

### **2.3 Survey Limitations**

As with any flora or fauna survey the absence of a species during surveys does not necessarily mean a species does not inhabit the survey area. False absences may be a result of several factors including the survey method adopted, the number of site visits undertaken, the home range size of the target species or the prevailing seasonal, climatic or environmental conditions during which surveys were conducted. To overcome potential survey limitations, appropriate seasonal surveys, survey stratification and replication was undertaken in accordance with the DECC (2004) survey guidelines.

### 3. EXISTING ENVIRONMENT

#### 3.1 Landscape Context

The subject site is located on the foothills of the Illawarra Escarpment within the Wollongong local government area in the Sydney Basin bioregion. The site has a generally south-west facing aspect and covers approximately 21.8 hectares. The site is located within the Lake Illawarra Catchment and drainage is to the south via an un-named tributary of Gibsons Creek.

The site has undergone significant historical disturbances associated with historical broad scale vegetation clearing and the land surface within the south-western section of the site has been disturbed by excavation works and the use of the site as a resource recovery facility.

The upper topographies of the site are located on the Gwynneville soil landscape and the lower lying disturbed areas of the site are located on the Fairy Meadow soil landscape.

Within the site the Gwynneville soil landscape comprises the areas on the footslopes of the Illawarra Escarpment, local relief is approximately 30 to 100m and slope gradients are up to 25%. The underlying geology consists of the Illawarra Coal Measures and occasional rock outcropping is present along a drainage line which intersects the site. The soils are characterised by Brown Podzolic Soils and Xanthozems on upper slopes and Lithosols on simple slopes and shallow Brown Earths on midslopes and lower slopes. This landscape once contained tall open forest and open forest, however is now extensively cleared.

The south-western section of the site occurs on the Fairy Meadow soil landscape and consists of cleared undulating hills and alluvial plain topography. The underlying geology is characterised by Quaternary sediments. Native vegetation within this area is completely cleared and slopes are generally <5% with relief of 20 to 30m. The natural soils are typically Alluvial Loams and Siliceous Sands, however significant soil disturbance is apparent.

#### 3.2 Existing Land Use

The majority of the proposed development footprint area of the site is currently utilised as a resource recovery facility. Other areas of the site contain vacant land.

#### 3.3 Vegetation Communities, Flora and Fauna Species and Habitats

##### 3.3.1 Vegetation Communities and Flora Species

###### ***Vegetation Communities***

The following vegetation communities were observed within the subject site during surveys:

- Disturbed Subtropical Rainforest;
- Disturbed Red Gum Forest;
- Regrowth Acacia and Exotic Shrubs; and
- Cleared Land.

Vegetation community descriptions are provided below, and vegetation community locations are shown in Figure 3.1.

#### **DISTURBED SUBTROPICAL RAINFOREST**

##### **Structure:**

<b>Trees:</b>	To 25 metres in height with 80% Projected Foliage Cover (PFC).
<b>Sub-canopy</b>	To 15 metres in height with 20% PFC.
<b>Shrubs:</b>	To 2 metres in height with >5% PFC.
<b>Groundlayer:</b>	To 0.5 metres in height with 30% PFC.

**Floristics:**

(Characteristic Species)

**Trees:** *Doryphora sassafras* and *Euroschinus falcata*.

**Sub-canopy:** *Doryphora sassafras*.

**Shrubs:** *Actephila lindleyi*, *Ficus coronata* and *Lantana camara*.

**Groundlayer:** *Arthropteris tenella* and *Adiantum formosum*.

**Weeds:** *Lantana camara*.

**Weed Invasion:**

Weed invasion is low throughout this community with the exception of edge areas with intergrade with the Cleared Land and Regrowth Acacia and Exotic Shrub communities which contain high levels of *Lantana*.

**Disturbance:**

The natural extent of this community across the site appears to have been reduced, through historical clearing and high levels of weed invasion, to three small remnant patches as shown in Figure 3.1. Disturbance is generally limited to clearing and weed invasion of edge areas.

**Variation:**

The remnant patch of this community within the southern section of the site contains one large canopy tree (*Ficus macrophylla*) over a small remnant patch of rainforest type shrubs.

**Location and Distribution:**

This community occurs as three small remnant patches of vegetation and occupies approximately 1.5 hectares as shown in Figure 3.1.

A small remanent patch of this vegetation community occurs within the proposed development footprint area.

**Classification:**

This vegetation community corresponds to Map Unit 4 – Lowland Dry-Subtropical Rainforest as mapped and described by NPWS (2002).

This vegetation community is listed within the *TSC Act* (1995) as the endangered ecological community, Illawarra Subtropical Rainforest in the Sydney Basin Bioregion.

**DISTURBED RED GUM FOREST****Structure:**

**Trees:** To 20 metres in height with 60% PFC.

**Sub-canopy** To 8 metres in height with 30% PFC.

**Shrubs:** To 2 metres in height with 80% PFC.

**Groundlayer:** To 1 metre in height with 90% PFC.

**Floristics:**

(Characteristic Species)

**Trees:** *Eucalyptus tereticornis* and *Eucalyptus fastigita*.

**Sub-canopy:** *Acacia maidenii*.

**Shrubs:** *Lantana camara* and *Acacia maidenii*.

**Groundlayer:** *Ageratina adenophora*, *Imperata cylindrica* and *Carex appressa*.

**Weeds:** *Ageratina adenophora* and *Lantana camara*.

**Weed Invasion:**

Weed invasion occurs in high levels throughout this community and is restricted to the shrub and groundcover layers.

**Disturbance:**

The natural extent of this community has been reduced by historical clearing and subsequent high levels of weed invasion.

**Variation:**

No notable variations were observed

**Location and Distribution:**

This vegetation community occurs as one 0.5 hectare remnant patch within the northern section of the site. The distribution of this community is shown in Figure 3.1.

This vegetation community does not occur within the proposed development area.

**Classification:**

This vegetation community is mapped by NPWS (2002) as Map Unit 13 Moist Box – Red Gum Foothills Forest. It is considered however that this community is most similar to a highly disturbed example of Map Unit 23 Coastal Grassy Red Gum Forest.

This vegetation community corresponds to the Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion endangered ecological community, listed within the *TSC Act* (1995).

## REGROWTH ACACIA AND EXOTIC SHRUBS

**Structure:**

**Tall Shrubs:** To 10 metres in height with 30% PFC.

**Low Shrubs:** To 4 metres in height with 60% PFC.

**Groundlayer:** To 1 metre in height with 50% PFC.

**Floristics:**

(Characteristic Species)

**Tall Shrubs:** *Acacia maidenii*, *Acacia mearnsii*, *Glochidion ferdinandi* and *Pittosporum undulatum*.

**Low Shrubs:** *Lantana camara*.

**Groundlayer:** *Pennisetum clandestinum*, *Paspalum dilatatum* and *Senecio madagascariensis*.

**Weeds:** *Lantana camara*, *Pennisetum clandestinum*, *Paspalum dilatatum* and *Senecio madagascariensis*.

**Weed Invasion:**

Weed invasion occurs in high levels throughout this community.

**Disturbance:**

This community predominantly consists of tall native shrub species mixed with high levels of weeds which have opportunistically regrown following historical clearing of naturally occurring rainforest and tall forest communities.

**Variation:**

Drainage line areas contained an open tall shrub layer of *Acacia mearnsii* and a higher diversity of flora including *Ficus coronata*, *Persicaria* spp. and several exotic including *Ageratina adenophora*, *Ricinus communis*, *Solanum mauritianum*, *Delairea odorata* and *Tradescantia fluminensis*.

**Location and Distribution:**

This vegetation community occurs throughout 12.5 hectares of the site within areas which have been historically cleared of native vegetation. The distribution of this community is shown in Figure 3.1.

This vegetation community is present within the proposed development footprint, including one small patch within the northern section of the footprint area and along the watercourse which intersects the site.

**Classification:**

This vegetation community corresponds to Map Unit 56(A) Disturbed Landscapes / Acacia Scrubs as described by NPWS (2002).

This vegetation community does not correspond to any endangered ecological communities listed within the *TSC Act* (1995) or the *EPBC Act* (1999).

**CLEARED LAND****Structure:**

**Shrubs:** To 2 metres in height with <5% PFC.

**Groundlayer:** To 1 metre in height with 0-100% PFC.

**Floristics:**

(Characteristic Species)

**Shrubs:** *Acacia maidenii*.

**Groundlayer:** *Pennisetum clandestinum*, *Paspalum dilatatum* and *Chloris gayana*.

**Weeds:** *Pennisetum clandestinum*, *Paspalum dilatatum* and *Chloris gayana*, *Ageratina adenophora* and *Axonopus fissifolius*.

**Weed Invasion:**

Weeds are the dominant flora species throughout the cleared areas of the site.

**Disturbance:**

Areas of Cleared Land consist predominantly of exotic grasses and areas occupied by the existing recycling facility operations.

**Variation:**

The areas of Cleared Land contain both areas devoid of vegetation and areas of exotic grasses.

**Location and Distribution:**

This vegetation community occupies approximately 7.3 hectares of the site. The distribution of this community is shown in Figure 3.1.

Cleared Land occurs extensively throughout the proposed development footprint area.

**Classification:**

This vegetation community corresponds to Map Unit 56(D) Disturbed Landscapes / Weeds and Exotics as described by NPWS (2002).

This vegetation community does not correspond to any endangered ecological communities listed within the *TSC Act* (1995) or the *EPBC Act* (1999).



### Flora Species Recorded

A detailed species list, including quadrat and transect data is provided in Table 3.1. No threatened flora species were observed during surveys.

TABLE 3.1 FLORA SPECIES OBSERVED ON THE SUBJECT SITE												
Family Name	Scientific Name	Common Name	Quadrats					Transects				
			1	2	3	4	5	1	2	3	4	5
Trees												
Anacardiaceae	<i>Euroschinus falcata</i> var. <i>falcata</i>	Ribbonwood	2									
Arecaceae	<i>Phoenix canariensis</i> *	Canary Island Date Palm							r			
Boraginaceae	<i>Ehretia acuminata</i>	Koda	1									
Cardiopteridaceae	<i>Citronella moorei</i>	Churnwood								o		
Casuarinaceae	<i>Allocasuarina torulosa</i>	Forest Oak										
Lauraceae	<i>Cinnamomum camphora</i> *	Camphor Laurel						r				
Meliaceae	<i>Melia azedarach</i> var. <i>australasica</i>	White Cedar						o	r			
Monimiaceae	<i>Doryphora sassafras</i>	Sassafras	4									
	<i>Hedycarya angustifolia</i>	Native Mulberry								o		
Moraceae	<i>Ficus coronata</i>	Sandpaper Fig							o	r		
	<i>Ficus macrophylla</i>	Moreton Bay Fig							r			
Myrtaceae	<i>Baloghia inophylla</i>	Brush Bloodwood	1									
	<i>Eucalyptus fastigiata</i>	Brown Barrel					1T					
	<i>Eucalyptus tereticornis</i>	Forest Red Gum					2T					
	<i>Melaleuca styphelioides</i>	Prickly-leaved Tea Tree								r	r	
	<i>Syzygium australe</i>	Brush Cherry	1									
Pittosporaceae	<i>Pittosporum undulatum</i>	Sweet Pittosporum		1	3				o	m		o
Rosaceae	<i>Prunus</i> sp*								r			
Sapindaceae	<i>Cupaniopsis anacardioides</i>	Tuckeroo		1					o			
Sterculiaceae	<i>Brachychiton acerifolius</i>	Illawarra Flame Tree	1									

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Family Name	Scientific Name	Common Name	Quadrats					Transects				
			1	2	3	4	5	1	2	3	4	5
Shrubs												
Apocynaceae	<i>Gomphocarpus fruticosus</i> *	Narrow Leaf Cotton Bush					1		r	o		c
Asteraceae	<i>Chrysanthemoides monilifera</i> subsp. <i>monilifera</i> *	Bitou Bush										
Cesalpinoioideae	<i>Senna pendula</i> var. <i>glabrata</i> *	-		1			1	c	o	o		o
Euphorbiaceae	<i>Breynia oblongifolia</i>	Coffee Bush								r		
	<i>Glochidion ferdinandii</i>	Cheese Tree										
Mimosoideae	<i>Acacia maidenii</i>	Maiden's Wattle			4		2	o		c		m
	<i>Acacia mearnsii</i>	Black Wattle						o	o	c		c
Moraceae	<i>Maclura cochinchinensis</i>	Cockspur Thorn					2			o		o
Musaceae	<i>Musa acuminata</i> *	Banana						r				
Oleaceae	<i>Ligustrum sinense</i> *	Small-leaved Privet							r			r
	<i>Olea europa</i> subsp. <i>cuspidata</i> *	African Olive								r		
Phyllanthaceae	<i>Actephila lindleyi</i>	Actephila	1									
Phytolaccaceae	<i>Phytolacca octandra</i> *	Inkweed										
Pittosporaceae	<i>Pittosporum multiflorum</i>	Orange Thorn		1					r			
Rosaceae	<i>Rosa rubignosa</i> *	Sweet Briar								r		
	<i>Rubus anglocandicans</i> *	Blackberry							r			
Solanaceae	<i>Cestrum parqui</i> *	Chilean Cestrum						o				
	<i>Datura ferox</i> *	Fierce Thornapple										
	<i>Datura stramonium</i> *	Common Thornapple						r				
	<i>Nicandra physalodes</i> *	Apple of Peru										
	<i>Solanum mauritianum</i> *	Wild Tobacco		3				o	o			
Verbenaceae	<i>Lantana camara</i> *	Lantana	1		4		4	v	o	c		c
Groundcovers												



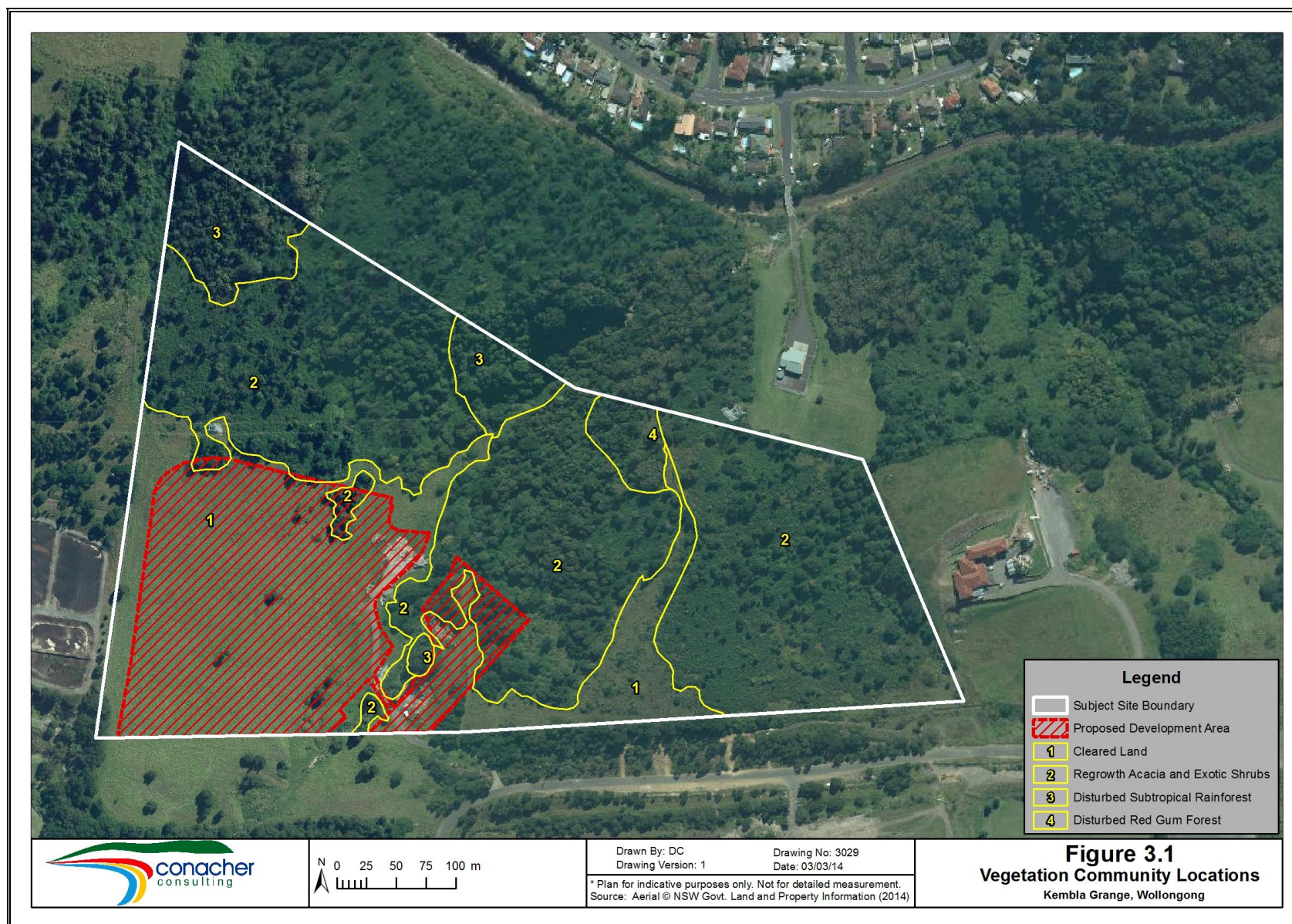
TABLE 3.1 FLORA SPECIES OBSERVED ON THE SUBJECT SITE												
Family Name	Scientific Name	Common Name	Quadrats					Transects				
			1	2	3	4	5	1	2	3	4	5
Adiantaceae	<i>Adiantum diaphanum</i>	Filmy Maidenhair	2									
	<i>Adiantum formosum</i>	Giant Maidenhair	3									
	<i>Adiantum hispidulum</i>	Rough Maidenhair		1								
Amaranthaceae	<i>Amaranthus sp</i> *	Amaranth		1					o		r	
Apiaceae	<i>Centella asiatica</i>	Swamp Pennywort					2					
Araceae	<i>Alocasia brisbanensis</i>	Cunjevoi		1				r	o			
	<i>Colocasia esculenta</i> *	Taro		1					r			
Asparagaceae	<i>Asparagus aethiopicus</i> *	Asparagus Fern										r
Asphodelaceae	<i>Aloe sp</i> *	Aloe						r				
Asteraceae	<i>Ageratina adenophora</i> *	Crofton Weed		2		2	4		o	c	r	c
	<i>Ageratina riparia</i> *	Mist Flower		2					m			
	<i>Bidens pilosa</i> *	Cobbler's Pegs		2	2			c	o	c	o	c
	<i>Bidens subalternans</i> *	Greater Beggar's Tick							r			
	<i>Cirsium vulgare</i> *	Spear Thistle			1			o		o	o	o
	<i>Conyza bonariensis</i> *	Flax-leaf Fleabane				2					o	
	<i>Conyza sumatrensis</i> *	Fleabane		2				o	o	m	o	o
	<i>Galinsoga parviflora</i> *	Potato Weed							r			
	<i>Senecio linearifolius</i>	Fireweed								o		o
	<i>Senecio madagascariensis</i> *	Fireweed			3	2		o		c	o	o
	<i>Sigesbeckia orientalis</i>	Indian Weed							o			
	<i>Sonchus oleraceus</i> *	Common Sow-thistle							r			
Blechnaceae	<i>Doodia aspera</i>	Rasp Fern	2									
Brassicaceae	<i>Brassica oleracea</i> *	Collards							o			
Campanulaceae	<i>Wahlenbergia gracilis</i>	Australian Bluebell								r		

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Family Name	Scientific Name	Common Name	Quadrats					Transects				
			1	2	3	4	5	1	2	3	4	5
Cannaceae	<i>Canna X generalis</i> *	Canna Lily		1					r			
Commelinaceae	<i>Commelina cyanea</i>	Scurvy Weed						o	r			
	<i>Tradescantia fluminensis</i> *	Wandering Jew		3					c			
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed						o		m		m
Cyperaceae	<i>Carex appressa</i>	Tall Sedge			3		3		o	m		m
	<i>Cyperus brevifolius</i> *	Mullumbimby Couch										
	<i>Cyperus rotundatus</i> *	-										
	<i>Cyperus sanguinolentus</i>	-										m
Euphorbiaceae	<i>Ricinus communis</i> *	Castor Oil Plant		3				r	c			
Faboideae	<i>Medicago sp</i> *											
	<i>Trifolium repens</i> *	White Clover				2				o	o	
Geraniaceae	<i>Geranium homeanum</i>	Northern Cranesbill						m	o	o	o	o
Juncaceae	<i>Juncus articulatus</i> *	Jointed Rush							r			
	<i>Juncus usitatus</i>	Common Rush					2	o		o	o	
Lamiaceae	<i>Stachys arvensis</i> *	Stagger Weed										
Malvaceae	<i>Modiola caroliniana</i> *	Red-flowered Mallow						o		m		
	<i>Sida rhombifolia</i> *	Paddy's Lucerne				2				o	o	m
Myrsinaceae	<i>Anagallis arvensis</i> *	Pimpernel								o		m
Oxalidaceae	<i>Oxalis corniculata</i> *	Yellow Wood Sorrel							r	o		
	<i>Oxalis latifolia</i> *	Pink Fishtail						r				
Plantaginaceae	<i>Plantago lanceolata</i> *	Ribwort				2					o	m
	<i>Veronica persica</i> *	Creeping Speedwell										
Poaceae	<i>Andropogon virginicus</i> *	Whisky Grass								o	o	o
	<i>Axonopus fissifolius</i> *	Narrow-leaf Carpet Grass				3		o		m	m	c

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Family Name	Scientific Name	Common Name	Quadrats					Transects				
			1	2	3	4	5	1	2	3	4	5
	<i>Chloris gayana</i> *	Rhodes Grass				3					m	
	<i>Chloris virgata</i> *	Feathertop Rhodes Grass									o	
	<i>Cynodon dactylon</i>	Common Couch						o		m	o	m
	<i>Dichelachne crinita</i>	Long-hair Plume Grass								o		
	<i>Digitaria sanguinalis</i> *	Crab Grass						o				
	<i>Eleusine indica</i> *	Crowsfoot Grass									o	
	<i>Eragrostis leptostachya</i>	Paddock Lovegrass										o
	<i>Holcus lanatus</i> *	Yorkshire Fog										o
	<i>Imperata cylindrica</i> var. <i>major</i>	Blady Grass					3					m
	<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Rice Grass			2					m	o	m
	<i>Oplismenus aemulus</i>	Basket Grass					2	m		o		o
	<i>Oplismenus imbecillis</i>	-					2					
	<i>Paspalum dilatatum</i> *	Paspalum			3	3		o		m	m	c
	<i>Pennisetum clandestinum</i> *	Kikuyu			4	5			m	c	v	c
	<i>Phalaris aquatica</i> *	Phalaris								o		
	<i>Setaria parviflora</i> *	Slender Pigeon Grass			2					c	o	c
	<i>Sporobolus africanus</i> *	Parramatta Grass								m		o
Polygonaceae	<i>Persicaria decipiens</i>	Slender Knotweed		3					c			
	<i>Persicaria hydropiper</i>	Water Pepper		4					c			
Polypodiaceae	<i>Pyrrosia rupestris</i>	Rock Felt Fern	1									
Rubiaceae	<i>Galium binifolium</i>	-					2					
Rutaceae	<i>Geijera salicifolia</i>											
Solanaceae	<i>Lycopersicon esculentum</i> *	Tomato		1					r			
	<i>Nicotiana suaveolens</i>	Native Tobacco								o		

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Family Name	Scientific Name	Common Name	Quadrats					Transects				
			1	2	3	4	5	1	2	3	4	5
	<i>Solanum chenopoides</i> *	Whitelip Nightshade		2					o			
	<i>Solanum nigrum</i> *	Black Nightshade						r	o			
	<i>Solanum pseudocapsicum</i> *	Jerusalem Cherry					1			o		o
Tectariaceae	<i>Arthropteris tenella</i>		3									
Tropaeolaceae	<i>Tropaeolum majus</i> *	Nasturtium		1					r			
Urticaceae	<i>Urtica dioica</i> *	Stinging Nettle		2					o			
Verbenaceae	<i>Verbena bonariensis</i> *	Purpletop			1			o		o	r	
	<i>Verbena rigida</i> *	Veined Verbena								o		o
Climbers												
Apocnyaceae	<i>Araujia sericifera</i> *	Moth Vine							o	o		
	<i>Marsdenia rostrata</i>	Common Milk Vine	2									
	<i>Parsonsia straminea</i>	Common Silkpod	1									
Asteraceae	<i>Delairea odorata</i> *	Cape Ivy		2				c	c	c		o
Basellaceae	<i>Anredera cordifolia</i> *	Madiera Vine		2					o			
Bignoniaceae	<i>Pandorea pandorana</i>	Wonga Vine					2					
Cucurbitaceae	<i>Cucumis myriocarpus</i> *	Paddy Melon										
Faboideae	<i>Glycine clandestina</i>	Twining Glycine								o		
	<i>Vicia sativa</i> *	Common Vetch				2				o	o	
	<i>Vicia tetrasperma</i> *	Slender Vetch				2					o	
Luzuriagaceae	<i>Geitonoplesium cymosum</i>	Scrambling Lily										
Passifloraceae	<i>Passiflora sp</i> *	Passionfruit							r			
	<i>Passiflora subpeltata</i> *	White Passionflower		2					o			
Polygonaceae	<i>Acetosa saggitata</i> *	Turkey Rhubarb		2					m			

TABLE 3.1 FLORA SPECIES OBSERVED ON THE SUBJECT SITE												
Family Name	Scientific Name	Common Name	Quadrats					Transects				
			1	2	3	4	5	1	2	3	4	5
KEY												
Cover abundance in quadrats 1 = rare / 2 = occasional / 3 = common / 4 = very common but less than 5% / 5 = 5-25% / 6 = 26-50% / 7 = 51-75% (T =No. Trees)												
Indicative frequency of occurrence in transects c = common, moderately common, o = occasional, r = rare												
Species name <sup>TS</sup> = Threatened Species / * = Introduced Species												





### 3.3.2 Fauna Species and Habitats

#### **Fauna Habitats**

The following main fauna habitat types were identified within the subject site:

- Disturbed Rainforest Vegetation;
- Disturbed Eucalypt Forest Vegetation;
- Regrowth Acacia and Exotic Shrub Vegetation;
- Cleared Land / Exotic Grassland Vegetation;
- Watercourses; and
- One Hollow Bearing Tree.

Fauna habitat areas are shown in Figure 3.2. An assessment of the resources present within the site for fauna species is provided in Table 3.2.

TABLE 3.2 FAUNA HABITAT RESOURCES PRESENT	
Nectar, seed and fruit producing trees and shrubs	<i>Acacia maidenii</i> (Maiden's Wattle) <i>Acacia mearnsii</i> (Black Wattle) <i>Allocasuarina torulosa</i> (Forest Oak) <i>Baloghia inophylla</i> (Brush Bloodwood) <i>Brachychiton acerifolius</i> (Illawarra Flame Tree) <i>Cinnamomum camphora</i> * (Camphor Laurel) <i>Citronella moorei</i> (Churnwood) <i>Cupaniopsis anacardioides</i> (Tuckeroo) <i>Ehretia acuminata</i> (Koda) <i>Eucalyptus fastigiata</i> (Brown Barrel) <i>Eucalyptus tereticornis</i> (Forest Red Gum) <i>Euroschinus falcata</i> var. <i>falcata</i> (Ribbonwood) <i>Ficus coronata</i> (Sandpaper Fig) <i>Ficus macrophylla</i> (Moreton Bay Fig) <i>Glochidion ferdinandii</i> (Cheese Tree) <i>Hedycarya angustifolia</i> (Native Mulberry) <i>Ligustrum sinense</i> * (Small-leaved Privet) <i>Maclura cochinchinensis</i> (Cockspur Thorn) <i>Melaleuca styphelioides</i> (Prickly-leaved Tea Tree) <i>Melia azedarach</i> var. <i>australasica</i> (White Cedar) <i>Musa acuminata</i> * (Banana) <i>Olea europa</i> subsp. <i>cuspidata</i> * (African Olive) <i>Phoenix canariensis</i> * (Canary Island Date Palm) <i>Pittosporum undulatum</i> (Sweet Pittosporum)
Winter flowering eucalypts	None present
Shrub structure	The Disturbed Eucalypt Forest and Regrowth Acacia Scrub communities contain dense shrub cover. Shrub cover is sparse in other areas of the site.
Ground habitats	Disturbed throughout the site. Generally consists of areas of bare earth under dense shrub vegetation and in disturbed areas and areas with high density growth of exotic grasses and herbs.
Hollow bearing trees	One hollow bearing tree was observed within the subject site. The tree was a large Moreton Bay Fig with a DBH of 1.2 metres, a height and canopy spread of 35 metres. One trunk hollow with an opening size of approximately 20 centimetres and two trunk hollows with opening sizes of approximately 40 centimetres were observed.
Rock Outcrops	Rock outcropping occurs along the upper slopes of the watercourse which intersects the site.
Bush rock	Scattered bush rock was observed within the Rainforest areas of the site.
Watercourses	An un-named second order watercourse intersects the site. Some riparian vegetation is present, however the watercourse is highly disturbed and mostly surrounded by exotic vegetation.
Wetland Areas	None present.
Permanent soaks and seepages	None observed outside watercourse areas.
Leaf litter	Present within forested areas of the site.



TABLE 3.2 FAUNA HABITAT RESOURCES PRESENT	
Nests and roosts	No active nests of roosts were observed.
Latrine or dens sites	None present
Bat tree roosts	One hollow bearing tree was observed which provides potential bat roosting habitat
Bat subterranean roosts (caves, culverts, tunnels etc.)	None observed.
Disturbance History	The majority of the site has been cleared with the exception of small remnants of disturbed rainforest and disturbed eucalypt forest vegetation within the northern sections of the site. Weed invasion is generally high throughout including within and adjacent to watercourse areas.

The habitats within the subject site have been extensively disturbed by previous clearing which has resulted in high levels of weed invasion and the modification of vegetation structure to both retained and cleared areas. Several of the vegetated areas of the site now contain dense regrowth of shrubs (particularly *Acacia* sp.) and dense thickets of Lantana. Several areas of cleared land dominated by exotic grasses are also present.

### **Fauna Species Observed**

Fauna species observed within the subject site are listed in Table 3.3.

One Grey-headed Flying-fox was observed foraging within an exotic palm tree (*Phoenix canariensis*) adjacent to the creek crossing during nocturnal surveys on 27 February 2014. Several other individuals were also observed flying over the site. This species is listed as threatened within the EPBC Act (1999) and the TSC Act (1995).

One Black-faced Monarch was recorded within the central northern patch of Disturbed Rainforest Habitat during diurnal surveys on 27 February 2014. This species is listed as migratory within the EPBC Act (1999).

All fauna species observed are considered relatively common within the local area.

TABLE 3.3 FAUNA OBSERVED AND RECORDED			
Family Name	Common Name	Scientific Name	Observation Method
<b>Amphibians</b>			
Myobatrachidae	Brown-striped Frog	<i>Limnodynastes peronii</i>	W
Myobatrachidae	Common Eastern Froglet	<i>Crinia signifera</i>	W
Myobatrachidae	Eastern Dwarf Tree Frog	<i>Litoria fallax</i>	W
Hylidae	Smooth Toadlet	<i>Uperoleia laevisgata</i>	W
<b>Reptiles</b>			
Scincidae	Dark-flecked Garden Sunskink	<i>Lampropholis delicata</i>	O
Agamidae	Eastern Water Dragon	<i>Physignathus lesueurii</i>	O
Scincidae	Pale-flecked Garden Sunskink	<i>Lampropholis guichenoti</i>	O
<b>Birds</b>			
Psittacidae	Australian King-Parrot	<i>Alisterus scapularis</i>	O
Artamidae	Australian Magpie	<i>Cracticus tibicen</i>	O
Corvidae	Australian Raven	<i>Corvus coronoides</i>	O
Threskiornithidae	Australian White Ibis	<i>Threskiornis molucca</i>	O
Anatidae	Australian Wood Duck	<i>Chenonetta jubata</i>	OW
Campephagidae	Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	OW
Monarchidae	Black-faced Monarch <sup>M</sup>	<i>Monarcha melanopsis</i>	OW
Accipitridae	Black-shouldered Kite	<i>Elanus axillaris</i>	O

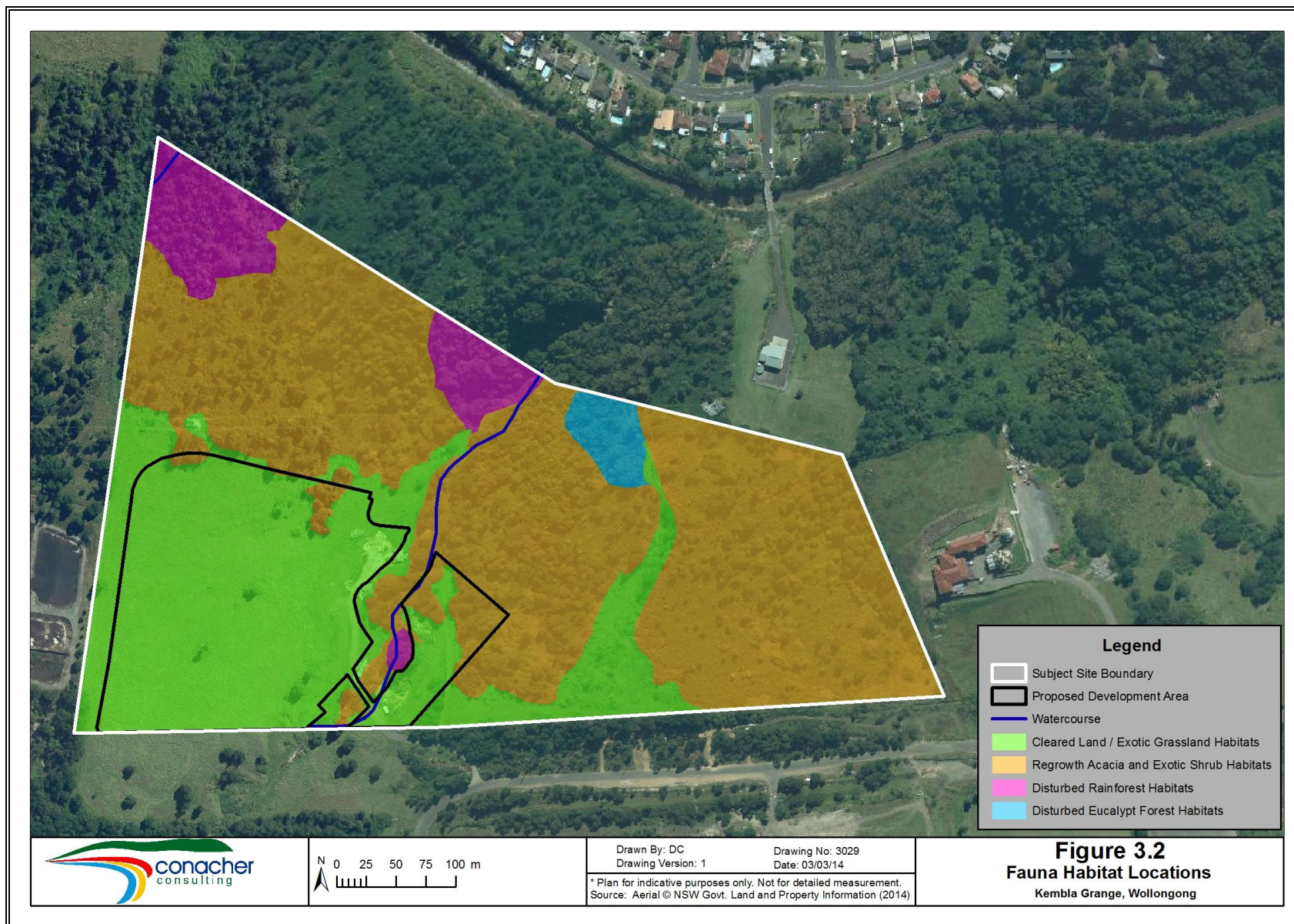
**TABLE 3.3**  
**FAUNA OBSERVED AND RECORDED**

Family Name	Common Name	Scientific Name	Observation Method
Acanthizidae	Brown Gerygone	<i>Gerygone mouki</i>	O
Accipitridae	Brown Goshawk	<i>Accipiter fasciatus</i>	O
Acanthizidae	Brown Thornbill	<i>Acanthiza pusilla</i>	OW
Anatidae	Chestnut Teal	<i>Anas castanea</i>	O
Turdidae	Common Blackbird*	<i>Turdus merula</i>	O
Sturnidae	Common Starling*	<i>Sturnus vulgaris</i>	O
Columbidae	Crested Pigeon	<i>Ocyphaps lophotes</i>	O
Coraciidae	Dollarbird	<i>Eurystomus orientalis</i>	OW
Psittacidae	Eastern Rosella	<i>Platycercus eximius</i>	OW
Meliphagidae	Eastern Spinebill	<i>Acanthorhynchus tenuirostris</i>	OW
Eupetidae	Eastern Whipbird	<i>Psophodes olivaceus</i>	OW
Petroicidae	Eastern Yellow Robin	<i>Eopsaltria australis</i>	OW
Fringillidae	European Goldfinch*	<i>Carduelis carduelis</i>	OW
Cacatuidae	Galah	<i>Eolophus roseicapillus</i>	OW
Artamidae	Grey Butcherbird	<i>Cracticus torquatus</i>	OW
Rhipiduridae	Grey Fantail	<i>Rhipidura albiscapa</i>	OW
Accipitridae	Grey Goshawk	<i>Accipiter novaehollandiae</i>	O
Halcyonidae	Laughing Kookaburra	<i>Dacelo novaeguineae</i>	OW
Monarchidae	Leaden Flycatcher	<i>Myiagra rubecula</i>	OW
Meliphagidae	Lewin's Honeyeater	<i>Meliphaga lewinii</i>	OW
Cacatuidae	Little Corella	<i>Cacatua sanguinea</i>	OW
Monarchidae	Magpie-lark	<i>Grallina cyanoleuca</i>	OW
Charadriidae	Masked Lapwing	<i>Vanellus miles</i>	OW
Meliphagidae	Noisy Miner	<i>Manorina melanocephala</i>	OW
Artamidae	Pied Butcherbird	<i>Cracticus nigrogularis</i>	OW
Psittacidae	Rainbow Lorikeet	<i>Trichoglossus haematodus</i>	OW
Meliphagidae	Red Wattlebird	<i>Anthochaera carunculata</i>	OW
Estrildidae	Red-browed Finch	<i>Neochmia temporalis</i>	OW
Pycnonotidae	Red-whiskered Bulbul*	<i>Pycnonotus jocosus</i>	OW
Halcyonidae	Sacred Kingfisher	<i>Todiramphus sanctus</i>	OW
Ptilonorhynchidae	Satin Bowerbird	<i>Ptilonorhynchus violaceus</i>	OW
Timaliidae	Silvereye	<i>Zosterops lateralis</i>	OW
Strigidae	Southern Boobook	<i>Ninox novaeseelandiae</i>	W
Cacatuidae	Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	OW
Maluridae	Superb Fairy-wren	<i>Malurus cyaneus</i>	OW
Accipitridae	Wedge-tailed Eagle	<i>Aquila audax</i>	O
Acanthizidae	White-browed Scrubwren	<i>Sericornis frontalis</i>	OW
Ardeidae	White-faced Heron	<i>Egretta novaehollandiae</i>	O
Rhipiduridae	Willie Wagtail	<i>Rhipidura leucophrys</i>	OW
Acanthizidae	Yellow Thornbill	<i>Acanthiza nana</i>	OW
Meliphagidae	Yellow-faced Honeyeater	<i>Lichenostomus chrysops</i>	OW
Cacatuidae	Yellow-tailed Black-Cockatoo	<i>Calyptorhynchus funereus</i>	OW
Acanthizidae	Yellow-throated Scrubwren	<i>Sericornis citreogularis</i>	OW
<b>Mammals</b>			
Dasyuridae	Brown Antechinus	<i>Antechinus stuartii</i>	T
Pseudocheiridae	Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>	O

Biodiversity Assessment Report – Wyllie Road, Kembla Grange (Ref: 4039F)

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TABLE 3.3 FAUNA OBSERVED AND RECORDED			
Family Name	Common Name	Scientific Name	Observation Method
Macropodidae	Swamp Wallaby	<i>Wallabia bicolor</i>	O
Muridae	Bush Rat	<i>Rattus fuscipes</i>	T
Muridae	House Mouse *	<i>Mus musculus</i>	T
Muridae	Black Rat *	<i>Rattus rattus</i>	T
Canidae	Dog *	<i>Canis lupus familiaris</i>	O
Leporidae	Rabbit *	<i>Oryctolagus cuniculus</i>	O
Cervidae	Rusa Deer *	<i>Cervus timorensis</i>	O
Pteropodidae	Grey-headed Flying-fox <sup>TS</sup>	<i>Pteropus poliocephalus</i>	O
Vespertilionidae	Long-eared Bat	<i>Nyctophilus sp.</i>	U
Vespertilionidae	Chocolate Wattled Bat	<i>Chalinolobus morio</i>	U
Vespertilionidae	Gould's Wattled Bat	<i>Chalinolobus gouldii</i>	U
Vespertilionidae	Little Forest Bat	<i>Vespadelus vulturnus</i>	U
<b>Fishes</b>			
Eleotridae	Flathead gudgeon	<i>Philypnodon grandiceps</i>	O
Anguillidae	Longfin eel	<i>Anguilla reinhardtii</i>	O
Retropinnidae	Australian Smelt	<i>Retropinna semoni</i>	O
Eleotridae	Striped Gudgeon	<i>Gobiomorphus australis</i>	O
Parastacidae	Dam Yabby	<i>Cherax destructor</i>	O
<b>Key to Observation Type</b> <div> <div>E - Nest / Roost</div> <div>F - Tracks / Scratchings</div> <div>FB - Burrow</div> <div>G - Crushed Cones</div> <div>H - Hair / Feathers / Skin</div> <div>K - Dead</div> <div>M - Miscellaneous Record</div> </div> <div> <div>O - Observed</div> <div>OW - Observed and Heard Call</div> <div>P - Scat</div> <div>Q - Camera</div> <div>T - Trapped</div> <div>U - Ultrasonic Recording</div> <div>W - Heard</div> </div>			
Note: * indicates introduced species <sup>TS</sup> indicates threatened species – M indicated <i>EPBC Act</i> (1999) listed migratory species			



### 3.4 Threatened Biodiversity

Details regarding the habitat attributes and indicative species for the endangered ecological communities known to be present in the local government area are provided in Table 3.4.

TABLE 3.4 ENDANGERED ECOLOGICAL COMMUNITIES OF THE AREA				
Name	TSC Act	EPBC Act	Habitat Requirements	Comments
Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions (BSF)	E	-	<b>Geology / Soils:</b> Occurs on deep, freely draining to damp sandy soils. <b>Topography:</b> Flat to moderate slopes within a few km of the sea and at altitudes below 100 m. <b>Characteristic Species:</b> <i>Eucalyptus botryoides</i> , <i>Eucalyptus pilularis</i> , <i>Banksia integrifolia</i> subsp. <i>integrifolia</i> and <i>Acmena smithii</i> .	No suitable habitat present.
Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions (CS)	E	V	<b>Geology / Soils:</b> Estuarine mud flats. <b>Topography:</b> Intertidal zone on the shores of estuaries and lagoons. <b>Characteristic Species:</b> <i>Sarcocornia quinqueflora</i> , <i>Sporobolus virginicus</i> , <i>Juncus kraussii</i> and <i>Baumea juncea</i> .	
Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregion (FWCF)	E	-	<b>Geology / Soils:</b> Silts, muds or humic loams. <b>Topography:</b> Depressions, flats, drainage lines, back swamps, lagoons and lakes associated with coastal floodplains. <b>Characteristic Species:</b> Composition is variable and dependent on water regime. May include amphibious grasses and sedges, emergent floating herbs and emergent tall sedges and floating and submerged aquatic herbs.	No suitable habitat present.
Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion (ILGW)	E	-	<b>Geology / Soils:</b> Generally on the Berry Siltstone, Budgong Sandstone and Quaternary Alluvium. <b>Topography:</b> Relatively gently sloping and undulating lands below 200metres elevation. <b>Characteristic Canopy Species:</b> <i>Eucalyptus tereticornis</i> , <i>Eucalyptus bosistoana</i> , <i>Eucalyptus eugenioides</i> , <i>Eucalyptus longifolia</i> ; and <i>Melaleuca decora</i> .	Observed during surveys.

TABLE 3.4 ENDANGERED ECOLOGICAL COMMUNITIES OF THE AREA				
Name	TSC Act	EPBC Act	Habitat Requirements	Comments
Illawarra Subtropical Rainforest in the Sydney Basin Bioregion (ISR)	E	-	<p><b>Geology / Soils:</b> High nutrient soils associated with the Permian Volcanics, but may occur on a range of geological substrates between Albion Park and Gerringong.</p> <p><b>Topography:</b> Relatively gently sloping and undulating lands of the coastal plain and escarpment foothills.</p> <p><b>Characteristic Canopy Species:</b> <i>Baloghia inophylla</i>, <i>Brachychiton acerifolius</i>, <i>Dendrocnide excelsa</i>, <i>Diploglottis australis</i>, <i>Ficus rubiginosa</i>, <i>Ficus superba</i> var. <i>henniana</i>, <i>Pennantia cunninghamii</i> and <i>Toona australis</i>.</p>	Observed during surveys.
Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions (LR)	E	CE	<p><b>Geology / Soils:</b> Sand dunes and on soils derived from underlying rocks</p> <p><b>Topography:</b> Located near the sea on coastal dunes, headland or riparian habitats.</p> <p><b>Characteristic Species:</b> Comprises the <i>Cupaniopsis anacardioides</i> - <i>Acmena</i> spp. alliance of Floyd (1990).</p>	No suitable habitat present.
Monte Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions	-	-	<p><b>Geology / Soils:</b> Occurs on basic volcanic or fine-grained sedimentary substrates or, occasionally, granite. Associated with accumulated peaty or organic-mineral sediments on poorly drained flats in the headwaters of streams.</p> <p><b>Topography:</b> Undulating tablelands and plateaus, above 400-500m elevation.</p> <p><b>Characteristic Species:</b> <i>Epacris</i> sp., <i>Hakea microcarpa</i>, <i>Leptospermum</i> sp., <i>Carex</i> sp. and <i>Poa</i> sp.</p>	No suitable habitat present.



TABLE 3.4 ENDANGERED ECOLOGICAL COMMUNITIES OF THE AREA				
Name	TSC Act	EPBC Act	Habitat Requirements	Comments
O'Hares Creek Shale Forest (OCSF)	-	-	<b>Geology / Soils:</b> deep, well drained red loam on small outcrops of Hawkesbury shale. <b>Topography:</b> Darkes Forest area on the Woronora Plateau. <b>Characteristic Species:</b> <i>Eucalyptus piperita</i> , <i>Eucalyptus globoidea</i> , <i>Angophora costata</i> , <i>Acacia binervata</i> , <i>Acacia longifolia</i> ssp. <i>longifolia</i> , <i>Leucopogon lanceolatus</i> var. <i>lanceolatus</i> , <i>Banksia spinulosa</i> var. <i>spinulosa</i> , <i>Calochlaena dubia</i> , <i>Pteridium esculentum</i> , <i>Doryanthes excelsa</i> , <i>Dianella caerulea</i> , <i>Lomandra longifolia</i> , <i>Blechnum cartilagineum</i> , <i>Entolasia stricta</i> and <i>Imperata cylindrica</i> var. <i>major</i> .	No suitable habitat present.
River-Flat Eucalypt Forest on Coastal Floodplains of the North Coast, Sydney basin and South East Corner bioregions (REFCF)	E	-	<b>Geology / Soils:</b> Silts, clay-loams and sandy loams. <b>Topography:</b> Periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. <b>Characteristic Species:</b> Eucalypt canopy with species belonging to the genus <i>Angophora</i> or the sections <i>Exsertaria</i> or <i>Transversaria</i> of the genus <i>Eucalyptus</i> . Has low abundance of <i>E. robusta</i> , <i>Casuarina</i> and <i>Melaleuca</i> species and a groundcover of soft-leaved forbs and grasses.	No suitable habitat present.
Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion (SSSFTSS)	-	-	<b>Geology and Soils:</b> Transitional sandstone-derived soils enriched from sources of additional nutrients. <b>Topography:</b> Heads and upper slopes of sandstone gullies, which are downslope from residual shale or ironstone caps. <b>Characteristic Species:</b> <i>Angophora costata</i> , <i>Eucalyptus piperita</i> and <i>E. pilularis</i> .	No suitable habitat present.



TABLE 3.4 ENDANGERED ECOLOGICAL COMMUNITIES OF THE AREA				
Name	TSC Act	EPBC Act	Habitat Requirements	Comments
Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions (SOFF)	E	-	<b>Geology / Soils:</b> Waterlogged or periodically inundated grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline. <b>Topography:</b> Flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. <b>Characteristic Species:</b> <i>Casuarina glauca</i> .	No suitable habitat present.
Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (SSFCF)	E	-	<b>Geology / Soils:</b> Waterlogged or periodically inundated humic clay loams and sandy loams. <b>Topography:</b> Alluvial flats and drainage lines associated with coastal floodplains. <b>Characteristic Species:</b> <i>Eucalyptus robusta</i> , <i>E. longifolia</i> , <i>E. botryoides</i> , <i>Melaleuca quinquenervia</i> and <i>M. ericifolia</i> .	No suitable habitat present.
Sydney Freshwater Wetlands in the Sydney Basin Bioregion (SFW)	E	-	<b>Geology / Soils:</b> Generally on the Warriewood and Tuggerah Soil Landscapes. <b>Topography:</b> Freshwater swamps in swales and depressions on sand dunes and low nutrient sandplain sites in coastal areas. <b>Characteristic Species:</b> <i>Eleocharis sphacelata</i> , <i>Baumea juncea</i> , <i>B. rubignosa</i> , <i>B. articulata</i> , <i>Gahnia sieberiana</i> , <i>Ludwigia peploides</i> and <i>Persicaria</i> sp.	No suitable habitat present.
Themeda Grasslands on Seacliffs and Coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions (TGSCH)	E	-	<b>Geology / Soils:</b> Found on a range of substrates including old sand dunes above cliffs and on basalt headlands, and less frequently on sandstone. <b>Topography:</b> Seacliffs and coastal headlands. <b>Characteristic Species:</b> <i>Themeda australis</i> .	No suitable habitat present.
CE = Critically Endangered    E = Endangered    V = Vulnerable				

The endangered ecological communities (EEC), Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion and Illawarra Subtropical Rainforest in the Sydney Basin Bioregion, were observed within the subject site during surveys.

The Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion EEC corresponds to the Disturbed Red Gum Forest community and the Illawarra Subtropical Rainforest in the Sydney Basin Bioregion EEC corresponds to the Disturbed Subtropical Rainforest vegetation community. The EEC's observed within the subject site are shown in Figure 3.3.