify an ecologist immediately. The Ecologist will advise on best approach to issue management.

Threatened Flora

It is recommended that a sample of the unidentified Bottlebrush (*Callistemon* sp.) is sent to the New South Wales Herbarium in order for its identity to be confirmed. It is possible the plant is the TSC Act Vulnerable Netted Bottlebrush (*C. linearifolia*).

This single plant will continue to exist *in situ* and unharmed on the subject site, during and post construction works as it occurs well outside the proposed development foot print. If the herbarium confirms the identification of the unidentified Bottlebrush to be Netted Bottlebrush, the plant should be protected *in situ*, and monitored. Regular weeding should be conducted around it in order to allow its proliferation.

Fauna and Habitat

Any construction, machinery operation, excavation, vehicle movement and other works that occur on the subject site should keep to a minimum any impact to the sandstone outcropping, particularly the extensive outcropping area containing caves and crevices that occurs on the western side of the subject site. These areas may provide roosting habitat for threatened microbats.

If outcropping sandstone is expected to be damaged or removed, a Project Ecologist should be assigned to undertake a pre-clearing survey to determine presence of any roosting microbats or other fauna. The findings of the pre-clearing survey should be compiled in a short report and provided to the client before works continue in this area.

The Project Ecologist should supervise the clearing activities and work in and around the sandstone outcropping to observe for any injured or displaced fauna. If such fauna is found during the works, the Project Ecologist will advise best approach for action.

Erosion Management

Ensure that adequate erosion and sediment measures are in place at all times during construction activity.

Storage, Stockpiling and Laydown Construction

Select storage, stockpile and laydown sites away from native vegetation.

4.3 Recommendations - Post Construction Phase

Managing Noxious Weeds and Exotic Flora

Noxious weeds, such as Lantana, Ochna and African Olive should be removed and controlled by qualified bush regeneration professionals.

Monitor future weed incursions and maintain a regular weed management control program as part of the approved Bushland Management Plan.

Remove exotic ornamental ground covers, herbs, shrubs and palms from the subject site and replace with locally indigenous native flora (see **Figure 2**) or with Council recommended Native Plants (Pittwater Council 2015a).

Some exotic plants may currently provide prey, nectar, fruit or shelter for fauna such as small birds. These plants should still be removed, but to reduce any potential negative influence on fauna, such plants should be progressively removed and replaced with ecological equivalent indigenous native flora from the respective indigenous community mapped in **Figure 2**.

All native plants used in plantings should be sourced from a local provenance nursery. Select species that will provide the same or increased optimal habitat functions as locally indigenous fauna.

It is recommended that bushland restoration work is commissioned by Council in the reserves surrounding the subject site in order to compliment the work being undertaken on the subject site. This will increase likelihood of controlling local noxious weed problems and in the long term will save resources spent on managing recurring weed infestations.

Storm-water

All spreader pipe system release will be directed along paths of natural runoff for the site. Prior to release, stormwater is to be piped through any tanks that may be required by the regulating authorities. It is not considered this will have any significant ecological effect.

Observing the precautionary principle, it is recommended that the proponent continues to monitor the response of stormwater flows from the vegetation on and off site. This should be conducted as part of the proposed Bushland Management Plan.

In the unlikely event of perceived adverse effects from storm water output exacerbated by the proposed development (e.g. confirmed enhanced nutrient enrichment and weed growth or dieback) an Ecologist and Geotechnical Engineer should be consulted to advise the best approach to action.

Sewerage

As per the stormwater system, if issues are perceived to be occurring as a result of sewerage, an Ecologist and Geotechnical Engineer should be consulted to advise the best approach to action.

Domestic Animals

Domestic animals have been determined to not require exclusion from the site owing to its urban nature, surrounded by other residencies which have no controls placed on domestic animals. The site also has a history of domestic animals kept on site. Some recommendations have been provided in this report to ensure future environmental harm caused by domestic animals is further reduced.

5. Summary

Narla have provided a summary of the Ecological assessment by answering the following questions as required by Pittwater Council.

a) What is the council classification of the site Category 1 - Core bushland, Category 2 - Fragmented bushland etc?

b) Is the site part of a habitat corridor and what rating does it have?

The subject site is not mapped as occurring within a designated Biodiversity Corridor as per *Pittwater 21 DCP – Wildlife Corridor Map (Figure 4)*. The adjacent land in North Avalon Headland Reserve is mapped as 'CO1 - Those areas though disturbed are likely to be of habitat value due to good crown cover and/or understory'.

c) How many listed species do, or could, occur on the site?

No Commonwealth or State-listed threatened fauna were encountered during the site survey. One Commonwealth listed fauna species (Large-eared Pied Bat) and three State-listed fauna species (Eastern Bent-wing Bat, Little Bent-wing Bat, and Large-eared Pied Bat) have potential to occur on the subject site.

Despite thorough in-field searches, no flora species of conservation significance listed under TSC Act or EPBC Act were confirmed on or immediately adjacent the subject site. This does not rule out the potential for some threatened species to still exist on the subject site in the seedbank or in dormancy (e.g. terrestrial orchids which only emerge after suitable rainfall and warmer temperatures) however this is deemed unlikely owing to the lack of local records of such species.

A plausible specimen of Netted Bottlebrush (*C.linearifolius*) was found within the subject site. This species is similar both to locally common Stiff Bottlebrush (*C. rigidus*) and the Narrow-leaved Bottlebrush (*C.linearis*). It is possible that the tree was planted or was a self-sown garden escapee however the possibility of it being the Vulnerable listed (TSC Act) Netted Bottlebrush (*C.linearifolius*) cannot be confirmed or ruled out at this stage.

d) How many locally or regionally significant species occur on the site?

33 regionally significant species have been designated as having potential habitat on or adjacent to the subject site. Long-nosed Bandicoot was confirmed by characteristic furrows in the ground within the bounds of the subject site. This species will continue to occur on the subject site during and post construction works.

e) How many species have had an 7-part test applied and have any indicated a SIS is required?

A 7-part test was applied to four species of fauna, one threatened pant and one EEC. There will be no significant impact on any occurring, or potentially occurring, Ecological features on the subject site, therefore a Species Impact Statement (SIS) is

deemed not necessary.

f) Have all reports that may influence the conclusions of this report been taken into consideration (bush fire, waste water, landscaping etc.)?

Yes

g) Is the proposed development in the location with the least environmental impact? If not could it be modified?

Yes. The proposed works will predominantly occur within the footprint of the existing dwelling (due to be demolished) and this is separated from sensitive vegetation communities by a buffer of ornamental gardens.

The ornamental gardens are going to be removed and revegetated with locally indigenous native plants (a decision by the owner), on conclusion of the proposed dwelling construction.

A small proportion of the south-west corner of the proposed dwelling will encroach into a small section of the natural sandstone outcropping on the subject site. Works in this area will be kept to a minimum. The proponent will also take precautionary measures to ensure least potential impact to any fauna inhabiting this sandstone habitat, including any potential roosting microbats. These measures involve:

1. engaging an Ecologist to undertake a targeted microbat survey of the site prior to any construction works, to identify the presence of roosting microbats, and
2. assigning an Ecologist to attend the site during any construction works within the area of sandstone outcropping to instruct workers on best method to minimise any potential impacts on sandstone dwelling fauna, including microbats.

h) Is the driveway, waste-water disposal area, water tanks etc in areas that result in least environmental impact?

Yes. There is a minor addition to the stormwater disposal system, in the form of a spreader pipe which will distribute stormwater from the proposed dwelling to areas where stormwater naturally flows during rainfall events.

i) Is vegetation being disturbed/modified and if yes what is the area (m2) of vegetation being directly lost (include fuel free zone, paving etc) and the area (m2) of vegetation that could be indirectly affected (waste-water areas, fuel reduction etc)?

Only one tree, a mature planted Norfolk Island Pine previously approved for removal by Council is to be removed during the proposed works. Recommendation made in this report and seconded by the arborists report are to replace the Norfolk Island Pine with a locally indigenous species of tree.

j) Do native plants dominate in the areas being lost?

No. Non-native plants dominate the areas being lost. No native vegetation is proposed for removal or disturbance due to the redevelopment works. Work zones are to be erected away from vegetated areas. Native vegetation will be planted in places where non-native vegetation is lost.

k) Are there any Endangered Ecological Communities being disturbed/modified? If yes what is the area (m²) of vegetation being directly lost (include fuel free zone, paving etc) and the area (m²) of vegetation that could be indirectly affected (waste-water areas, fuel reduction etc)?

No native vegetation is scheduled to be cleared, disturbed or modified. All construction works will be directed to avoid disturbing or modifying any of the Littoral Rainforest Endangered Ecological Community. As an extra precaution, a 7-part Test was performed for the Littoral Rainforest in order to fully identify and assess potential indirect impacts (**Appendix 2**).

l) Is landscaping proposed and does it conform with Council requirements. If is this being amended and where (ESP or Landscaping Plan)?

A Landscape Plan has been produced (Selena Hannan 2016). The Landscape Plan provides a comprehensive design and species list for the landscaping to be conducted around the proposed dwelling. The Landscape Design uses only local flora species arranged in a manner that reflects local bushland, council requirements and local ecological considerations. Additionally communications with the property owner have confirmed a personal interest in further enhancing native regeneration.

m) Are fire mitigation measure proposed and will they impact on native species?

The Bushfire Hazard Assessment Report (Building Code & Bushfire Hazard Solutions 2016) recommended that the entire property is managed as an Inner Protection Area (IPA) which is described in Appendix 2 of Planning for Bush Fire Protection 2006: Landscaping will be designed to reflect the requirements of an IPA; however, the removal of existing native trees and shrubbery is not required or expected to take place.

n) Should domestic animals be excluded from the site and if so which species and where should they be excluded from?

There is no requirement to exclude domestic animals from the site owing to its urban nature, surrounded by other residencies which have no controls placed on domestic animals. The subject site and its owners have a history of keeping domestic animals with no noticeable ecological effect.

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Appendices

Appendix 1 - Summary Table for Threatened Species

Appendix 2 - Impact Assessments

Assessment of Significance (7-part Test)

- Littoral Rainforest
- Netted Bottlebrush (*Callistemon linearifolius*)

EPBC Act Significant Impact Guidelines Assessment

- Large-eared Pied Bat (*Chalinolobus picatus*)

Appendix 3 - Fauna and Flora Species Lists

Appendix 1 - Summary Table for Threatened Species

Species, Population, Community.	Listing Status	Habitat presence as per Habitat for Threatened Species in Pittwater	Key habitat (ref PC)	Will Development result in loss of habitat?	Will Dev. result in habitat modification?	If Dev. was modified could habitat be retained?	Will the Dev. impact on key habitat features?	If Dev. was modified could these be retained?	7-part test (y/n)
Threatened and Migratory Fauna Species									
Koala (<i>Phascolarctos cinereus</i>)	- Vulnerable (TSC Act) - Vulnerable (EPBC Act) - Endangered population in Pittwater LGA (TSC Act)	No	Swamp Mahogany Forest, ecotone between Spotted Gum Forest & Hawkesbury Sandstone Open-Forest, Northern form of Coastal Sandstone Woodland at Whale Beach, Red Bloodwood - Scribbly Gum Woodland, Bilgola Plateau Forest and the Grey Ironbark - Grey Gum form of the Newport Bangalay Woodland	No	No. No removal or alteration of native vegetation.	n/a	No. No removal of Eucalyptus trees or other likely foraging/ habitat tree.	n/a	No
Spotted-tailed Quoll (<i>Dasyurus maculatus</i>)	- Vulnerable (TSC Act) - Endangered (EPBC Act)	Yes	All vegetation types in the Pittwater area, particularly connected, mature remnants with abundant hollow logs and sandstone caves. Spotted-tail Quoll are most likely to be found in the Ku-ring-gai Chase and Garigal National Parks, and in bushland areas connected to these parks.	No	No. No removal or alteration of native vegetation.	n/a	No. Native scrub habitat is outside of work zone Potential habitat nearby is unlikely to be affected.	n/a	No
Southern Brown Bandicoot (<i>Isoodon obesulus</i>)	- Vulnerable (TSC Act) - Endangered (EPBC Act)	Yes	Heathland, scrub or in an open forest that has a heathy understorey.	No	No. No removal or alteration of native vegetation.	n/a	No. Native scrub habitat is outside of work zone	n/a	No

Bush Stone-curlew (<i>Burhinus</i> <i>grallarius</i>)	Endangered (EPBC Act)	No	Open forests and woodlands with a sparse grassy ground layer and fallen timber. Although not usually a bird of wetlands, many of the birds reported in NSW coastal districts in the more recent years have been associated with mangroves and saltmarshes in estuaries	No	No. Relevant habitat is not within the subject site, nor within the surrounding area.	n/a	No. Relevant habitat is not within the subject site, nor within the surrounding area.	n/a	No
Giant Dragonfly (<i>Petalura</i> <i>gigantea</i>)	Endangered (TSC Act)	No	Habitat is boggy seepages and swamps, near permanent fresh water.	No	No. Relevant habitat is not within the subject site, nor within the surrounding area.	n/a	No. Relevant habitat is not within the subject site, nor within the surrounding area.	n/a	No

Squirrel Glider (<i>Petaurus norfolcensis</i>)	- Vulnerable (TSC Act) - Endangered population from Bushrangers Hill north (TSC Act)	No	Their coastal habitats range from 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 a critical habitat requirement. In coastal New South Wales they typically inhabit areas with a diversity of tree and shrub species, including high nectar-producing species and one or more winter-flowering. Require habitat with lots of tree hollows to use as their dens and for raising their young. Records have been found in Careel Bay/Avalon/Newport area of Barrenjoey Peninsula. This suggests that although urban areas with food plants are important for movements and as a feeding resource for Squirrel Gliders on Barrenjoey Peninsula, it is the large bushland reserves, such as Stapleton Park (1.3km away), Angophora Reserve (1.5km away) and Attunga Reserve (1.6km away), and linking smaller reserves, such as Palmgrove (1.4km away) and Toongari Reserves (1.4km away), that seem to provide the core refuge and breeding habitat.	No	No. No removal or alteration of native vegetation.	n/a	No. No removal or alteration of native vegetation.	n/a	No
Eastern Pygmy-possum (<i>Cercartetus nanus</i>)	Vulnerable (TSC Act).	Yes	Found in a broad range of habitats from rainforest through sclerophyll forest, woodland and heath. There have been records for a number of locations in the Ku-ring-gai Chase National Park however, outside there are only two records. One was seen in Church Point in 1969 and another was rescued and released in Ingleside in 2005.	No	No. No provided there is no removal of native vegetation specifically nectar providing trees e.g. <i>Banksia integrifolia</i> .	n/a	No. No removal or alteration of native vegetation.	n/a	No

Large-eared Pied Bat (<i>Chalinolobus dwyeri</i>)	- Vulnerable (TSC Act) - Vulnerable (EPBC Act)	Yes	Habitats include dry and wet eucalypt forest, <i>Callitris</i> forest, and eucalypt forest with a rainforest understorey, sub-alpine woodland and sandstone outcrop country. Daytime roost sites are caves and disused mine shafts, and even the abandoned, bottle-shaped mud nests of Fairy Martins. In Pittwater they have been seen using St Michaels Cave (roughly 300m NE), between Avalon and Bangallley Head from 1998 until 2005. It is likely that the species is still currently using this cave.	No	Yes. A small portion of sandstone outcrops may be damaged (no more than 40m ²) as a consequence of building the proposed new dwelling.	n/a	Yes. A small portion of sandstone outcrops may be damaged (no more than 40m ²) as a consequence of building the proposed new dwelling. All native vegetated foraging habitat will remain outside of work zone and more to be created.	No	Yes
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Eastern Bent-wing Bat (<i>Miniopterus schreibersii oceanensis</i>)	Vulnerable (TSC Act)	Yes	Occupy a wide range of habitats including wet and dry sclerophyll forest, open woodland, paperbark forest, rainforests and grasslands, but it is typically found in well-timbered valleys. The chief habitat requirements for this species are suitable roosting and breeding sites. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. In Sydney Metro CMA (which includes Pittwater) preferred habitat includes Karst (limestone) caves. No known maternity colonies. Associated with a large range of vegetation communities. In Pittwater there is a regular occurrence of this species in St Michaels Cave at Avalon (roughly 300m NE). This is an important roosting site for the Sydney region. There is also a record in the New South Wales Wildlife Atlas of this species from within 100m of the subject site.	No	Yes. A small portion of sandstone outcrops may be damaged (no more than 40m ²) as a consequence of building the proposed new dwelling.	n/a	Yes. A small portion of sandstone outcrops may be damaged (no more than 40m ²) as a consequence of building the proposed new dwelling. All native vegetated foraging habitats will remain outside of work zone and more to be created.	No	Yes
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Little Bent-wing Bat (<i>Miniopterus australis</i>)	Vulnerable (TSC Act)	Yes	In Pittwater they have been recorded at Katandra Bushland Sanctuary (1995), Angophora Reserve (1995 and 2006) and Burrendong Place, Avalon (1995). Preference is given to well-timbered habitats such as rainforest, sclerophyll forests, melaleuca swamps and coastal forests. This species is a cave-dweller, congregating into maternity roosts in the summer and dispersing to smaller colonies during winter. They also use mines, tunnels and culverts. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. In Sydney Metro CMA (which includes Pittwater) preferred habitat includes Karst (limestone) caves. No known maternity colonies. Associated with a large range of vegetation communities. In Pittwater there is a regular occurrence of this species in St Michaels Cave at Avalon (roughly 300m NE). This is an important roosting site for the Sydney region. There is also a record in the New South Wales Wildlife Atlas of this species from within 100m of the subject site.	No	Yes. A small portion of sandstone outcrops may be damaged (no more than 40m ²) as a consequence of building the proposed new dwelling.	n/a	Yes. A small portion of sandstone outcrops may be damaged (no more than 40m ²) as a consequence of building the proposed new dwelling. All native vegetated foraging habitat will remain outside of work zone and more to be created.	n/a	No
Greater Broad-nosed Bat (<i>Scoteanax rueppellii</i>)	Vulnerable (TSC Act)	Yes	Dry and wet eucalypt forest and woodland, rainforest, but show a preference for moist gully forests. It usually roosts in tree hollows (chiefly eucalypts), but has also been recorded in the roof spaces of old buildings. It is believed to be dependent on mature forest on soils of high fertility.	No	No. Potential habitat will not be impacted provided there is no removal of native vegetation	n/a	No. Primary foraging habitat lies outside of work zone. No potential natural roost habitat present.	n/a	No

Little Red Flying Fox (<i>Pteropus scapulatus</i>)	Secure	Yes	Found throughout coastal and subcoastal n. and e. Australia. Roosts by day in streamside trees and feeds in a range of tropical, subtropical and temperate forests and woodlands. Nomadic species moving in relation to food supply. Feed primarily on blossom, but may forage on fruit, sap and insects when blossom is unavailable. May eat cultivated fruit in times of natural food shortage. Closest records are single sightings from Patonga and Manly (ALA search 20/5/16).	No	No. No removal or alteration of native vegetation.	n/a	No. No removal or alteration of native vegetation.	n/a	No
Grey-headed Flying Fox (<i>Pteropus poliocephalus</i>)	- Vulnerable (TSC Act) - Vulnerable (EPBC Act)	Yes	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Can travel up to 50 km from the camp to forage; commuting distances are more often greater than 20 km. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines. In Pittwater, there are two camp sites for the Grey-headed flying fox. They are located in Cannes Reserve, Avalon and Warriewood Wetlands.	No	No. No provided there is no removal of native vegetation specifically nectar providing trees e.g. <i>Banksia interifolia</i> .	n/a	No. No removal or alteration of native vegetation.	n/a	No

Red-crowned Toadlet (<i>Pseudophryne australis</i>)	Vulnerable (TSC Act)	No	Specifically in areas that have sandstone geology, including open woodland, eucalypt forest and heath. They prefer steep escarpments and plateaus, and low undulating ranges. Here they stay close to the ridge-top, where they hide under flat sandstone bush-rock. But you may also find them nearby under logs, beneath thick ground litter, especially if it is near a large tree or in a rock crevice. In Pittwater, the Red-crowned Toadlet has been recorded in Deep Creek Reserve, Narrabeen, Ingleside, Church Point and Bayview. Breeding habitat is ephemeral or intermittent low order drainage lines with a build-up of litter or other debris within heath or eucalypt forest on sandstone. Forage within 50 metres of breeding habitat.	No	No. Habitat on subject site is suboptimal for foraging, low potential for breeding habitat due to lack of soak/ water holding areas necessary for breeding.	n/a	No. No potential habitat within work zones. No removal or alteration of native vegetation. No change to drainage lines.	n/a	No
Giant Burrowing Frog (<i>Heleioporus australiacus</i>)	- Vulnerable (TSC Act) - Vulnerable (EPBC Act)	No	For most of the year, you will find the Giant Burrowing Frog on a ridge within several hundred metres of a small, densely vegetated creek. Foraging habitat is Heath, woodland or forest, on most soils except not generally found where there is a grassy ground layer. Breeding requires soaks or pools in 1st or 2nd order streams, ponded sections of unmarked drainage lines, culverts and other ridge top structures containing water, upland swamps. In the Pittwater area, Giant Burrowing Frogs are most likely to be found in bushland on sandstone plains. Records show them in the upper reaches of Narrabeen Creek and Fern Creek.	No	No. Relevant densely vegetated creek/ soak habitat is not within the subject site, nor within the surrounding area.	n/a	No. No potential habitat within work zones. No removal or alteration of native vegetation. No change to drainage lines.	n/a	No

Rosenberg's Goanna (Heath Monitor) (<i>Varanus rosenbergi</i>)	Vulnerable (TSC Act)	Yes	Commonly found on the ground in eucalyptus woodlands and heathland. It is more typical of ridgetop and plateau vegetation than the more common Lace Monitor (<i>Varanus varius</i>), which often occurs in gully forests (Smith and Smith 1990a). It is also more of a ground dweller than the Lace Monitor, although it will climb trees when threatened. Rosenberg's Goannas shelter in burrows, hollow logs, rock crevices or under dense bushes In Pittwater there have been numerous records in the Ingleside area from 1993 to 1999 as well as Kuring-gai Chase and Garigal National Parks. The most recent record was in 2007 at Bayview.	No	No. No removal or alteration of native vegetation.	n/a	No. No removal or alteration of native vegetation.	n/a	No
Regent Honeyeater (<i>Xanthomyza phrygia</i>)	- Critically Endangered (TSC Act) - Critically Endangered (EPBC Act)	Yes	Ideal habitat is woodland with a large number of mature trees (especially box ironbark) with dense foliage forming a forest canopy. Also found in forest edges, wooded farmland, urban patches of eucalyptus and coastal heathland and scrub with flowering banksias.	No	No. No removal or alteration of native vegetation.	n/a	No. No removal or alteration of native vegetation.	n/a	No
Swift Parrot (<i>Lathamus discolor</i>)	- Endangered (TSC Act) - Endangered (EPBC Act)	Yes	Found mostly on the coast and on the south-west slopes. Occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Particularly attracted to areas of flowering Swamp Mahogany in the Pittwater area.	No	No. No removal or alteration of native vegetation.	n/a	No. No removal or alteration of native vegetation.	n/a	No

Glossy Black-cockatoo (<i>Calypthohynchus lathamii</i>)	Vulnerable (TSC Act)	No	Two major habitat requirements: she-oaks (trees and shrubs of the genera <i>Allocasuarina</i> and <i>Casuarina</i>), the seeds of which are almost their only food source; and old eucalypts (live or dead) with large hollows for nesting.	No	No. No removal or alteration of native vegetation.	n/a	No. No removal or alteration of native vegetation.	n/a	No
Masked Owl (<i>Tyto novaehollandiae</i>)	Vulnerable (TSC Act)	Yes	Eucalypt forest and woodland, with a sparse mid-storey and where there is a mosaic of dense and open vegetation, including at ground cover level. Suitable open habitats include grassland, sedgeland, heathland, chenopod shrubland, saltmarsh, canegrass, wetlands and gardens.	No	No. No removal or alteration of native vegetation.	n/a	No. No removal or alteration of native vegetation.	n/a	No
Barking Owl (<i>Ninox connivens</i>)	Vulnerable (TSC Act)	Yes	Eucalypt forest and woodland, usually on fairly fertile soils. Barking Owls seem to prefer open woodland vegetation and forest margins, rather than forest interiors.	No	No. No removal or alteration of native vegetation.	n/a	No. No removal or alteration of native vegetation.	n/a	No
Powerful Owl (<i>Ninox strenua</i>)	Vulnerable (TSC Act)	Yes	In New South Wales, you will find the Powerful Owl in eastern forests from the coast to tablelands. Requires generous stands of forest, preferring wetter eucalyptus forest, but also inhabit dry eucalyptus forest, woodland, riparian habitat and rainforest.	No	No. No removal or alteration of native vegetation.	n/a	No. No removal or alteration of native vegetation.	n/a	No
Osprey (<i>Pandion haliaetus</i>)	Vulnerable (TSC Act)	Yes	Favour coastal areas, especially the mouths of large rivers, estuaries, lagoons and lakes. In the Pittwater area, Narrabeen Lagoon appears to be the most favoured feeding habitat of the Osprey.	Yes	No. No removal or alteration of native vegetation.	n/a	No. No removal or alteration of native vegetation.	No	No

Australasian Bittern (<i>Botaurus poiciloptilus</i>)	- Endangered (TSC Act) - Endangered (EPBC Act)	No	The Australasian Bittern favours freshwater wetlands with tall, dense vegetation. However, it also occurs in estuarine and brackish wetlands, and sometimes in flooded, rank pastures. It tends to keep to dense vegetation. In Pittwater, there have been a number of reports of the Bittern from Deep Creek (where it appears to be a regular inhabitant) and Narrabeen Lagoon.	No	No. Relevant habitat is not within subject site nor in the surrounding area	n/a	No. Relevant habitat is not within subject site nor in the surrounding area	n/a	No
Black Bittern (<i>Ixobrychus flavicollis</i>)	Vulnerable (TSC Act)	No	Usually found along timbered watercourses, in wetlands where there are fringing trees and particularly in northern Australia, in mangroves. Occurs in both freshwater habitats and estuarine or brackish habitats and is generally associated with permanent rather than temporary waters.	No	No. Relevant habitat is not within subject site nor in the surrounding area	n/a	No. No removal or alteration of native vegetation.	n/a	No
Sooty Oystercatcher (<i>Haematopus fuliginosus</i>)	Vulnerable (TSC Act)	Yes	The species occurs all along the NSW coast, but apparently breeds only on offshore islands. They favour intertidal rock platforms and reefs for feeding, but also forage on ocean beaches and occasionally estuarine mudflats. Particularly suitable areas for Sooty Oystercatchers in Pittwater are located at Turimetta Head, Mona Vale Headland, Bungan Head/Little Reef, South Bilgola Headland, Bangallley Head, Little Head and Barrenjoey Headland.	No	No. Relevant habitat is not within subject site.	n/a	No. Relevant habitat is not within subject site.	n/a	No

Pied Oystercatcher (<i>Haematopus longirostris</i>)	Endangered (TSC Act)	No	The Pied Oystercatcher favours ocean beaches and estuarine sand and mudflats. At high tide, when their feeding grounds are covered, they gather in small flocks to roost on rocks or mud islands above water. In Pittwater the Pied Oystercatcher was originally a resident breeding species but the high levels of human disturbance on the local beaches and mudflats have since rendered them uninhabitable for this species. It now only occurs as a very rare and unusual visitor to the area.	No	No. Relevant habitat is not within subject site.	n/a	No. Relevant habitat is not within subject site.	n/a	No
Adam's Emerald Dragonfly (<i>Archaeophya adamsi</i>)	Endangered (FM Act)	No	Larvae have been found in narrow, shaded riffle zones with moss and abundant riparian vegetation (often closed canopy) in small to moderate sized creeks with gravel or sandy bottoms. Adult dragonflies generally fly away from the water to mature before returning to breed.	No	No. Relevant habitat is not within subject site.	n/a	No. Relevant habitat is not within subject site.	n/a	No
Eastern Freetail-bat (<i>Mormopterus norfolkensis</i>)	Vulnerable (TSC Act)	Yes	They can mostly be found in dry eucalypt forest and woodland and sometimes rainforests and wet sclerophyll forest. The Eastern Freetail Bat mainly roosts in tree hollows but have been located in a roof cavity. One record exists for Pittwater from 2003-2004 in Bayview.	No	No. No removal or alteration of native vegetation.	n/a	No. No removal or alteration of native vegetation.	n/a	No

Southern Myotis (<i>Myotis macropus</i>)	Vulnerable (TSC Act)	No	The Southern Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, and storm water channels, buildings, under bridges and in dense foliage. Roosts are usually positioned near a fairly still water source suitable for foraging. Forage over streams and pools catching insects and small fish by raking their feet across the water surface.	No	No. No removal or alteration of native vegetation.	n/a	No. No removal or alteration of native vegetation.	n/a	No
Sanderling (<i>Calidris alba</i>)	Vulnerable (TSC Act)	No	Occur in coastal areas on low beaches of firm sand, near reefs and inlets, along tidal mudflats and bare open coastal lagoons. It prefers open sandy beaches exposed to open sea-swell, exposed sandbars and spits.	No	No. Relevant habitat is not within subject site.	n/a	No. Relevant habitat is not within subject site.	n/a	No
Great Knot (<i>Calidris tenuirostris</i>)	Vulnerable (TSC Act)	No	It occurs within sheltered, coastal habitats containing large, intertidal mudflats or sandflats, including inlets, bays, harbours, estuaries and lagoons. Often recorded on sandy beaches with mudflats nearby, sandy spits and inlets and sometimes on exposed reefs or rock platforms.	No	No. Relevant habitat is not within subject site.	n/a	No. Relevant habitat is not within subject site.	n/a	No
Gang-gang Cockatoo (<i>Callocephalon fimbriatum</i>)	Vulnerable (TSC Act)	No	In the summer they prefer tall mountain forest and woodland, with areas heavily timbered with eucalypts and often with dense acacia understorey. In winter the species often ranges further into drier and more open eucalypt forests and woodlands at lower altitudes and it's during this time when they are more likely to be seen in urban areas.	No	No. Relevant habitat is not within subject site.	n/a	No. Relevant habitat is not within subject site.	n/a	No

Greater Sand-plover (<i>Charadrius leschenaultia</i>)	Vulnerable (TSC Act)	No	They are found right around the Australian coast between October and January. The species breeds in central Asia and those that migrate to summer in Australia keep mainly to the northwest coast. Some stragglers may reach more southern parts in small groups of five or six but rarely stay long. It feeds mainly on small crustaceans and molluscs on tidal sand and mud flats, crabs and shrimps. Individual birds feed over a small area.	No	No. Relevant habitat is not within subject site.	n/a	No. Relevant habitat is not within subject site.	n/a	No
Lesser Sand-plover (<i>Charadrius mongolus</i>)	Vulnerable (TSC Act)	No	It visits Australia when it migrates South in winter from its breeding habitat in Asia. In Australia the species may occur around the entire coast. They use beaches in sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats. There is one record for Warriewood from 1998, presumably in the wetlands. They tend to stay in flocks, often sharing roosting and feeding sites with other waders. Suitable roost sites include sandy beaches, spits and rocky shores.	No	No. Relevant habitat is not within subject site.	n/a	No. Relevant habitat is not within subject site.	n/a	No

Eastern Bristlebird (<i>Dasyornis brachypterus</i>)	- Endangered (TSC Act) - Endangered (EPBC Act)	Yes	Habitat for central and southern populations is characterised by dense, low vegetation including heath and open woodland with a heathy understorey. Types are fire prone. Requires dense (>80% projected cover) heath/sedgeland or woodland with dense heath understorey. (Burnt heath will not be able to be fully utilised until 3 years after fire) to forage and breed. Potential habitat exists for this species in the Pittwater area, but there are no recent records of this species from the area. If it did occur in the Pittwater it is now extinct. Closest population to the subject site occurs in the Barren Grounds Nature Reserve, Budderoo National Park and the Jervis Bay area.	No	No. Relevant habitat occurs within the subject site but species is extinct in Pittwater.	n/a	No. Relevant habitat occurs within the subject site but species is extinct in Pittwater.	n/a	No
Black-tailed Godwit (<i>Limosa limosa</i>)	Vulnerable (TSC Act)	No	Usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. It is a migratory wading bird that breeds in Mongolia and Eastern Siberia (Palearctic) and flies to Australia for the southern summer, arriving in August and leaving in March. In NSW, it is most frequently recorded at Kooragang Island (Hunter River estuary), with occasional records elsewhere along the north and south coast, and inland.	No	No. Relevant habitat is not within subject site.	n/a	No. Relevant habitat is not within subject site.	n/a	No
Little Shearwater (<i>Puffinus assimilis</i>)	Vulnerable (TSC Act)	No	A widespread species in the subtropical Atlantic, Pacific and Indian Oceans. Lord Howe Island has one of the larger breeding colonies in the Australian region. In Sydney Metro CMA (inc. Pittwater) is may be seen foraging in marine waters or breeding on off shore islands.	No	No. Relevant habitat is not within subject site.	n/a	No. Relevant habitat is not within subject site.	n/a	No

Flesh-footed Shearwater (<i>Puffinus assimilis</i>)	Vulnerable (TSC Act)	No	A widespread species in the subtropical Atlantic, Pacific and Indian Oceans. In Sydney Metro CMA (inc. Pittwater) it may be seen foraging in marine waters or breeding on off shore islands	No	No. Relevant habitat is not within subject site.	n/a	No. Relevant habitat is not within subject site.	n/a	No
Painted Snipe (<i>Rostratula australis</i>)	- Endangered (TSC Act) - Endangered (EPBC Act)	No	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	No	No. Relevant habitat is not within subject site.	n/a	No. Relevant habitat is not within subject site.	n/a	No
Little Tern (<i>Sternula albigrons</i>)	Endangered (TSC Act)	No	The species is mostly coastal, however will occasionally occur further inland using harbours, inlets and rivers but still within a few kilometres of the sea shore. It is found on the north, east and south-east Australian coasts. The Little Tern arrives in NSW from September to November, when it migrates from Asia to breed. There has been one recording in Pittwater (date unknown).	No	No. Relevant habitat is not within subject site.	n/a	No. Relevant habitat is not within subject site.	n/a	No
Terek Sandpiper (<i>Xenus cinereus</i>)	Vulnerable (TSC Act)	No	They visit the west, north and east coasts of Australia, during its non-breeding season in August through to April. The species breeds south of the Arctic from southern Finland to north-eastern Siberia. Records show they forage in coastal mudflats, lagoons, creeks and estuaries, with a preference for mangroves. There is one record from the Warriewood area, presumably in the wetlands.	No	No. Relevant habitat is not within subject site.	n/a	No. Relevant habitat is not within subject site.	n/a	No

Green Turtle (<i>Chelonia mydas</i>)	- Vulnerable (TSC Act) - Vulnerable (EPBC Act)	No	Occurs in tropical and warm temperate waters worldwide. This Turtle is carnivorous, with adults also foraging on seaweed and seagrasses. This species has been recorded along the coast as well as in Pittwater, near Elvina Bay.	No	No. Relevant habitat is not within subject site.	n/a	No. Relevant habitat is not within subject site.	n/a	No
Leathery Turtle (<i>Dermochelys coriacea</i>)	- Endangered (TSC Act) - Endangered (EPBC Act)	No	It is the world's most widespread reptile using open ocean and coastlines from north of the arctic circle to south of New Zealand, including most of the Australian coast, with the exception of coral reefs. This species nests in the tropics, with breeding in Australia limited to mid-eastern Queensland. This turtle forages only on jellyfish and other gelatinous invertebrates. This species was recorded south of Refuge Bay in Cowan Creek.	No	No. Relevant habitat is not within subject site.	n/a	No. Relevant habitat is not within subject site.	n/a	No
Broad-headed Snake (<i>Hoplocephalus bungaroides</i>)	- Endangered (TSC Act) - Vulnerable (EPBC Act)	Yes	Habitat consists of sandstone outcrops and escarpments, where the vegetation is usually woodland, open woodland or heath and often with a north-westerly aspect. Potential habitat exists for this species in the Pittwater area, but there are no recent records of this species from the area. If it did occur in the Pittwater it is now extinct. Nearest population occurs in the Royal National Park.		No. Relevant habitat occurs within the subject site but species is extinct in Pittwater.	n/a	No. Relevant habitat occurs within the subject site but species is extinct in Pittwater.	n/a	No

Species, Population, Community.	Listing Status	Habitat presence as per Habitat for Threatened Species in Pittwater	Key habitat (ref PC)	Will Development result in loss of habitat?	Will Dev. result in habitat modification?	If Dev. was modified could habitat be retained?	Will the Dev. impact on key habitat features?	If Dev. was modified could these be retained?	7-part test (y/n))
Threatened Flora Species									
Coastal (Sand) Spurge (<i>Chamaesyce psammogeton</i>)	Endangered (TSC Act)	No	Grows on fore-dunes, pebbly strandlines and exposed headlands, often with Spinifex (<i>Spinifex sericeus</i>) and Prickly Couch (<i>Zoysia macrantha</i>). Sand Spurge seeds float, so some dispersal between beaches may occur. The species was recorded at Avalon Beach in 1987 by Peter Clarke (Atlas of NSW Wildlife). It has also been recorded at Palm Beach (Benson and McDougall 1995). It is also predicted to occur in Pittwater (Part A) on fore dunes and headlands.	No	No. Relevant habitat is not within subject site.	n/a	No. Relevant habitat is not within subject site.	n/a	No
Angus' Onion Orchid (<i>Microtis angusii</i>)	- Endangered (TSC Act) - Endangered (EPBC Act)	Yes	Known from Ingleside, north of Sydney. Recent study has expanded this range from original single discovery site (Eco Logical, 2015). This site was highly disturbed and contained modified soils and thus may not fully represent preferred natural habitat. Further research required. The most likely natural habitat of <i>Microtis angusii</i> in the Pittwater-Warringah area is the Duffys Forest Vegetation Community.	No	No. Relevant habitat is not within subject site.	n/a	No. Relevant habitat is not within subject site.	n/a	No

Netted Bottle Brush (<i>Callistemon linearifolius</i>)	Vulnerable (TSC Act)	Yes	In the Sydney Metro CMA the Netted Bottle Brush is known to be associated with the following vegetation communities: Cumberland Dry Sclerophyll Forest, Sydney Coastal Dry Sclerophyll, Coastal Floodplain Wetlands, Coastal Swamp Forest, Eastern Riverine Forest, Coastal Valley Grassy Woodlands and Sydney Coastal Heath. Recorded from the Georges River to Hawkesbury River in 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.	No	Designated searches performed in the subject site. One unconfirmed specimen found.	No, work zones are will be maintained outside of the area likely to cause direct or indirect impacts	No	Potential habitat is outside of work zones and unlikely to be impacted.	Yes
<i>Darwinia biflora</i>	- Vulnerable (TSC Act) - Vulnerable (EPBC Act)	Yes	Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone. Associated overstorey species include <i>Eucalyptus haemastoma</i>, <i>Corymbia gummifera</i> and/or <i>E. squamosa</i>. The vegetation structure is usually woodland, open forest or scrub-heath.	No	Designated searches performed in the subject site revealed no specimens.	n/a	Potential habitat is outside of work zones and unlikely to be detrimentally changed.	n/a	No

<i>Epacris purpurascens</i> var. <i>purpurascens</i>	Vulnerable (TSC Act)	No	Found in a range of habitat types, most of which have a strong shale soil influence. Within the Sydney Metro CMA it is associated with the following vegetation classes: Cumberland Dry Sclerophyll Forest, Eastern Riverine Forests, Coastal Valley Grassy Woodlands and Northern Hinterland Wet Sclerophyll Forests.	No	No. Relevant habitat is not within subject site nor in the surrounding area	n/a	No. Relevant habitat is not within subject site nor in the surrounding area	n/a	No
<i>Haloragodendron lucasii</i>	- Endangered (TSC Act) - Endangered (EPBC Act)	No	The known locations of this species are confined to a very narrow distribution on the north shore of Sydney. Associated with dry sclerophyll forest. Reported to grow in moist sandy loam soils in sheltered aspects, and on gentle slopes below cliff-lines near creeks in low open woodland. Associated with high soil moisture and relatively high soil-phosphorus levels.	No	No. Relevant habitat is not within subject site nor in the surrounding area	n/a	No. Relevant habitat is not within subject site nor in the surrounding area	n/a	No
<i>Leptospermum deanei</i>	- Vulnerable (TSC Act) - Vulnerable (EPBC Act)	Yes	Woodland on lower hill slopes or near creeks. Sandy alluvial soil or sand over sandstone. Occurs in Riparian Scrub - e.g. <i>Tristaniopsis laurina</i>, <i>Baechea myrtifolia</i>; Woodland - e.g. <i>Eucalyptus haemstoma</i>; and Open Forest - e.g. <i>Angophora costata</i>, <i>Leptospermum trinervium</i>, <i>Banksia ericifolia</i>.	No	Designated searches performed in the subject site revealed no specimens.	n/a	Potential habitat is outside of work zones and unlikely to be detrimentally changed.	n/a	No

Deane's Paperbark (<i>Melaleuca deanei</i>)	- Vulnerable (TSC Act) - Vulnerable (EPBC Act)	Yes	The species occurs mostly in ridgetop woodland, with only 5% of sites in heath on sandstone. Within the Sydney Metro CMA it is known to occur within Pittwater (Part B). Associated with the following vegetation community classes: Sydney Coastal Dry Sclerophyll Forests, Coastal Valley Grassy Woodlands and Sydney Coastal Heath.	No	Designated searches performed in the subject site revealed no specimens.	n/a	Potential habitat is outside of work zones and unlikely to be detrimentally changed.	n/a	No
Narrow-leafed Wiltonia (<i>Wiltonia backhousei</i>)	Vulnerable (TSC Act)	No	Salt marsh and margins, saline areas, rocky shoreline. Associated with mangrove swamps and saltmarsh vegetation communities. Known in Pittwater (Part B) CMA and predicted in Pittwater Part A.	No	No. Relevant habitat is not within subject site nor in the surrounding area.	n/a	No. Relevant habitat is not within subject site nor in the surrounding area.	n/a	No
Heart leaved Stringy-bark - <i>Eucalyptus camfieldii</i>	- Vulnerable (TSC Act) - Vulnerable (EPBC Act)	Yes	Found on sandstone ridgetops with shallow, low-nutrient soils, often where drainage is restricted. Soils are sandy or loamy, often lateritic. As yet, not recorded in the Pittwater Council area. However, it occurs just outside the area in Ku-ring-gai Chase National Park, west of Elvina Bay (Lembit 1997, Atlas of NSW Wildlife). It is a potential inhabitant of ridges and plateaus on Hawkesbury Sandstone geology in the western and southern parts of Pittwater.	No	Designated searches performed in the subject site revealed no specimens.	n/a	Potential habitat is outside of work zones and unlikely to be detrimentally changed.	n/a	No

Curved Rice-flower - <i>Pimelea curviflora</i>	- Vulnerable (TSC Act) - Vulnerable (EPBC Act)	Yes	In Warringah, <i>Pimelea curviflora</i> var. <i>curviflora</i> is mainly found in the Duffys Forest Vegetation Community (Smith and Smith 1997b, 2000). This community is associated with shale lenses on ridges in Hawkesbury Sandstone geology. A population on the southern side of Narrabeen Lagoon is an exception, being found in Angophora Woodland, a Hawkesbury Sandstone community dominated by <i>Angophora costata</i> and found on ridges and slopes in the vicinity of coastal lagoons and estuaries (Smith and Smith 1995, 1997b). This community, like the Duffys Forest Vegetation Community, is a taller vegetation type than is typical of Hawkesbury Sandstone ridges, and appears to be associated with more fertile conditions.	No	No. Relevant habitat is not within subject site nor in the surrounding area.	n/a	No. Relevant habitat is not within subject site nor in the surrounding area.	n/a	No
Glandular Pink-bell - <i>Tetratheca glandulosa</i>	Vulnerable (TSC Act)	Yes	Usually grows on Hawkesbury Sandstone ridges and plateaus in eucalypt woodland, scrub and heath on sandy or rocky soils. In the Warringah-Pittwater area, it is sometimes found in the endangered Duffys Forest Vegetation Community, which is associated with shale lenses in Hawkesbury Sandstone, but occurs more often in other Hawkesbury Sandstone ridgetop woodland and heath communities.	No	Designated searches performed in the subject site revealed no specimens.	n/a	Potential habitat is outside of work zones and unlikely to be detrimentally changed.	n/a	

Magenta Lillypilly – <i>Syzygium paniculatum</i>	- Endangered (TSC Act) - Vulnerable (EPBC Act)	Yes	Typically grows in littoral (beach) rainforest on coastal sand dunes or in gallery (watercourse) rainforest on alluvial soils (Benson and McDougall 1998). However, it also grows in other rainforest types and in wetter eucalypt forest types. Known from the Pittwater CMA. Closest known records are approximately 1 km away from subject site.	No	Designated searches performed in the subject site revealed no specimens.	n/a	Potential habitat is outside of work zones and unlikely to be detrimentally changed.	n/a	No
Caley's Grevillea - <i>Grevillea caleyi</i>	- Critically Endangered (TSC Act) - Endangered (EPBC Act)	Yes	Grevillea caleyi occurs in northern Sydney over an area of approximately 6 x 6 km which is centred on Terrey Hills and also includes parts of Duffys Forest, Belrose and Ingleside. Within this distribution some 20 stands of Grevillea caleyi, remnants of former populations, persist (Scott et al. 1995, as updated 2000). Only five of these stands occur within, or partly within, National Parks and Wildlife Service lands: three in Ku-ring-gai Chase National Park and two in the eastern section of Garigal National Park.	No	Designated searches performed in the subject site revealed no specimens.	n/a	Potential habitat is outside of work zones and unlikely to be detrimentally changed.	n/a	No
Bauer's Midge Orchid - <i>Genoplesium baueri</i>	- Endangered (TSC Act) - Endangered (EPBC Act)	Yes	Known to occur within the Pittwater (Part B) catchment associated with Sydney Coastal Heath vegetation community. Occurs in a wide range of woodland, forest and heath types. No proximal records.	Potential	Potential habitat is outside of work zones and unlikely to be detrimentally changed.	n/a	Potential habitat is outside of work zones and unlikely to be detrimentally changed.		

Hairy Geebung - <i>Persoonia hirsuta</i>	- Endangered (TSC Act) - Endangered (EPBC Act)	Yes	Typically grows in woodland or scrub/heath on sandstone, often where there is a clay influence at a shale/sandstone ecotone. In Pittwater the species has been recorded in Ku-ring-gai Chase National Park and from within the vicinity of the Baha'i Temple at Ingleside. At both the Baha'i Temple and Tumbledown Dick Hill, the species was growing in the Duffys Forest Vegetation Community on lateritic soils associated with shale lenses within Hawkesbury Sandstone.	Potential	Designated searches performed in the subject site revealed no specimens.	n/a	Potential habitat is outside of work zones and unlikely to be detrimentally changed.	n/a	No
Threatened Ecological Communities									
Pittwater Spotted Gum Forest	Endangered (TSC Act)	No	Pittwater Spotted Gum Forest occurs on shale-derived soils with high rainfall on lower hillslopes on the Barrenjoey Peninsula, Scotland Island and the western Pittwater foreshores. It is made up of both Coastal Dry Spotted Gum Forest and Coastal Moist Spotted Gum Forest.	No	Designated searches performed in the subject site revealed that the vegetation assemblage was not characteristic.	n/a	Potential habitat is not found within the area surrounding the subject site.	n/a	No
Duffys Forest Ecological Community	Endangered (TSC Act)	No	Duffys Forest Ecological Community is found on Hawkesbury Sandstone Ridges and is generally associated with shale lenses and lateritic soils. Only two small stands of this community are known in the Pittwater Council area, one in Plateau Park, Bilgola and the other around the Baha'i Temple in Ingleside.	No	Designated searches performed in the subject site revealed that the vegetation assemblage was not characteristic.	n/a	Potential habitat is not found within the area surrounding the subject site.	n/a	No

Freshwater Wetlands on Coastal Floodplains	Endangered (TSC Act)	No	Associated with coastal areas subject to periodic flooding and in which standing fresh water persists for at least part of the year in most years. Typically occurs on silts, muds or humic loams in low-lying parts of floodplains, alluvial flats, depressions, drainage lines, backswamps, lagoons and lakes but may also occur in backbarrier landforms where floodplains adjoin coastal sandplains. Known from along the majority of the NSW coast. However, it is distinct from Sydney Freshwater Wetlands which are associated with sandplains in the Sydney Basin bioregion. Extensively cleared and modified.	No	Designated searches performed in the subject site revealed that the vegetation assemblage was not characteristic.	n/a	Potential habitat is not found within the area surrounding the subject site.	n/a	No
Sydney Freshwater Wetlands	Endangered (TSC Act)	No	Sydney Freshwater Wetlands (SFW) occurs on sand dunes and low-nutrient sandplains along coastal areas in the Sydney Basin bioregion. In Pittwater there are only a small number of sites where SFW can be found. The largest of these is Warriewood Wetlands, one of the last remnants of sandplain within the Sydney region. Other sites include Mona Vale Golf Course, Warriewood Square, Boondah Depot, and Rat Park Sports Centre.	No	Designated searches performed in the subject site revealed that the vegetation assemblage was not characteristic.	n/a	Potential habitat is not found within the area surrounding the subject site.	n/a	No
River-Flat Eucalypt Forest on Coastal Floodplains	Endangered (TSC Act)	No	Associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Typically form mosaics with other floodplain forest communities and treeless wetlands, and often fringe treeless floodplain lagoons or wetlands with semi-permanent standing water.	No	Designated searches performed in the subject site revealed that the vegetation assemblage was not characteristic.	n/a	Potential habitat is not found within the area surrounding the subject site.	n/a	No

Swamp Oak Floodplain Forest	Endangered (TSC)	No	The community is found in close proximity to rivers and estuaries and is generally found on soils with a saline influence. The soils of the community may be quite wet and as such the composition of species present will vary markedly from site to site. In Pittwater it is represented by Estuarine Swamp Oak Forest and Estuarine Reedland which form components of the Swamp Oak Floodplain Forest EEC.	No	Designated searches performed in the subject site revealed that the vegetation assemblage was not characteristic.	n/a	Potential habitat is not found within the area surrounding the subject site.	n/a	No
Swamp Sclerophyll Forest on Coastal Floodplains	Endangered (TSC Act)	No	Associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. The composition of the community is primarily determined by the frequency and duration of waterlogging and the texture, salinity nutrient and moisture content of the soil, and latitude. The composition and structure of the understorey is influenced by grazing and fire history, changes to hydrology and soil salinity and other disturbance, and may have a substantial component of exotic grasses, vines and forbs. In Pittwater, this EEC is made up of the Coastal Flats Swamp Mahogany Forest.	No	Designated searches performed in the subject site revealed that the vegetation assemblage was not characteristic.	n/a	Potential habitat is not found within the area surrounding the subject site.	n/a	No

Littoral Rainforest	- Endangered (TSC Act) - Critically Endangered (EPBC Act)	Yes	Littoral Rainforest occurs close to the sea (generally within 2km) where there is exposure to salt-laden winds. Rainforest plants dominate the area - vines can form a major part of the canopy along with trees such as Eucalypts and Banksias, making this vegetation community truly unique. In Pittwater, Littoral Rainforest is made up of three vegetation communities. These include Coastal Dune Littoral Rainforest, Coastal Escarpment Littoral Rainforest and Coastal Headland Littoral Thicket.	Yes	No. Work zones will be kept clear of the Littoral Rainforest patch as defined in this report.	Work zones will be kept clear of the Littoral Rainforest patch as defined in this report.	Work zones must be kept clear of the Littoral Rainforest patch as defined in this report.	A sustained effort must be maintained to minimize flow on impacts from work zones incl. erosion, soil disturbance, storm water runoff and weed spread.	Yes
Coastal Saltmarsh	- Endangered (TSC Act) - Vulnerable (EPBC Act)	No	Coastal Saltmarsh is frequently found as a zone on the landward side of mangrove stands typically between the Mean High Tide and the King Tide marks. It survives in a niche created by the hyper saline conditions that restricts terrestrial species, and the lack of regular tidal flushing that restricts mangrove species. Sites in Pittwater incl. Winnererremy Bay, Careel Bay, Refuge Cove, Saltpan Cove and Winji Jimmi.	No	Designated searches performed in the subject site revealed that the vegetation assemblage was not characteristic.	n/a	Potential habitat is not found within the area surrounding the subject site.	n/a	No

Themeda Grasslands	Endangered (TSC Act)	No	Themeda grasslands can be found on a small number of seacliffs and coastal headlands within the Pittwater Council area. They include Long Reef Point, Narrabeen Head, Turimetta Head and Mona Vale Headland Reserve. Smaller remnant areas can also occur on other headlands with sandstone derived soils, seacliffs and talus slopes. Overall, the community has a highly restricted geographic distribution comprising small, but widely scattered patches.	No	Designated searches performed in the subject site revealed that the vegetation assemblage was not characteristic.	n/a	Potential habitat is not found within the area surrounding the subject site.	n/a	No
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Appendix 2 – Impact Assessments

EP&A Act/ TSC Act Assessment of Significance (7-part Test)

- Littoral Rainforest
- *Callistemon linearifolius*

EPBC Act Significant Impact Guidelines Assessment

- Large-eared Pied Bat (*Chalinolobus picatus*)

NSW Threatened Species Act – Assessment of Significance (7-part Test) for the Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions Endangered Ecological Community		
(a) in the case of a threatened species, whether the action proposed 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,		n/a
(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,		n/a
(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:	(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 extent of the redevelopment works are not proposed to extend significantly beyond the current footprint. The subject site has a history of disturbance associated with urbanisation which is also unlikely to be substantially increased. The proposed work notably avoids any clearing of native vegetation, particularly that within the designated Littoral Rainforest patch. This patch is situated near to the property boundary away from work zones with an intermediary buffer of ornamental garden and coastal scrub vegetated areas. Based on this it was considered that the proposed works are unlikely to have significant impact on the extent or composition of the ecological community. Recommendations have been made to prevent and mitigate any potential impacts.
	(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,	
(d) in relation to the habitat of a threatened species, population or ecological community:	(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and	No native vegetation is scheduled to be cleared in association with the proposed works. There may be existing edge effects which will continue during the proposed works due to the nature of the small sized patch and its proximity to residential properties. The impact of this will not be substantially increased during the proposed works. Surrounding the subject site to the east, south and west is designated bushland which will remain unaltered by the proposed works. This area will maintain connectivity with other areas of native vegetation. Effort will be made to protect and enhance the Littoral Rainforest as part of the Bushland Management Plan. Furthermore native vegetation including Littoral Rainforest area and the surrounding vegetation are not to be cleared in association to the development works. Work zones must be erected so that they will not come within direct contact with the designated patch of Littoral Rainforest.
	(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and	
	(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,	
(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),		Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions).

**NSW Threatened Species Act – Assessment of Significance (7-part Test)
for the
Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
Endangered Ecological Community**

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

OEH has listed 12 Priority actions to help enhance Littoral Rainforest. Of these those relevant to the subject site have been highlighted in **bold**.

- Collate existing information on vegetation mapping and associated data for this EEC and identify gaps in knowledge
- Conduct targeted field surveys and ground truthing to fill data gaps and clarify condition of remnants.
- Prepare identification and impact assessment guidelines and distribute to consent and determining authorities.
- Use mechanisms such as Voluntary Conservation Agreements to promote the protection of this EEC on private land.
- **Liaise with landholders and undertake and promote programs that ameliorate threats such as grazing and human disturbance.**
- Enhance the capacity of persons involved in the assessment of impacts on this EEC to ensure the best informed decisions are made.
- **Undertake weed control for Bitou Bush and Boneseed at priority sites in accordance with the approved Threat Abatement Plan and associated PAS actions.**
- **Identify and prioritise other specific threats and undertake appropriate on-ground site management strategies where required.**
- Undertake control of feral pigs and horses at identified key sites.
- **Undertake bush regeneration to restore, expand and reconnect remnants where considered practical.**
- Determine location, species composition and threats to remaining remnants to assist with prioritising restoration works.
- Collect seed for NSW Seedbank. Develop collection program in collaboration with BGT - all known provenances (conservation collection).
- Investigate seed viability, germination, dormancy and longevity (in natural environment and in storage).

The above have been addressed by performing designated site searches for both Boneseed and Bitou Bush, communicating with land holders of the presence of this EEC within their property and providing recommendations for threat abatement and habitat protection/enhancement. Bush regeneration works are already in action in nearby and surrounding bushland reserves, Bangalley Head and North Avalon Headland and should be continued, particularly in the council-managed area to the immediate south of the Littoral Rainforest remnant.

NSW Threatened Species Act – Assessment of Significance (7-part Test) for the Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions Endangered Ecological Community	
(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.	Key Threatening Processes (KTPs) listed under Schedule 3 of the TSC Act associated with Littoral Rainforest are:- ▪ Invasion of weeds threatens the integrity of particular stands. ▪ Clearing or damage to stand-margins resulting in salt and wind damage and loss of canopy integrity. ▪ Clearing and/or physical disturbance to the understorey and surrounds from actions such as firewood collection, grazing, human visitation and rubbish dumping. ▪ Inappropriate collection of plant species (eg. epiphytes). ▪ Fire, particularly along the boundary of the community. ▪ Introduction of pathogens. ▪ Loss of fauna due to predation from feral animals. ▪ Invasion of native plant communities by African Olive <i>Olea europaea</i> L. subsp. <i>cuspidata</i> ▪ Clearing and fragmentation of stands not protected by State Environmental Planning Policy 26. The proposed works are considered unlikely to result in an increased impact, under the provision that the mitigation recommendations outlined in this report are followed and construction works do not impact the Littoral Rainforest patch. No native vegetation clearing has been proposed. Subsequent site utilisation during and post works is expected to remain unchanged, in terms of human visitation, plant/ firewood collection and rubbish dumping.

NSW Threatened Species Act – Assessment of Significance (7-part Test) for the Netted Bottle Brush (<i>Callistemon linearifolius</i>)	
Conservation Status:	Vulnerable
(a) in the case of a threatened species, whether the action proposed 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,	Netted Bottle Brush (<i>Callistemon linearifolius</i>) is a perennial shrub that flowers in spring -summer. The one (yet unconfirmed) plant identified on the subject site occurs outside of the proposed work zone. This means it should not be directly impacted by the proposed works. Indirect impacts are hard to quantify as the Ecology of this species is currently Data-deficient. Some pollinators such as nectarivorous birds may be frightened off visiting during the work periods; however this should not have significant impacts on any local viable populations (if existent) which will continue to be available for cross pollination in subsequent years. Insects are likely to continue visitation unimpinged by the proposed works.
(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,	n/a
(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:	(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,
	n/a

**NSW Threatened Species Act – Assessment of Significance (7-part Test)
for the
Netted Bottle Brush (*Callistemon linearifolius*)**

(d) in relation to the habitat of a threatened species, population or ecological community:	(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and	No native vegetation is scheduled to be cleared in association to the proposed works. There may be existing edge affects which will continue during the proposed works due to the nature of the small sized patch and its proximity to residential properties. The impact of this will not be substantially increased during the proposed works. Designated bushland surrounds the subject site to the east, south and west which provides a significantly larger area of potential habitat which will remain unaltered by the proposed works. This area will maintain connectivity with other potential specimens nearby and provide suitable habitat for self-propagation. No fragmentation is expected.
	(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and	
	(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,	
(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),	Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for <i>C. linearifolius</i> in New South Wales.	
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,	This species has been assigned to the Data-deficient species management stream under the Saving our Species program (OEH) at the time of this assessment (May 2016). Thus no formal actions have been proposed to form a recovery plan or threat abatement plan. Listed Activities to assist this species are as follow:- ▪ Search for the species in suitable habitat in areas that are proposed for development or management actions, protect any such site found. ▪ Protect known habitat from clearing or disturbance. ▪ Determine response of species to fire and develop and promote a recommended fire regime. These have been addressed in this report by the recommendation that the specimen be formally identified thus enabling it to be registered within the area. The specimen has been specified to be protected from clearing or habitat disturbance in accordance with the Precautionary Principle prior to formal identification. Future potential fire management will need to be address if/ when the specimen is formally identified and coordinated with Pittwater Council and current bush regeneration works in the surrounding North Avalon and Banaalllev Bushland Reserves.	

NSW Threatened Species Act – Assessment of Significance (7-part Test) for the Netted Bottle Brush (<i>Callistemon linearifolius</i>)	
(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.	Only one Key Threatening Processes is considered relevant to this species:- Clearing of native vegetation These issues are deemed unlikely to be further exacerbated by the proposed works. Furthermore, effort is being taken to actively remove weeds and restore native vegetation across the subject site. This will help the <i>C.linearifolius</i>.
Conclusion	It is concluded that there will be no significant impacts upon Netted Bottle Brush (<i>Callistemon linearifolius</i>). No SIS is required.
References	
NSW OEH (2013) Netted Bottle Brush – profile http://www.environment.nsw.gov.au/ThreatenedSpeciesApp/profile.aspx?id=10129 [May 2016]	

NSW Threatened Species Act – Assessment of Significance (7-part Test) for Cave-roosting Microbat Species Large-eared Pied Bat (<i>Chalinolobus dwyeri</i>) Eastern Bent-wing Bat (<i>Miniopterus schreibersii oceanensis</i>) Little Bet-wing Bat (<i>Miniopterus australis</i>)	
Conservation Status:	Vulnerable
(a) in the case of a threatened species, whether the action proposed 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,	These three microbat species all require similar rock crack and crevice habitat for temporary (daytime) roost sites between night time foraging bouts. They may also use some of this habitat for winter torpor (suspended animation). Rock crack and crevice habitat exists on the subject site. There has been no confirmation of use (by microbats) of any of the potential habitat that exists on the subject site so the precautionary principle applied and these species were assumed to potentially occur. Use of cave habitat can only be confirmed during the warmer months (spring – summer) when these species are active and calling. The predicted direct loss of potential roosting habitat will be no more than 40m² of sandstone outcropping through construction of the proposed new dwelling. Indirect impacts to potential roosting habitat from construction-related vibration and cave collapse are considered unlikely. Extensive suitable potential roosting habitat occurs to the east of the subject site in Council reserve. It is considered that any impacts to any potential roosting habitat, will be

NSW Threatened Species Act – Assessment of Significance (7-part Test) for Cave-roosting Microbat Species Large-eared Pied Bat (<i>Chalinolobus dwyeri</i>) Eastern Bent-wing Bat (<i>Miniopterus schreibersii oceanensis</i>) Little Bent-wing Bat (<i>Miniopterus australis</i>)		
		minor and insignificant and there will be no 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.
(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,		n/a
(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:	(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	n/a
	(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,	
(d) in relation to the habitat of a threatened species, population or ecological community:	(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and	No native vegetation (potential foraging habitat) is scheduled to be cleared in association to the proposed works. There may be existing edge effects which will continue during the proposed works due to the nature of the small sized patch and its proximity to residential properties. The impact of this will not be substantially increased during the proposed works. Surrounding the subject site to the east, south and west is designated bushland which provides a significantly larger area of potential foraging habitat which will remain unaltered by the proposed works. Rock crack and crevice habitat exists on the subject site. There has been no confirmation of use (by microbats) of any of the potential habitat that exists on the subject site so the precautionary principle applied and these species were assumed to potentially occur. Use of cave habitat can only be confirmed during the warmer months (spring – summer) when these species are active and calling. The predicted direct loss of potential roosting habitat will be no more than 40m² of sandstone outcropping through construction of the proposed new dwelling. Indirect impacts to potential roosting habitat from construction-related vibration and cave collapse are considered unlikely. Extensive suitable potential roosting habitat occurs to the east of the subject site in Council reserve. No habitat fragmentation or isolation is expected. The maximum 40m² of sandstone outcropping to be removed or modified is not crucial to the the long-term survival of the three species in the locality.
	(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and	
	(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,	

NSW Threatened Species Act – Assessment of Significance (7-part Test) for Cave-roosting Microbat Species Large-eared Pied Bat (<i>Chalinolobus dwyeri</i>) Eastern Bent-wing Bat (<i>Miniopterus schreibersii oceanensis</i>) Little Bent-wing Bat (<i>Miniopterus australis</i>)	
(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),	Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for these species locally.
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,	A Recovery Plan was produced for the Large-eared Pied Bat. This plan covers all of the cave-roosting bats covered in this 7-part test as all three species have the similar roosting and foraging requirements locally. A list of Recovery Actions have been produced for the Large-eared Pied Bat, Little Bent-wing Bat and Eastern Bent-wing Bat. The Recovery Actions most relevant to the subject site are: • Identify and protect roost habitat artificial structures (eg culverts, old buildings and derelict mines). • Undertake restoration and augmentation planting and/or direct seeding, including species from the ground layer and understorey in areas of degraded and/or potentially suitable habitat where weeds can be effectively managed. Revegetation should focus on expanding existing smaller areas of suitable habitat and connecting areas of suitable habitat to create corridors for movement. A diversity of local native species should be planted. • Check that cave entrances are not blocked in a way that prevents easy continual access by bats. Monitor the density of vegetation (native or exotic) at the entrance to any active or potential maternity or hibernation roost cave and manually remove (do not use chemicals) as necessary to ensure bats have ready access year round. • Raise awareness amongst landholders in close proximity (approximately 15km radius) to maternity or hibernation roost caves, of the potential impacts of using harmful pesticides and other chemicals and discourage their use in or adjacent to habitat areas. The proposed project will comply with all of the above recommended actions. The recommended actions will be addressed as part of the Bushland Management Plan for the subject site.
(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.	The following threats have been identified for these bat species. • Disturbance by recreational cavers and general public accessing caves and adjacent areas particularly during winter or breeding. • Loss of high productivity foraging habitat. • Introduction of exotic pathogens, particularly white-nose fungus. • Cave entrances being blocked for human health and safety reasons, or vegetation (particularly blackberries) encroaching on and blocking cave entrances. • Hazard reduction and wildfire fires during the breeding season. Only one Key Threatening Processes is considered relevant to this species:- Clearing of native vegetation

**NSW Threatened Species Act – Assessment of Significance (7-part Test)
for
Cave-roosting Microbat Species**

**Large-eared Pied Bat (*Chalinolobus dwyeri*)
Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*)
Little Bent-wing Bat (*Miniopterus australis*)**

	These issues are deemed unlikely to be further exacerbated by the proposed works.
Conclusion	It is concluded that there will be no significant impacts upon Large-eared Pied Bat (<i>Chalinolobus dwyeri</i>), Eastern Bent-wing Bat (<i>Miniopterus schreibersii oceanensis</i>) or Little Bent-wing Bat (<i>Miniopterus australis</i>). No SIS is required.

References

Pittwater Council (2012) Little Bent-wing Bat Profile
http://www.pittwater.nsw.gov.au/environment/native_animals/native_fauna_management_plan/threatened_fauna_species_list/little_bent-wing_bat [May 2016]

NSW Office of Environment and Heritage (2016) Eastern Bent-wing Bat Profile
<http://www.environment.nsw.gov.au/ThreatenedSpeciesApp/profile.aspx?id=10534> [May 2016]
QLD DERM (2011). National Recovery Plan for the Large-eared Pied Bat.

NSW OEH (2013) Large-eared Pied Bat Profile
<http://www.environment.nsw.gov.au/ThreatenedSpeciesApp/profile.aspx?id=10157> [May 2016]

Commonwealth Environment Protection and Biodiversity Conservation Act 1999
Assessment of Significant Impact Criteria
for the
Large-eared Pied Bat (*Chalinolobus dwyeri*)
EPBC Act Status: Vulnerable

Significant impact criteria

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

• lead to a long-term decrease in the size of a population	The proposed action will not lead to a long-term decrease in the size of a population. The proposed action may remove a small area of potential, temporary (non-maternal) roost habitat (no more than 40m²) other impacts to this habitat or nearby known roosting habitat are unlikely. There will be no impact to vegetation around which this species forages. Suitable foraging and roosting habitat will remain on and around the subject site.
• reduce the area of occupancy of the species	The proposed action may lead to a small decrease in area of occupancy, however this decrease will be limited to the small area of unconfirmed potential roosting habitat that may exist within the maximum of 40m² of sandstone crevice habitat that may be removed for construction of the proposed dwelling There will be no impact to vegetation around which this species forages. Suitable foraging and roosting habitat will remain on and around the subject site. Known roosting habitat (St Michaels Cave) will remain to the east of the subject site. This habitat will remain unharmed.
• fragment an existing population into two or more populations	This does not apply. No such fragmentation will take place.
• adversely affect habitat critical to the survival of a species	The action will not adversely affect habitat critical to the survival of either of this species.
• disrupt the breeding cycle of a population	There will be no disruption to the breeding cycle of a population as this species does not breed locally and no suitable breeding habitat exists on the subject site.
• modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The action will not modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline. The decrease in potential habitat will be limited to the small area of unconfirmed potential roosting habitat that may exist within the maximum of 40m² of sandstone crevice habitat that may be removed for construction of the proposed dwelling There will be no impact to vegetation around which this species forages. Suitable foraging and roosting habitat will remain on and around the subject site. Known roosting habitat (St Michaels Cave) will remain to the east of the subject site. This habitat will remain unharmed.
• result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	The proponent will monitor exotic species and address any infestations if they occur. Weeds were not a significant issue on the subject property at the time of the field survey, however they were a significant issue in the adjoining Council reserves. Invasive predators were not an issue at this site.
• introduce disease that may cause the species to decline, or	The proposed action will not introduce disease that may cause the species to decline.
• interfere with the recovery of the species.	The proposed project will not interfere with the recovery of the species.

Conclusion

There will be no significant impact on Large-eared Pied Bat (*Chalinolobus dwyeri*) therefore the proposed action should not warrant a Commonwealth EPBC Act Referral.

References:

QLD Department of Environment and Resource Management (2011). National Recovery Plan for the Large-eared Pied Bat.

NSW Office of Environment and Heritage (2013) Large-eared Pied Bat Profile
<http://www.environment.nsw.gov.au/ThreatenedSpeciesApp/profile.aspx?id=10157> [May 2016]

Appendix 3 – Fauna and Flora

Species Lists

Table 2. Flora recorded in the subject site

Scientific Names	Common Names	Exotic	Native		General Abundance
			Littoral RF	Coastal Scrub	
<i>Acacia longifolia</i> subsp. <i>sophorae</i>	Coastal Wattle		*	***	***
<i>Acetosa sagittata</i>	Turkey Rhuburb	x			***
<i>Acmena smithii</i>	Common Lilly Pilly		*		*
<i>Actinotus helianthi</i>	Flannel Flower			**	**
<i>Agapanthus</i> sp	Agapanthus	x			**
<i>Alstroemeria psittacina</i>	Parrot Alstroemeria	x			***
<i>Anagallis arvensis</i>	Pimpernel	x			*
<i>Araucaria heterophylla</i>	Norfolk Island Pine	x			*
<i>Asparagus aethiopicus</i>	Ground Asparagus Fern	x			***
<i>Banksia integrifolia</i>	Coastal Banksia		*	***	***
<i>Banksia serrata</i> (cultivar)	Old Man Banksia				*
<i>Breynia oblongifolia</i>	Coffee Bush		*	*	*
<i>Bryophyllum delagoense</i>	Mother of Millions	x			***
<i>Callistemon</i> sp.	Bottlebrush		*		*
<i>Camellia japonica</i>	Camellia	x			*
<i>Carpobrotus glaucescens</i>	Pigface			**	**
<i>Cassytha</i> sp.	Dodder			*	*
<i>Chlorophytum comosum</i>	Spider Plant	x			*
<i>Cirsium arvense</i>	Spear Thistle	x			*
<i>Clivia miniata</i>	Clivia	x			*
<i>Commelina cyanea</i>	Commelina		*	**	**
<i>Conyza bonariensis</i>	Fleabane	x			***
<i>Coprosma repens</i>	Mirror bush	x			**
<i>Correa alba</i>	White Correa			**	**
<i>Cotoneaster glaucophyllus</i>	Cotoneaster	x			*
<i>Cyrtomium falcatum</i>	Holly Fern	x			*
<i>Dianella caerulea</i>	Blue Flax Lily		*	**	**
<i>Dietes grandiflora</i>	Wild Iris	x			*
<i>Dodonaea triquetra</i>	Large-leaf Hop Bush			*	*
<i>Ehrharta erecta</i>	Panic Veldtgrass	x			***
<i>Elaeocarpus reticulatus</i>	Blueberry Ash			*	*
<i>Entolasia stricta</i>	Wiry Panic		*	**	**
<i>Ficinia (Isolepis) nodosa</i>	Knobby Club-rush		*	**	**
<i>Ficus rubiginosa</i>	Port Jackson fig			*	*
<i>Fresia</i> sp.	Freesia	x			*
<i>Fumaria officinalis</i>	Fumaria	x			***
<i>Geitonoplesium cymosum</i>	Scrambling Lily			*	*
<i>Glochidion ferdinandi</i>	Cheese Tree		***	*	***
<i>Gonocarpus micranthus</i>	Gonocarpus		*		*
<i>Goodenia ovata</i>	Hop Goodenia		*		*
<i>Howea forsteriana</i>	Kentia Palm	x			*
<i>Hydrangea macrophylla</i>	Hydrangea	x			*

Scientific Names	Common Names	Exotic	Native		General Abundance
			Littoral RF	Coastal Scrub	
<i>Hydrocotyle bonnariensis</i>	Hydrocotyle	X			**
<i>Hypochaeris radicata</i>	Flatweed	X			*
<i>Kennedia rubicunda</i>	Dusky Coral Pea		*	***	***
<i>Kunzea ambigua</i>	Tick Bush			*	*
<i>Lantana camara</i>	Lantana	X			**
<i>Leptospermum juniperinum</i>	Prickly Tea-tree			*	*
<i>Leptospermum laevigatum</i>	Coastal Tea Tree		*	***	***
<i>Liriope muscari</i>	Lily Turf	X			***
<i>Livistona australis</i>	Cabbage Tree Palm		*		*
<i>Lomandra longifolia</i>	Honey Reed		*	***	***
<i>Lonicera japonica</i>	Japanese Honeysuckle	X			***
<i>Melaleuca hypericifolia</i>	Hillock Bush		*	*	*
<i>Microlaena stipoides</i>	Weeping Rice Grass		**	**	**
<i>Muehlenbeckia complexa</i>	Wire Vine	X			*
<i>Myrsine variabilis</i>	Muttonwood		**		**
<i>Nephrolepis cordifolia</i>	Fishbone Fern	X			**
<i>Notelaea longifolia</i> f. <i>longifolia</i>	Large Mock-olive		**		**
<i>Notelaea ovata</i>	Ovate Mock-olive		*		*
<i>Ochna serrulata</i>	Ochna	X			*
<i>Olea europaea</i> subsp. <i>cuspidata</i>	African Olive	X			*
<i>Osteospermum ecklonis</i>	Cape Daisy	X			**
<i>Paspalum dilatatum</i>	Paspalum	X			**
<i>Paspalum urvillei</i>	Vasey Grass	X			*
<i>Pennisetum clandestinum</i>	Kikuyu	X			***
<i>Philotheca myoporoides</i>	Long Leaf Wax Flower			*	*
<i>Pittosporum undulatum</i>	Sweet Pittosporum		*	**	**
<i>Plumeria rubra</i>	Frangipani	X			*
<i>Psidium guajava</i>	Dwarf Guava	X			*
<i>Raphirolepis indica</i>	Indian Hawthorn	X			*
<i>Rosa</i> sp.	Rose	X			*
<i>Senna pendula</i>	Cassia	X			*
<i>Smilax glyciphylla</i>	Sweet Sarsaparilla		*		*
<i>Solanum nigrum</i>	Black-berry Nightshade	X			*
<i>Solanum seaforthianum</i>	Climbing Nightshade	X			*
<i>Soncus oleraceus</i>	Sow Thistle	X			**
<i>Tropaeolum majus</i>	Nasturtium	X			*
<i>Viola hederacea</i>	Ivy-leaved Violet	X			***
<i>Westringia fruticosa</i>	Coastal Rosemary			***	***
<i>Zieria smithii</i>	Sandfly Zieria			*	*

Key to Abundance Rating - Plants

* = few - observed infrequently (>5% cover)

** = many - observed often on the site (5 - 30% cover)

*** = abundant - almost always seen (31 - 100% cover)

Table 3. Fauna recorded in the subject site

Scientific Name	Common Name	Abundance Rating
Mammals		
<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum	*
<i>Perameles nasuta</i>	Long-nosed Bandicoot	*
Reptiles		
<i>Cryptoblepharus pulcher</i>	Elegant snake-eyed skink	*
<i>Lampropholis guichenoti</i>	Garden Skink	
<i>Lampropholis delicata</i>	Grass Skink	**
Birds		
<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk	*
<i>Anthochaera chrysoptera</i>	Little Wattlebird	**
<i>Anthochaera carunculata</i>	Red Wattle Bird	*
<i>Falco peregrinus</i>	Peregrine Falcon	*
<i>Hirundo neoxena</i>	Welcome Swallow	*
<i>Manorina melanocephala</i>	Noisy Miner	**
<i>Malurus cyaneus</i>	Superb Fairy-wren	*
<i>Malurus lamberti</i>	Variegated Fairy-wren	*
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	**
<i>Sericornis frontalis</i>	White-browed Scrub wren	*
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	***
Key to Abundance Rating - Animals		
* = few - observed infrequently (1 - 2 individuals)		
** = many - observed often on the site (3 - 10 individuals)		
*** = abundant - almost always seen (11 - 100 individuals)		