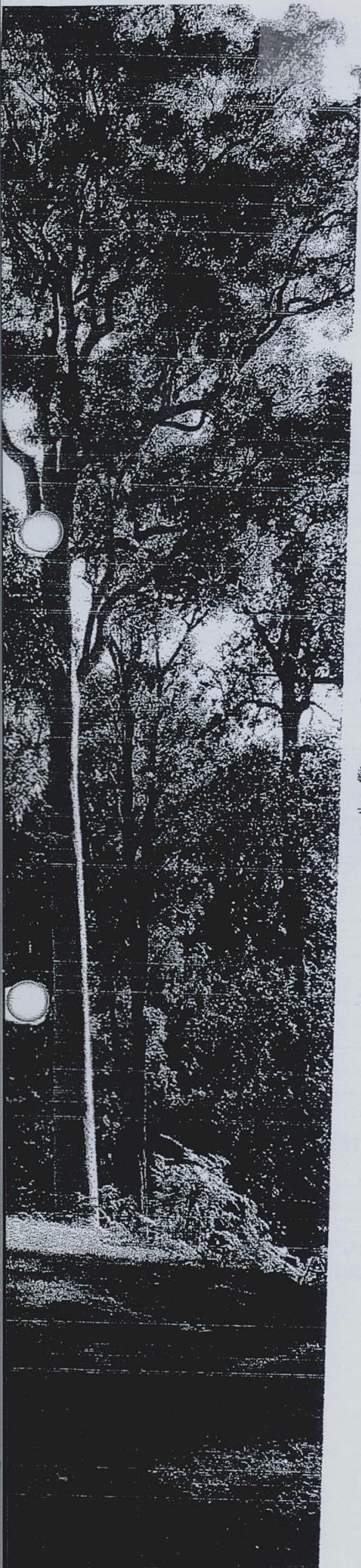




Ecological Site Analysis

120 & 122 Mona Vale Road, Warriewood

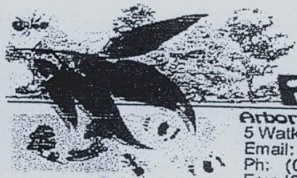
13th July 2011

prepared by

Mark Couston CPESC. - Ass. Dip. Env. Ctr. (CSU), Grad. Dip. Env. Mgmt. (CSU),

Cert. Soil & Water Mgmt. (UWS), MESA, MECA, MRBIA

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Footprint Green Pty Ltd

Arboricultural, Environmental & Horticultural Consultants

5 Watkins Road, Avalon Beach, NSW 2107

Email: mail@footprintgreen.com.au

Ph: (02) 99188877

Fax: (02) 99188876

ABN 34 097 138 817

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Footprint Green Pty Ltd
 Horticultural, Environmental & Horticultural Consultants
 5 Watkins Road, Avalon Beach, NSW 2107
 Email: mail@footprintgreen.com.au
 Ph: (02) 99188877
 Fax: (02) 99188876

ABN 34 097 138 817

1. introduction

1.1 background

This report has been prepared to present the findings of detailed flora and fauna surveys and habitat assessments carried out over the site known as 120 & 122 Mona Vale Road, Warriewood. This report also incorporates species and ecological communities known to occur within the local area which have been identified through database and literature searches.

Specific assessment has been undertaken to identify potential habitats of threatened species, populations and ecological communities known to occur in the local area and listed in the schedules of the *Threatened Species Conservation Act (NSW) 1995*.

Subsequent site inspections and field work were conducted between the 3rd May & 10th June 2011. For the purposes of this report the allotments known as 120 & 122 Mona Vale Road, Warriewood will be referred to as the site.

1.2 existing site

The site is located on the southern side of Mona Vale Road and the topography ranges from moderately- steeply sloping to undulating slopes.

The site is currently used for rural activities and contains a number of greenhouses, detached sheds, open paddocks with remnant trees and indigenous vegetation along the steeper riparian areas of Narrabeen Creek.



Figure 1.1 Existing site looking east to Boundary Street.

1.3

NSW Environmental planning & assessment

Whilst there are a several State Acts and planning instruments that relate to flora and fauna issues, those covered in this report include:

- relevant species, populations and communities listed in the schedules of the *Threatened Species Conservation Act 1995 (NSW)*;
- S. 5A(2) (7-part test) *Environmental Planning and Assessment Act 1979 (NSW)*;

Should this report conclude that the proposed development will have a significant impact on species, communities or populations listed in the schedules of *Threatened Species Conservation Act 1995 (NSW)* a more detailed Species Impact Statement will need to be prepared in accordance with the requirements of the *Threatened Species Conservation Act 1995 (NSW)*.

1.4

Commonwealth context

This report identifies flora and fauna species or communities, relevant to the site, that are listed under Part 13 Division 1 of the *Environment Protection & Biodiversity Act 1999 (Cwlth)* (EPBC) as being of "matters of national environmental significance". Consideration must be given as to whether the proposed development will, or is likely to have a "significant impact" on "matters of national environmental significance".

A bilateral agreement was made in January 2007 between the Commonwealth & NSW Governments whereby the Commonwealth Government recognised the NSW assessment process in the *Environmental Planning and Assessment Act 1979 (NSW)*.

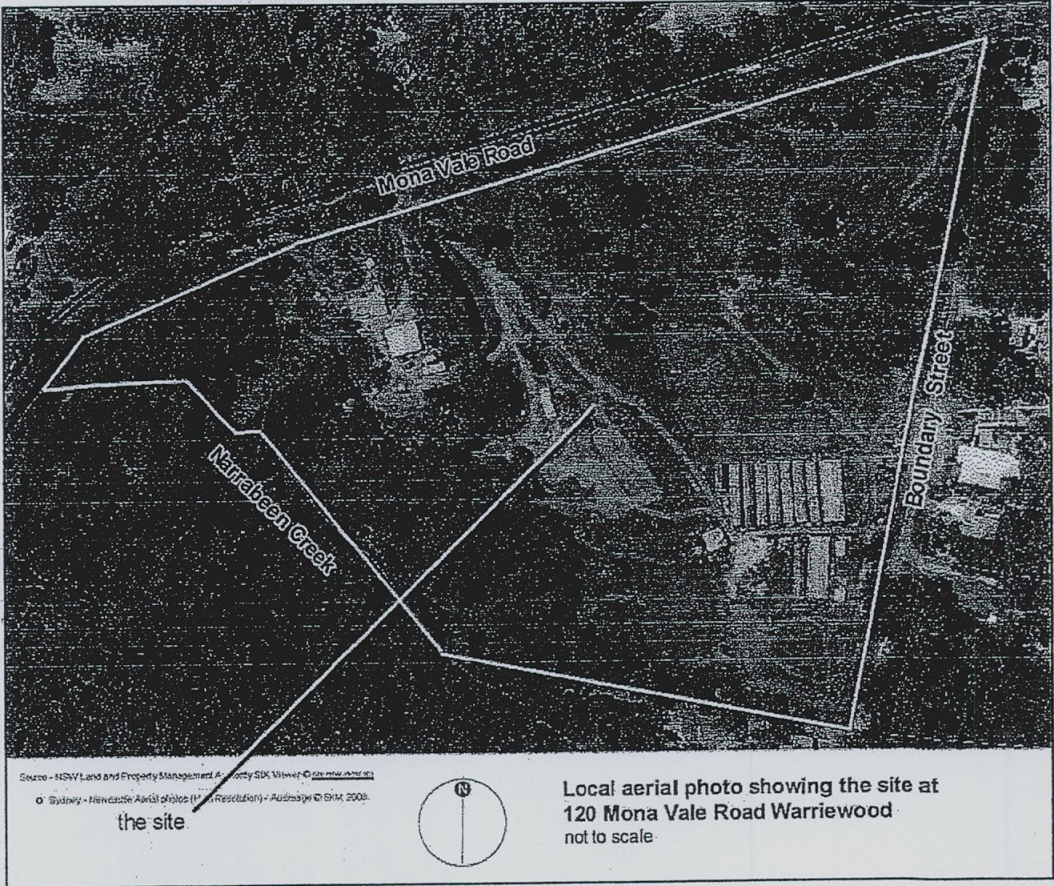
In accordance with this agreement "controlled actions" as defined in the *Environment Protection & Biodiversity Act 1999 (Cwlth)* relating to threatened species, do not require assessment under Part 8 of the *Environment Protection & Biodiversity Act 1999 (Cwlth)* where they are assessed or approved under Part 3A, 4 or 5 of the *Environmental Planning and Assessment Act 1979 (NSW)*.

2. the site

2.1

general information

The subject site consists of Lot 1 in DP 308009 and Lots 3, 4 & 5 in DP 12460 and is known as 120 & 122 Mona Vale Road, Warriewood and has a combined area of approximately 8.33 hectares. The site has the reference co-ordinates of AMG (56) 340700E and 6272300N and is currently zoned Non Urban 1(a).



2.2

geology

2.2.1 Site geology

Although no exploratory excavation was conducted, based upon site and local observations, rock outcrops and soil types, the geology associated with the site appears to be consistent with that described as Hawkesbury Sandstone (Herbert, 1983) with some influences of the underlying Narrabeen Geological Group.

2.2.2 Hawkesbury Sandstone

Hawkesbury Sandstone consists of sediments laid down during the mid Triassic Period, some 230 million years ago.

During the mid Triassic period a major shift in the watershed pattern occurred and the Sydney basin experienced the deposition of quartz sediments from the south west (Herbert, 1983). These quartz sediments were deposited by vigorous braided streams and they deposited a thick blanket of Hawkesbury Sandstone over the earlier Newport Formation sediments.

2.2.3 Narrabeen Geological Group

The Narrabeen Geological Group consists of sediments laid down during the early part of the Triassic Period, some 245 million years ago. It is made up of interbedded laminate and shale with quartz to lithic quartz sandstone. Clay pellet sandstone also occur south of the Hawkesbury River (Herbert, 1983)

2.3

soil landscape

2.3.1 Subject site

The landform consists of a central crest and simple slopes that give way to 2 open depressions, one being Narrabeen Creek on the south western boundary and another smaller drainage line towards the north eastern portion of the site.

The site has a predominately easterly aspect with slope / gradients generally ranging from between moderately inclined 10° (18%) to steep 28° (53%). Sandstone rock outcrops are also evident particularly in the steeper slopes on the southern side of the central crest.

The soils over the steeper south western portion of the site retain the natural soil profiles and although other parts of the site have been disturbed some characteristics of the natural soils remain. Where the natural soil profiles are evident, the soils appear to be influenced by Narrabeen Geological Group and range from brown to yellow podsolic soils and in other areas varying depths of siliceous sand.

Based upon this information and the geology it is considered that the site is consistent with that described as the Watagan Soil Landscape (Chapman & Murphy 1989).

2.3.2 Watagan Soil Landscape

The Watagan Soil Landscape is described as being rolling to very steep hills of fine grained sediments, having a local relief of 60m – 120m, slopes >25%, occasional sandstone boulder and benches. The soils are described as shallow to deep lithosols / siliceous sands and yellow podsolic soils on sandstone and brown, red and gleyed podsolic soils on shales (Chapman & Murphy 1989).

2.4 catchment

The site is divided into 2 catchments by a central ridge.

The southern portion of the site drains to Narrabeen Creek which forms part of the allotment boundary. Narrabeen Creek is an open channel meandering through residential and commercial land uses to join Mullet Creek and in turn Narrabeen Lakes and the Tasman Sea.

The northern portion of the site drains to an open channel and immediately down stream of the site overland flows in the channel are to be collected and piped as part of a recent development approval. This piped drainage system is likely to be connected to inter-allotment drainage lines which appear to discharge into Cahill Creek which in turn discharges into the Pittwater inlet.

2.5 vegetation & habitats

2.5.1 Vegetation & habitat units

The site has been considered in 3 main habitat units based upon similarities in the vegetation's physical structure, floristic composition, level of disturbance and the current land use.

- Area A - Open Forest,
- Area B – Disturbed Woodland & Scrubland areas
- Area C – Open Paddocks & Infrastructure areas.

3. flora & fauna survey

3.1 flora species survey methods

3.1.1 Flora literature search

Records of threatened flora species were obtained from the Office of Environment & Heritage's (OEH, 2010) Wildlife Atlas database searching a 10km grid square centred on the site (AMG(56) 340700 E and 6272300 N).

3.1.2 Flora field surveys

The flora survey covered an area of approximately 8 ha over the site using the Random Meander Method described by Cropper (1993) and focussed on the undisturbed and less modified parts of the site. The main flora field survey was conducted on the 20/05/10 and the 10/06/11. Where there was some taxonomic species uncertainty, samples were taken for verification using recognised floristic keys.

Specific effort was undertaken to identify optimal and sub-optimal habitats of threatened species and communities and in these areas detailed searches were undertaken.

Species identifications are consistent with the nomenclature in Harden (1992, 1993, 2000 & 2002) with recent name changes as amended in the Royal Botanic Gardens Sydney publication *Cunninghamia*.

3.2 fauna species survey methods

3.2.1 Fauna literature search

Records of threatened fauna species and populations were obtained from Office of Environment & Heritage's (OEH, 2010) Wildlife Atlas database searching a 10km grid square centred on the site (AMG(56) 340700 E and 6272300 N).

3.2.2 Fauna field surveys

3.2.2.1 Habitat assessment

Because of the cryptic nature of many fauna species and seasonal limitations of short term surveys, a habitat assessment was conducted to identify potential habitats where threatened and other fauna species could reside or forage as well as noting key habitat features.

3.2.2.2 Herpetofauna diurnal observations

A 60 minute herpetofauna survey was conducted during daylight hours in conjunction with the flora survey on the 20/05/11. This was an active survey involving identifying differing microhabitats such as leaf litter, logs, dense ground cover vegetation and rubble and each microhabitat was searched by hand. This survey focussed on the rear portion of the site and the sandstone rock outcrops.

3.2.2.3 Nocturnal fauna sightings

Spotlighting was conducted to identify frogs, bats, mammals and nocturnal birds and reptiles and specifically targeted small ground mammals, possums, gliders, and owls. Two (2) 60-minute surveys were undertaken on the site using a 100-watt hand held spotlights. This survey was conducted on dusk extending for 60 minutes into the early evening on the 27/05/11 & 02/06/11.

3.2.2.4 Diurnal bird observations and call recognition

Four (4), 60 minute surveys were undertaken, of which 2 were conducted in the afternoon of 27/05/11 and 02/06/11 and 2 was conducted in the mornings on 28/05/11 and 03/06/11.

3.2.2.5 Ultrasonic bat detection

Ultrasonic bat detection was undertaken over 2 nights commencing on the evening of the 27/05/11 and again on the 02/06/11. Recording equipment was activated before dusk, running throughout the night until the following morning. Bat ultrasonic recordings were taken using an Anabat II detector with a digital ZCAIM storage unit and recordings were identified by Ray Williams from Ecotone Environmental Consultants.

3.2.2.6 Call playback

No nocturnal call play back of Owls was conducted as it disrupts the activities of nocturnal mammals.

Call playback for Red-crowned Toadlet (*Pseudophryne australis*) and Giant Burrowing Frog (*Heleioporus australiacus*) was conducted on the evening of the 27/05/11 & 02/06/11 as part of the spotlight survey focussing on the drainage line and peripheral areas and again during the day on the 20/05/11. Call play back involved broadcasting separate calls for a 5 minute period and listening for 3 minutes for a response.

3.2.2.7 Hair tube traps

Ten (10) hair tube traps were deployed to identify mammals such as rodents, gliders, bandicoots and possums. Of the 15 hair tubes, 10 were larger tubes with 90mm diameter and 5 were smaller tubes with a 50mm diameter. Ten (10) hair tubes were placed on the ground, (9 large & 1 small) and 5 (1 large & 4 small) hair tubes were located in trees/shrubs at 1.5m -2m above ground level. Hair tubes were baited with a mixture consisting of peanut butter, rolled oats, honey, canola oil, almond essence, aniseed essence and left for 6 nights between the 03/06/11 and 10/06/11. Hair samples collected were identified by Barbara Triggs of dead Finish using the method outlined by Brunner & Coleman (1974).

3.2.2.8 Opportunistic sighting, calls, scats and scratchings

During the course of individual surveys opportunistic observations, calls, scats, tracks and scratchings were also recorded both within the study area and locally off site.

3.3 survey findings

3.3.1 Flora species data

The following table identifies flora species:

- listed in the schedules of the *Environment Protection & Biodiversity Conservation Act 1999 (Cwth)* and recorded within a 10km grid square centred on the site in the *Wildlife Atlas (OEH, 2010)*;
- listed in the schedules of the *Threatened Species Conservation Act 1995 (NSW)* and recorded within a 10km grid square centred on the site in the *Wildlife Atlas (OEH 2010)*;
- listed in Schedule 13 of the *National Parks & Wildlife Act 1974 (NSW)* and recorded on site; and
- recorded on the site as part of field surveys.

OEH Wildlife Atlas	Recorded On Site – Area A	Recorded On Site – Area B	Recorded On Site – Area C	Genus species	Common Name	Autochthony	Conservation Status
✓	✓			Acacia decurrens	Black Wattle	Indigenous	Unprotected
		✓		Acacia longifolia	Sydney Golden Wattle	Indigenous	Unprotected
		✓		Acacia longissima	Narrow-leaved Wattle	Indigenous	Unprotected
✓	✓			Acacia terminalis subsp. augustifolia	Sunshine Wattle	Indigenous	Unprotected
✓	✓			Acacia ulicifolia	Prickly Moses Wattle	Indigenous	Unprotected
				Acetosa sagittata	Potato Vine/	Exotic	Noxious
		✓	✓	Acmena smithii	Lilly Pilly	Indigenous	Unprotected
		✓	✓	Adiantum aethiopicum	Common Maidenhair Fern	Indigenous	Protected
	✓	✓	✓	Adiantum formosum	Giant Maidenhair Fern	Indigenous	Protected
	✓			Ageratina adenophora	Crofton Weed	Exotic	Unprotected
	✓	✓	✓	Ageratina riparia	Mist Flower	Exotic	Unprotected
	✓			Allocasuarina torulosa	Forest Oak	Indigenous	Unprotected
	✓			Andropogon virginicus	Whisky Grass	Exotic	Unprotected
	✓	✓	✓	Angophora costata	Sydney Red/Rusty Gum	Indigenous	Unprotected
	✓	✓	✓	Araujia sericiflora	Moth Vine	Exotic	Noxious
	✓		✓	Arbutus unedo	Irish Strawberry Tree	Exotic	Unprotected

QEH Wildlife Atlas	Recorded On Site – Area A	Recorded On Site – Area B	Recorded On Site – Area C	Genus species	Common Name	Autochthony	Conservation Status
✓		✓		<i>Asparagus aethiopicus</i>	Asparagus Fern	Exotic	Noxious
	✓			<i>Astrotricha floccosa</i>	Star-hairs	Indigenous	Unprotected
	✓			<i>Backhousia myrtifolia</i>	Ironwood/Grey Myrtle Tree	Indigenous	Unprotected
		✓		<i>Banksia integrifolia</i>	Coastal Banksia	Indigenous	Unprotected
	✓			<i>Banksia serrata</i>	Old Man Banksia	Indigenous	Unprotected
		✓		<i>Banksia spinulosa</i>	Hairpin Banksia	Indigenous	Unprotected
	✓		✓	<i>Bidens pilosa</i>	Cobbler's Peg	Exotic	Unprotected
		✓		<i>Billardiera scandens</i>	Appleberry	Indigenous	Unprotected
		✓		<i>Blechnum cartilagineum</i>	Gristle Fern	Indigenous	Unprotected
	✓			<i>Boronia ledifolia</i>	Ledum/Sydney Boronia	Indigenous	Protected
	✓			<i>Boronia pinnata</i>	Pinnate Boronia	Indigenous	Protected
	✓	✓		<i>Breynia oblongifolia</i>	Coffee Bush Shrub	Indigenous	Unprotected
	✓			<i>Bursaria spinosa</i>	Native Blackthorn	Indigenous	Unprotected
	✓			<i>Callicoma serratifolia</i>	Black Wattle	Indigenous	Unprotected
✓				<i>Callistemon linearifolius</i>	Netted Bottle Brush	Indigenous	Vulnerable NSW
	✓			<i>Callistemon rigidus</i>	Stiff Bottlebrush	Indigenous	Unprotected
	✓	✓		<i>Calochlaena dubia</i>	Common Ground Fern	Indigenous	Protected
	✓		✓	<i>Cassytha sp.</i>	Devil's Twine	Indigenous	Unprotected
	✓			<i>Cayratia clematidea</i>	Slender Grape	Indigenous	Unprotected
		✓	✓	<i>Centella asiatica</i>	Swamp Pennywort	Indigenous	Unprotected
	✓			<i>Ceratopetalum apetalum</i>	Coachwood Tree	Indigenous	Unprotected
	✓			<i>Cestrum parqui</i>	Green Cestrum	Exotic	Noxious
			✓	<i>Chlorophytum comosum</i>	Ribbon / Spider Plant	Exotic	Unprotected
		✓		<i>Cinnamomum camphora</i>	Camphor Laurel	Exotic	Noxious
	✓	✓		<i>Cissus hypoglauca</i>	Giant Water Vine	Indigenous	Unprotected
		✓		<i>Clerodendrum tomentosum</i>	Hairy Clerodendrum	Indigenous	Unprotected
		✓		<i>Commelina cyanea</i>	Scurvy Weed	Indigenous	Unprotected

OEH Wildlife Atlas	Recorded On Site – Area A	Recorded On Site – Area B	Recorded On Site – Area C	Genus species	Common Name	Autochthony	Conservation Status
✓	✓		✓	<i>Conyza bonariensis</i>	Flaxleaf Fleabane	Exotic	Unprotected
	✓			<i>Correa reflexa</i>	Native Fuchsia	Indigenous	Unprotected
	✓			<i>Crocea exalata</i>	-	Indigenous	Protected
	✓	✓		<i>Cyathea australis</i>	Rough Treefern	Indigenous	Protected
	✓	✓		<i>Cyathea cooperi</i>	Straw Treefern	Native	Protected
			✓	<i>Cynodon dactylon</i>	Common Couch Grass	Exotic	Unprotected
	✓			<i>Dampiera purpurea</i>	-	Indigenous	Unprotected
✓				<i>Darwinia biflora</i>	-	Indigenous	Vulnerable NSW
	✓			<i>Dianella caerulea</i>	Blue Flax Lily	Indigenous	Unprotected
			✓	<i>Diets bicolor</i>	Diets	Exotic	Unprotected
	✓	✓		<i>Dodonaea triquetra</i>	Hop Bush	Indigenous	Unprotected
			✓	<i>Ehrharta erecta</i>	Panic Veldtgrass	Exotic	Unprotected
	✓			<i>Elaeocarpus reticulatus</i>	Blueberry Ash	Indigenous	Unprotected
		✓	✓	<i>Entolasia marginata</i>	Bordered Panic	Indigenous	Unprotected
	✓	✓	✓	<i>Entolasia stricta</i>	Wiry Panic	Indigenous	Unprotected
✓				<i>Epacris purpurascens</i> var. <i>purpurascens</i>	-	Indigenous	Vulnerable NSW
			✓	<i>Eragrostis curvula</i>	African Love Grass	Exotic	Unprotected
		✓	✓	<i>Eucalyptus botryoides</i>	Bangalay	Indigenous	Unprotected
✓	✓			<i>Eucalyptus camfieldii</i>	Heart-Leaved Stringybark	Indigenous	Vulnerable NSW, Cwth
✓				<i>Eucalyptus nicholii</i>	Narrow-Leaf Peppermint	Native	Vulnerable NSW
		✓		<i>Eucalyptus paniculata</i>	Grey Ironbark	Indigenous	Unprotected
	✓			<i>Eucalyptus piperita</i>	Sydney Peppermint	Indigenous	Unprotected
	✓			<i>Eucalyptus punctata</i>	Grey Gum	Indigenous	Unprotected
✓				<i>Eucalyptus scoparia</i>	Wallangarra White Gum	Native	Endangered NSW, Vulnerable Cwth
	✓	✓		<i>Eucalyptus umbra</i>	Broad-leaved White Mahogany	Indigenous	Unprotected
	✓			<i>Eustrephus latifolius</i>	Wombat Berry	Indigenous	Unprotected
	✓			<i>Exocarpos cupressiformis</i>	Cherry Ballart / Native Cherry	Indigenous	Unprotected

OEH Wildlife Atlas	Recorded On Site - Area A	Recorded On Site - Area B	Recorded On Site - Area C	Genus species	Common Name	Autochthony	Conservation Status
✓	✓	✓	✓	<i>Gahnia sieberiana</i>	Sawsedge	Indigenous	Protected
	✓	✓		<i>Geitonoplesium cymosum</i>	Scrambling Lilly	Indigenous	Unprotected
		✓		<i>Genista monspessulana</i>	Montpellier Broom	Exotic	Noxious
		✓		<i>Gleichenia dicarpa</i>	Coral Fern	Indigenous	Unprotected
		✓		<i>Glochidion ferdinandi</i>	Cheese Tree	Indigenous	Unprotected
		✓		<i>Glycine clandestina</i>	Twining Glycine	Indigenous	Unprotected
	✓		✓	<i>Gonocarpus tetracoides</i>	Raspwort	Indigenous	Unprotected
✓				<i>Grammitis stenophylla</i>	Narrow-leaf Finger Fern	Indigenous	Endangered NSW
✓				<i>Grevillea caleyi</i>	Caley's Grevillea	Indigenous	Endangered NSW, Cwlth
	✓			<i>Grevillea sericea</i>	Pink Spider Flower	Indigenous	Unprotected
	✓			<i>Gymnostachys anceps</i>	Settler's Flax	Indigenous	Unprotected
	✓			<i>Hakea dactyloides</i>	Broad-leaved Hakea	Indigenous	Unprotected
	✓			<i>Hedychium gardnerianum</i>	Ginger Lily	Exotic	Unprotected
	✓	✓		<i>Hibbertia dentata</i>	Twining Guinea Flower	Indigenous	Unprotected
		✓		<i>Histiopteris incisa</i>	Bat's-wing Fern	Indigenous	Unprotected
	✓			<i>Homalanthus populifolius</i>	Bleeding Heart / Native Poplar	Indigenous	Unprotected
		✓	✓	<i>Hydrocotyle bonariensis</i>	Pennywort	Exotic	Unprotected
		✓		<i>Hypolepis muelleri</i>	Harsh Ground Fern	Indigenous	Unprotected
		✓	✓	<i>Imperata cylindrica</i>	Blady Grass	Indigenous	Unprotected
				<i>Ipomoea cairica</i>	Coastal Morning Glory	Exotic	Unprotected
		✓		<i>Ipomoea indica</i>	Blue Morning Glory	Exotic	Noxious
	✓			<i>Kennedia rubicunda</i>	Red Kennedy Pea	Indigenous	Unprotected
	✓	✓	✓	<i>Kunzea ambigua</i>	Tick Bush	Indigenous	Unprotected
				<i>Lambertia formosa</i>	Mountain Devil	Indigenous	Unprotected
	✓	✓	✓	<i>Lantana camara</i>	Lantana	Exotic	Noxious
	✓			<i>Lepidosperma filiforme</i>	-	Indigenous	Unprotected
	✓			<i>Lepidosperma laterale</i>	Variable Sword-sedge	Indigenous	Unprotected

IOEH Wildlife Atlas	Recorded On Site – Area A	Recorded On Site – Area B	Recorded On Site – Area C	Genus species	Common Name	Autochthony	Conservation Status
✓	✓			<i>Leptospermum deanei</i>	-	Indigenous	Vulnerable NSW, Cwth
	✓			<i>Leptospermum trinervium</i>	Paperbark Tea-tree	Indigenous	Unprotected
	✓	✓	✓	<i>Livistona australis</i>	Cabbage Palm / Fan Palm	Indigenous	Protected
	✓			<i>Lomandra filiformis</i>	Wattle Mat-rush	Indigenous	Unprotected
	✓	✓		<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	Indigenous	Unprotected
	✓			<i>Lomatia silaifolia</i>	Crinkle Bush	Indigenous	Protected
	✓			<i>Marsdenia rostrata</i>	Common Milk Vine	Indigenous	Unprotected
	✓	✓		<i>Marsdenia suaveolens</i>	Scented Marsdenia	Indigenous	Unprotected
		✓		<i>Maytenus silvestris</i>	Narrow-leaved Orangebark	Indigenous	Unprotected
		✓		<i>Micrantheum ericoides</i>	-	Indigenous	Unprotected
		✓	✓	<i>Microlaena stipoides</i>	Weeping Grass	Indigenous	Unprotected
	✓	✓		<i>Microtis angusii</i>	Angus's Onion Orchid	Indigenous	Endangered NSW, Cwth
✓				<i>Morinda jasminoides</i>	Morinda	Indigenous	Unprotected
	✓			<i>Musa acuminata</i>	Edible banana	Exotic	Unprotected
	✓	✓	✓	<i>Nephrolepis cordifolia</i>	Fishbone Fern	Native	Unprotected
	✓	✓		<i>Notelaea longifolia</i>	Large Mock-olive	Indigenous	Unprotected
		✓		<i>Olea europaea subsp. cuspidata</i>	African Olive	Exotic	Noxious
		✓	✓	<i>Oplismenus imbecillis</i>	Basket Grass	Indigenous	Unprotected
			✓	<i>Oxalis sp.</i>	Oxalis	Exotic	Unprotected
			✓	<i>Ozothamnus diosmifolius</i>	White Dogwood	Indigenous	Unprotected
		✓		<i>Pandorea pandorana</i>	Wonga Wonga Vine	Indigenous	Unprotected
		✓		<i>Parsonsia straminea</i>	Common Silkpod	Indigenous	Unprotected
	✓			<i>Paspalum dilatatum</i>	Paspalum	Exotic	Unprotected
			✓	<i>Paspalum unvillei</i>	Vasey Grass	Exotic	Unprotected
	✓			<i>Passiflora edulis</i>	Common Passionfruit	Exotic	Unprotected
	✓			<i>Pennisetum clandestinum</i>	Kikuyu Grass	Exotic	Unprotected
	✓	✓	✓	<i>Phebalium dentatum</i>	Toothed Phebalium	Indigenous	Unprotected

OEH Wildlife Atlas	Recorded On Site – Area A	Recorded On Site – Area B	Recorded On Site – Area C	Genus species	Common Name	Autochthony	Conservation Status
✓	✓	✓	✓	<i>Plimelea curviflora</i> var. <i>curviflora</i>	Curved Rice-flower	Indigenous	Vulnerable NSW
	✓	✓	✓	<i>Plimelea linifolia</i>	Slender Rice-flower	Indigenous	Unprotected
	✓	✓	✓	<i>Pittosporum revolutum</i>	Yellow / Rough Fruit Pittosporum	Indigenous	Unprotected
	✓	✓	✓	<i>Pittosporum undulatum</i>	Native Daphne	Indigenous	Unprotected
		✓	✓	<i>Plantago lanceolata</i>	Lambs Tongue	Exotic	Unprotected
		✓	✓	<i>Plectranthus parviflorus</i>	Cockspur	Indigenous	Unprotected
		✓	✓	<i>Podolobium ilicifolium</i>	Prickly Shaggy Pea	Indigenous	Unprotected
	✓	✓	✓	<i>Polyscias sambucifolia</i>	Elderberry Panax	Indigenous	Unprotected
		✓	✓	<i>Pomaderris ferruginea</i>	Rusty Pomaderris	Indigenous	Unprotected
	✓			<i>Pomax umbellata</i>	Pomax	Indigenous	Unprotected
			✓	<i>Populus sp.</i>	Poplar	Exotic	Unprotected
	✓	✓		<i>Pratia purpurascens</i>	Whiteroot	Indigenous	Unprotected
	✓			<i>Prostanthera denticulata</i>	Rough Mint-bush	Indigenous	Unprotected
		✓		<i>Pseuderanthemum variabile</i>	Pastel Flower	Indigenous	Unprotected
	✓	✓	✓	<i>Pteridium esculentum</i>	Bracken Common	Indigenous	Unprotected
	✓			<i>Pultenaea dentata</i>	Clustered Bush-pea	Indigenous	Unprotected
	✓			<i>Pultenaea flexilis</i>	Graceful Bush-pea	Indigenous	Unprotected
	✓	✓		<i>Rapanea variabilis</i>	Muttonwood	Indigenous	Unprotected
		✓	✓	<i>Rubus fruticosus</i>	Blackberry	Exotic	Unprotected
			✓	<i>Rumex brownii</i>	Swamp Dock	Indigenous	Unprotected
	✓	✓	✓	<i>Sarcopetalum harveyanum</i>	Pearl Vine	Indigenous	Unprotected
		✓	✓	<i>Senecio madagascariensis</i>	Fireweed	Exotic	Unprotected
		✓	✓	<i>Senna pendula</i>	Cassia	Exotic	Unprotected
		✓	✓	<i>Sida rhombifolia</i>	Paddy's Lucerne	Exotic	Unprotected
		✓	✓	<i>Smilax australis</i>	Sarsaparilla	Indigenous	Unprotected
	✓	✓	✓	<i>Smilax glycyphylla</i>	Sweet Sarsaparilla	Indigenous	Unprotected
		✓	✓	<i>Solanum mauritanium</i>	Wild Tobacco Tree	Exotic	Unprotected

OEH Wildlife Atlas	Recorded On Site - Area A	Recorded On Site - Area B	Recorded On Site - Area C	Genus/species	Common Name	Autochthony	Conservation Status
✓	Recorded On Site - Area A	Recorded On Site - Area B	Recorded On Site - Area C	Unprotected / Protected / Schedule 13 National Parks & Wildlife Act 1974 (NSW) / Vulnerable NSW / Endangered NSW / Critically Endangered NSW / Threatened Species Conservation Act 1996 (NSW) / Noxious / Noxious Weeds Act 1993 (NSW) / Critically Endangered Cwth / Endangered Cwth / Vulnerable Cwth - Environment Protection & Biodiversity Conservation Act 1999 (Cwth)			
			✓	<i>Solanum nigrum</i>	Blackberry Nightshade	Exotic	Unprotected
			✓	<i>Sporobolus indicus</i>	Parramatta Grass	Exotic	Unprotected
			✓	<i>Stellaria media</i>	Chickweed	Exotic	Unprotected
	✓			<i>Stephania japonica</i>	Snake Vine	Indigenous	Unprotected
	✓			<i>Styphelia tubiflora</i>	Red Five-Corner	Indigenous	Unprotected
	✓	✓		<i>Syncarpia glomulifera</i>	Turpentine	Indigenous	Unprotected
	✓	✓		<i>Synoum glandulosum</i>	Scentless Rosewood	Indigenous	Unprotected
✓	✓			<i>Syzygium paniculatum</i>	Magenta Lillypill	Indigenous	Vulnerable NSW
			✓	<i>Taraxacum officinale</i>	Dandelion	Exotic	Unprotected
✓				<i>Tetradlea glandulosa</i>	Glandular Pink-bell	Indigenous	Vulnerable NSW
	✓			<i>Tradescantia fluminensis</i>	Wandering Jew	Exotic	Noxious
	✓			<i>Trochocarpa laurina</i>	Tree Heath	Indigenous	Unprotected
			✓	<i>Verbera bonariensis</i>	Purple Top	Exotic	Unprotected
		✓	✓	<i>Veronica plebeia</i>	Trailing Speedwell	Indigenous	Unprotected
				<i>Watsonia meriana</i> cv. <i>Bulbillifera</i>	Wild Watsonia	Exotic	Unprotected
	✓			<i>Watsonia</i> sp.	Watsonia	Exotic	Unprotected
	✓			<i>Wilkiea huegeliana</i>	Veiny Wilkiea	Indigenous	Unprotected
	✓			<i>Xanthorrhoea</i> spp.	Grass Tree	Indigenous	Protected
	✓			<i>Xanthosia pilosa</i>	Woolly Xanthosia	Indigenous	Unprotected
	✓	✓		<i>Zieria laevigata</i>	Smooth Zieria	Indigenous	Unprotected

3.3.2 Fauna species data

The following table identifies flora species:

- listed in the schedules of the *Environment Protection & Biodiversity Conservation Act 1999 (Cwth)* and recorded within a 10km grid square centred on the site in the Wildlife Atlas (OEH, 2010), and
- listed in the schedules of the *Threatened Species Conservation Act 1995 (NSW)* and recorded within a 10km grid square centred on the site in the Wildlife Atlas (OEH 2010), and
- recorded on the site as part of field surveys.

Wildlife Atlas DECC (2010)	Recorded on Site	Class	Genus species	Common Name	Autochthony	Conservation Status
✓ Recorded / Identified Unprotected / Protected Cwth / Endangered Cwth	✓ Recorded / Identified Unprotected / Protected Cwth / Endangered Cwth	✓ Recorded / Identified Unprotected / Protected Cwth / Endangered Cwth	✓ Recorded / Identified Unprotected / Protected Cwth / Endangered Cwth	✓ Recorded / Identified Unprotected / Protected Cwth / Endangered Cwth	✓ Recorded / Identified Unprotected / Protected Cwth / Endangered Cwth	✓ Recorded / Identified Unprotected / Protected Cwth / Endangered Cwth
	✓	Amphibia	<i>Critia signifera</i>	Common Eastern Froglet	Native	Protected
✓		Amphibia	<i>Heleioporus australiacus</i>	Giant Burrowing Frog	Native	Vulnerable NSW, Cwth
✓		Amphibia	<i>Pseudophryne australis</i>	Red-crowned Toadlet	Native	Vulnerable NSW
	✓	Arachnida	<i>Isopodella sp.</i>	Common Huntsman	Native	Unprotected
	✓	Arachnida	<i>Ixodes holocyclus</i>	Paralysis Tick	Native	Unprotected
	✓	Arachnida	<i>Phonognatha graeffei</i>	Leaf-curling Spider	Native	Unprotected
	✓	Aves	<i>Anthochaera carunculata</i>	Red Wattlebird	Native	Protected
	✓	Aves	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	Native	Protected
✓		Aves	<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	Native	Vulnerable NSW
✓		Aves	<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	Native	Vulnerable NSW
	✓	Aves	<i>Corvus coronoides</i>	Australian Raven	Native	Protected
	✓	Aves	<i>Cracticus torquatus</i>	Grey Butcherbird	Native	Protected
	✓	Aves	<i>Dacelo novaeguineae</i>	Laughing Kookaburra	Native	Protected
	✓	Aves	<i>Eolophus roseicapillus</i>	Galah	Native	Protected
	✓	Aves	<i>Eurystomus orientalis</i>	Dollarbird	Native	Protected
	✓	Aves	<i>Gallus gallus domesticus</i>	Domestic Chicken	Introduced	Unprotected
	✓	Aves	<i>Gymnorhina tibicen</i>	Australian Magpie	Native	Protected
	✓	Aves	<i>Hirundo neoxena</i>	Welcome Swallow	Native	Protected
✓		Aves	<i>Ixobrychus flavicollis</i>	Black Bittern	Native	Vulnerable NSW

Wildlife Atlas DECC (2010)	Recorded on Site	Class	Genus species	Common Name	Autochthony	Conservation Status
✓		Aves	<i>Lathamus discolor</i>	Swift Parrot	Native	Endangered NSW, Cwth
	✓	Aves	<i>Malurus cyaneus</i>	Superb Fairy-wren	Native	Protected
	✓	Aves	<i>Manorina melanocephala</i>	Noisy Miner	Native	Protected
✓		Aves	<i>Melithreptus gularis</i>	Black-chinned Honeyeater	Native	Vulnerable NSW
✓		Aves	<i>Ninox connivens</i>	Barking Owl	Native	Vulnerable NSW
		Aves	<i>Ninox strenua</i>	Powerful Owl	Native	Vulnerable NSW
	✓	Aves	<i>Oriolus sagittatus</i>	Olive-backed Oriole	Native	Protected
	✓	Aves	<i>Pardalotus punctatus</i>	Spotted Pardalote	Native	Protected
	✓	Aves	<i>Phylidonyris nigra</i>	White-cheeked Honeyeater	Native	Protected
	✓	Aves	<i>Psophodes olivaceus</i>	Eastern Whipbird	Native	Protected
	✓	Aves	<i>Rhipidura leucophrys</i>	Willie Wagtail	Native	Protected
	✓	Aves	<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	Native	Protected
✓		Aves	<i>Tyto novaehollandiae</i>	Masked Owl	Native	Vulnerable NSW
	✓	Aves	<i>Vanellus miles</i>	Masked Lapwing	Native	Protected
	✓	Aves	<i>Zosterops lateralis</i>	Silverye	Native	Protected
	✓	Insecta	<i>Apis mellifera</i>	European Honey Bee	Introduced	Unprotected
	✓	Insecta	<i>Myrmecia brevinoda</i>	Giant Bullant (red/orange)	Native	Unprotected
	✓	Insecta	<i>Nasutitermes walkeri</i>	Niggerhead Termite	Native	Unprotected
	✓	Mammalia	<i>Bos sp.</i>	Cattle	Introduced	Unprotected
	✓	Mammalia	<i>Canis lupus familiaris</i>	Domestic Dog	Introduced	Unprotected
✓		Mammalia	<i>Cercartetus nanus</i>	Eastern Pigmy-possum	Native	Vulnerable NSW
	✓	Mammalia	<i>Chalinolobus morio</i>	Chocolate Wattled Bat	Native	Protected
✓		Mammalia	<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	Native	Vulnerable NSW, Endangered Cwth
	✓	Mammalia	<i>Felis catus</i>	Cat	Introduced	Unprotected
✓		Mammalia	<i>Isodon obesulus obesulus</i>	Southern Brown Bandicoot	Native	Endangered NSW, Cwth
✓	✓	Mammalia	<i>Miniopterus schreibersii oceanensis</i>	Eastern Bent-wing Bat	Native	Vulnerable NSW, Cwth
	✓	Mammalia	<i>Oryctolagus cuniculus</i>	Rabbit	Introduced	Unprotected

Wildlife Atlas DECC (2010)	Recorded on Site	Class	Genus species	Common Name	Autochthony	Conservation Status
✓ Recorded / Identified Unprotected / Protected Cwth / Endangered Cwth	✓	Mammalia	Ovis aries	Sheep (domestic)	Introduced	Unprotected
	✓	Mammalia	Perameles nasuta	Long-nosed Bandicoot	Native	Protected
✓		Mammalia	Phascogale crassirostris	Koala	Native	Vulnerable NSW
✓		Mammalia	Pteropus poliocephalus	Grey-headed Flying-fox	Native	Vulnerable NSW, Cwth
	✓	Mammalia	Trichosurus vulpecula	Common Brushtail Possum	Native	Protected
	✓	Mammalia	Vespertilio vulturnus	Little Forest Bat	Native	Protected
	✓	Mammalia	Wallabia bicolor	Swamp Wallaby	Native	Protected
	✓	Reptilia	Hemiaspis signata	Black-bellied Swamp Snake	Native	Protected
	✓	Reptilia	Lampropholis delicata	Delicate Skink	Native	Protected
	✓	Reptilia	Morelia spilota spilota	Diamond Python	Introduced	Protected
	✓	Reptilia	Phyllurus platurus	Broad-tailed Gecko	Native	Protected
	✓	Reptilia	Physignathus lesueurii	Eastern Water Dragon	Native	Protected
	✓	Reptilia	Pseudonaja textilis	Eastern Brown Snake	Native	Protected
	✓	Reptilia	Tiliqua scincoides	Common / Eastern Blue-tongue	Native	Protected
✓		Reptilia	Varanus rosenbergi	Rosenberg's Goanna / Heath Monitor	Native	Vulnerable NSW

3.3.3 Ecological Communities

Based upon the community descriptions identified by the NSW Scientific Committee and supplemented by those identified by Benson & Howell (1994), the following table identifies vegetation communities:

- listed in the schedules of the *Threatened Species Conservation Act 1995 (NSW)* as endangered ecological communities and are known to occur in the Pittwater Local Government Area,
- recorded on the site from field surveys and where possible the description is consistent with those described by Benson & Howell (1994).

DECC	Recorded On Site	Community name	Brief Description	Conservation Status
Vulnerable NSW / Endangered NSW / Threatened Species Conservation Act 1995 (NSW) / Critically Endangered Cwith / Endangered Cwith / Vulnerable Cwith / Environment Protection & Biodiversity Conservation Act 1999 (Cwith)				
✓		Pittwater Spotted Gum Forest	The forest occurs on shale-derived soils from the Newport Formation geology of the Narrabeen group in Pittwater. Characteristic species include <i>Corymbia maculata</i> , <i>Eucalyptus punctata</i> , <i>Eucalyptus umbra</i> , <i>Angophora floribunda</i> and <i>Corymbia gummifera</i> . (NSW Scientific Committee 1998).	Endangered
✓		Duffy's Forest	The forest occurs on lateritic soils and deeply weathered shale soils typically found on lower ridges in Kuring-gai. Characteristic tree species include <i>Eucalyptus capitelata</i> , <i>Eucalyptus sieberi</i> , <i>Eucalyptus oblonga</i> , and <i>Angophora costata</i> . (NSW Scientific Committee 1998).	Endangered
✓		Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions	The ecological community associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Swamp Sclerophyll Forest on Coastal Floodplains generally occurs below 20 m (though sometimes up to 50 m) elevation. The structure of the community is typically open forest and the dominant trees include <i>Eucalyptus robusta</i> (Swamp Mahogany), <i>Melaleuca quinquenervia</i> (Paperbark) and, south from Sydney, <i>Eucalyptus botryoides</i> (Bangalay) and <i>Eucalyptus longifolia</i> (Woollybutt) (NSW Scientific Committee 2005).	Endangered
✓		Littoral rainforest in the NSW North Coast, Sydney Basin and South East Corner bioregions	The Forest Littoral Rainforest generally is a closed forest, the structure and composition of which is strongly influenced by proximity to the ocean. The plant species in this ecological community are predominantly rainforest species with evergreen mesic or coriaceous leaves. Several species have compound leaves, and vines may be a major component of the canopy. The community comprises the <i>Cupaniopsis anacardioides</i> - <i>Acmena</i> spp. alliance of Floyd (1990) which includes five sub-alliances which include <i>Syzygium leuhmannii</i> , <i>Acmena smithii</i> , <i>Ficus</i> sp., <i>Livistona</i> sp., & <i>Podocarpus</i> sp. (NSW Scientific Committee 2004).	Endangered
	✓	Sydney Sandstone Gully Forest	The Sydney Sandstone Gully Forest is comprised of 3 recognised sub-units including: - Open forest / woodland dominated by <i>Eucalyptus piperita</i> (Sydney Peppermint), <i>Angophora costata</i> (Sydney Red Gum) and <i>Eucalyptus pilularis</i> (Blackbutt) - Tall open forest dominated by <i>Eucalyptus pilularis</i> (Blackbutt) and <i>Syncarpia glomulifera</i> (Turpentine) - Closed Forest dominated by <i>Ceratopetalum apetalum</i> (Coachwood Tree) (Benson & Howell 1994).	Relatively Common

4. habitat assessment

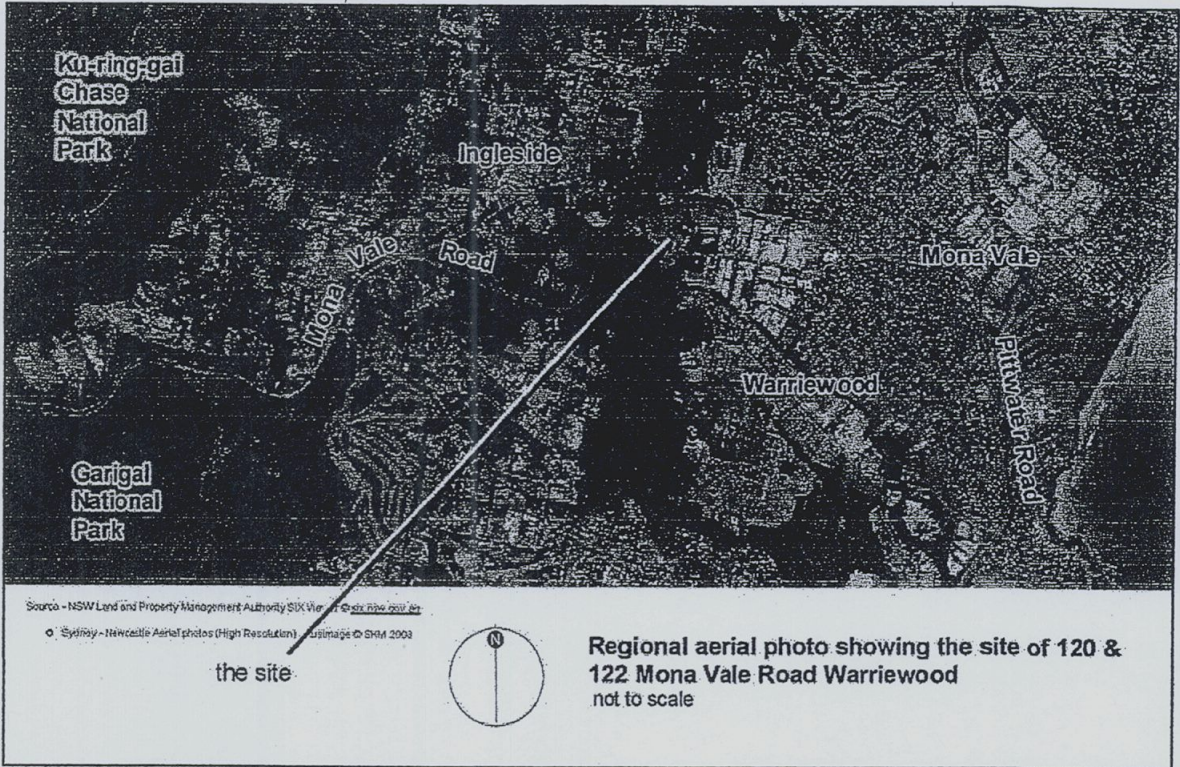
4.1 local & regional context

The site is on the slopes of the Warriewood / Ingleside escarpment and is set in a landscape consisting of commercial developments, rural land residential dwellings and remnant bushland.

The land immediately to the south of the site is relatively steep and contains remnant bushland, natural habitats and riparian areas along Narrabeen Creek.

To the east of the site the land is largely developed with commercial and residential buildings and a small pocket of bushland remains on the Uniting Church land 200m east of the site.

The site is bounded by Mona Vale Road to the north and west, and beyond the road the land consists of a residential development set amongst bushland habitats.



The site adjoins (south) the bushland reserves that form the Warriewood escarpment, is within 2.5km, north east, of Garigal National Park and is within 2.5km south east from Ku-ring-gai Chase National Park.

4.2

site habitats

4.2.1 Habitats on the site

For the purposes of this report the site has been considered in 3 main habitat units based upon similarities in the vegetation's physical structure, floristic composition, level of disturbance and the current land use.

- Area A - Open Forest,
- Area B – Disturbed Woodland & Scrubland areas
- Area C – Open Paddocks & Infrastructure areas

4.2.2 Open Forest habitats

The open forest habitats cover the undeveloped portions of the site and are primarily associated with the steeper land adjacent Narrabeen Creek.

The vegetation has an open forest structure and is dominated by Broad-leaved White Mahogany (*Eucalyptus umbra*), Sydney Red Gum (*Angophora costata*), Bangalay (*Eucalyptus botryoides*), and Grey Gum (*Eucalyptus punctata*). Other species in the canopy and sub-canopy include Forest Oak (*Allocasuarina torulosa*), Sydney Peppermint (*Eucalyptus piperita*).

In the riparian areas and sheltered parts of this area species such as Grey Myrtle (*Backhousia myrtifolia*), Turpentine (*Syncarpia glomulifera*), Coachwood Tree (*Ceratopetalum apetalum*), Black Wattle (*Callicoma serratifolia*), Tree Heath (*Trochocarpa laurina*) and Magenta Lillypilly (*Syzygium paniculatum*) can be found. On the drier upper slopes species including Old Man Banksia (*Banksia serrata*) and Broad-leaved Hakea (*Hakea dactyloides*) are evident.

The riparian areas occur along the incised gully and a number of sandstone rock outcrops occur. The watercourse itself cascades over 2 main scarps on the site and sandstone boulders occur along the length of the watercourse. The 2 main scarps in this area have several rock overhangs that provide shelter and faunal refuges. Several trees in this area also contain habitat hollows.



Figure 4.1 Vegetation & habitats in the Open Forest.

4.2.3 Disturbed Woodland & Scrubland areas

These habitats occur in isolated patches over the site primarily in the moderate slopes on the site and along the northern central drainage line. The tree canopy in these areas varies from being absent, consisting of isolated trees or containing stands of trees. These areas are characterised by having little or no understorey vegetation and ground covers being dense thickets of Bracken (*Pteridium esculentum*).

Along the drainage line and in particular the lower gully, the vegetation structure retains canopy trees of Bangalay (*Eucalyptus botryoides*), Grey Ironbark (*Eucalyptus paniculata*) and Broad-leaved White Mahogany (*Eucalyptus umbra*) with other sub-canopy species such as Cabbage Palm (*Livistona australis*) being present.



Figure 4.2 Vegetation & habitats drainage gully in the Disturbed Woodland & Scrubland areas.

Other areas of the Disturbed Woodland & Scrubland are scattered across the site where maintenance slashing is not regularly carried out. These areas are generally on moderately steep slopes or where rocky boulders occur.

Within these habitats, towards the Open Forest, there is a large, prominent, senescing Red Gum (*Angophora costata*) with several habitat hollows present

Along the northern part of site's boundary fronting Boundary Street there is a band of trees consisting of Turpentine (*Syncarpia glomulifera*), Bangalay (*Eucalyptus botryoides*) and others along with the typical Bracken (*Pteridium esculentum*) ground cover.

4.2.4 Open Paddocks & Infrastructure areas

These areas consist of the roads, tracks, glasshouses, sheds and the dwelling and include areas that are mown, slashed and grazed. The allotment is grazed by free ranging cattle and sheep. Goats and pigs are also confined to areas of the site.

The open areas over much of the site are cleared of trees however the northern paddocks contain isolated remnant tree cover predominately Grey Ironbark (*Eucalyptus paniculata*) and Broad-leaved White Mahogany (*Eucalyptus umbra*).

The ground covers vary across this area ranging from high levels of Kikuyu Grass (*Pennisetum clandestinum*) typically around the existing dwelling to areas of Blady Grass (*Imperata cylindrica*), Weeping Grass (*Microlaena stipoides*) with African Love Grass (*Eragrostis curvula*) and Panic Veldtgrass (*Ehrharta erecta*). Regrowth of Slender Rice-flower (*Pimelea linifolia*) also occurs in the northern open paddocks.



Figure 4.3 Typical views of the open paddocks grazed by cattle and sheep.

4.2.5 Fauna habitats

The Open Forest area contains a variety of habitat features including the riparian habitats of Narrabeen Creek, the banks and bed of the creek itself, rock boulders, rock ledges and rock overhangs, 2 main waterfalls, dead trees with a dense understorey and natural ground cover layers that include logs and leaf litter. These habitats accommodate a range of fauna including small insectivorous birds such as *Spotted Pardalote* (*Pardalotus punctatus*) and *Superb Fairy-wren* (*Malurus cyaneus*) reptiles such as Eastern Water Dragon (*Physignathus lesueurii*) and Broad-tailed Gecko (*Phyllurus platurus*) and several mammals including Common Brushtail Possum (*Trichosurus vulpecula*) and Long-nosed Bandicoot (*Perameles nasuta*). The rock overhangs associated with the waterfalls may also provide refuge habitat for Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*).



Figure 4.4 Upper waterfall & rock overhangs of Narrabeen Creek in the south western corner of the site.

The Disturbed Woodland & Scrubland areas also provide refuge habitats for Common Brushtail Possum (*Trichosurus vulpecula*) and Long-nosed Bandicoot (*Perameles nasuta*) however the bird species that forage in the open are typically Australian Raven (*Corvus coronoides*), Willie Wagtail (*Rhipidura leucophrys*), and Noisy Miner (*Manorina melanocephala*).

Around the drainage line, dams and their peripheral areas in the disturbed Woodland & Scrubland, a colony of Common Eastern Froglet (*Crinia signifera*) were commonly heard calling. Despite nocturnal and diurnal call backs in favourable conditions, no calls of Red-crowned Toadlet (*Pseudophryne australis*) and Giant Burrowing Frog (*Heleioporus australiacus*) were noted.

Swamp Wallaby (*Wallabia bicolor*) scats and evidence of Long-nosed Bandicoot (*Perameles nasuta*) were observed across the site.

The large prominent, senescing Red Gum (*Angophora costata*) within the disturbed area has several habitat hollows. During the course of the surveys the tree was used as a diurnal roost site by Laughing Kookaburra (*Dacelo novaeguineae*) and Rainbow Lorikeet (*Trichoglossus haematodus*) with Rainbow Lorikeet (*Trichoglossus haematodus*) and Sulphur-crested Cockatoo (*Cacatua galerita*) using the hollows on dusk.



Figure 4.5 The large prominent, senescing Red Gum (*Angophora costata*) with habitat hollows being used by Rainbow Lorikeets *Trichoglossus haematodus*) and Sulphur-crested Cockatoos (*Cacatua*

The range and population size of several native hollow-using species such as Sulphur-crested Cockatoo (*Cacatua galerita*) and Rainbow Lorikeet (*Trichoglossus haematodus*) has increased significantly since European settlement (Gibbons & Lindenmayer, 2002). These species are known to displace other more sensitive species that use small hollows as refuge and/ or breeding. Aggressive species such as Noisy Miners (*Manorina melanocephala*) have also been known to displace more sensitive species (Franklin et al., 1989, Grey et al., 1998).

4.3 critical habitat

Critical habitat is declared under the provisions of the Threatened Species Conservation Act 1995. This site is not listed as being part of any gazetted critical habitat. Currently the critical habitats listed in the schedules of the Act are

- Gould's Petrel;
- Little Penguin habitat in Sydney's North Harbour;
- Mitchell's Rainforest Snail in Stott's Island Nature Reserve;
- *Wollemia nobilis* (The Wollemi Pine);
- *Bomaderry zieria* within the Bomaderry bushland - critical habitat recommendation;
- Eastern Suburbs Banksia Scrub Endangered Ecological Community - critical habitat recommendation, and

The site is not considered to be critical habitat for the purposes of the *Threatened Species Conservation Act 1995 (NSW)*.

5. consideration of the site habitats & habitats of threatened species

5.1 threatened species habitat assessment

The following assessment is made with regards to threatened species, populations and ecological communities identified in the survey data tables in this report despite whether they were recorded on the site as part of the field assessments or whether they have been recorded previously within a 10 kilometres grid square centres on the site (OEH, 2010). The following habitat assessment takes into account;

- the potential habitats on the site, and
- the relationship between the habitats of species, communities and populations to the habitats on this site.

5.2 site habitats and relationships to habitats of threatened flora

Conservation Status	Genus/species	Common Name	Habitat Requirements	Likelihood of Occurrence on site	Relationship to the site
X Site not considered significant for the species			✓ Species habitats potentially affected and require consideration in site planning process.		
Vulnerable NSW	<i>Callistemon linearifolius</i>	Nelited Bottle Brush	The species has been recorded growing in dry sclerophyll forest on the coast and adjacent ranges. Its known distribution occurs from the Georges River to Hawkesbury River in the Sydney area and north to Nelson Bay. Other records in 2000 have been from Coal Cliffs in the Southern Rivers CMA. Within the Sydney area, recent records are predominately limited to the Hornsby Plateau area near the Hawkesbury River and 2 records of the species also occur within Pittwater. Currently only 5-6 populations of the previous 22 populations remain. Three of these populations occur within Ku-ring-gai Chase National Park, Lion Island Nature Reserve, and Spectacle Island Nature Reserve.	Very marginal suitable habitat - unlikely to occur	X
Vulnerable NSW, Cwth	<i>Darwinia biflora</i>	-	Occurs on the edges of weathered shale capped ridges particularly at the intergrade with Hawkesbury sandstone. Most sites are on Lucas Heights Soil Landscape. The vegetation association often includes <i>Eucalyptus haenastoma</i> , <i>Corymbia gummifera</i> and or <i>E. squamosa</i> and the structure is usually woodland, open forest or scrub-heath (OEH, 2003).	Not considered to be suitable habitat - unlikely to occur.	X
Vulnerable NSW	<i>Epacris purpurascens</i> var. <i>purpurascens</i>	-	<i>Epacris purpurascens</i> var. <i>purpurascens</i> is found at 30 locations in and around Sydney extending from Gosford in the north, Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in the south. Its habitat consists of ridgetop drainage depressions supporting wet heath within or adjoining shale cap communities such as Stringybark and Ironbark woodlands and various shale/sandstone transition forest (OEH, 2002)	Not considered to be suitable habitat - unlikely to occur.	X
Vulnerable NSW, Cwth	<i>Eucalyptus camfieldii</i>	Heart-Leaved Stringybark	This species is found on lateritic soils of the Mittagong formation and in Hawkesbury sandstone. Usually located on upper slopes and ridge tops its habitat is characterized by well drained soils and associated with dry sclerophyll woodlands and scrub.	Not considered to be suitable habitat - unlikely to occur.	X
Vulnerable NSW	<i>Eucalyptus nicholii</i>	Narrow-Leaf Peppermint	The species is endemic on the northern tablelands of NSW however it is widely planted as an urban street tree and in gardens. It is quite rare in the wild and is confined to the New England Tablelands of NSW, where it occurs from Nundle to north of Tenterfield, largely on private property. The species grows in dry grassy woodland, on shallow and infertile soils, mainly on growing on porphyry or granite soils (Brooker & Kleing, 1999).	The site is well beyond the natural distribution of the species.	X
Vulnerable NSW, Endangered Cwth	<i>Eucalyptus scoparia</i>	Willow Gum	Occurring mainly in Queensland, the species reaches its southern natural distribution limits in northern NSW. There are only 3 known natural locations where small populations occur. All 3 locations occur in the Tenterfield area none of which occur in conservation reserves (NSW Scientific Committee 2002). The species has been used in the horticultural industry and has been planted widely as a street tree and as an ornamental species around Sydney.	The site is well beyond the natural distribution of the species.	X
Endangered NSW	<i>Grammitis stenophylla</i>	Narrow-leaf Finger Fern	The species is an epiphyte or lithophyte and is known to occur in Queensland and eastern New South Wales. Its habitat includes moist areas on rocks or in trees, usually near streams, in rainforest and moist eucalypt forest.	Habitat present in the Open Forest riparian areas.	✓
Endangered NSW, Cwth	<i>Grevillea caleyi</i>	Caley's Grevillea	This species typically grows on Mittagong soil landscapes characterized by lateritic soils rich in iron and can be associated with the Duffy's Forest vegetation association.	Not considered to be suitable habitat - unlikely to occur.	X
Vulnerable NSW, Cwth	<i>Leptospermum deanei</i>	-	Found in Devilin's Creek in Pennant Hills Park, Cheltenham, amongst sandstone rocks in sandy soil adjacent creek/watercourse.	Habitat present in the Open Forest riparian areas.	✓
Endangered NSW, Cwth	<i>Microtis angusii</i>	Angus's Onion Orchid	The habitat is somewhat unclear occurring west of Lithgow NSW near Sunny Corner and at Ingleside in an old roadside soil dump stockpile area. It is thought that the local habitat of this species is similar to that of the Duffy's Forest association on lateritic soils.	Not considered to be suitable habitat - unlikely to occur.	X

Conservation Status	Genus species	Common Name	Habitat Requirements	Likelihood of Occurrence on site	Relationship to the site
X Site not considered significant for the species.			✓ Species habitats potentially affected and require consideration in site planning process.		
Vulnerable NSW, Cwth	<i>Pimelea curviflora</i> <i>var. curviflora</i>	Curved Rice-flower	This species is confined to the coastal areas around Sydney found growing on Hawkesbury sandstone (Harden 2000) or on lateritic soils in similar habit to that occupied by the Duffys Forest association (Smith & Smith 2000).	Not considered to be suitable habitat - unlikely to occur.	X
Vulnerable NSW, Cwth	<i>Syzygium paniculatum</i>	Magenta Lillypilly	The species has been known to be associated with coastal dunes and Littoral Rainforest and is also found in riparian habitats (Payne 1997). The species has been commercially propagated and sold and is known to have been planted in a variety of urban habitats. The species has been recorded growing on moist slopes on Narrabeen Group geology (Smith & Smith 2000).	Habitat present in the Open Forest riparian areas & drainage lines.	✓
Vulnerable NSW, Cwth	<i>Tetralthea glandulosa</i>	Glandular Pink-bell	This species typically grows on dryer open sites of Hawkesbury sandstone and can be found in open forests, woodlands and scrub. Grows in sandy or rocky heath or scrub (Gardner & Murray ex. Harden 1992) and is often found in deeper soils.	Habitat present in the Open Forest Areas	✓

5.3 site habitats and relationships to habitats of threatened fauna

Conservation Status (NSW)	Class	Genus species	Common Name	Habitat	Likelihood of Occurrence on site	Relationship to the site
X Site not considered significant for the species.				✓ Species habitats potentially affected and require consideration in site planning process.		
Vulnerable NSW, Cwth	Amphibia	<i>Heleporus australiacus</i>	Giant Burrowing Frog	Sandy soil on sandstone ridges where sandy creek banks provide opportunities for burrowing. Tadpoles are typically found in rocky pools in the upper reaches of permanent and ephemeral creeks (Mahoney 1993)	Not considered to be suitable habitat - unlikely to occur.	X
Vulnerable NSW	Amphibia	<i>Pseudophryne australis</i>	Red-crowned Toadlet	Red-crowned Toadlets do not usually live along permanent flowing water courses such as occur in gullies. Instead preferring permanently moist soaks, areas of dense ground vegetation or litter along or near head-water stream beds. The species is known to inhabit upper forested slopes and ridges on Hawkesbury sandstone or Narrabeen group preferring moist sandstone habitats with grass and debris near ephemeral watercourses. Red-crowned Toadlets have not been recorded breeding in permanently flowing streams or waters that are even mildly polluted (OEH, 2001).	Marginal habitat present in the Open Forest areas & drainage lines.	✓
Vulnerable NSW	Aves	<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	With a range restricted to south eastern NSW and south eastern Victoria the species feeds on terminal leaves of eucalypts or in hawthorn hedges and nests in deep hollows in eucalypts (Slater 1993). The species occurs in a variety of forests and woodlands and the last known breeding population in the metropolitan Sydney area is in the Hornsby/ Ku-ring-gai area. The species shows a strong nest site fidelity (NSW Scientific Committee 2001).	Breeding & roosting habitat present in the Open Forest areas and foraging habitat in other areas of the site.	✓

Conservation Status (NSW)	Class	Genus species	Common Name	Habitat	Likelihood of Occurrence on site	Relationship to the site
X Site not considered significant for the species. ✓ Species habitats potentially affected and require consideration in site planning process						
Vulnerable NSW	Aves	<i>Calyptrorhynchus lathamii</i>	Glossy Black-Cockatoo	Considered rare in a national context, but moderately common in N.S.W. Because of its dependence on one type of food it is considered to be vulnerable. It nests in large hollows of dead trees and roosts in both wet and dry eucalypts, feeding on Casuarina and Allocasuarina seeds. Feed in open Casuarina woodland, primarily where the Forest Oak (<i>Allocasuarina torulosa</i>) occurs.	Breeding, roosting habitat present in the Open Forest areas.	✓
Vulnerable NSW	Aves	<i>Ixobrychus flavicollis</i>	Black Bittern	Is known to inhabit mangroves and streamside vegetation including small creeks. Feeding is mostly undertaken at night where they stand and wait for small insects, crustaceans and small fish.	Not considered to be suitable core breeding or foraging habitat - unlikely to occur.	X
Endangered NSW, Cwlth	Aves	<i>Lathamus discolor</i>	Swift Parrot	The Swift Parrot inhabits eucalypt forests and breeds in hollows of mature and senescent trees in Tasmania. On the mainland it feeds off winter flowering Eucalypts although it will also feed on lerps, honeydew, Banksia nectar, fruits, seeds and other plant material as well as insects and their larvae (Forshaw & Cooper 1981, Garnett 1992). In New South Wales important foraging tree species include, <i>Eucalyptus macrocarpa</i> (Grey Box), <i>Eucalyptus sideroxylon</i> (Mugga Ironbark) on the western slopes and <i>Eucalyptus tereticornis</i> (Forest Red Gum), <i>Eucalyptus fibrosa</i> (Red Iron Bark), <i>Corymbia maculata</i> (Spotted Gum), <i>Eucalyptus robusta</i> (Swamp Mahogany) and <i>Corymbia gumifera</i> (Red Bloodwood) (Swift Parrot Recovery Team, 2000). Since 1980 there have been some 60 sightings recorded in the Wildlife Atlas database (OEH 2010) within the Sydney Metropolitan Areas and locally small flocks were reported at Ingleside in 1986 (Cooper 1990). In 1938 hundreds of Swift Parrots were reported feeding in <i>Eucalyptus robusta</i> (Swamp Mahogany) in Warriewood (Hindwood 1939).	No core breeding habitat present, very limited foraging habitat - unlikely to occur.	X
Vulnerable NSW	Aves	<i>Melithreptus gularis</i>	Black-chinned Honeyeater	The eastern subspecies is predominantly found west of the Great Dividing Range in a narrow belt through NSW into southern Queensland, and south into Victoria and South Australia where it occupies eucalypt woodlands within an approximate annual rainfall range of 400-700mm (Blakers et al. 1984) and is rarely recorded east of the Great Dividing Range, although regularly observed from the Richmond River district. The species is mainly found in woodlands containing box-ironbark associations and River Red Gum. Black-chinned Honeyeaters and occurred in drier coastal woodlands of the Cumberland Plain, Western Sydney (NSW Scientific Committee, 2001). Black-chinned Honeyeaters are likely to experience high levels of competition from aggressive honeyeater species such as Noisy Miners and increased nest predation is expected from increasing populations of predators such as Pied Currawongs and Australian Ravens, particularly in small remnants (Major et al. 1998). The species is usually seen in pairs and small groups of up to 12 birds which have large home ranges of at least 5 hectares where they foraging rapidly along outer twigs, underside of branches and trunks, probing for insects. Nectar is taken from flowers and honeydew is gleaned from foliage.	The species is unlikely to occur and is often be displaced by more aggressive urban fauna species.	X
Vulnerable NSW	Aves	<i>Ninox connivens</i>	Barking Owl	The species can be found inhabiting eucalypt forests, paperbark and other woodlands, dense scrubs, foothills, river red gums and other large trees near watercourses. The species is dependant on large hollows of mature eucalypts for nests. The bird feeds on prey such as rabbits, rats, gliders and birds such as Rosella and starlings (Smith & Smith 2000).	Breeding & roosting habitat present in the Open Forest areas and foraging habitat in other areas of the site.	✓

Conservation Status (NSW)	Class	Genus/species	Common Name	Habitat	Likelihood of Occurrence on site	Relationship to the site
X Site not considered significant for the species ✓ Species: habitats potentially affected and require consideration in site planning process						
Vulnerable NSW	Aves	<i>Ninox strenua</i>	Powerful Owl	The species has a range of 400 -1500ha (Davey 1993) and is known to nest in hollows in Eucalypts between 9-37m above ground usually in secluded well-vegetated gullies and usually occupying the largest emergent trees. Powerful Owls live alone or in pairs which occupy a permanent territory containing a number of roost sites and one or more nesting sites. The species feeds over a large range on small to medium sized mammals, including gliders, ringtail possum and immature brushtail possums.	Breeding & roosting habitat present in the Open Forest areas and foraging habitat in other areas of the site.	✓
Vulnerable NSW	Aves	<i>Tyto novaehollandiae</i>	Masked Owl	It is generally considered as a bird of forest margins recorded in wet and dry open forests and woodlands and urban areas (Debus & Rose 1994). The southern subspecies occupies a home range of 5 -10 km ² within a diverse range of habitats that provide large hollow-bearing trees for roosting and nesting (Kavanagh & Murray 1996) often in riparian forests. It has also been known to roost and nest in caves and preys on mammals typically less than 600g such as rats, mice, rabbits, sugar gliders and ringtail possums (Slater 1993, Debus & Rose 1996).	Breeding & roosting habitat present in the Open Forest areas and foraging habitat in other areas of the site.	✓
Vulnerable NSW	Mammalia	<i>Cercartetus nanus</i>	Eastern Pigmy-possum	Is found in a range of habitats from rainforest, sclerophyll forests to sclerophyll tree heath and the species range extends from south eastern Qld to south eastern SA and Tasmania (Turner & Ward 2000). It feeds on insects including spiders, termites, beetles and moths as well as nectar and pollen from banksias, eucalypts and callistemon. It is generally nocturnal and whilst preferring to nest in small tree hollows it has been found in small constructed nests of shredded bark. It appears to be solitary with males having a range of about 0.68 ha and females having a range of 0.35 ha (Turner & Ward 2000).	Habitats likely to be restricted to the Open Forest areas of the site.	✓
Vulnerable NSW, Endangered Cwth	Mammalia	<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	Found in a range of habitats and generally preying on medium size mammals and birds such as possums, small wallabies, rats, birds, domestic fowl, bandicoots, rabbits and also feed on insects and carrion. It is estimated that the range of the species is in the order of 500 – 3000ha using hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites.	Habitats likely to be restricted to the Open Forest areas of the site.	✓
Endangered NSW, Cwth	Mammalia	<i>Isodon obesulus</i>	Southern Brown Bandicoot	Has a patchy distribution along the southeast coast in NSW and reaches its most northern limit at the Hawkesbury River and has been recorded in the larger tracts of bushland in Ku-ring-gai Chase, Garigal National Parks and in Nadgee Nature Reserve. This species prefers sandy soil with scrubby vegetation and /or areas of low ground cover that is periodically burnt (Braithwaite 1995). The species displays a preference for regenerating sites following disturbance (OEI, 2006). The species is known to feed on ants, beetle larvae and plant material and some fungal species and whilst recorded in Ku-ring-gai Chase and Garigal National Parks. The species is not known to occur in small patches of bushland	Habitats likely to be restricted to the Open Forest areas of the site.	✓
Vulnerable NSW, Cwth	Mammalia	<i>Miniopterus schreibersii oceanensis</i>	Eastern Bent-wing Bat	The species has been recorded along the north coast of Australia from Qld to Vic and parts of northern WA and NT. Having been recorded in a variety of habitats it is typically found in well-timbered valleys. It roosts during the daylight hours in caves and has been recorded roosting in large storm water pipes. They fly quickly above tree tops in valleys, making fast dives to catch prey which are insects, mostly moths.	Roosting habitats restricted to the Open Forest areas of the site.	✓
Vulnerable NSW	Mammalia	<i>Mormopterus norfolkensis</i>	Eastern Freetail Bat	The species has a range along the eastern coastal strip of Australia extending from southern Queensland to southern NSW. Has been recorded roosting in tree hollows and feeds on flying insects. They forage above the tree canopy in forests or along the edges of forests, (Allison & Hoyer 1995). The habitat preference of this species is unclear. It has been predominantly recorded in dry eucalypt forest and woodland, but has been recorded in moist and edge environments. The wing morphology indicates that this species is adapted to the more open habitats.	Roosting habitat mainly restricted to the Open Forest areas with some limited potential in other areas of the site.	✓

Conservation Status (NSW)	Class	Genus species	Common Name	Habitat	Likelihood of Occurrence on site	Relationship to the site
X Vulnerable NSW	Mammalia	<i>Phascolarctos cinereus</i>	✓ Koala	Species habitats potentially affected and require consideration in site planning process. Koalas feed on foliage from the genera <i>Eucalyptus</i> , <i>Corymbia</i> and <i>Angophora</i> . They appear to have a preference for feeding in <i>Eucalyptus punctata</i> (Grey Gum), however other species such as <i>E. haemastoma</i> (Scribbly Gum), <i>E. robusta</i> (Swamp Mahogany) and non endemic species such as <i>E. nicholii</i> (Narrow-leaved Black Peppermint). Other species that appear to be under-exploited include <i>Corymbia maculata</i> (Spotted Gum), <i>Corymbia gummifera</i> (Red Bloodwood) and <i>Angophora costata</i> (Sydney Red Gum) to a lesser degree other species. (Smith & Smith 2000).	Refuge & foraging habitat present in the Open Forest areas with some foraging habitat across other areas of the site.	✓
Vulnerable NSW, Cwth	Mammalia	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	The species has 2 permanent maternal colonies in Sydney at Gordon and at Cabramatta. Other temporary colonies exist at the Botanical Gardens. The species predominately feeds on nectar and when blossoms are unavailable it feeds on fruit.	Not considered to be core breeding / roosting habitat, foraging opportunities present	✓
Vulnerable NSW	Reptilia	<i>Varanus rosenbergi</i>	Rosenberg's Goanna /Heath Monitor	Mostly a terrestrial species inhabits burrows logs and rock crevices (Cogger 2000). It is a mobile species that occupies a home range of about 20 ha (King & Green, 1999) and typically inhabits woodland and heath found on sandstone ridge tops and plateaus. It feeds on a range of species, including invertebrates, small lizards, snakes and bird eggs. Associated with termites, the mounds of which this species nests in; termite mounds are a critical habitat component	Limited breeding habitat in the Open Forest area, some foraging habitat present across the site.	✓

5/4 site habitats and relationships to habitats of endangered ecological communities

Conservation Status	Ecological Community	Habitat	Likelihood of Occurrence on site	Relationship to the site
Endangered NSW	Pittwater Spotted Gum Forest	The forest occurs on shale-derived soils from the Newport Formation geology of the Narrabeen group in Pittwater. Characteristic tree species include <i>Corymbia maculata</i> , <i>Eucalyptus punctata</i> , <i>Eucalyptus umbra</i> , <i>Angophora floribunda</i> and <i>Corymbia gummifera</i> . (NSW Scientific Committee 1998).	Habitat not present	X
Endangered NSW	Duffy's Forest	The forest occurs on lateritic soils and deeply weathered shale soils typically found on lower ridges in Ku-ring-gai. Characteristic tree species include <i>Eucalyptus capitellata</i> , <i>Eucalyptus sieberi</i> , <i>Eucalyptus oblonga</i> , and <i>Angophora costata</i> . (NSW Scientific Committee 1998).	Habitat not present	X
Endangered NSW	Swamp Sclerophyll Forest on Coastal Floodplains	The forest complex is found on the Cockle Bay, Tacoma Swamp and Warriewood Soil Landscapes and the vegetation structure ranges from forest to scrub to reedland and includes open-forest. Characteristic species include <i>Eucalyptus robusta</i> , <i>Eucalyptus botryoides</i> , <i>Livistona australis</i> , <i>Melaleuca linearifolia</i> , <i>Melaleuca styphelioides</i> , <i>Melaleuca ericifolia</i> and in some cases <i>Phragmites australis</i> .	Habitat not present	X
Endangered NSW	Littoral rainforest in the NSW North Coast, Sydney Basin and South East Corner bioregions	The Forest Littoral Rainforest generally is a closed forest, the structure and composition of which is strongly influenced by proximity to the ocean. The plant species in this ecological community are predominantly rainforest species with evergreen mesic or coriaceous leaves. Several species have compound leaves, and vines may be a major component of the canopy. The community comprises the <i>Cupaniopsis anacardioides</i> - <i>Acmena spp.</i> alliance of Floyd (1990) which includes five sub-alliances which include <i>Syzygium leuhmannii</i> , <i>Acmena smithii</i> , <i>Ficus sp.</i> , <i>Livistona sp.</i> , & <i>Podocarpus sp.</i> (NSW Scientific Committee 2004).	Habitat not present	X

5/5 site habitats and relationships to habitats of threatened populations

Conservation Status	Type	Population Name	Habitat	Likelihood of Occurrence on site	Relationship to the site
Endangered NSW	Fauna	Koala, <i>Phascolarctos cinereus</i> , in the Pittwater Local Government Area.	The population occurs between Ingleside and Elanora heights to Palm Beach on the Barrenjoey Peninsula. Koalas feed on foliage from the genera <i>Eucalyptus</i> , <i>Corymbia</i> and <i>Angophora</i> . They appear to have a preference for feeding in <i>Eucalyptus punctata</i> (Grey Gum), however other species such as <i>E. haemastoma</i> (Scribbly Gum), <i>E. robusta</i> (Swamp Mahogany) and non endemic species such as <i>E. nicholii</i> (Narrow-leaved Black Peppermint). Other species that appear to be under-exploited include <i>Corymbia maculata</i> (Spotted Gum), <i>Corymbia gummifera</i> (Red Bloodwood) and <i>Angophora costata</i> (Sydney Red Gum) to a lesser degree other species. (Smith & Smith 2000).	Refuge & foraging habitat present in the Open Forest areas with some foraging habitat across other areas of the site.	✓

6. site planning considerations

6.1 riparian habitat planning

6.1.1 Office of Water's Requirements

Narrabeen Creek forms part of the sites southern boundary and is considered to be a 2nd order watercourse for the purposes of the Office of Water's (2011) Controlled Activities Guidelines for Riparian Areas.

The gully line running in a west-east direction across the centre of the site provides a flow path for overland stormwater flows and is dammed in the lower parts of the site adjacent Boundary Street. Recent approval has been granted to pipe overland flows downstream of the gully on the site. Assessments made as part of the consent on the down stream allotment have not considered the drainage line to be a river/watercourse for the purposes of the *Water management Act 200 (NSW)* and the Office of Water's (2011) Controlled Activities Guidelines for Riparian Areas have not been considered applicable.

Narrabeen Creek is considered to be a 2nd order watercourse and the guidelines (OoW, 2011) recommend a 20m wide Core Riparian Zone be provided within which native vegetation and habitats should be retained or revegetated. The 20m wide Core Riparian Zone is measured from to top of the bank of the watercourse.

Beyond the Core Riparian Zone the guidelines (OoW, 2011) recommend that an additional 10m wide Vegetation Buffer should be provided to protect the Core Riparian Zone. Infrastructure such as roads, drainage, stormwater structures, services, bushfire asset protection zones etc. should be located outside the vegetation buffer area.

6.2 key habitat components on the site

6.2.1 Open Forest Habitats

The Open Forest area on the site has a number of key habitat features such as Narrabeen Creek, the creek banks and riparian vegetation, slopes containing dry sclerophyll vegetation, rock boulders and rock overhangs, dead trees and logs etc. Although the Magenta Lillypilly (*Syzygium paniculatum*) and the Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*) were the only threatened species recorded as part of the field surveys, the Open Forest area potentially provide habitats for a number of threatened flora and fauna species.

6.2.2 Disturbed Woodland & Scrubland areas

These areas are more simplistic in vegetation structure and species diversity than the Open Forest areas on the site. Important habitat components in these areas are the lower gully line characterised by the Grey Ironbark (*Eucalyptus paniculata*) and Broad-leaved White Mahogany (*Eucalyptus umbra*) and Cabbage Palm (*Livistona australis*) and the tree canopy along the site frontage towards Boundary Street.

6.2.3 Open Paddocks & Infrastructure areas

These areas do not contain essential habitat components for threatened species however the northern paddock slopes contain a number of mature trees that do provide an ecological function and contribution to the local ecology.

6.3

site planning guidelines based upon ecological principals

To minimise the impacts on threatened species and the local ecology and to comply with the requirements of the Office of Water' guidelines (2011) the following site planning priorities are listed in order of importance.

- Retain the vegetation and habitats in the riparian areas (30m from top of bank) along Narrabeen Creek;
- Maximise the retention of vegetation and habitats within the Open Forest area;
- Maximise the retention of vegetation and habitats in the lower gully line in the Disturbed Woodland & Scrubland;
- Maximise the retention of other areas of the Disturbed Woodland & Scrubland, and
- Maximise the retention of indigenous trees in the Open Paddocks & Infrastructure areas of the site.

7. threatened species assessment

7.1

NSW assessment process

The potential impacts of the proposed development on species, populations and communities listed in the schedules of the *Threatened Species Conservation Act 1995* (NSW), are considered against the criteria in Part 1 section 5A(2) of the *Environmental Planning and Assessment Act 1979* (NSW). This criteria is designed to determine "whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats", and consequently, whether a Species Impact Statement is required.

Whilst no subdivision master plan has been prepared further consideration will be required for the following species:

- Narrow-leaf Finger Fern (*Grammitis stenophylla*);
- *Leptospermum deanei*;
- Magenta Lillypilly (*Syzygium paniculatum*);
- Glandular Pink-bell (*Tetratheca glandulosa*);
- Red-crowned Toadlet (*Pseudophryne australis*);
- Gang-gang Cockatoo (*Callocephalon fimbriatum*);
- Glossy Black-Cockatoo (*Calyptorhynchus lathamii*);
- Barking Owl (*Ninox connivens*);
- Powerful Owl (*Ninox strenua*);
- Masked Owl (*Tyto novaehollandiae*);
- Eastern Pigmy-possum (*Cercartetus nanus*);
- Spotted-tailed Quoll (*Dasyurus maculates*);
- Southern Brown Bandicoot (*Isodon obesulus*);
- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*);
- Eastern Freetail Bat (*Mormopterus norfolkensis*);
- Grey-headed Flying-fox (*Pteropus poliocephalus*), and
- Rosenberg's Goanna /Heath Monitor (*Varanus rosenbergi*)

Part 13 Division 1 of the *Environment Protection & Biodiversity Act 1999 (Cwlth)* (EPBC) lists flora, fauna and ecological communities that are considered to be "matters of national environmental significance". Under the Act consideration must be given as to whether the proposed actions will, or is likely to have a "significant impact" on "matters of national environmental significance".

To minimise duplication in the environmental assessment procedures, a bilateral agreement was made in January 2007 between the Commonwealth & NSW Governments giving accreditation of New South Wales assessment processes in relation to threatened species, populations and ecological communities.

The agreement provides for "Controlled Actions" as defined in the *Environment Protection & Biodiversity Act 1999 (Cwlth)* relating to threatened species, to no longer require assessment under Part 8 of the *Environment Protection & Biodiversity Act 1999 (Cwlth)* where they are assessed under Part 3A, 4 or 5 of the *Environmental Planning and Assessment Act 1979 (NSW)*.

The NSW assessment process, in particular Part 1 section 5A (2) of the *Environmental Planning and Assessment Act 1979 (NSW)*, is acknowledged in the bilateral agreement and it is deemed to satisfies the requirements for assessments of "Controlled Actions". It is therefore logical to assume that the NSW assessment process equally satisfies the assessment requirements for actions that are not considered to be "Controlled Actions".

8. summary

8.1

conclusion

This report has been prepared to present the findings of detailed flora and fauna surveys and habitat assessments carried out over the site known as 120 & 122 Mona Vale Road, Warriewood. This report also incorporates species and ecological communities known to occur within the local area which have been identified through database and literature searches.

Specific assessment has been undertaken to identify potential habitats of threatened species, populations and ecological communities known to occur in the local area and listed in the schedules of the *Threatened Species Conservation Act (NSW) 1995*.

The site is located on the southern side of Mona Vale Road and the topography ranges from moderately- steeply sloping to undulating slopes. The site is currently used for rural activities and contains a number of greenhouses, detached sheds, open paddocks with remnant trees and indigenous vegetation along the steeper riparian areas of Narrabeen Creek

A detailed flora survey was conducted on the site and a range of fauna survey techniques have been carried out on and adjacent the site. In addition to this a habitat assessment and database / literature search has been carried out to identify threatened flora and fauna that potentially could occur on the site.

The site has been considered in 3 main habitat units based upon similarities in the vegetation's physical structure, floristic composition, level of disturbance and the current land use.

- Area A - Open Forest,
- Area B – Disturbed Woodland & Scrubland areas
- Area C – Open Paddocks & Infrastructure areas.

Despite extensive field survey the Magenta Lillypilly (*Syzygium paniculatum*) and the Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*) were the only threatened species recorded on the site.

To minimise the impacts on threatened species and the local ecology and to comply with the requirements of the Office of Water' guidelines (2011) the following site planning priorities are listed in order of importance.

- Retain the vegetation and habitats in the riparian areas (30m from top of bank) along Narrabeen Creek;
- Maximise the retention of vegetation and habitats within the Open Forest area;
- Maximise the retention of vegetation and habitats in the lower gully line in the Disturbed Woodland & Scrubland;
- Maximise the retention of other areas of the Disturbed Woodland & Scrubland, and
- Maximise the retention of indigenous trees in the Open Paddocks & Infrastructure areas of the site.

At the time of producing this report the subdivision master plan for the site has not been finalised. The site contains potential habitat of the following threatened species and once the final design plans are documented further consideration will be required to assess the impacts on the following species:

- Narrow-leaf Finger Fern (*Grammitis stenophylla*);
- *Leptospermum deanei*;
- Magenta Lillypilly (*Syzygium paniculatum*);
- Glandular Pink-bell (*Tetratheca glandulosa*);
- Red-crowned Toadlet (*Pseudophryne australis*);
- Gang-gang Cockatoo (*Callocephalon fimbriatum*);
- Glossy Black-Cockatoo (*Calyptrorhynchus lathamii*);
- Barking Owl (*Ninox connivens*);
- Powerful Owl (*Ninox strenua*);
- Masked Owl (*Tyto novaehollandiae*);
- Eastern Pigmy-possum (*Cercartetus nanus*);
- Spotted-tailed Quoll (*Dasyurus maculates*);
- Southern Brown Bandicoot (*Isodon obesulus*);
- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*);
- Eastern Freetail Bat (*Mormopterus norfolkensis*);
- Grey-headed Flying-fox (*Pteropus poliocephalus*), and
- Rosenberg's Goanna /Heath Monitor (*Varanus rosenbergi*)

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