Travers

bushfire & ecology

ecological constraints analysis

Boondah Precinct Masterplan

July 2013
(REF:A13030F)

Ecological Constraints Analysis

Boondah Precinct Masterplan

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Date:	3 July 2013
File:	A13030F

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Survey effort has been reduced to provide an indication of the insitu vegetation and fauna habitat present. The 7 part test is based on this survey data and further survey may result in the observation of threatened species not considered in this assessment. Consequently further target threatened species survey may be required by the determining authority. The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy. Consequently the location of all mapped features is to be confirmed by a registered surveyor.

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List of abbreviations

APZ	asset protection zone
BPA	bushfire protection assessment
CLUMP	conservation land use management plan
DCP	Development Control Plan
DEC	NSW Department of Environment and Conservation (superseded by DECC from 4/07)
DECC	NSW Department of Environment and Climate Change (superseded by DECCW from 10/09)
DECCW	NSW Department of Environment, Climate Change and Water (superseded by OEH from 4/11)
EEC	endangered ecological community
EPA	Environmental Protection Agency
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESMP	ecological site management plan
FF	flora and fauna assessment
FM Act	*Fisheries Management Act 1994*
FMP	fuel management plan
HTA	habitat tree assessment
IPA	inner protection area
LEP	Local Environment Plan
LGA	local government area
NES	national environmental significance
NPWS	NSW National Parks and Wildlife Service
NSW DPI	NSW Department of Industry and Investment
OEH	Office of Environment and Heritage (Part of the NSW Department of Premier and Cabinet)
OPA	outer protection area
PBP	*Planning for bushfire protection 2006: A Guide for Councils, Planners, Fire Authorities and Developers*
POM	plan of management
RF Act	*Rural Fires Act*
RFS	NSW Rural Fire Service
ROTAP	rare or threatened Australian plants
SEPP 44	*State Environmental Protection Policy No 44 – Koala Habitat Protection*
SEWPAC	Federal Department of Sustainability, Environment, Water, Population and Communities
SIS	species impact statement

SULE	safe useful life expectancy
TPO	tree preservation order
TPZ	tree preservation zone
TRRP	tree retention and removal plan
TSC Act	*Threatened Species Conservation Act 1995*
VMP	vegetation management plan

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APPENDICES

Figures

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Ecological Constraints

Travers bushfire & ecology has been requested to prepare a flora and fauna constraints analysis for the Boondah Precinct Masterplan located along Boondah Road, Warriewood.

1.0 Background

In 2012 *Travers bushfire & ecology* was requested to provide a preliminary a flora and fauna constraints analysis of six (6) properties off Boondah Road, Warriewood. The findings of that report have been reassessed, incorporating the Warriewood Southern Buffer to inform the preparation of the Boondah Precinct Masterplan.

Flora survey has been undertaken on two (2) occasions over two (2) days in autumn 2012 and autumn 2013, whilst one (1) fauna survey has been undertaken over two (2) days in autumn 2013. All surveys have included some level of targeted threatened species survey for relevant species that have been recorded in close proximity and have potential habitat present.

2.0 Site Description

The subject site encompasses six (6) properties owned by;

- *Henlen Pty Ltd* – Lot 9 DP 806132; 1.51ha
- *Kamfam Pty Ltd* – Lot 2 DP 574339; 1.02ha
- *Trbojevic Pty Ltd* – Lot 5 DP 26902; 1.02ha
- *Henry Fraser Pty Ltd* – Lot 4 DP 26902; 1.02ha
- *Cassius Investments Pty Ltd* – Lot 3 DP 26902; 1.01ha
- *Rooke* - Lot 2 DP 552465; 0.61ha

Figures 2, 3 and 4 show the location of each land owner.

The study area incorporates the lots within the subject site as well as the naturally occurring habitats in the immediate surrounds, including the western side of Narrabeen Creek along this portion and the eastern fringes of the Warriewood Wetlands.

The land area has the general landscape characteristics:

- Geology – Quaternary; alluvium, gravel, sand, silt and clay
- Soils – Warriewood Soil Landscape (deep sandy soils over quaternary sands with a high water table and localised flooding) and Disturbed Terrain
- Vegetation – Floodplain forests, wetlands and Bangalay forests

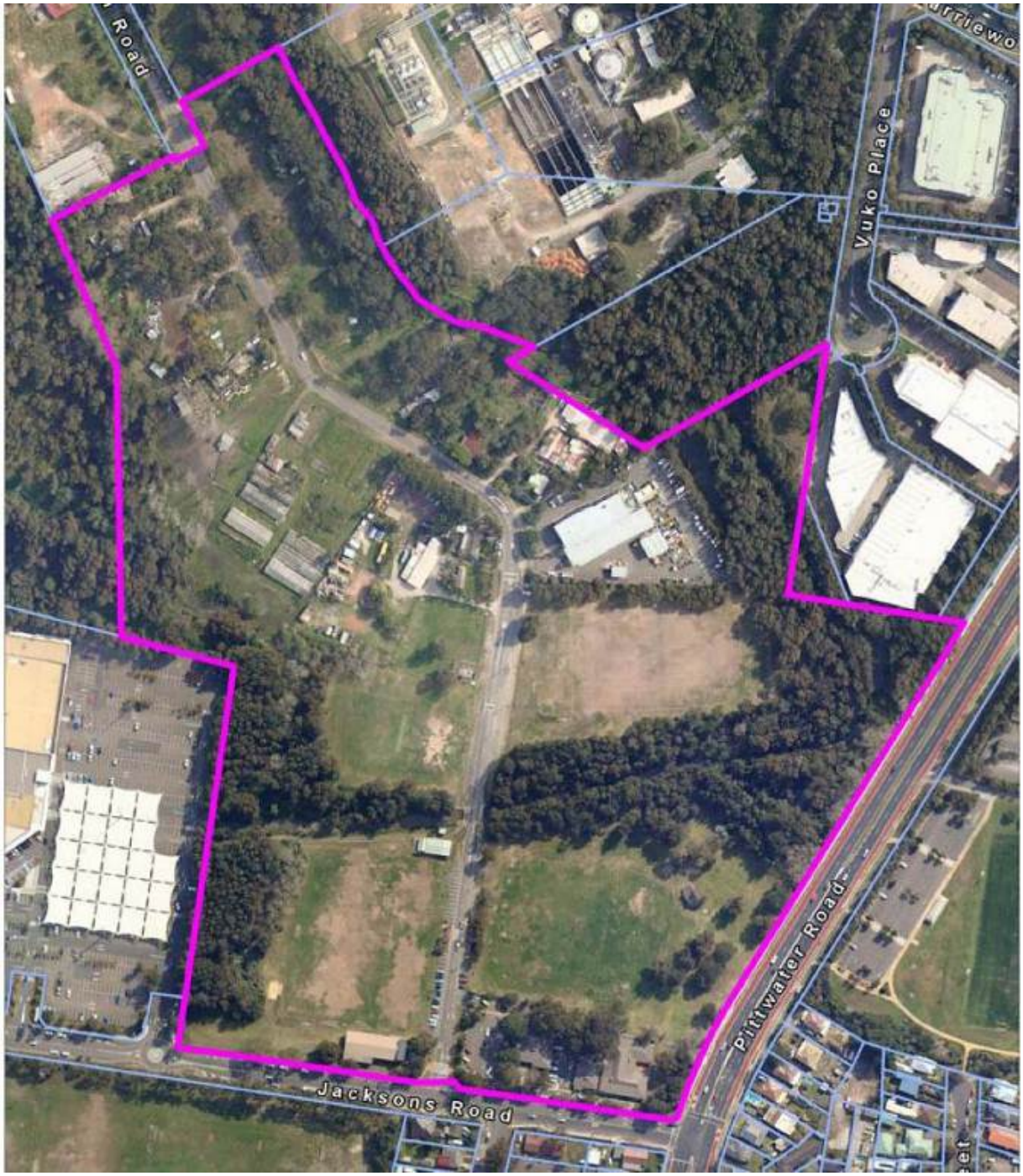

Figure 1 – Warriewood Southern Buffer
(Source: Extract from Figure 3 of the 'Draft Warriewood Strategic Review')

3.0 Survey

3.1 Flora

An inspection of the subject site was undertaken on 15 May 2012 over approximately four (4) hours. Survey included ground-truthing of vegetation communities utilising aerial photography and 6x20x20m floristic quadrats to determine vegetation types.

Survey on 13 April 2013 was undertaken over approximately five (5) hours and included 8x20x20 quadrats and target searches for threatened flora species where applicable. This survey was extended outside of the properties described in Section 2 to incorporate the Southern Buffer and immediately beyond. Further site reconnaissance found that properties in the northern portion of the Southern Buffer contained two (2) endangered ecological

community (EEC) vegetation types, Swamp Sclerophyll Forest on Coastal Floodplains as well as Swamp Oak Floodplain Forest. To the immediate north and west of *Centro* (shopping centre), the vegetation is largely the EEC Freshwater Wetlands with patches of Swamp Oak Floodplain Forest.

3.2 Fauna

Fauna field survey was undertaken on the 8 & 9 April 2013. Fauna field survey locations are shown on Figure 4 and included:

- *Four (4) diurnal bird census points* undertaken along the western interface within natural habitats. A minimum of 15 minutes of survey was undertaken at each census point in an area radiating out to between 20-40m. Bird census points were selected to give an even spread and representation along the fringes of high quality habitat within the Warriewood Wetlands. Census points were also commenced in locations where bird activity was apparent, as often different small bird species are found foraging together. Opportunistic diurnal bird survey was conducted between census points and whilst undertaking other diurnal surveys.

- *Nocturnal call-playback* for threatened species with suitable habitat present and / or nearby records, including Masked Owl (*Tyto novaehollandiae*), Powerful Owl (*Ninox strenua*), Barking Owl (*Ninox connivens*), Black Bittern (*Ixobrychus flavicollis*), Australian Bittern (*Botaurus poiciloptilus*), Bush Stone-curlew (*Burhinus grallarius*), Koala (*Phascolarctos cinereus*) and Green and Golden Bell Frog (*Litoria aurea*).

- *Nocturnal spotlighting* along forest / woodland edges and within the nearby Warriewood wetland area.

- *Passive Anabat monitoring (x3)* which involves leaving a bat recorder in a fixed mounted position to record call sequences of passing bats for the first few hours after dusk. Recording locations are determined in order to represent different available foraging structures for various micro-chiropteran bat species. The Large-footed Myotis was targeted by recording along the Narrabeen Creek including one recorder near to existing culverts where this species is known to roost. One *Anabat* recorder placed along the swamp forest edge did not record due to a faulty flash card and is not included in the effort.

- *Identification of significant habitat trees*. These are defined as trees containing large hollows suitable for use by owls / cockatoos or containing a number of good quality hollows typically consisting of more than one (1) medium (10-30cm) sized hollow. A tree may also be considered significant where evidence of use by select fauna is found, such as Yellow-bellied Glider sap feed tree, raptor nest, or owl roost.

- *Threatened fauna species habitat assessment* with consideration of threatened fauna species previously recorded within 10km of the subject site area on the *Atlas of NSW Wildlife* (OEH 2013) and species listed as having potential habitat within 10km as considered by the *EPBC Protected Matters Search Tool* (SEWPAC 2013).

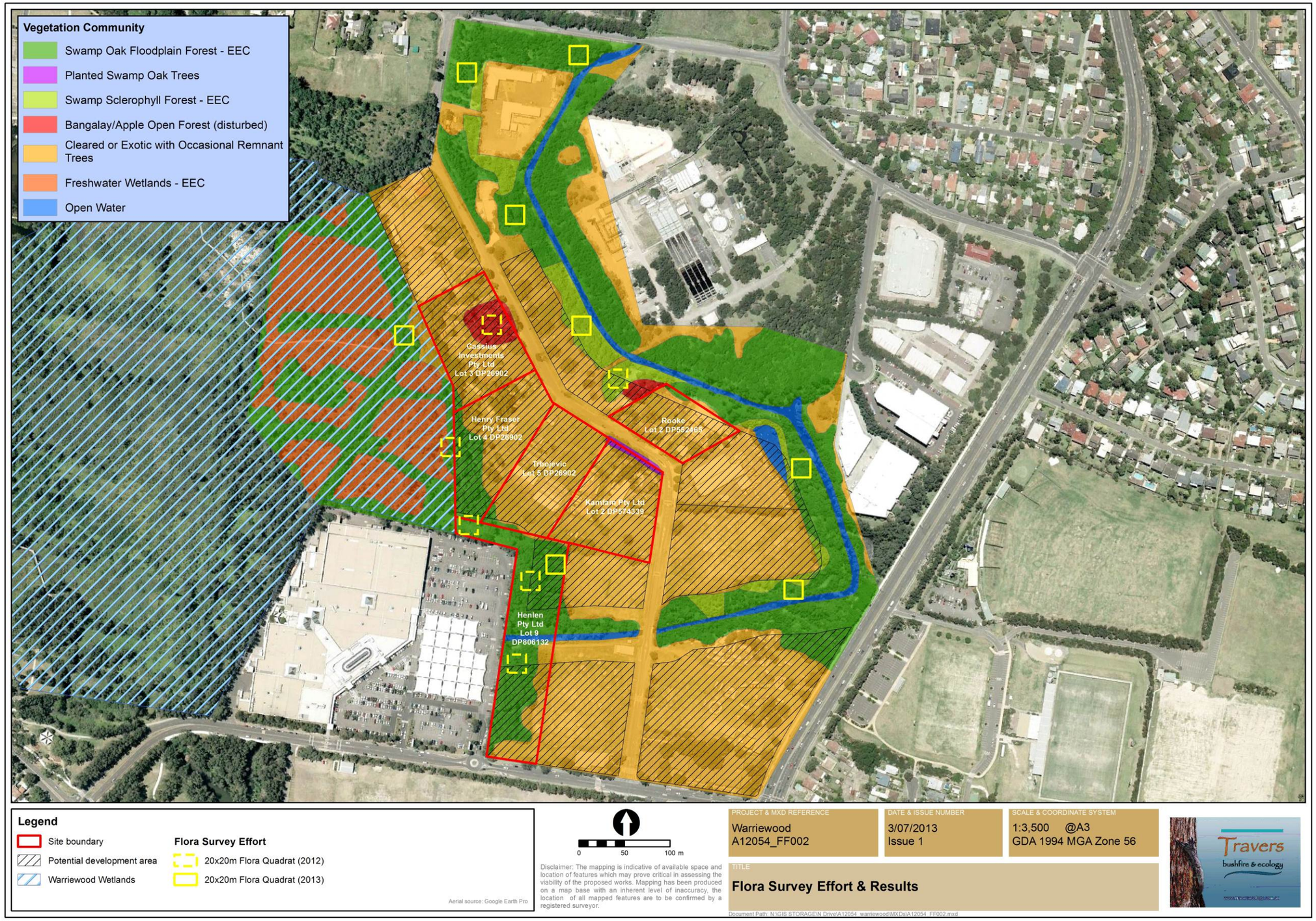

Figure 2 - Vegetation Communities

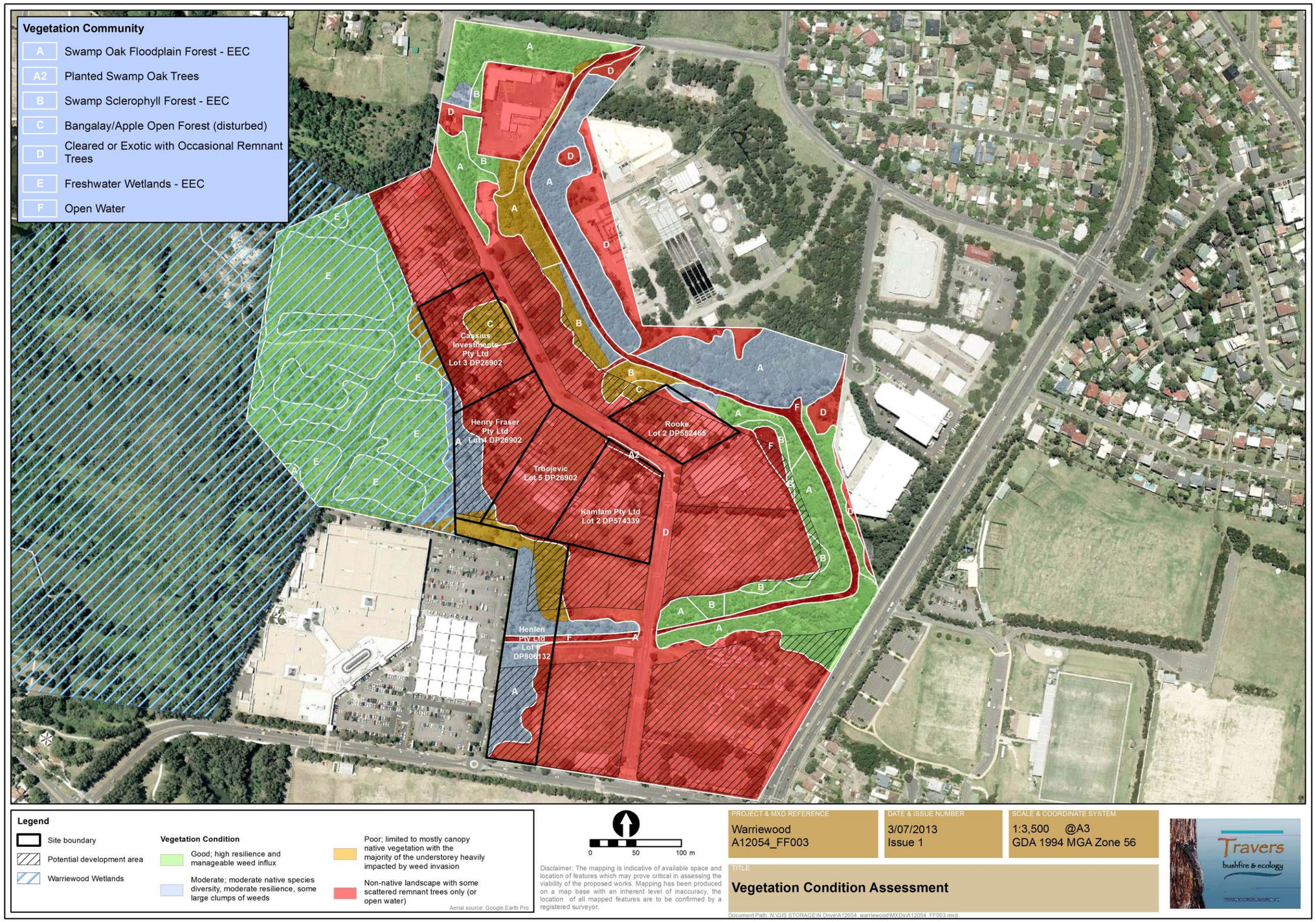

Figure 3 – Vegetation Condition Assessment

Figure 4 - Fauna Survey Effort & Results

4.0 Flora

Seven (7) distinct vegetation types were observed within the study area. These include;

- Swamp Oak Floodplain Forest (EEC)
- Planted Swamp Oak Trees
- Swamp Sclerophyll Forest (EEC)
- Bangalay / Apple Open Forest (disturbed)
- Cleared or Exotic with Occasional Remnant Trees
- Freshwater Wetlands (EEC)
- Open Water

4.1 Swamp Oak Floodplain Forest

Canopy consists of Swamp Oak (*Casuarina glauca*) to a height of 15-22m and a projected foliage cover of 40-75%. Occasional weed species such as Coral Tree (*Erythrina sykesii*) were observed, however, larger plumes such as those on the eastern edge of the Henlen property were delineated into a different vegetation community.

The mid-storey is largely devoid of native vegetation, however, occasional small trees, palms and shrubs were present such as *Melaleuca linariifolia, Melaleuca ericifolia, Glochidion ferdinandi* and *Livistona australis* up to 10% projected foliage cover. The mid-storey contains a large portion of invasive weeds such as Lantana, Senna, Camphor Laurel, Morning Glory and Japanese Honeysuckle in several of the quadrat sites.

Photo 1 – *Swamp Oak Floodplain Forest Vegetation on the Henlen property*

The ground layer contains a number of sedges, herbs and ferns that varied in coverage considerably between the quadrats.

Photo 2 – *Swamp Oak Floodplain Forest Vegetation at the back of Warriewood Centre, 10m from the car park*

Common ground cover species include *Phragmites australis, Juncus* spp., *Gahnia sieberiana, Parsonsia straminea, Hypolepis muelleri, Centella asiatica, Carex appressa, Commelina cyanea, Centella asiatica, Blechnum cartilagineum* and *Viola hederacea.*

Swamp Oak Floodplain Forest is an EEC. Portions of the EEC are disturbed and may or may not warrant inclusion in a protection zone, particularly along the fringes of the larger remnants of vegetation.

4.2 Planted Swamp Oak Trees

As the name suggests, this describes a linear line of Swamp Oak trees on the edge of the Kamfam property. The line of trees appears to have been planted and, whilst they are the same species that dominate the canopy of the EEC Swamp Oak Floodplain Forest, they are not considered to be EEC.

Photo 3 – *Line of Swamp Oak trees on the Kamfam property*

4.3 Swamp Sclerophyll Forest

The Swamp Mahogany Forest occurs on lands owned by *Sydney Water* and within some of the Council's open space lands. It occurs predominantly between the creek line and Boondah Road. Some vegetation is highly disturbed due to horses grazing amongst the remnant trees whilst some patches are of higher quality. The Swamp Sclerophyll Forest graduates into the Swamp Oak Floodplain Forest along the creek line and many swamp oak trees are present within this scattered vegetation community.

The canopy consists of a single eucalypt species, *Eucalyptus robusta* (Swamp Mahogany) with a projected foliage cover of 35% and a height of 18-22m and includes *Casuarina glauca* as a common species. The native-storey is absent in some patches, replaced by species such as Green Cestrum, Lantana and Senna to a projected foliage cover of 30%. In the smaller scattered remnants around the playing field, the Swamp Mahogany trees are juvenile to semi-mature and given there has been weed control undertaken, the native mid-storey is present. There have also been plantings undertaken around the playing field.

In some parts of this vegetation community, the understorey has been grazed by horses and there is limited vegetation in the ground layer. In more intact remnants around the playing field, the ground layer is moderately diverse and has been enhanced through weeding and regeneration.

This vegetation community is consistent with the EEC Swamp Sclerophyll Forest on Coastal Floodplains.

Photo 4 – Swamp Mahogany vegetation within Quadrat 6 which has a managed / disturbed understorey due to previous clearing and horse grazing

4.4 Bangalay / Apple Open Forest (disturbed)

This vegetation community occurs within the Cassius and Rooke properties.

On the Cassius property, a few Smooth-barked Apples (*Angophora costata*) coexist amongst the Bangalays (*Eucalyptus botryoides*) and on the Rooke property, the trees are all Bangalays. The projected foliage cover of the canopy is approximately 25-35% and the height of the trees is between 15-20m. It should be noted that the majority of the native mid-storey is absent and replaced by weed species such as Green Cestrum, Lantana and Senna.

The ground layer contains very limited native species. No native mid or ground layer species were noted in the quadrat undertaken in this vegetation type on the Cassius property.

This vegetation community is not considered to be part of an EEC.

Photo 5 – *Quadrat amongst the Bangalays and Smooth-barked Apple trees*

Photo 6 – *Remnant Bangalay trees on the Rooke property*

4.5 Cleared or Exotic with Occasional Remnant Trees

This vegetation community occupies a large portion of the study area incorporating cleared areas, playing fields, grazed paddocks, planted vegetation and heavily weed infested patches. Some patches of Coral Trees (*Erythrina sykesii*) occur adjacent to playing fields and at the back of the *Cassius Investments* property.

Photo 7 – *Exotic trees and weedy stockpile on the Cassius Investments property*

4.6 Freshwater Wetlands

Colloquially referred to as the Warriewood Wetlands, these occur to the north and west of Warriewood Centre ('Centro' shopping centre). The wetland boundary occurs only a few metres from the Warriewood Southern Buffer boundary (to the west).

The sensitive vegetation is part of the EEC Freshwater Wetlands and contains a number of unique species that are considered rare or endemic to northern Sydney. No quadrats or other stratified survey have been undertaken within this vegetation community by this firm. Some species observed by random meander are however listed in Appendix 1. Some common species observed include *Melaleluca ericifolia, Persicaria* spp., *Azolla pinnata, Schoenoplectus* sp., *Eleocharis sphacelata, Casuarina glauca, Juncus* spp., and *Phragmites australis.*

The noxious weed *Ludwigia peruviana* was present.

Photo 8 – *Wetlands approximately 100m north of Warriewood Centre*

4.7 Open Water

This incorporates the creek line (Narrabeen Creek) and basin area behind the Boondah Road Council Depot. There is generally no vegetation within the creek line, or it is very limited to a few standard creek line species like *Persicaria.* The noxious weed *Ludwigia peruviana* was present.

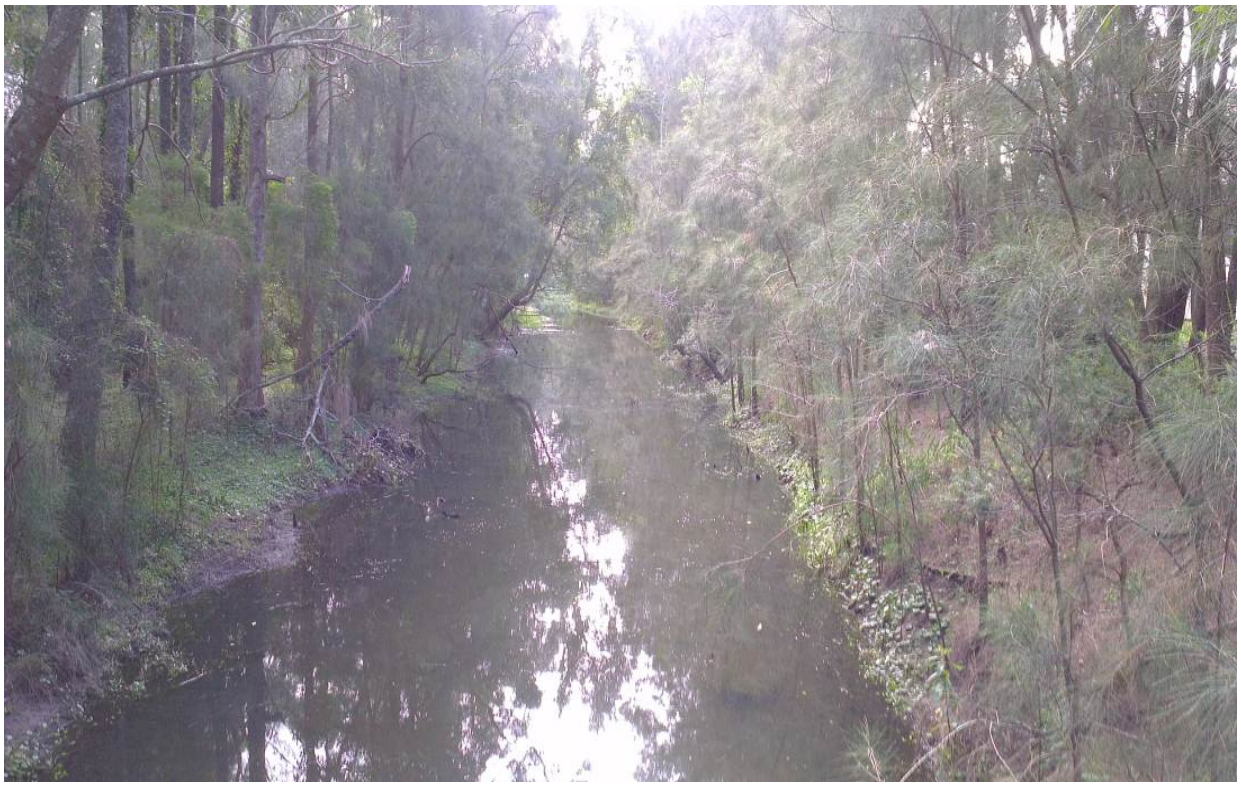

Photo 9 – *Creek line east of the playing field and Council Depot looking north*

4.8 Threatened Flora Species

Threatened Species Conservation Act (TSC Act) – A search of the *Atlas of NSW Wildlife* (OEH, 2013) indicated a list of species that have been recorded within a 10km radius of the subject site. These species are listed in Appendix 2, Table A2.1 and are considered for potential habitat within the subject site.

Environmental Protection Biodiversity Conservation Act (EPBC Act) – A review of the schedules of the *EPBC Act* indicated the potential for a list of threatened flora species to occur within a 10km radius of the subject site. These species have also been listed in Appendix 2 Table A2.1 for consideration of potential to occur.

Based on the habitat assessment within Table A2.1, it is considered that the subject site provides potential habitat for the following threatened flora species. These species will be required to undergo a 7 part test of significance at the time of a development application.

COMMON NAME	TSC Act	EPBC Act	Potential to occur
Callistemon linearifolius	V	-	low
Melaleuca biconvexa	V	V	low

Despite the potential habitat, none of these species were observed during the flora survey.

Callistemon linearifolius has been recorded nearby to the Warriewood Wetlands. The surrounding habitat may provide some form of potential habitat.

Melaleuca biconvexa occurs in swamp locations nearby creeks in alluvial soils near the coast. The site provides potential habitat, however, given that there are no recordings of the species within a 10km radius, the likelihood of occurrence is considered low.

Given these threatened flora species have not been sighted within the Warriewood Southern Buffer, there are not likely to be any threatened flora species constraints to future development potential.

4.9 Endangered Populations

No endangered flora populations occur within a 10km radius of the subject site and there are no known endangered flora populations recognised within the Warringah LGA.

5.0 Fauna

5.1 Fauna Habitat

A search for significant habitat trees was undertaken during survey. No significant habitat trees were identified within the study area or are likely nearby. These include trees containing large hollows suitable for nesting by owls / cockatoos or containing a number of high quality medium or small hollows. The lack of hollows is attributed to historical land clearance within previously eucalypt forested areas and the lack of hollows within the remaining Swamp Oak forest areas.

One (1) tree was identified as containing a raptor nest located in the south western corner of the open paddock areas. A photo of this nest was sent to birding expert John Young for identification who concluded it most likely belongs to a non-threatened goshawk species. As this nest is not likely to belong to any threatened or protected migratory bird species, it is not likely to offer a constraint to development.

5.2 Threatened Fauna Species

TSC Act – A search of the *Atlas of NSW Wildlife* (OEH, 2013) provided a list of threatened fauna species previously recorded within a 10km radius of the subject site. These species are listed in Attachment 2, (Table A2.2) and are considered for potential habitat within the subject site. Strictly coastal and oceanic threatened species found within 10km have not been included.

Fisheries Management Act (FM Act) – No habitat suitable for threatened aquatic species were observed within the subject site and, as such, the provisions of this Act do not require any further consideration.

EPBC Act – A review of the schedules of the *EPBC Act* identified a list of threatened fauna species or species habitat likely to occur within a 10km radius of the subject site. These species have been listed in Attachment 2 (Table A2.2).

In accordance with Table A2.2, the following state and nationally listed threatened fauna species are considered to have potential habitat within the subject site. These species should be considered for impact assessment in any future development application.

COMMON NAME	TSC Act	EPBC Act	Potential to occur
Grey-headed Flying-fox	V	V	recorded
Eastern Bentwing-bat	V	-	recorded
Little Lorikeet	V	-	✓
Swift Parrot	E	E	✓
Barking Owl	V	-	✓
Powerful Owl	V	-	✓
Little Bentwing-bat	V	-	✓
Large-footed Myotis	V	-	✓
Black Bittern	V	-	low
Little Eagle	V	-	low
Osprey	V	-	low
Bush Stone-curlew	E	-	low
Regent Honeyeater	E4A	E	low
Varied Sittella	V	-	low
Scarlet Robin	V	-	low
East-coast Freetail Bat	V	-	low

COMMON NAME	TSC Act	EPBC Act	Potential to occur
Greater Broad-nosed Bat	V	-	low
Green and Golden Bell Frog	E	V	unlikely
Australasian Bittern	E	E	unlikely
Gang-gang Cockatoo	V	-	unlikely
Masked Owl	V	-	unlikely
Spotted-tailed Quoll	V	E	unlikely
Southern Brown Bandicoot	E	E	unlikely
Koala	V	V	unlikely

Two (2) threatened fauna species - Eastern Bentwing-bat (*Miniopterus orianae oceansis*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) were recorded present during survey. Other threatened fauna species have been recorded in the nearby locality and in recent years, such as Barking Owl, that potentially use the study area on a seasonal or periodic basis.

5.2.1 Eastern Bentwing-bat (Miniopterus orianae oceanensis)

The Eastern Bentwing-bat forages above and below the canopy within open forests and woodlands, feeding on small flying insects, predominantly moths (Dwyer 1995). The Eastern Bentwing-bat is known to roost in a range of habitats including stormwater channels, under bridges, occasionally in buildings, old mines and, in particular, caves (Dwyer 1995). Caves are an important resource for this species, particularly for breeding where maternity caves must have suitable temperature, humidity and physical dimensions to permit breeding (Dwyer 1995). Roost sites in tree hollows have not been reported within the literature reviewed.

This species has not been identified as utilising culverts for maternity roosts. Maternity roosts rather are occupied by up to 100, 000 females with only twelve (12) maternity roosts known throughout the complete range (Hoy & Hall 2008).

The Eastern Bentwing-bat was recorded foraging at both *Anabat* stations during survey (see Figure 4 for recorded locations). It is considered that the subject site provides suitable foraging habitat throughout for this species. Roosting habitat may be present in old buildings and structures present as well as within culverts along Narrabeen Creek, however no suitable breeding habitat is present.

This species is not likely to offer a constraint to future development within the subject site, as suitable foraging and roosting habitat remains well represented in the locality and will likely continue within the site following development.

5.2.2 Grey-headed Flying-fox (Pteropus poliocephalus)

Grey-Headed Flying-foxes are canopy feeding frugivores and nectarivores, inhabiting a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas. This species roosts in camps, which may contain tens of thousands of individuals.

Camps are commonly formed in gullies, typically not far from water and usually in vegetation with a dense canopy (Tidemann 1998). Camps can be found in riparian rainforest patches, Melaleuca stands, mangroves, riparian woodland or modified vegetation in urban areas. Loyalty to a site is high and some camps in NSW have been used for over a century (NSW NPWS 2001). Some camps are used at the same time every year by hundreds of thousands of flying-foxes while others are used sporadically by a few hundred individuals (Strahan 1995). Generally, foraging is within 20km of camps, however, individuals are known to commute up to 50km to a productive food source.

It is considered that the subject site contains suitable foraging, roosting and breeding habitat for the Grey-headed Flying-fox. Roosting habitat is only present along the fringes of Narrabeen Creek and the fringes of the Warriewood Wetlands. This species has not been recorded roosting within the subject site, however, a small roosting camp of approximately 100 individuals was recorded roosting approximately 150m to the south west during survey (see Figure 4). This roosting location was at the north western edge of the *Centro* shopping complex within the more suitable roosting habitat of Warriewood Wetlands.

The Warriewood Wetlands provide, high quality habitat for a high diversity of fauna including threatened species and this number would be greater had the wetlands remained well connected to contiguous areas of natural habitat. Some natural vegetation along the narrow western fringe of the subject site contributes to this habitat area but is not expected to be utilised for roosting when the camp seasonally swells in size according to local foraging resources.

The Swamp Mahogany trees present within the subject site may offer unique winter foraging resources for this species within the locality. This remains to be investigated with a review of other nearby Swamp Mahogany stands. Otherwise, this species is not likely to offer a constraint to development within the subject site.

5.3 Protected Migratory Species

Protected migratory species listed under the *EPBC Act* are considered for habitat potential in Table A2.3. No protected migratory bird species were recorded during survey or are considered likely to offer constraints to development within the subject site. This is providing that riparian habitats along Narrabeen Creek are appropriately protected and also given the high quality protected habitat available within the neighbouring Warriewood Wetlands.

5.4 SEPP 44 (Koala Habitat Protection)

The subject site is required to be considered under SEPP 44 as it falls within the Pittwater local government area (LGA), which is listed on Schedule 1 of this Policy. In addition, the total area of the subject site is greater than 1ha, hence, Part 2 – Development Control of Koala Habitats of the Policy applies.

Potential Koala habitat (PKH) is defined as land where at least 15% of the total number of trees in the upper or lower strata constitutes any of the tree species listed in Schedule 2 of the Policy.

Core Koala habitat (CKH) is defined as an area of land with a resident population of Koalas, evidenced by attributes such as breeding females (i.e. females with young) and recent sightings of and historical records of a population.

Step 1 – Is the land PKH?

Two Koala food tree species – Swamp Mahogany (*Eucalyptus robusta* and Tallowwood (*Eucalyptus microcorys*), as listed on Schedule 2 of SEPP 44, were recorded within the study area. Tallowwood occurs as planted specimens in a patch of approximately ten (10) individual trees within the Cleared or Exotic with Occasional Remnant Trees vegetation community. Although such non-endemic mature planted trees may be available for use by Koalas in locations where Koala populations occur, SEPP only applies to “areas of native vegetation” in consideration to PKH and therefore these trees are not considered here in determining PKH.

Swamp Mahogany trees occur naturally as a number of mature individuals on the eastern side of Boondah Road. These trees comprised greater than 15% of the total number of trees within the Swamp Sclerophyll Forest community and combined with additional trees immediately adjacent within the Cleared or Exotic with Occasional Remnant Trees

Community. Figure 4 shows the location of this community and other identified locations where Swamp Mahogany occurs within the study area and immediate surrounds. Therefore, this community and additional stands within study area are classified under SEPP 44 as PKH.

Step 2 – Is the land CKH?

No Koalas were directly observed at the time of fauna survey, which included diurnal searches of trees, call-playback techniques and spotlighting.

Potential presence based on local records and remaining local habitat connectivity is discussed below in Section 4.5 given that any remaining local Koalas are part of the endangered Koala population in the Pittwater LGA. Based on these considerations, the study area is not likely to form CKH under the definitions of SEPP 44. As a precautionary approach, it is recommended that target survey of Koala activity is undertaken within study area to effectively rule out presence where any removal of mature Swamp Mahogany is required. This is particularly so given that naturally occurring Swamp Mahogany trees are limited in presence within the immediate locality.

5.5 Endangered Populations

Two (2) endangered fauna populations are recorded within 10km of the study area. These include the Koala population in the Pittwater LGA and the Squirrel Glider population on Barrenjoey Peninsula.

The Squirrel Glider population is identified north of Bushrangers Hill which is located more than 3km to the north of the study area. There are no records of Squirrel Glider within this distance and therefore the study area is not considered to contribute any habitat of importance to this population.

Koalas forming part of the endangered population have been previously recorded in the locality surrounding to the study area. These records are mostly prior to 1950 with the most recent nearby record located north of the study area in 1975. All of these nearby Koala records are to a 1km accuracy, suggesting they were estimated / approximate locations of historical sightings. The study area contains a mature stand of Swamp Mahogany trees located between Boondah Road and Narrabeen Creek, as well as along the fringes of the Warriewood Wetlands.

There is no doubt that the Swamp Mahogany trees present within the study area would have formed important habitat for the local Koala population when this population was previously well represented in the nearby locality. Habitat removal, fragmentation and isolation in the Pittwater LGA over the last hundred years or so has put high pressures on this population which has diminished to what now seems a non-viable population. Stressed Koalas competing with urban landscapes are more susceptible to disease and poor population dynamics.

Based on records alone, it is unlikely that any remaining Koalas that cling onto remaining habitats in the Pittwater LGA still utilise the available habitat present within the study area. Locations of Swamp Mahogany observed during the flora survey within and near to the study area are shown on Figure 4. This tree is not only an important Koala feed tree but is a profuse winter flowering resource to nectar dependent fauna, including the endangered migratory Swift Parrot which has also been recorded in the locality.

It is recommended, where possible, to retain stands of Swamp Mahogany trees in connective associations to the Warriewood Wetlands or the Narrabeen Creek riparian habitat area. In the case that the proponent may apply to remove any mature stands of Swamp Mahogany, it is recommended that target survey of Koala activity (by use of SAT

survey under *Phillips & Callaghan* 2008) is undertaken within the study area to effectively rule out presence.

5.6 Riparian and Bushfire Constraints

A desktop assessment of riparian and bushfire constraints has been undertaken in accordance with recommended buffers in the NSW Office of Water Guidelines for Controlled Activities (2012) and Planning for Bushfire Protection (2006) and AS3959 (2009) Building in Bushfire Prone Areas.

The results of the desktop assessment have been mapped on Figure 5. Note that a full watercourse assessment report and bushfire protection assessment report would be required to fully define all best practice riparian and bushfire management measures that would apply to the Boondah Precinct Masterplan.

Figure 5 identifies the main north south watercourse as a second order stream requiring a riparian setback of 20 from the top of bank.

The minimum bushfire protection setback lines have been provided for commercial, residential and special fire protection development types subject to the grades within and surrounding the study area.

5.7 Corridor Options

Figure 5 also illustrates the 3 habitat corridor options including:

- Corridor Option 1 – Southern Corridor on the north eastern corner of Warriewood Centre (current vegetation corridor)
- Corridor option 2 - the southernmost corridor leading south across Jacksons Road to cleared open space (existing vegetation)
- Corridor Option 3 – Northern Corridor (recreated) across Boondah Road

Corridor option 1 represents keeping the existing vegetation link which creates a break in the development landscape which is not necessarily a desirable outcome from a development perspective. This corridor would maintain current habitat connectivity of the site to Warriewood Wetland. Its current ecological value is questioned and may be more effectively replaced with piped stormwater drainage and a new habitat corridor in an alternative location.

Corridor option 2 leads to the south across Jacksons Road to cleared open space. It has no direct vegetated link extending beyond the site caused by Jacksons Road. An existing 10 m Swamp Mahogany Corridor extends along Jacksons Road. It would only be of ecological benefit if a 20m plus wide corridor was also created down the southern side of the road to link to the riparian corridor to the south west of Warriewood Centre re-joining the old riparian corridor. Terrestrial connectivity such as provided by large culverts under Jacksons Road would also be an advantage in conjunction with creating a flood drainage. As an option for removal of the existing vegetation around Warriewood Centre it provides the least ecological benefit but has ecological and hydrological merit with enhancement of vegetation corridors on the southern side of Jacksons Road.

Corridor option 3 involves creation of a new corridor to the north across Boondah Road to provide an overland link to Warriewood Wetland from the existing riparian corridor. Corridor option 3 has been drawn as a 45 m wide fully vegetated corridor to minimise the bushfire implications for surrounding development. For on ground habitat connectivity an underpass may be created using inverted concrete culverts. This corridor may also have a role to play in draining flooded landscapes subject to the design and ground levels.

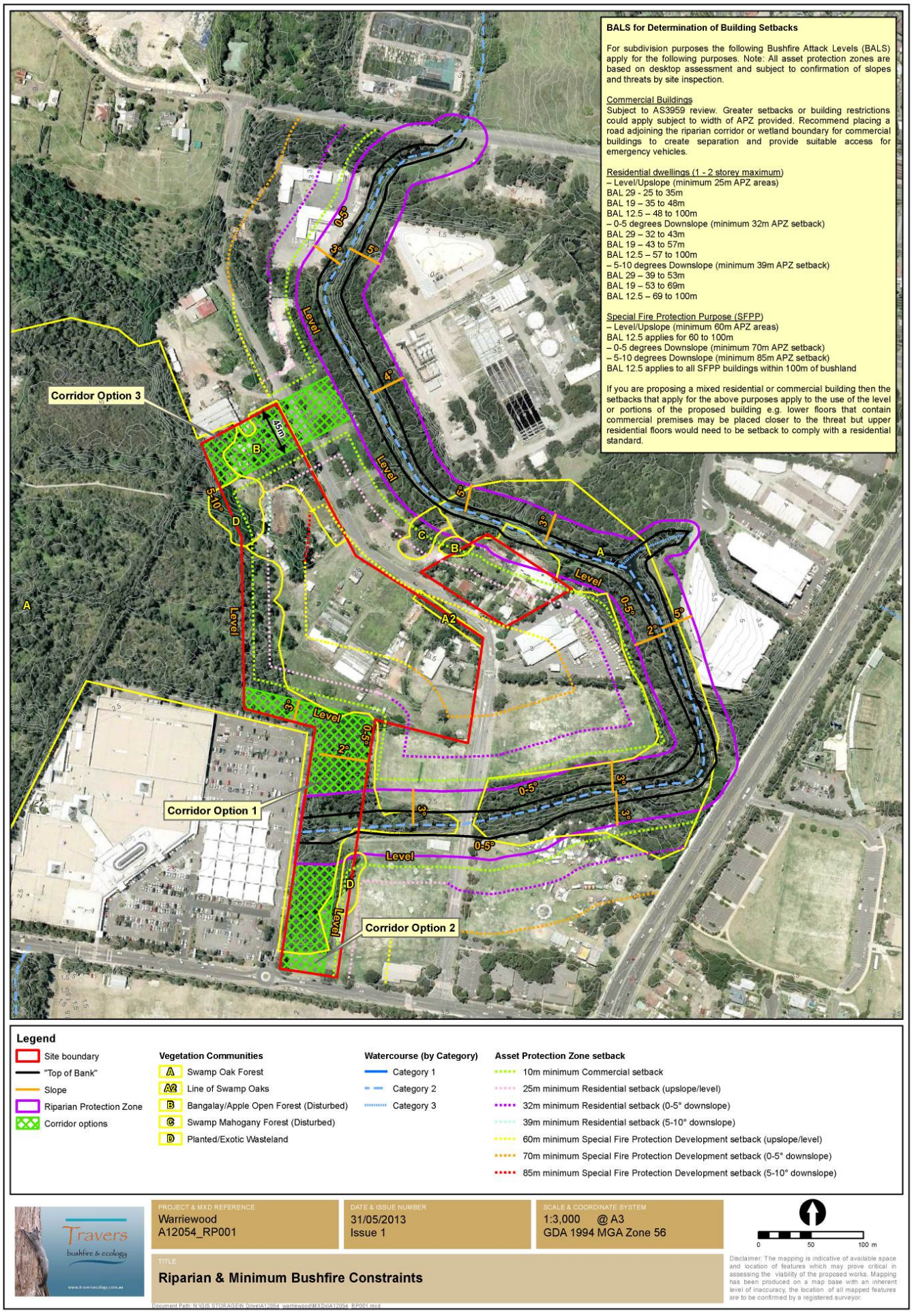

Figure 5 – Corridor options including riparian and bushfire setbacks

The northern most corridor option appears to provide the best outcome ecologically in the event that existing vegetation is removed surrounding Centro to allow expansion of retail facilities. A minimum width of 45 m is recommended to maximise the ecological value of the corridor or maintaining habitat connectivity with Warriewood Wetland.

The southern corridor option has ecological merit if a widened habitat corridor can be provided adjoining Jacksons Road.

6.0 Conclusions

The site has limited value for threatened flora and fauna species. This is due to the highly fragmented vegetation and the remaining natural habitat that exists around the perimeter of highly disturbed lands not directly linked by any high quality habitat corridor to large contiguous areas of natural vegetation. The riparian vegetation is linked by a limited corridor to Warriewood Wetland adjoining Warriewood Centre and two alternative corridor options are provided in the event that the existing vegetation link is removed for development. The northern most corridor option 3 would have least obstacles for implementation and can be undertaken as part of the Boondah Precinct Masterplan.

No threatened flora species have been recorded to date within the Warriewood Southern Buffer and, given the habitat available, there is a low likelihood of finding threatened species.

The EECs present, including Swamp Sclerophyll Forest and Swamp Oak Floodplain Forest provide a constraint to future development. They are typically occurring in an area that is subject to flooding, or within potential riparian corridors.

There are some areas of Swamp Oak Floodplain Forest that may be developable immediately north east of Warriewood Centre however a buffer to the wetland should be retained in the form of retained vegetation and / or partially vegetated APZs.

In respect to threatened fauna species, the subject site provides recorded foraging habitat for Grey-headed Flying-fox and Eastern Bentwing-bat, as well as potential foraging by other species.

The other threatened fauna species which have a high potential to frequent the site seasonally, or on occasion, include the Powerful Owl, Barking Owl, Little Lorikeet, Swift Parrot, Little Bentwing-bat and Large-footed Myotis. The existing culverts at the intersection of Narrabeen Creek and Boondah Road may have breeding / roosting potential for Large-footed Myotis and roosting potential for the little Bentwing-bat.

Based on the survey results, the study area is not likely to be part of any important breeding habitat, or central to the habitat requirements of these threatened species. The removal of habitats present within the subject site is therefore not likely critical to life-cycle requirements of these species, or likely to significantly disturb behaviour.

It is important to retain, and where appropriate restore, riparian habitat along Narrabeen Creek that ensure habitat connectivity is maintained in the locality. It is also important to ensure that any proposal associated with the study area does not impact directly or indirectly on the high quality habitat available in the adjacent Warriewood Wetlands to the west. In association with these habitats, the Swamp Mahogany trees within the study area may play an important function for providing unique foraging resources in the locality, particularly for the endangered Swift Parrot.

6.1 Recommendations

To minimise adverse ecological impacts, the following mitigation measures are proposed:

1. Any loss of EEC vegetation be offset internally if possible through revegetation immediately within the riparian corridor and adjoining Warriewood Wetland.

2. Maintain a managed buffer to the Warriewood Wetland vegetation. A partially vegetated APZ may be an appropriate outcome.

3. In the event that the existing vegetation links are removed on the north eastern corner of Centro, provide a recreated northern corridor (option 3) approximately 45 m in width to maintain or enhance habitat connectivity throughout the landscape.

4. Swamp Mahogany locations within the study area and nearby have been identified on Figure 4. This tree is an important Koala feed tree and a profuse winter flowering resource for the endangered migratory Swift Parrot, as well as the Grey-headed Flying-fox (which was recorded roosting nearby in the wetland area to the south west). It is recommended to retain stands of Swamp Mahogany trees where possible and to plant this species throughout the landscape to provide long term foraging resources.

5. The site contains a number of possums. Most of these are denning within the artificial structures present, given the lack of natural hollows. As the Common Ringtail Possum, in particular, is an important prey species for the Powerful Owl, it is recommended that nest boxes, as part of habitat supplementation, are installed in natural habitat areas prior to any future dismantling of buildings within the subject site. This should be accompanied by a detailed habitat tree survey such that appropriate numbers of boxes can be determined. Nest boxes should be constructed from weatherproof material to ensure longevity.

6. It should be noted that the threatened Eastern Bentwing-bat which was recorded during survey has potential to utilise artificial structures for roosting, but not breeding purposes. As such, any disturbance of a roost during a dismantling process should be effectively managed.

7. Undertake weed control works within the Narrabeen Creek corridor and remove large exotic trees such as *Erythrina sykessi.*

In accordance with ecological assessment purposes under the *TSC Act* and the *EPBC Act*, the following target survey is recommended for:-

- Koalas based on proximity to a listed endangered population by use of SAT survey under *Phillips & Callaghan* 2008, and

- Target survey for Swift Parrot over winter is undertaken within the study area to effectively rule out presence. This may be undertaken at the same time if during the winter flowering period.

Travers bushfire and ecology notes that the likelihood of Koalas occurring within the Warriewood Southern Buffer is low.

Appendix 1

Flora & Fauna Species Lists

Table A1.1 Flora species observed within the subject site and immediately adjacent

Family	Scientific Name	Common Name
TREES		
Mimosaceae	*Acacia parramattensis*	Sydney Green Wattle
Myrtaceae	*Acmena smithii*	Lillypilly
Rhamnaceae	*Alphitonia excelsa*	Red Ash
Myrtaceae	*Angophora costata*	Smooth-barked Apple
Arecaceae	*Archontophoenix alexandrae*	Alexandra Palm
Sterculiaceae	*Brachychiton populneus*	Kurrajong
Casuarinaceae	*Casuarina glauca*	Swamp Oak
Lauraceae	*Cinnamomum camphora**	Camphor Laurel
Myrtaceae	*Corymbia maculata*	Spotted Gum
Sapindaceae	*Cupaniopsis anacardioides*	Tuckeroo
Cyatheaceae	*Cyathea australis*	Rough Tree-fern
Eleocarpaceae	*Elaeocarpus reticulatus*	Blueberry Ash
Fabaceae	*Erythrina sykesii**	Coral Tree
Myrtaceae	*Eucalyptus botryoides*	Bangalay / Southern Mahogany
Myrtaceae	*Eucalyptus microcorys*	Tallowwood
Myrtaceae	*Eucalyptus robusta*	Swamp Mahogany
Moraceae	*Ficus sp.*	Fig
Euphorbiaceae	*Glochidion ferdinandii*	Cheese Tree
Bignoniaceae	*Jacaranda mimosifolia**	Jacaranda
Arecaceae	*Livistona australis*	Cabbage Tree Palm
Myrtaceae	*Melaleuca linariifolia*	Snow in Summer
Myrtaceae	*Melaleuca quinquenervia*	Broad-leaved Paperbark
Musaceae	*Musa acuminata**	Banana
Oleaceae	*Olea europa* subsp. *africana**	Common Olive
Arecaceae	*Phoenix canariensis**	Canary Island Date Palm
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum
Salicaceae	*Salix babylonica**	Weeping Willow
Myrtaceae	*Syncarpia glomulifera*	Turpentine
SHRUBS		
Mimosaceae	*Acacia elongata*	Swamp Wattle
Mimosaceae	*Acacia longifolia* var. *longifolia*	Sydney Golden Wattle
Mimosaceae	*Acacia saligna*	Orange Wattle
Euphorbiaceae	*Breynia oblongifolia*	Coffee Bush
Solanaceae	*Cestrum parqui**	Chilean Cestrum
Apocnynaceae	*Gomphocarpus fruiticosus**	Narrow Leaf Cotton Bush
Proteaceae	*Hakea salicifolia*	Willow Hakea
Euphorbiaceae	*Homalanthus populifolius*	Bleeding Heart
Myrtaceae	*Kunzea ambigua*	Tick Bush
Verbenaceae	*Lantana camara**	Lantana
Oleaceae	*Ligustrum lucidum**	Large-leaved Privet
Oleaceae	*Ligustrum sinense**	Small-leaved Privet
Celastraceae	*Maytenus silvestris*	-
Myrtaceae	*Melaleuca armillaris*	Bracelet Honey Myrtle
Myrtaceae	*Melaleuca ericifolia*	Swamp Paperbark
Araceae	*Monstera deliciosa**	Fruit-salad Plant
Ochnaceae	*Ochna serrulata**	Mickey Mouse Plant
Asteraceae	*Osteospermum fruticosum**	Shrubby Daisy-bush
Pittosporaceae	*Pittosporum revolutum*	Yellow Pittosporum

Family	Scientific Name	Common Name
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax
Euphorbiaceae	*Ricinus communis**	Castor Oil Plant
Rosaceae	*Rubus fruticosus* sp. agg.*	Blackberry Complex
Cesalpinioideae	*Senna pendula* var. *glabrata**	-
Solanaceae	*Solanum mauritianum**	Wild Tobacco
GROUNDCOVERS		
Polygonaceae	*Acetosa saggitata**	Turkey Rhubarb
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair
Asteraceae	*Ageratina adenophorum**	Crofton Weed
Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed
Myrsinaceae	*Anagallis arvensis**	Scarlet Pimpernel
Poaceae	*Andropogon virginicus**	Whisky Grass
Poaceae	*Arundo donax**	Giant Reed
Asparagaceae	*Asparagus aethiopicus**	Asparagus Fern
Aspleniaceae	*Asplenium australasicum*	Birds Nest Fern
Poaceae	*Axonopus fissifolius**	Narrow-leaf Carpet Grass
Azollaceae	*Azolla pinnata*	Ferny Azolla
Restionaceae	*Baloskion tetraphyllum*	
Cyperaceae	*Baumea juncea*	-
Asteraceae	*Bidens pilosa**	Cobbler's Pegs
Blechnaceae	*Blechnum cartilagineum*	Gristle Fern
Cyperaceae	*Bolboschoenus fluviatilis*	Marsh Clubrush
Dicksoniaceae	*Calochlaena dubia*	False Bracken
Brassicaceae	*Capsella bursa-pastoris**	Shepherds purse
Cyperaceae	*Carex appressa*	Tall Sedge
Apiaceae	*Centella asiatica*	Swamp Pennywort
Liliaceae	*Chlorophytum comosum**	Spider Plant
Commelinaceae	*Commelina cyanea*	Scurvy Weed
Asteraceae	*Conyza sumatrensis**	Fleabane
Poaceae	*Cortaderia selloana**	Pampas Grass
Apiaceae	*Cyclospermum leptophyllum**	Slender Celery
Poaceae	*Cynodon dactylon*	Common Couch
Cyperaceae	*Cyperus brevifolius**	Mullumbimby Couch
Cyperaceae	*Cyperus gracilis*	-
Cyperaceae	*Cyperus polystachyos*	-
Cyperaceae	*Cyperus rotundatus**	-
Phormiaceae	*Dianella caerulea*	Flax Lily
Poaceae	*Ehrharta erecta**	Panic Veldtgrass
Pontederiaceae	*Eichornia crassipes**	Water Hyacinth
Poaceae	*Entolasia stricta*	Wiry Panic
Cyperaceae	*Eleocharis sphacelata*	Tall Spike-rush
Asteraceae	*Erechtites valerianifolia**	Brazilian Fireweed
Euphorbiaceae	*Euphorbia peplus**	Spurge
Cyperaceae	*Facinia nodosa*	-
Cyperaceae	*Gahnia clarkei*	Tall Saw-sedge
Cyperaceae	*Gahnia sieberiana*	Red-fruited Saw-sedge
Geraniaceae	*Geranium homeanum*	Northern Cranesbill
Zingiberaceae	*Hedychium gardnerianum**	Ginger Lily
Apiaceae	*Hydrocotyle bonariensis**	Kurnell Curse / Pennywort
Apiaceae	*Hydrocotyle peduncularis*	Pennywort
Clusiaceae	*Hypericum perforatum**	St Johns Wort

Family	Scientific Name	Common Name
Asteraceae	*Hypochaeris glabra**	Smooth Catsear
Asteraceae	*Hypochaeris radicata**	Flatweed
Dennstaedtiaceae	*Hypolepis muelleri*	Harsh Ground Fern
Poaceae	*Imperata cylindrica* var. *major*	Blady Grass
Juncaceae	*Juncus usitatus*	Common Rush
Liliaceae	*Lilium formosanum**	Formosan Lily
Onagraceae	*Ludwigia peruviana**	Water Primrose
Lamiaceae	*Mentha* sp.*	Mint
Poaceae	*Microlaena stipoides* var. *stipoides*	Weeping Rice Grass
Malvaceae	*Modiola caroliniana**	Red-flowered Mallow
Poaceae	*Oplismenus aemulus*	Basket Grass
Oxalidaceae	*Oxalis corniculata**	Yellow Wood Sorrel
Urticaceae	*Parietaria judaica**	wall pellitory
Poaceae	*Paspalum dilatatum**	Paspalum
Poaceae	*Paspalum urvillei**	Vasey Grass
Poaceae	*Pennisetum clandestinum**	Kikuyu
Polygonaceae	*Persicaria decipiens*	Slender Knotweed
Polygonaceae	*Persicaria strigosa*	-
Poaceae	*Phragmites australis*	Common Reed
Plantaginaceae	*Plantago lanceolata**	Ribwort
Portulacaceae	*Portulaca oleracea*	Purslane
Lobeliaceae	*Pratia purpurascens*	Whiteroot
Dennstaedtiaceae	*Pteridium esculentum*	Bracken
Ranunculaceae	*Ranunculus repens**	Creeping Buttercup
Polygonaceae	*Rumex crispus**	Curled Dock
Cyperaceae	*Schoenoplectus validus*	River Club-rush
Cyperaceae	*Schoenus brevifolius*	Bog-rush
Asteraceae	*Senecio madagascariensis**	Fireweed
Poaceae	*Setaria parviflora**	-
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne
Solanaceae	*Solanum nigrum**	Black Nightshade
Asteraceae	*Soliva sessilis**	Jojo
Asteraceae	*Sonchus asper* subsp. *asper**	Prickly Sowthistle
Asteraceae	*Sonchus oleraceus**	Common Sow-thistle
Poaceae	*Sporobolus creber*	Slender Rat's Tail Grass
Poaceae	*Stenotaphrum secundatum**	Buffalo Grass
Strelitzeaceae	*Strelitzea juncea**	Bird of Paradise
Asteraceae	*Tagetes minuta**	Stinking Roger
Asteraceae	*Taraxacum officinale**	Dandelion
Aizoaceae	*Tetragonia tetragonioides*	New Zealand Spinach
Commelinaceae	*Tradescantia albiflora**	Wandering Jew
Fabaceae	*Trifolium repens**	White Clover
Juncaginaceae	*Triglochin microtuberosum*	Water Ribbons
Typhaceae	*Typha orientalis*	Cumbungi
Scrophulariaceae	*Verbascum virgatum**	Twiggy Mullein
Verbenaceae	*Verbena bonariensis**	Purpletop
Verbenaceae	*Verbena litoralis**	Coastal Verbena
Violaceae	*Viola hederacea*	Ivy-leaved Violet
Violaceae	*Viola odorata**	Sweet Violet
Iridaceae	*Watsonia meriana**	Wild Watsonia
VINES		

Family	Scientific Name	Common Name
Basellaceae	*Anredera cordifolia**	Madiera Vine
Apocnyaceae	*Araujia sericifolia**	Mothvine
Sapindaceae	*Cardiospermum grandiflorum**	Balloon Vine, Love in a Puff
Vitaceae	*Cayratia clematidea*	Slender Grape
Dioscoreaceae	*Dioscorea transversa*	Native Yam
Convolvulaceae	*Ipomoea indica**	Coastal Morning Glory
Caprifoliaceae	*Lonicera japonica**	Japanese Honeysuckle
Apocynaceae	*Parsonsia straminea*	Common Silkpod
Passifloraceae	*Passiflora edulis**	Common Passionfruit
Menispermiaceae	*Stephania japonica* var. *discolor*	Snake Vine
Fabaceae	*Vicia sativa* subsp. *sativa**	Common Vetch

Table A1.2 Fauna species observed within the subject site and nearby

Common name	Scientific name	Method Observed
Birds		April 2013
Australian Brush-turkey	*Alectura lathami*	O
Australian Magpie	*Gymnorhina tibicen*	O C
Australian Raven	*Corvus coronoides*	O C
Brown Thornbill	*Acanthiza pulsilla*	C
Chestnut Teal	*Anas castanea*	O C
Common Bronzewing	*Phaps chalcoptera*	O
Common Myna *	*Acridotheres tristis*	C
Eastern Spinebill	*Acanthorhynchus tenuirostris*	O C
Eastern Whipbird	*Psophodes olivaceus*	C
Galah	*Cacatua roseicapilla*	O C
Golden Whistler	*Pachycephala pectoralis*	O C
Grey Butcherbird	*Cracticus torquatus*	C
Grey Fantail	*Rhipidura fuliginosa*	O C
Laughing Kookaburra	*Dacelo novaeguineae*	O C
Magpie-lark	*Grallina cyanoleuca*	O
Masked Lapwing	*Vanellus miles*	O C
Musk Lorikeet	*Glossopsitta concinna*	O C
Noisy Miner	*Manorina melanocephala*	C
Olive-backed Oriole	*Oriolus sagittatus*	O C
Pacific Black Duck	*Anas superciliosa*	O
Pied Currawong	*Strepera graculina*	O C
Purple Swamphen	*Porphyrio porphyrio*	O C
Rainbow Lorikeet	*Trichoglossus haematodus*	O C
Red Junglefowl *	*Gallus gallus*	O C
Red Wattlebird	*Anthochaera carunculata*	C
Red-whiskered Bulbul *	*Pycnonotus jocosus*	O C
Silvereye	*Zosterops lateralis*	O C
Spotted Pardalote	*Pardalotus punctatus*	C
Spotted Turtle-Dove *	*Streptopelia chinensis*	O
Sulphur Crested Cockatoo	*Cacatua galerita*	O C
Superb Fairy-wren	*Malurus cyaneus*	O C
Tawny Frogmouth	*Podargus strigoides*	O
Variegated Fairy-wren	*Malurus lamberti*	O C
White-browed Scrubwren	*Sericornis frontalis*	O C
White-cheeked Honeyeater	*Phylidonyris nigra*	C
Willie Wagtail	*Rhipidura leucophrys*	O C
Yellow Thornbill	*Acanthiza nana*	O C
Mammals		
Black Rat *	*Rattus rattus*	T
Common Brushtail Possum	*Trichosurus vulpecula*	S
Common Ringtail Possum	*Pseudocheirus peregrinus*	S
Domesticated Dog *	*Canis familiaris*	O
Eastern Bentwing-bat [TS]	*Miniopterus orianae oceansis*	A
Gould's Wattled Bat	*Chalinolobus gouldii*	A
Grey-headed Flying-fox [TS]	*Pteropus poliocephalus*	S
Horse *	*Equus caballus*	O
Little Forest Bat	*Vespadelus vulturnus*	A
Rabbit *	*Oryctolagus cuniculus*	S

Common name	Scientific name	Method Observed
Reptiles		
Delicate Skink	*Lampropholis delicata*	O
Eastern Water Skink	*Eulamprus quoyii*	O
Red-Bellied Black Snake	*Pseudechis porphyriacus*	O
Amphibians		
Common Eastern Froglet	*Crinia signifera*	C
Striped Marsh Frog	*Limnodynastes peronii*	C

Note: * indicates introduced species
TS indicates threatened species

All species listed are identified to a high level of certainty unless otherwise noted as:

PR indicates species identified to a 'probable' level of certainty
PO indicates species identified to a 'possible' level of certainty

A	-	Anabat II/SD-1	C	-	Call identification
O	-	Observation	P	-	Call-playback response
T	-	Trap (*Elliott*, cage, etc)	H	-	Habitat search
S	-	Spotlight	I	-	Scat, track or sign identification

Appendix 2

Threatened Flora and Fauna Species Habitat Assessment

Table A2.1 – Threatened flora species habitat assessment

Scientific Name DATABASE SOURCE	TSC Act	EPBC Act	GROWTH FORM AND HABITAT REQUIREMENTS	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				TO BE CONSIDERED IN FUTURE 7 PART TEST OF SIGNIFICANCE (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Acacia bynoeana OEH	E1	V	Erect or spreading shrub to 0.3m high growing in heath and dry sclerophyll Open Forest on sandy soils. Often associated with disturbed areas such as roadsides. Distribution limits N-Newcastle S-Berrima.	x	marginal	x	x	unlikely	x
Acacia terminalis subsp. *terminalis* OEH EPBC	E1	E	Erect shrub to 2m tall, flowers from March to July. Occurs in eucalypt woodland or forest, usually in sandy soil on creek banks, hillslopes or in shallow soil in rock crevices and sandstone platforms on cliffs. Typically restricted to the Port Jackson and eastern suburbs of Sydney.	x	x	-	-	x	x
Asterolasia elegans EPBC	E1	E	Erect shrub 1-3m high growing in moist sclerophyll forests on Hawkesbury sandstone slopes hillsides. Distribution limits Maroota region.	x	x	-	-	x	x
Boronia umbellata OEH	V	V	Orara Boronia is an open shrub, 1 – 2m tall. Geographically restricted to Glenreagh and Lower Bucca, north of Coffs Harbour where it grows around gullies in wet open forest.	x	x	-	-	x	x
Caladenia tessellata EPBC	E1	V	Terrestrial orchid. Clay-loam or sandy soils. Distribution limits N-Swansea S-south of Eden.	x	marginal	x	x	unlikely	x
Callistemon linearifolius OEH	V	-	Shrub to 4m high. Dry sclerophyll forest on coast and adjacent ranges. Distribution limits N-Nelson Bay S-Georges River.	x	limited	✓	x	low	✓

Scientific Name DATABASE SOURCE	TSC Act	EPBC Act	GROWTH FORM AND HABITAT REQUIREMENTS	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				TO BE CONSIDERED IN FUTURE 7 PART TEST OF SIGNIFICANCE (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Chamaesyce psammogeton OEH	E1	-	Prostrate herb. Coastal dunes. Distribution limits N-Tweed Heads S-Jervis Bay	x	x	-	-	x	x
Cryptostylis hunteriana OEH EPBC	V	V	Saprophytic orchid. Grows in swamp heath on sandy soils. Distribution limits N-Gibraltar Range S-south of Eden.	x	marginal	x	x	unlikely	x
Darwinia biflora OEH EPBC	V	V	Erect or spreading shrub to 0.8m high. Grows in heath or understorey of woodland on or near shale-capped ridges underlain by Hawkesbury sandstone. Distribution limits N-Gosford S-Cheltenham.	x	x	-	-	x	x
Deyeuxia appressa EPBC	E1	E	Erect grass to 0.9m high. Grows on wet ground. Distribution limits N-Hornsby S-Bankstown.	x	marginal	x	x	unlikely	x
Diuris bracteata OEH	E1	Extinct	An orchid that grows in dry sclerophyll woodland. Was thought to be extinct until approximately 10yrs ago. Found in the Sydney Basin Bioregion. Flowers in September.	x	x	-	-	x	x
Epacris purpurascens var. *purpurascens* OEH	V	-	Erect shrub to 1.5m high growing in sclerophyll forest and scrub and near creeks and swamps on Sandstone. Distribution limits N-Gosford S-Blue Mountains.	x	x	-	-	x	x
Eucalyptus camfieldii OEH EPBC	V	V	Stringybark to 10m high. Grows on coastal shrub heath and woodlands on sandy soils derived from alluviums and Hawkesbury sandstone. Distribution limits N-Norah Head S-Royal NP.	x	x	-	-	x	x

Scientific Name DATABASE SOURCE	TSC Act	EPBC Act	GROWTH FORM AND HABITAT REQUIREMENTS	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				TO BE CONSIDERED IN FUTURE 7 PART TEST OF SIGNIFICANCE (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Eucalyptus nicholii OEH	V	-	This species is widely planted as an urban street tree and in gardens but is quite rare in the wild. It is confined to the New England Tablelands of NSW, where it occurs from Nundle to north of Tenterfield, largely on private property.	x	x	-	-	x	x
Eucalyptus scoparia OEH EPBC	E1	V	Smooth-barked tree only known from vicinity of Bald Rock.	x	x	-	-	x	x
Genoplesium baueri OEH	E1	-	A terrestrial orchid that grows in sparse sclerophyll forest and moss gardens over sandstone. Distribution limits N – Hunter Valley S – Nowra	x	x	-	-	x	x
Grammitis stenophylla OEH	E1	-	A small lithophytic fern with fronds generally <5cm. Occurs in rainforest and wet sclerophyll forest in the coastal divisions of NSW.	x	x	-	-	x	x
Grevillea caleyi OEH EPBC	E1	E	Shrub mostly 1-3m high. Grows in laterite. Distribution limits Terrey Hills-Belrose area.	x	x	-	-	x	x
Haloragodendron lucasii OEH EPBC	E1	E	Straggling shrub to 1.5m high. Grows in open forest on sheltered slopes near creeks. Distribution limits Ku-ring-gai Plateau and Mt Wilson.	x	x	-	-	x	x
Hibbertia puberula OEH	E1	-	Shrublets with branches up to 30cm long. Not been seen for 40 years however early records are from Hawkesbury River area in Sydney and the Blue Mountains.	x	x	-	-	x	x

Scientific Name DATABASE SOURCE	TSC Act	EPBC Act	GROWTH FORM AND HABITAT REQUIREMENTS	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				TO BE CONSIDERED IN FUTURE 7 PART TEST OF SIGNIFICANCE (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Hibbertia superans OEH	E1	-	Small spreading shrub to 0.3m high. Grows on sandstone, usually in or near SSTF. Distribution limits N-Glenorie S-Kellyville disjunct Mt Boss.	x	x	-	-	x	x
Kunzea rupestris OEH EPBC	V	V	Shrub to 1.5m high. Grows in cracks and fissures on Hawkesbury sandstone rock platforms. Distribution limits N-Maroota S-Glenorie.	x	x	-	-	x	x
Leptospermum deanei OEH EPBC	V	V	Shrub to 5m high. Grows on forested slopes. Distribution limits Near watershed of Lane Cove River.	x	x	-	-	x	x
Melaleuca biconvexa EPBC	V	V	Tall shrub. Grows in wetlands adjoining perennial streams and on the banks of those streams, generally within the geological series known as the Terrigal Formation. Distribution limits N-Port Macquarie S-Jervis Bay.	x	✓	x	x	low	✓
Melaleuca deanei OEH EPBC	V	V	Shrub to 3m high. Grows in heath on sandstone. Distribution limits N-Gosford S-Nowra.	x	x	-	-	x	x
Microtis angusii OEH EPBC	E1	E	Terrestrial orchid which is known from two populations, Mona Vale and Sunny Corner. Grows in well-drained laterite in grassy woodland.	x	x	-	-	x	x
Pelargonium sp. *Striatellum* EPBC	E1	E	Herb to 90cm tall which grows in damp places especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance. Varied distribution from SE NSW to QLD.	x	x	-	-	x	x

Scientific Name DATABASE SOURCE	TSC Act	EPBC Act	GROWTH FORM AND HABITAT REQUIREMENTS	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				TO BE CONSIDERED IN FUTURE 7 PART TEST OF SIGNIFICANCE (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Persoonia hirsuta OEH EPBC	E1	E	Erect to decumbent shrub. Grows in dry sclerophyll forest and woodland on Hawkesbury sandstone with infrequent fire histories. Distribution limits N-Glen Davis S-Hill Top.	x	x	-	-	x	x
Persoonia laxa OEH	E4	Ext.	Decumbent or prostrate shrub. Not been seen since 1908. Once recorded in Newport and Manly.	x	x	-	-	x	x
Persoonia mollis subsp. *maxima* OEH	E1	E	Erect to prostrate shrub. Grows in moist to wet sclerophyll forests on Hawkesbury sandstone. Distribution limits N-Cowan S-Hornsby.	x	x	-	-	x	x
Pimelea curviflora var. *curviflora* OEH EPBC	V	V	Woody herb or sub-shrub to 0.2-1.2m high. Grows on Hawkesbury sandstone near shale outcrops. Distribution Sydney.	x	x	-	-	x	x
Prostanthera junonis OEH	E1	E	Small shrub. Grows in sclerophyll forest and heath in shallow soil on sandstone. Distribution limits Somersby region.	x	x	-	-	x	x
Prostanthera marifolia OEH EPBC	E4a	Critic. E	Erect shrub to 0.3m high. Woodland dominated by Eucalyptus sieberi and Corymbia gummifera. In deeply weathered clay soil with ironstone nodules. Has been recorded previously in the Sydney Harbour region.	x	x	-	-	x	x
Senecio spathulatus OEH	E	-	A low growing daisy that prefers primary dunes. Known to occur at Cape Howe and between Kurnell north to Myall Lakes National Park. Also occurs in coastal locations in eastern Victoria.	x	x	-	-	x	x

Scientific Name DATABASE SOURCE	TSC Act	EPBC Act	GROWTH FORM AND HABITAT REQUIREMENTS	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				TO BE CONSIDERED IN FUTURE 7 PART TEST OF SIGNIFICANCE (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Streblus pendulinus EPBC	-	E	Tree or large shrub to 6m tall. Coastal species along watercourses in warmer rainforest area.	x	x	-	-	x	x
Syzygium paniculatum OEH EPBC	V	V	Small tree. Subtropical and littoral rainforest on sandy soil. Distribution limits N-Forster S-Jervis Bay.	x	x	-	-	x	x
Tetratheca glandulosa OEH EPBC	V	V	Spreading shrub to 0.2m high. Sandy or rocky heath or scrub. Distribution limits N-Mangrove Mountain S-Port Jackson.	x	x	-	-	x	x
Triplarina imbricata EPBC	E1	E	A shrub to 2.8m tall, flowers from Nov-Dec. Occurs in heath, often in damp places along creek lines; coast and adjacent ranges. Known from the Tabulum and Nymboida districts in NE NSW.	x	x	-	-	x	x

OEH	- Denotes species listed within 10km of the subject site on the *Atlas of NSW Wildlife*
EPBC	- Denotes species listed within 10km of the subject site in the *EPBC Act* habitat search
V	- Denotes vulnerable listed species under the relevant Act
E or E1	- Denotes endangered listed species under the relevant Act
NOTE:	1. This field is not considered if no suitable habitat is present within the subject site 2. 'records' refer to those provided by the *Atlas of NSW Wildlife* 3. 'nearby' or 'recent' records are species specific accounting for home range, dispersal ability and life cycle.

Table A2.2 - Threatened fauna species habitat assessment

COMMON NAME *Scientific Name* DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT *Distribution Limit*	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				TO BE CONSIDERED IN FUTURE 7 PART TEST OF SIGNIFICANCE (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Giant Burrowing Frog *Heleioporus australiacus* OEH EPBC	V	V	Inhabits open forests and riparian forests along non-perennial streams, digging burrows into sandy creek banks. *Distribution Limit: N-Near Singleton S-South of Eden.*	×	×	-	-	×	×
Stuttering Frog *Mixophyes balbus* EPBC	E	V	Terrestrial inhabitant of rainforest and wet sclerophyll forests. *Distribution Limit: N-near Tenterfield S-South of Bombala*.	×	×	-	-	×	×
Giant Barred Frog *Mixophyes iteratus* EPBC	E	E	Terrestrial inhabitant of rainforest and open forests. *Distribution Limit: N-Border Ranges National Park. S-Narooma.*	×	×	-	-	×	×
Red-crowned Toadlet *Pseudophryne australis* OEH	V	-	Prefers sandstone areas, breeds in grass and debris beside non-perennial creeks or gutters. Individuals can also be found under logs and rocks in non-breeding periods. *Distribution Limit: N-Pokolbin. S-near Wollongong.*	×	×	-	-	×	×
Green and Golden Bell Frog *Litoria aurea* OEH EPBC	E	V	Prefers the edges of permanent water, streams, swamps, creeks, lagoons, farm dams and ornamental ponds. Often found under debris. *Distribution Limit: N-Byron Bay S-South of Eden.*	×	✓	×	×	unlikely	✓

COMMON NAME *Scientific Name* DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT *Distribution Limit*	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				TO BE CONSIDERED IN FUTURE 7 PART TEST OF SIGNIFICANCE (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Littlejohn's Tree Frog *Litoria littlejohnii* EPBC	V	V	Found in wet and dry sclerophyll forest associated with sandstone outcrops at altitudes 280-1000m on eastern slopes of Great Dividing Range. Prefers flowing rocky streams. *Distribution Limit: N-Hunter River S-Eden.*	×	×	-	-	×	×
Rosenberg's Goanna *Varanus rosenbergi* OEH	V	-	Hawkesbury sandstone outcrop specialist. Inhabits woodlands, dry open forests and heathland sheltering in burrows, hollow logs, rock crevices and outcrops. *Distribution Limit: N-Nr Broke. S-Nowra Located in scattered patches near Sydney, Nowra and Goulburn.*	×	×	-	-	×	×
Broad-headed Snake *Hoplocephalus bungaroides* EPBC	E	V	Sandstone outcrops, exfoliated rock slabs and tree hollows in coastal and near coastal areas. *Distribution Limit: N-Mudgee Park. S-Nowra.*	×	×	-	-	×	×
Wompoo Fruit-dove *Ptilinopus magnificus* OEH	V	-	Inhabits large undisturbed patches of lowland and adjacent highland rainforest and moist eucalypt forests where it feeds on fruit. *Distribution Limit: N-Tweed Heads. S-Sydney.*	×	×	-	-	×	×

COMMON NAME *Scientific Name* DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT *Distribution Limit*	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				TO BE CONSIDERED IN FUTURE 7 PART TEST OF SIGNIFICANCE (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Superb Fruit-dove *Ptilinopus superbus* OEH	V	-	Rainforests, adjacent mangroves, eucalypt forests, scrubland with native fruits. *Distribution Limit: N-Border Ranges National Park. S-Bateman's Bay.*	×	×	-	-	×	×
Australasian Bittern *Botaurus poiciloptilus* OEH EPBC	E	E	Found in or over water of shallow freshwater or brackish wetlands with tall reedbeds, sedges, rushes, cumbungi, lignum and also in ricefields, drains in tussocky paddocks, occasionally saltmarsh, brackish wetlands. *Distribution Limit: N-North of Lismore. S- Eden.*	×	✓	✓	×	unlikely	✓
Black Bittern *Ixobrychus flavicollis* OEH	V	-	Found in shadowy, leafy waterside trees such as callistemons, casuarinas, paperbarks, eucalypts, mangroves and willows along tidal creeks, freshwater and brackish streams and ponds, sheltered mudflats and oyster slats. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	✓	✓	×	low	✓
Little Eagle *Hieraaetus morphnoides* OEH	V	-	Utilises plains, foothills, open forests, woodlands and scrublands; river red gums on watercourses and lakes. *Distribution Limit - N-Tweed Heads. S-South of Eden.*	×	✓	×	×	low	✓
Osprey *Pandion haliaetus* OEH	V	-	Utilises waterbodies including coastal waters, inlets, lakes, estuaries and offshore islands with a dead tree for perching and feeding. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	marginal	✓	×	low	✓

COMMON NAME *Scientific Name* DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT *Distribution Limit*	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				TO BE CONSIDERED IN FUTURE 7 PART TEST OF SIGNIFICANCE (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Red Goshawk *Erythrotriorchis radiatus* EPBC	E	V	Inhabits tall open forests and woodlands. Breeds in tall trees adjacent to watercourses of wetlands. *Distribution Limit: N-Border Ranges National Park. S-Foster.*	×	×	-	-	×	×
Bush Stone-curlew *Burhinus grallarius* OEH	E	-	Utilises open forests and savannah woodlands, sometimes dune scrub, savannah and mangrove fringes. *Distribution Limit: N-Border Ranges National Park. S-Near Nowra.*	×	✓	×	✓	low	✓
Sooty Oystercatcher *Haematopus fuliginosus* OEH	V	-	Exclusively coastal in distribution foraging along rocky coastlines and estuaries. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	×	-	-	×	×
Pied Oystercatcher *Haematopus longirostris* OEH	V	-	Inhabits coastal beaches and estuarine flats. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	×	-	-	×	×
Australian Painted Snipe *Rostratula australis* EPBC	V	V	Most numerous within the Murray-Darling basin and inland Australia within marshes and freshwater wetlands with swampy vegetation. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	×	-	-	×	×

COMMON NAME *Scientific Name* DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT *Distribution Limit*	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				TO BE CONSIDERED IN FUTURE 7 PART TEST OF SIGNIFICANCE (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Gang-gang Cockatoo *Callocephalon fimbriatum* OEH	V	-	Prefers wetter forests and woodlands from sea level to > 2,000m on Great Dividing Range, timbered foothills and valleys, timbered watercourses, coastal scrubs, farmlands and suburban gardens. *Distribution Limit: mid north coast of NSW to western Victoria.*	×	✓	✓	×	unlikely	✓
Glossy Black-Cockatoo *Calyptorhynchus lathami* OEH	V	-	Open forests with *Allocasuarina* species and hollows for nesting. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	×	-	-	×	×
Little Lorikeet *Glossopsitta pusilla* OEH	V	-	Inhabits forests, woodlands; large trees in open country; timbered watercourses, shelterbeds, and street trees. *Distribution Limit: N-Tweed Heads. S-South of Eden*.	×	✓	✓	✓	✓	✓
Swift Parrot *Lathamus discolour* OEH EPBC	E	E	Inhabits eucalypt forests and woodlands with winter flowering eucalypts. *Distribution Limit: N-Border Ranges National Park. S-South of Eden*.	×	✓	✓	×	✓	✓
Turquoise Parrot *Neophema pulchella* OEH	V	-	Inhabits coastal scrubland, open forest and timbered grassland, especially ecotones between dry hardwood forests and grasslands. *Distribution Limit: N-Near Tenterfield. S-South of Eden.*	×	×	-	-	×	×

COMMON NAME *Scientific Name* DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT *Distribution Limit*	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				TO BE CONSIDERED IN FUTURE 7 PART TEST OF SIGNIFICANCE (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Barking Owl *Ninox connivens* OEH	V	-	Inhabits principally woodlands but also open forests and partially cleared land and utilises hollows for nesting. *Distribution Limits: N-Border Ranges National Park. S-Eden.*	×	✓	✓	✓	✓	✓
Powerful Owl *Ninox strenua* OEH	V	-	Forests containing mature trees for shelter or breeding and densely vegetated gullies for roosting. *Distribution Limits: N-Border Ranges National Park. S-Eden.*	×	✓	✓	✓	✓	✓
Masked Owl *Tyto novaehollandiae* OEH	V	-	Open forest and woodlands with cleared areas for hunting and hollow trees or dense vegetation for roosting. *Distribution Limit: N-Border Ranges National Park. S-Eden.*	×	✓	×	×	unlikely	✓
Eastern Bristlebird *Dasyornis brachypterus* EPBC	E	E	Coastal woodlands, dense scrubs and heathlands, especially where low heathland borders taller woodland or dense tall tea-tree. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	×	-	-	×	×
Black-chinned Honeyeater *Melithreptus gularis gularis* OEH	V	-	Found in woodlands containing box-ironbark associations and River Red Gums, also drier coastal woodlands of the Cumberland Plain and Hunter Richmond and Clarence. *Distribution Limit: N-Cape York Pen. Qld. S-Victor H. Mt Lofty Ra & Flinders Ra. SA.*	×	✓	×	×	Not likely	×

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					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Regent Honeyeater *Xanthomyza Phrygia* OEH EPBC	E4A	E	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. *Distribution Limit: N-Urbanville. S-Eden.*	×	✓	✓	×	low	✓
Varied Sittella *Daphoenositta chrysoptera* OEH	V	-	Open eucalypt woodlands / forests (except heavier rainforests); mallee, inland acacia, coastal tea-tree scrubs; golf courses, shelterbelts, orchards, parks, scrubby gardens. *Distribution Limit: N-Border Ranges National Park. S-South of Eden*.	×	✓	×	✓	low	✓
Scarlet Robin *Petroica boodang* OEH	V	-	Found in foothill forests, woodlands, watercourses; in autumn-winter, more open habitats: river red gum woodlands, golf courses, parks, orchards, gardens. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	✓	×	×	low	✓
Spotted-tailed Quoll *Dasyurus maculatus* OEH EPBC	V	E	Dry and moist open forests containing rock caves, hollow logs or trees. *Distribution Limit: N-Mt Warning National Park. S-South of Eden.*	×	✓	✓	×	unlikely	✓

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					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Southern Brown Bandicoot *Isoodon obesulus* OEH EPBC	E	E	Utilises a range of habitats containing thick ground cover - open forest, woodland, heath, cleared land, urbanised areas and regenerating bushland. *Distribution Limit: N-Kempsey. S-South of Eden.*	×	marginal	✓	×	unlikely	✓
Koala *Phascolarctos cinereus* OEH EPBC	V	V	Inhabits both wet and dry eucalypt forest on high nutrient soils containing preferred feed trees. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	marginal	✓	×	unlikely	✓
Eastern Pygmy Possum *Cercatetus nanus* OEH	V	-	Found in a variety of habitats from rainforest through open forest to heath. Feeds on insects but also gathers pollen from banksias, eucalypts and bottlebrushes. Nests in banksias and myrtaceous shrubs. *Distribution Limit: N-Tweed Heads. S-Eden.*	×	×	-	-	×	×
Squirrel Glider *Petaurus norfolcensis* OEH	V	-	Mixed aged stands of eucalypt forest & woodlands including gum barked & high nectar producing species & hollow bearing trees. *Distribution Limit: N-Tweed Heads. S-Albury.*	×	marginal	×	×	Not likely	×
Long-nosed Potoroo *Potorous tridactylus* EPBC	V	V	Coastal heath and dry and wet sclerophyll forests with a dense understorey. *Distribution Limit: N-Mt Warning National Park. S-South of Eden.*	×	×	-	-	×	×

COMMON NAME *Scientific Name* DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT *Distribution Limit*	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				TO BE CONSIDERED IN FUTURE 7 PART TEST OF SIGNIFICANCE (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Brush-tailed Rock-wallaby *Petrogale penicillata* EPBC	E	V	Found in rocky gorges with a vegetation of rainforest or open forests to isolated rocky outcrops in semi-arid woodland country. *Distribution Limit: N-North of Tenterfield. S-Bombala.*	×	×	-	-	×	×
Grey-headed Flying-fox *Pteropus poliocephalus* OEH EPBC	V	V	Found in a variety of habitats including rainforest, mangroves, paperbark swamp, wet and dry open forest and cultivated areas. Forms camps commonly found in gullies and in vegetation with a dense canopy. *Distribution Limit: N-Tweed Heads. S-Eden.*	✓	-	-	-	-	✓
East-coast Freetail Bat *Micronomus norfolkensis* OEH	V	-	Inhabits open forests and woodlands foraging above the canopy and along the edge of forests. Roosts in tree hollows, under bark and buildings. *Distribution Limit: N-Woodenbong. S-Pambula.*	×	✓	×	×	low	✓
Large-eared Pied Bat *Chalinolobus dwyeri* OEH EPBC	V	V	Warm-temperate to subtropical dry sclerophyll forest and woodland. Roosts in caves, tunnels and tree hollows in colonies of up to 30 animals. *Distribution Limit: N-Border Ranges National Park. S-Wollongong.*	×	×	-	-	×	×

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					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Little Bentwing-bat *Miniopterus australis* OEH	V	-	Roosts in caves, old buildings and structures in the higher rainfall forests along the south coast of Australia. *Distribution Limit: N-Border Ranges National Park. S-Sydney.*	×	✓	✓	✓	✓	✓
Eastern Bentwing-bat *Miniopterus orianae oceansis* OEH	V	-	Prefers areas where there are caves, old mines, old buildings, stormwater drains and well-timbered areas. *Distribution Limit: N-Border Ranges National Park. S-South of Eden.*	✓	-	-	-	-	✓
Large-footed Myotis *Myotis macropus* OEH	V	-	Roosts in caves, mines, tunnels, buildings, tree hollows and under bridges. Forages over open water. *Distribution limits: N-Border Ranges National Park. S-South of Eden.*	×	✓	✓	✓	✓	✓
Greater Broad-nosed Bat *Scoteanax rueppellii* OEH	V	-	Inhabits areas containing moist river and creek systems, especially tree lined creeks. *Distribution Limit: N-Border Ranges National Park. S-Pambula.*	×	✓	×	✓	low	✓

COMMON NAME *Scientific Name* DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT *Distribution Limit*	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				TO BE CONSIDERED IN FUTURE 7 PART TEST OF SIGNIFICANCE (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
New Holland Mouse *Pseudomys novaehollandiae* EPBC	-	V	Occurs in heathlands, woodlands, open forest and paperbark swamps and on sandy, loamy or rocky soils. Coastal populations have a marked preference for sandy substrates, a heathy understorey of leguminous shrubs less than 1m high and sparse ground litter. Recolonise of regenerating burnt areas. *Distribution Limit: N-Border Ranges National Park. S-South of Eden.*	×	marginal	×	×	Not likely	×
Macquarie Perch *Macquaria australasica* EPBC	V	E	Occurs in south east Australia at moderate to high altitudes in rivers and reservoirs. Historical records show the species was widespread and abundant in the upper reaches of the Lachlan, Murrumbidgee and Murray Rivers and their tributaries. Allen (1989) states that introduced populations are present in Nepean River and water supply dams in the Sydney area. Occurs in lakes and flowing streams, usually in deep holes.	×	×	-	-	×	×
Australian Greyling *Prototroctes maraena* EPBC	Part 2, Section 19 – Protected Fish	V	Clear, moderate to fast flowing water in the upper reaches of rivers (sometimes to altitudes above 1,000m). Typically found in gravel bottom pools. Often forming aggregations below barriers to upstream movement (eg weirs, waterfalls).	×	×	-	-	×	×

OEH	-	Denotes species listed within 10km of the subject site on the *Atlas of NSW Wildlife*
EPBC	-	Denotes species listed within 10km of the subject site in the *EPBC Act* habitat search

COMMON NAME *Scientific Name* DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT *Distribution Limit*	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				TO BE CONSIDERED IN FUTURE 7 PART TEST OF SIGNIFICANCE (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	

V	-	Denotes vulnerable listed species under the relevant Act
E	-	Denotes endangered listed species under the relevant Act
NOTE:	1.	This field is not considered if no suitable habitat is present within the subject site
	2.	'records' refer to those provided by the *Atlas of NSW Wildlife*
	3.	'nearby' or 'recent' records are species specific accounting for home range, dispersal ability and life cycle.

Table A2.3 provides an assessment of potential habitat within the subject site for nationally protected migratory fauna species recorded within 10km on the *EPBC Protected Matters Tool*. Nationally threatened migratory species are considered in Table A2.2 above.

Table A2.3 – Migratory fauna habitat assessment

COMMON NAME *Scientific Name*	PREFERRED HABITAT *Migratory Breeding*	Suitable habitat present (✓)	Recorded on Site (✓)	COMMENTS
White-bellied Sea Eagle (*Haliaeetus leucogaster*)	Coasts, islands, estuaries, inlets, large rivers, inland lakes, reservoirs. *Sedentary; dispersive.*	✓	×	-
White-throated Needletail (*Hirundapus caudacutus*)	Airspace over forests, woodlands, farmlands, plains, lakes, coasts, towns; companies forage often along favoured hilltops and timbered ranges. *Breeds Siberia, Himalayas, east to Japan. Summer migrant to eastern Australia.*	✓	×	-
Rainbow Bee-eater (*Merops ornatus*)	Open woodlands with sandy, loamy soil; sandridges, sandspits, riverbanks, road cuttings, beaches, dunes, cliffs, mangroves, rainforest, woodlands, golf courses. *Breeding resident in northern Australia. Summer breeding migrant to south-east and south-west Australia.*	×	-	-
Black-faced Monarch (*Monarcha melanopsis*)	Rainforests, eucalypt woodlands; coastal scrubs; damp gullies in rainforest, eucalypt forest; more open woodland when migrating. *Summer breeding migrant to coastal south-east Australia, otherwise uncommon*.	✓	×	-
Spectacled Monarch (*Monarcha trivirgatus*)	Understorey of mountain/lowland rainforest, thickly wooded gullies, waterside vegetation, mostly well below canopy. *Summer breeding migrant to south east Qld and north east NSW down to Port Stephens from Sept / Oct to May. Uncommon in southern part of range.*	marginal	-	-
Satin Flycatcher (*Myiagra cyanoleuca*)	Heavily vegetated gullies in forests, taller woodlands, usually above shrub-layer; during migration, coastal forests, woodlands, mangroves, trees in open country, gardens. *Breeds mostly south east Australia and Tasmania over warmer months, winters in north east Qld.*	✓	×	-

COMMON NAME *Scientific Name*	PREFERRED HABITAT *Migratory Breeding*	Suitable habitat present (✓)	Recorded on Site (✓)	COMMENTS
Rufous Fantail (*Rhipidura rufifrons*)	Undergrowth of rainforests / wetter eucalypt forests / gullies; monsoon forests, paperbarks, sub-inland and coastal scrubs; mangroves, watercourses; parks, gardens. On migration, farms, streets buildings. *Breeding migrant to south east Australia over warmer months. Altitudinal migrant in north east NSW in mountain forests during warmer months.*	✓	-	-
Great Egret (*Ardea alba*)	Shallows of rivers, estuaries; tidal mudflats, freshwater wetlands; sewerage ponds, irrigation areas, larger dams, etc. *Dispersive; cosmopolitan.*	✓	×	-
Cattle Egret (*Ardea ibis*)	Stock paddocks, pastures, croplands, garbage tips, wetlands, tidal mudflats, drains. *Breeds in summer in warmer parts of range including NSW*.	✓	×	-
Latham's Snipe (*Gallinago hardwickii*)	Soft wet ground or shallow water with tussocks and other green or dead growth; wet parts of paddocks; seepage below dams; irrigated areas; scrub or open woodland from sea-level to alpine bogs over 2,000m; samphire on saltmarshes; mangrove fringes. *Breeds Japan. Regular summer migrant to Australia. Some overwinter.*	✓	×	-
Fork-tailed Swift (*Apus pacificus*)	Aerial: over open country, from semi-arid deserts to coasts, islands; sometimes over forests, cities. *Breeds Siberia, Himalayas, east to Japan south east Asia. Summer migrant to east Australia. Mass movements associated with late summer low pressure systems into east Australia. Otherwise uncommon.*	✓	×	-