WARNING

Note that this Vegetation Community Map depicts clearly defined boundaries between vegetation communities that are the product of individual interpretation and are not distinguished by clearly defined boundaries on the ground.

Therefore, this map should only be treated as an indication of approximate peripheries between delineated vegetation communities.

Caution should therefore be exercised when using this data for purposes requiring high levels of accuracy. Furthermore, no account for intergrading areas between delineated vegetation communities has been made.

LEGEND

- Development Estate
- Conservation Lands

VEGETATION COMMUNITIES

- MU 5 - Alluvial Tall Moist Forest
- MU 12 - Hunter Valley Moist Forest
- MU 15 - Coastal Foothills Spotted Gum - Ironbark Forest
- MU 17 - Lower Hunter Spotted Gum Ironbark Forest
- MU 19 - Hunter Lowland Redgum Forest
- MU 30 - Coastal Plains Smooth-barked Apple Woodland
- MU 37 - Swamp Mahogany - Paperbark Forest
- MU 40 - Swamp Oak - Rushland Forest
- MU 46 - Freshwater Wetland Complex
- Weeds and Cleared Areas
- Dams

THREATENED FLORA SPECIES

- *Tetratheca juncea*

0 0.5 1km

TITLE: Figure 4-5 Distribution of Tetratheca juncea Minmi - Link Road

CLIENT: Coal & Allied Operations Pty Ltd

PLANNING SURVEYING ECOLOGY

HARPER SOMERS O'SULLIVAN

SCALE: 1: 18000 at A3 Size **DRAWN:** D. Landenberger **APPROVED:** M. Doherty

DATUM: MGA Zone 56 (GDA 94) **DATE:** 10/3/2008

LAYOUT REF: J:\JOBS\24k\24530 Hunter Valley\Drafting\Ecology\....\ALL WORKSPACES Minmi\Link Road\24530 Fig 4-4 Distribution of Tetratheca juncea A-A3

CONTOUR INTERVAL: N/A

JOB REF: 24530-2

241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
T: 02 4961 6500 F: 02 4961 6794 E: survey@hso.com.au W:www.hso.com.au ABN 11 093 343 858

4.1.9 Groundwater Dependent Ecosystems

GDEs is a broad definition covering all ecosystems which are dependent upon groundwater either permanently or occasionally to survive (DLWC, 2002). Several of the vegetation communities on the Link Road Minmi Development Estate have been identified as GDE's, and these include Freshwater Wetland Complex, HLRF and ATMF (Refer to Figure 4-6). Identification of GDE's depends upon the location of the vegetation communities in relation to groundwater. GDE's are typically the communities which are located in drainage depressions, swamps and creeklines, where groundwater comes up to the surface.

Matthei (1995) has mapped several soil landscapes within the Link Road Minmi Development Estate and these include Killingworth (erosional), Beresfield (residual) and Bobs Farm (Estuarine). The erosional soils of Killingworth are mapped at the higher elevations and are likely to be comprised of clay soil overlying weathered rock. The soil landscape of Beresfield has been mapped in the northern portion of the Development Estate at the high elevations adjoining Hexham Swamp. This soil landscape is similar to Killingworth in that residual clay loams occur over weather rock. However, lower lying areas in the north of the Development Estate are likely to have regular inundation due to the close proximity to Hexham Swamp where the groundwater table is often on the surface. Hexham Swamp is part of the floodplain of the Hunter River. The estuarine soils of Bobs Farm are subject to waterlogging and have permanently high watertables, this soil landscape is mapped in the northern portion of the Development Estate and adjoining Hexham Swamp.

There are three vegetation communities which occur within the Development Estate are classified as GDE's and these include, HLRF, ATMF and Freshwater Wetland Complex. These vegetation communities occur on the estuarine soils of Bob's Farm and within the northern portion of the Development Estate. The ATMF which occurs to the south of Minmi occur on residual soils and the presence of this community is most likely to be a result of surface runoff rather than groundwater dependence. Therefore, southern occurrences of ATMF have not been mapped as GDEs.

GDE's have been classified into several different types according to DLWC (2006). These classes take into consideration aquifer, ecological and geomorphic types Table 4-6 below outlines the GDE types, classes and sub-classes as per DLWC (2006) which occur within the Minmi Link Road Development Estate.

Table 4-2: GDE's Types and Classes for Link Road Minmi Development Estate

Vegetation Community at Minmi - Link Road	GDE TYPE	Class	Description of Class	Habitat
Alluvial Tall Moist Forest (northern occurrences)	Riparian & Terrestrial Vegetation (T)	T1	Riparian Vegetation Community	Terrestrial
Hunter Lowland Redgum Forest	Riparian & Terrestrial Vegetation (T)	T1	Riparian Vegetation Community	Terrestrial
Redgum Roughbarked Apple Forest	Riparian & Terrestrial Vegetation (T)	T1	Riparian Vegetation Community	Terrestrial
Freshwater Wetland Complex	Wetlands (W)	W2	Coastal Floodplain Freshwater Forested Wetland	Epigean

WARNING

Note that this Vegetation Community Map depicts clearly defined boundaries between vegetation communities that are the product of individual interpretation and are not distinguished by clearly defined boundaries 'on the ground'.

Therefore, this map should only be treated as an indication of approximate peripheries between delineated vegetation communities.

Caution should therefore be exercised when using this data for purposes requiring high levels of accuracy. Furthermore, no account for intergrading areas between delineated vegetation communities has been made.

LEGEND

Conservation Lands

Development Estate

GROUNDWATER DEPENDANT ECOSYSTEMS

MU 19 - Hunter Lowland Redgum Forest

MU 46 - Freshwater Wetland Complex

MU 5 - Alluvial Tall Moist Forest

MU 5 - Alluvial Tall Moist Forest - Not Groundwater Dependent

0 0.5 1km

TITLE: Figure 4-6 Groundwater Dependant Ecosystems
Link Road - Minmi

CLIENT: Coal & Allied Operations Pty Ltd

SCALE: 1: 18000 at A3 Size **DRAWN:** D. Landenberger **APPROVED:** M. Doherty

DATUM: MGA Zone 56 (GDA 94) **DATE:** 17/10/2008

LAYOUT REF: J:\JOBS\24k\24530 Hunter Valley\Drafting\Ecology\Northern Lands\ALL WORKSPACES\MinimiLink Road\24530 Fig 4-6 Minmi LR GDE A-A3

CONTOUR INTERVAL: N/A

JOB REF: 24530-2

PLANNING SURVEYING ECOLOGY

HARPER SOMERS O'SULLIVAN

241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
T: 02 4961 6500 F: 02 4961 6794 E: survey@hso.com.au W:www.hso.com.au ABN 11 093 343 858

4.2 Fauna

The results of fauna survey work carried out on the site are presented in the following section. A comprehensive list of species expected and recorded during the survey period is presented in Appendix E. Threatened species recorded during the survey period are depicted in Figure 4-8.

4.2.1 NPWS Threatened Species Database Search Results

The results of the above search indicated that 58 threatened fauna species have been previously recorded within 10km (DECC Wildlife Atlas 2008) of the Development Estate (Refer to Figure 4-7). A total of 20 of these species are highly unlikely to occur within the Development Estate due to the absence of suitable habitat. From the remaining 38 species, four were recorded during fauna surveys (indicated by an asterisk '*' in the following list). For a number of these species no suitable habitat occurs within the site, but discussion is added below with regard to the potential for these species to occur in line with the precautionary approach incorporated into this EAR assessment process.

Litoria aurea	Green and Golden Bell Frog
Litoria brevipalmata	Green-thighed Frog
Varanus rosenbergi	Heath Monitor
Botaurus poiciloptilus	Australasian Bittern
Lophoictinia isura	Square-tailed Kite
Callocephalon fimbriatum	Gang-Gang Cockatoo
Calyptorhynchus lathami	Glossy Black-Cockatoo
Melanodryas cucullata	Hooded Robin
Stagonopleura guttata	Diamond Firetail
Pomatostomus temporalis	Grey-crowned Babbler
Chthonicola sagittatus	Speckled Warbler
Climacteris picumnus	Brown Treecreeper
Melithreptus gularis	Black-chinned Honeyeater
Anthochaera phrygia	Regent Honeyeater
Lathamus discolor	Swift Parrot
Neophema pulchella	Turquoise Parrot
Ninox connivens	Barking Owl
Ninox strenua	Powerful Owl
Tyto novaehollandiae	Masked Owl
Tyto tenebricosa	Sooty Owl
Ptilinopus magnificus	Wompoo Fruit-Dove
Ptilinopus regina	Rose-crowned Fruit-Dove
Ptilinopus superbus	Superb Fruit-Dove
Dasyurus maculatus	Spotted-tailed Quoll

Phascogale tapoatafa	Brush-tailed Phascogale
Petaurus australis	Yellow-bellied Glider
Petaurus norfolcensis	Squirrel Glider
Phascolarctos cinereus	Koala*
Pteropus poliocephalus	Grey-headed Flying-fox*
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat
Miniopterus australis	Little Bentwing-bat*
Mormopterus norfolkensis	Eastern Freetail-bat*
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat
Falsistrellus tasmaniensis	Eastern False Pipistrelle
Chalinolobus dwyeri	Large-eared Pied Bat
Myotis adversus	Large-footed Myotis
Scoteanax rueppellii	Greater Broad-nosed Bat
Vespadelus troughtoni	Eastern Cave Bat

In addition to the above threatened species a further 20 threatened wetland, estuarine and inland fauna species have been recorded within a 10 km radius of the site. These species have appeared in wider locality searches as consequence of the site's proximity to estuarine and wetland habitats and rare local records of inland species. These species have not been included within the above 10 km threatened species list, as potential impacts within the site will not include the inland, wetland and estuarine habitats in which they occur and these habitats do not occur on site.

Anseranas semipalmata	Magpie Goose
Stictonetta naevosa	Freckled Duck
Charadrius leschenaultia	Greater Sand-plover
Calidris tenuirostris	Great Knot
Chelodina mydas	Green Turtle
Charadrius mongolus	Lesser Sand-plover
Pterodroma leucoptera	Gould's Petrel
Pterodroma solandri	Providence Petrel
Sterna albifrons	Little Tern
Haematopus longirostris	Pied Oystercatcher
Irediparra gallinaceae	Comb-crested Jacana
Pandion cristatus	Osprey
Hamirostra melanosternon	Black-breasted Buzzard
Ephippiorhynchus asiaticus	Black-necked Stork
Ixobrychus flavicollis	Black Bittern
Limicola falcinellus	Broad-billed Sandpiper
Limosa limosa	Black-tailed Godwit

Oxyura australis	Blue-billed Duck
Rostratula australis	Australian Painted Snipe
Xenus cinerius	Terek Sandpiper

The southern portion of the Link Road – Minmi Development Estate is characterised by open forest habitat offering opportunities for local fauna species including a number of threatened species as listed above. Hollow-bearing trees within these forest habitats may be used by hollow-dwelling Microchiropteran bats for roosting purposes, and the canopy would provide foraging habitat for threatened insectivorous species during the warmer months. There are hollows within the forest habitats of sufficient size to represent potential nesting sites for Glossy Black-Cockatoos and there are areas containing *Allocasuarina torulosa* or *A. littoralis*, which are feed tree species for these cockatoos.

The forested areas of the Development Estates also contain hollows that are of sufficient size to represent nesting and roosting sites for forest owl species and these habitats provide suitable foraging habitat for both *Ninox strenua* (Powerful Owl) and *Tyto novaehollandiae* (Masked Owl) potentially occurring in the area. The record of a *Ninox connivens* (Barking Owl) in the wider locality is considered to be a rare occurrence as this species is not common in coastal areas and this is supported by a general lack of records from the region.

Petaurus norfolcensis (Squirrel Gliders) have been recorded within the site to the south of Link Road. This species appears to favour open forest habitats within the Link Road – Minmi Development Estate. Although *Petaurus norfolcensis* (Squirrel Glider) was not recorded within habitat north of Link Road, this species has potential to utilise the habitat within this area.

An individual *Phascolarctos cinereus* (Koala) was observed within the site during nocturnal surveys. Due to a lack of evidence to suggest that the site supports a local population, the individual was identified as a probable immature male travelling between populations. This species favours forested habitats containing high densities of preferred Koala feed trees. Despite the occurrence of the SEPP 44 listed Koala feed tree *Eucalyptus punctata* and the closely related *E. propinqua* within the site there are no previous records of this species within the site or within the locality of the site. The records of a *Phascolarctos cinereus* (Koala) in the wider region include high densities to the north of the Hunter River within the Port Stephens – Medowie area and sparse records in the Watagan Mountains area.

Winter-flowering sclerophyllous tree species within the site include *Corymbia maculata* (Spotted Gum). This species is widespread across the site within the identified Ironbark- Spotted Gum Open Forest. Through winter these stands would potentially provide foraging resources for Flying-foxes, *Lathamus discolor* (Swift Parrot) and *Xanthomyza phrygia* (Regent Honeyeater) which may periodically occur in the local area – though these species were not recorded during the survey period despite targeted surveys.

A record of the *Dasyurus maculatus* (Spotted-tailed Quoll) occurs within 10 km of the Development Estate and is located east of Lake Macquarie. This record is considered somewhat unusual as it occurs in an area that is isolated from extensive high quality habitat in relatively close proximity to residential areas. Nevertheless, this record does not occur within habitat continuous with the Development Estate and the next nearest record occurs some 18 km away in the Watagan Mountains, although there may be potential habitat for this species within land to be retained for

conservation purposes at Stockrington. The site's habitats are unlikely to contain an adequate combination of sufficient remoteness, quality or extent for this species.

There are no wetland habitats within the site of sufficient extent or of the open nature that is suited to *Ephippiorhynchus asiaticus* (Black-necked Stork). Furthermore, there is no suitable habitat within the site for a range of other wetland bird species, including *Irediparra gallinaceae* (Comb-crested Jacana), *Rostratula australis* (Australian Painted Snipe), *Stictonetta naevosa* (Freckled Duck), *Anseranas semipalmata* (Magpie Goose) and *Oxyura australis* (Blue-billed Duck) despite their occurrence in the wider locality and in some instances, records within the site (Atlas of NSW Wildlife data 2008). The occurrence of records for some threatened waterbird species within dry forests of the site is likely due to the proximity of wetlands on the Hexham flood plain and the inherent inaccuracy within some spatial data supplied to the NSW NPWS.

The site does not contain extensive estuarine habitats for *Ixobrychus flavicollis* (Black Bittern). Furthermore, there is no suitable habitat within the site for a range of other estuarine or oceanic bird species, such as *Sterna albifrons* (Little Tern) and *Charadrius mongolus* (Lesser Sand Plover) despite their occurrence in the wider locality within the Lower Hunter River estuary.

4.2.2 Regionally Significant Fauna Species

Lake Macquarie Flora and Fauna Guidelines (2001) contain a list of regionally significant fauna species occurring across Lower Hunter LGA's, of which nine were identified within the site during surveys and are listed as follows:

Amphibolurus muricatus	Jacky Lizard
Calyptrohynchus funereus	Yellow-tailed Black-Cockatoo
Turnix varia	Painted Button-quail
Haliaeetus leucogaster	White-bellied Sea-Eagle
Petaurus breviceps	Sugar Glider
Acrobates pygmaeus	Feather-tailed Glider
Demansia psammophis	Yellow-faced Whip Snake
Limnodynastes tasmaniensis	Spotted Grass Frog
Pseudophryne coriacea	Red-backed Toadlet

WARNING
No part of this plan should be used for critica design dimensions. Confirmation of critical positions should be obtained from Harper Somers O' Sullivan Pty Ltd.

LEGEND

- Development Estate
- Conservation Lands
- Australasian Bittern
- Barking Owl
- Black-chinned Honeyeater (eastern subspecies)
- Brown Treecreeper
- Brush-tailed Phascogale
- Diamond Firetail
- Eastern Bentwing-bat
- Eastern Cave Bat
- Eastern False Pipistrelle
- Eastern Freetail-bat
- Gang-gang Cockatoo
- Glossy Black-Cockatoo
- Greater Broad-nosed Bat
- Green and Golden Bell Frog
- Green-thighed Frog
- Grey-crowned Babbler (eastern subspecies)
- Grey-headed Flying-fox
- Hooded Robin
- Hooded Robin (south-eastern form)
- Koala
- Large-eared Pied Bat
- Large-footed Myotis
- Little Bentwing-bat
- Magpie Goose
- Masked Owl
- Powerful Owl
- Regent Honeyeater
- Rose-crowned Fruit-Dove
- Sooty Owl
- Speckled Warbler
- Spotted-tailed Quoll
- Square-tailed Kite
- Squirrel Glider
- Superb Fruit-Dove
- Swift Parrot
- Turquoise Parrot
- Wompoo Fruit-Dove
- Yellow-bellied Glider
- Yellow-bellied Sheathtail-bat

0 2 4km

TITLE: Figure 4-7
NPWS Atlas Fauna Records
Minmi - Link Road

CLIENT: Coal & Allied Operations Pty Ltd

PLANNING SURVEYING ECOLOGY

HARPER SOMERS O'SULLIVAN

SCALE: 1: 95000 at A3 Size
DRAWN: A.Saddington
APPROVED: M. Doherty
DATUM: MGA Zone 56 (GDA 94)
DATE: 30/07/2008
LAYOUT REF: J:\JOBS\24k\24530 Hunter Valley\Drafting\Ecology\Northern Lands\ALL WORKSPACES \REPORTS\MinmiLinkRdReport\24530-2 Figure 4-6 NPWS Atlas Fauna Records A-A3
CONTOUR INTERVAL: N/A
JOB REF: 24530-2

241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
T: 02 4961 6500 F: 02 4961 6794 E: survey@hso.com.au W:www.hso.com.au ABN 11 093 343 858

4.2.3 Terrestrial Mammals

Mammals recorded within the site encompassed species from terrestrial, arboreal and aerial guilds. Terrestrial fauna survey captures were dominated by *Antechinus stuartii* (Brown Antechinus), particularly where understorey vegetation densities were higher within open forest habitats. *Rattus fuscipes* (Bush Rat) was found to occur across the site within terrestrial fauna surveys. *Rattus rattus* (Black Rat) was found south of link road situated within drainage lines and likely to be associated with the adjacent residential and industrial areas of West Wallsend and Northlakes. In addition to these small terrestrial mammals, foxes or secondary fox indications, such as scent marking and scats, were encountered throughout the site, but generally along track lines.

Wallabia bicolour (Swamp Wallaby) and *Macropus rufogriseus* (Red-necked Wallaby) were observed across the site during diurnal and nocturnal surveys. Grazing opportunities occur across the site for these species.

4.2.4 Arboreal Mammals

Petaurus breviceps (Sugar Glider) was identified during arboreal fauna surveys, through captures of both males and females in arboreal traps both to the north and south of the Link Road and was heard to call within several locations within the Development Estate. This species was identified to be utilising open forest habitat with a moderate to closed understorey. *Petaurus norfolcensis* (Squirrel Glider) was identified during arboreal fauna trapping within open forest associated with a drainage line within the portion of the site south of Link Road. Two female and one male *Petaurus norfolcensis* were captured at this location. The two female captures were on different nights and may have been the same individual, since marking was not undertaken and weights were similar.

Pseudocheirus peregrinus (Ring-tail Possum), *Acrobates pygmaeus* (Feathertail Glider) and *Trichosurus vulpecula* (Common Brush-tail Possum) were observed during nocturnal spotlighting surveys on several occasions within open forest habitat with moderate understorey complexity in the Development Estate.

Trichosurus vulpecula (Common Brush-tail Possum) and *Petaurus* sp. (Sugar/Squirrel Glider) were recorded via hair tube sampling within the Development Estates.

4.2.5 Bats

A number of Microchiropteran bat species were detected within the site during nocturnal bat call recording surveys with a definite – probable confidence, including *Tadarida australis* (White-striped Freetail Bat), *Miniopterus australis* (Little Bentwing-bat), *Mormopterus norfolkensis* (East-coast Freetail Bat), *Mormopterus* species 2 (Eastern Freetail Bat), *Chalinolobus gouldii* (Gould's Wattled Bat), *Chalinolobus morio* (Chocolate Wattled Bat), *Vespadelus* darlingtonia (Large Forest Bat) *Vespadelus* vulturnus (Little Forest Bat) and *Rhinolophus megaphyllus* (Eastern Horseshoe Bat). Note: *Miniopterus australis* and *Mormopterus norfolkensis* are listed as Vulnerable under the *TSC Act*.

Pteropus poliocephalus (Grey-headed Flying Fox) was observed foraging and was heard calling within the site during nocturnal survey work. Habitat occurs across the site in the form of flowering sclerophyllous tree species with the winter-flowering species *Corymbia maculata* (Spotted Gum) being of note during the survey period.

4.2.6 Avifauna

There are a range of habitat opportunities for different avifauna guilds within the Link Road – Minmi Development Estate encompassing highly disturbed cleared areas through dry sclerophyll woodlands and open forests to wet sclerophyll forests. Large areas of the Development Estate are wooded, particularly in the southern areas surrounding the Newcastle Link Road and a range of common forest bird species were noted during fauna surveys.

Observed forest bird species encompassed a number of groups with those species recorded including, Whistlers and Thrushes, Robins, Flycatchers, Fairy-wrens, Scrub-wrens, Thornbills, Whipbirds, Cuckoos, Finches, Butcherbirds and birds of prey amongst others. Within these bird groups, species with specific preferences for wet or dry forest habitats were often encompassed, such as Golden Whistler and Rufous Whistler, Rufous Fantail and Grey Fantail and Grey Goshawk and Brown Goshawk.

The canopies of wooded habitats within the site contain a diversity of tree species that together offer a year round continuity in blossom resources for a range of nectivorous bird species such as honeyeaters and lorikeets. The canopy also represents abundant foraging opportunities for those birds that hunt the invertebrate fauna that foliage and flowering trees attract. Understorey strata density varies across the wooded habitats with the greatest complexity occurring within the gullies. This gully habitat provides cover, foraging and nesting opportunities for small bird species occurring within these habitats and adjacent wooded ridges and slopes. Understorey strata within dry forest habitats include patchy shrub layers that provide foraging and a range of nesting opportunities for small forest bird species such as Thornbills, Scrub-wrens, Finches and Fairy-wrens.

Despite the presence of mesic flora species in the site's gullies, this vegetation only occurs as understorey elements. These wet sclerophyll understorey strata have not developed into extensive closed canopy communities. Therefore, these habitats do not provide a significant range of fruiting plant species as required by strictly frugivorous bird species, including those threatened Fruit-dove species that occur on rare occasions within the Lower Hunter Region. CPSBAW understoreys also include nectar producing plant species, such as banksias and Gymea Lilies, which provide additional foraging for nectivorous bird species, including Spinebills and Yellow-faced Honeyeaters and shelter for small understorey species.

Dams within the site provide only marginal habitat for wetland bird species, due to the general lack of extensive wetland vegetation, as such only a small number of common waterbirds species (Little Black Cormorant, Pacific Black Duck and White-faced Heron) were noted within these habitats.

Open cleared areas within the Development Estate offer little opportunity for avifauna apart from those common pasture and open space birds, which are suited to modified habitats, including, Australian Magpie, Welcome Swallow, Masked Lapwings and Crested Pigeons. Where open areas contain remnant stands of canopy trees common open forest birds such as Eastern Rosellas, Noisy Miners, Grey and Pied Butcherbirds occur, but the lack of understorey vegetation

compromises the capacity for these habitats to support small bird species other than canopy specialists like the White-throated Gerygone, Spotted and Striated Pardalotes and Mistletoebirds.

Throughout the open forest habitats there is a sparse presence of *Allocasuarina* sp. (She Oaks), which are the source of the dominant food resource for *Calyptorhynchus lathami* (Glossy Black-Cockatoo). No chewed *Allocasuarina littoralis* (Black She-oak) nuts were noted within the site to indicate the recent presence of Glossy Black-Cockatoos.

Extensive wooded habitats within the site, containing moderate to high levels of understorey structural diversity and low to moderately-high hollow-bearing tree resources, support populations of terrestrial and arboreal mammal species. These habitat attributes are important features for forest owl species, particularly *Ninox strenua* (Powerful Owl) and *Tyto novaehollandiae* (Masked Owl). A Masked Owl record occurs within the north-eastern section of the Development Estate (Atlas of NSW Wildlife) and a Powerful Owl was observed roosting in wet sclerophyll forest within Tank Paddock Conservation Estate to the north of the site during associated fauna surveys. Although neither the Masked Owl or Powerful Owl were recorded within the Development Estate during fauna surveys, the presence of potential habitat and records within the locality suggests that their use of the Development Estate as part of local distributions and movements cannot be discounted. There are hollows of sufficient size within the Development Estate to represent potential breeding opportunities for this species.

Swift Parrot Target Survey Results

The widespread occurrence of *Corymbia maculata* (Spotted Gum) across large areas of both proposed Development and Conservation Estates suggests that these lands have the potential to attract Swift Parrots during those seasons when Spotted Gum is an important winter flowering species within the central to lower Hunter Valley. However targeted survey during 2008 over the development estate did not result in any Swift Parrot observations.

4.2.7 Amphibians

A total of 10 common species of frog were identified within the Development Estate including *Crinia signifera* (Common Froglet), *Litoria fallax* (Eastern Dwarf Tree Frog), *Litoria latopalmata* (Broad-palmed Frog), *Pseudophryne coriacea* (Red-backed Toadlet) and *Lymnodynastes peronii* (Striped Marsh Frog).

Although a number of threatened frog species are known to occur within the region, in particular those belonging to the Genus *Crinia*, *Mixophyes*, *Pseudophryne*, *Litoria* and *Heleioporus*, habitat within the site is not suited to these threatened species. *Mixophyes* spp. occur in montane creeklines, *Pseudophryne australis* and *Heleioporus australiacus* occur within Sydney Sandstone habitats to the south of the Hunter and regionally *Crinia tinnula* occurs in swamp woodland and swamp forest communities around Port Stephens and Lake Macquarie. *Litoria brevipalmata* has been recorded on the valley floor in the Cessnock LGA, but onsite habitat is inconsistent with those areas where it has been regionally recorded.

In a historical context habitat attributes that occur within the site, such as creekline and dam edge vegetation, were once recognised as suitable habitat for *Litoria aurea* (Green and Golden Bell Frog). During the 1960's and early 1970's this species was a common frog species frequently encountered in association with *Typha orientalis*

(Cumbungi) (RPS HSO ecologist pers. obs.). However, this species was not observed within these habitat types onsite and this species is now more reliably observed within the Lower Hunter River floodplain in association with near estuarine wetland habitats.

4.2.8 Reptiles

The most commonly encountered reptiles within the Development Estate were common skink species occurring within ground debris, particularly *Lampropholis delicata* (Grass Skink), which was observed across all wooded habitats within the site. *Saiphos equalis* (Three-toed Skink) was found sheltering under dead vegetation in open forest habitats. *Ctenotus robustus* (Striped Skink) was found sheltering below dead vegetation within open forest habitat.

Two species of dragon lizard were observed within the site. *Amphibolurus muricatus* (Jacky Lizard) was observed in open forest habitat and *Physignathus lesuerii* (Eastern Water Dragon) was observed in wet sclerophyll forest at the northern end of Minmi. *Varanus varius* (Lace Monitor) was also observed in open forest habitat within the site.

One snake species was observed within open forest habitat, being *Demansia psammophis* (Yellow-faced Whip Snake) and *Chelodina longicollis* (Long-necked Tortoise) was observed in dams within the site.

WARNING

No part of this plan should be used for critical design dimensions. Confirmation of critical positions should be obtained from Harper Somers O'Sullivan Pty Ltd.

LEGEND

Development Estate

Threatened Species

- Greyheaded Flyingfox
- Little Bentwing Bat
- Powerful Owl
- Squirrel Glider
- Koala Observation

0 400 800m

TITLE: Figure 4-8 Threatened Fauna Species Records
Minmi - Link Road

CLIENT: Coal & Allied Operations Pty Ltd

SCALE: 1: 14998.5 at A3 Size **DRAWN:** A.Saddington **APPROVED:** M.Doherty

DATUM: MGA Zone 56 (GDA 94) **DATE:** 5/11/2008

LAYOUT REF:J:\JOBS\24k\24530 Hunter Valley\Drafting\Ecology\Northern Lands\ALL WORKSPACES\REPORTS\MinmiLinkRdReport\24530-2 Figure 4-8 Threatened Fauna Specied Results A-A3

CONTOUR INTERVAL: N/A

JOB REF: 24530-2

PLANNING SURVEYING ECOLOGY

HARPER SOMERS O'SULLIVAN

241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
T: 02 4961 6500 F: 02 4961 6794 E: survey@hso.com.au W:www.hso.com.au ABN 11 093 343 858

4.3 Habitat Survey

4.3.1 Flora Habitat

The vegetation communities present throughout the site offer a number of suitable habitat types for an array of native flora species. A number of geomorphological factors contribute to the diversity of vegetation communities present within the Link Road Minmi Development Estate. These factors include the geology, soils, elevation, topography and rainfall patterns. This range of geomorphological influences has produced a number of different vegetation communities. The condition of the vegetation communities varies across the site and generally corresponds to the proximity to urban development, tracks, infrastructure easements and previous long history of underground mining, grazing and other associated land-use practices within the site.

The main disturbances within areas away from proximate development generally entail unformed tracks and infrastructure easements and associated access tracks and the associated erosion across the sites. These tracks are regularly used by motorbike riders and to a lesser extent four-wheel drive vehicles. Soil erosion is present throughout and within close proximity to the majority of the tracks, with pasture weed incursions and rubbish dumping also occurring in close proximity to tracks. In addition to the aforementioned disturbances, the tracks also fragment the vegetation communities across the site.

A number of threatened flora species are known to occur locally within LHSGIF, CPSBAW, CFSGIF and ATMF. LHSGIF elsewhere within the region is known to contain *Grevillea parviflora* subsp. *parviflora*, *Callistemon linearifolius*, *Rutidosis heterogama* and in some cases *Tetratheca juncea*. Threatened flora species known to be associated with CPSBAW are *Tetratheca juncea, Grevillea parviflora* subsp. *parviflora*, *Angophora inopina* and *Cryptostylis hunteriana*. A threatened flora species known to be associated with CFHSGIF is *Tetratheca juncea*. Threatened flora species known to be associated with ATMF are *Melaleuca biconvexa*, *Dendrobium melaleucaphilum* and *Syzygium paniculatum*.

A number of ROTAP listed flora are known to occur within LHSGIF, including *Grevillea montana*, *Macrozamia flexuosa* and *Eucalyptus fergusonii* ssp. *fergusonii. Macrozamia flexuosa* is also known to occur within CPSBAW. ATMF in the region is known to contain the ROTAP listed *Callistemon shiressii*. Furthermore, at least one Regionally Significant plant species, being *Grevillea humilis* has been noted as occurring within the vicinity of the site in CPSBAW.

ATMF lying within the riparian corridors traversing the site on the northern and southern sides of the Newcastle Link Road, in the east and the far north of the site offer opportunities for mesic vegetation, including serious introduced weeds like *Lantana camara* (Lantana).

Other than opportunities for weeds within cleared easements, vegetation community disturbances within the site are limited to edge effects associated with access tracks and occasional incidences of rubbish dumping. Rubbish dumping is confined to access tracks, with the greatest occurrences proximate to main roads.

4.3.2 Fauna Habitat

Fauna recorded within the site varies with respect to vegetation quality, density and community form. The site encompasses vegetation communities ranging from dry and wet sclerophyll vegetation associations with dams and ephemeral creek lines attracting streamside vegetation and denser understorey habitats. The variation in vegetation within the site provides habitat for a diversity of common fauna species and opportunities for a low to moderate number of threatened fauna species.

The flowering times of Eucalypts and other dominant trees have potential to supply nectar and foraging opportunities for a diversity of species throughout the majority of the year. Dominant tree species and flowering period are contained in Table 4-3 below.

Table 4-3: Dominant Tree Species and Flowering Period

Threatened Flora Species	TSC listed	EPBC listed	Habitats (But not confined to) Map units REMS	Potential Threatened Fauna Species that May be attracted by Blossom	Flowering Period (Best time to Survey) in Months of the Year											
					J	F	M	A	M	J	J	A	S	O	N	D
Angophora costata	NA	NA	17	Micro bats (insects), gliders.	■	■								■	■	■
Corymbia maculata	NA	NA	15 &17	Micro bats (insects), Flying Foxes, Gliders, Regent Honeyeater, Swift Parrot	■				■	■	■	■	■	■	■	■
Corymbia gummifera	NA	NA	15, 30	Micro bats (insects), Flying Foxes, Gliders	■	■	■	■								
Eucalyptus acmenoides	NA	NA	5	Micro bats (insects), Flying Foxes, Gliders	■										■	■
Eucalyptus fergusonii subsp. *dorsiventralis**	NA	NA	17	Micro bats (insects), Flying Foxes, Gliders, Regent Honeyeater, Swift Parrot		■	■	■	■	■						
Eucalyptus fibrosa	NA	NA	17	Micro bats (insects), Flying Foxes, Gliders, Regent Honeyeater			■	■	■	■	■	■	■	■	■	
Eucalyptus globoidea	NA	NA	17	Micro bats (insects), Flying Foxes, Gliders, Regent Honeyeater, Swift Parrot				■	■	■						
Eucalyptus grandis	NA	NA	5	Micro bats (insects), Flying Foxes, Gliders, Regent Honeyeater, Swift Parrot				■	■	■	■	■				
Eucalyptus paniculata / propinqua	NA	NA	5	Micro bats (insects), Flying Foxes, Gliders, Regent Honeyeater, Swift Parrot	■				■	■	■	■	■	■	■	■

Threatened Flora Species	TSC listed	EPBC listed	Habitats (But not confined to) Map units REMS	Potential Threatened Fauna Species that May be attracted by Blossom	Flowering Period (Best time to Survey) in Months of the Year											
					J	F	M	A	M	J	J	A	S	O	N	D
Eucalyptus punctata	NA	NA	5 & 15	Micro bats (insects), Flying Foxes, Gliders, Regent Honeyeater	■	■	■	■								■
Eucalyptus resinifera	NA	NA	15, 30, 31, 34 37, 39, 42, 51	Micro bats (insects), Flying Foxes, Gliders	■	■								■	■	■

Dark shading represents core flowering times for canopy trees as reported in the literature and light shading represents those times when flowering has been noted by RPS HSO ecologists outside these core flowering periods.

* The flowering period for *Eucalyptus fergusonii* is not reported within the literature, but RPS HSO ecologists have noted it flowering during March and April in the Bulahdelah area.

Note: The cleared areas occurring within the site are considered to be insignificant in terms of providing habitat for native fauna species aside from providing foraging habitat along the ecotone between cleared and forested areas (such as for hunting bats).

Terrestrial Mammals

Open Forest communities provide moderately suitable habitat for a number of terrestrial mammals. Habitat quality for terrestrial fauna is dependent upon the amount of available groundcover, density and floristic diversity of shrubs and grasses and land use history (e.g. selective logging, clearing, grazing and understorey management practices).

The cleared areas with open understorey, sparse trees and occurrence of grasses and exotic species within the site provide limited suitable habitat for common native browsers, such as various Macropod species. These areas also provide habitat for pest species such as *Lepus capensis* (Brown Hare), *Oryctolagus cuniculus* (Rabbit) and *Vulpes vulpes* (Fox).

Trends observed from the trapping surveys indicate that small mammals such as *Antechinus stuartii* (Brown Antechinus) and Native Rats were of low to moderate abundances throughout the site, due to the relatively open nature of most understorey strata within vegetation communities across the site.

Arboreal Mammals

Open Forest communities contain abundant foraging resources such as foliage, pollen, nectar and invertebrates for Possums, Gliders and potentially, Koalas. The dominant tree species have potential to supply nectar for the majority of the year. However, most areas are characterised by trees of limited maturity, which limits the incidence of hollow-bearing trees across the site. Generally those areas where greatest opportunities for hollow-bearing trees occur within CPSBAW and ATMF. CFSGIF and LHSGIF exhibited a lower incidence of hollow-bearing trees, due to the

presence of tree species that are less likely to develop hollows before higher levels of maturity.

Cleared, open and disturbed areas with a low diversity and density of Eucalypt species hold limited habitat for arboreal species.

Bats

The wooded and adjacent open areas within the site provide extensive insectivorous foraging habitat for microchiropteran bat species. The mix of dominant tree species has the potential to provide a continuous supply of nectar throughout the year, thus attracting insect populations for a range of microchiropteran bats that occur within the locality. Although there is a relatively low incidence of hollow bearing trees within the site, it is likely that canopy trees would contain at least a sparse incidence of small hollows, which are utilised by some Microchiropteran bats. Furthermore, the site is continuous with habitat to the west and there are unbroken linkages to forests spilling off the Sugarloaf Range to the south, which would enable species occurring in the wider locality to utilise foraging habitat within the site without having to traverse vast areas of cleared land. Rocky outcrops and other cave like built form structures are present within the site. These may provide roosting and denning habitat for cave dwelling species.

Canopy trees within the site also offer blossom foraging opportunities for Grey-headed Flying-foxes. This species travels widely to access foraging resources and there are abundant blossom resources within the site for this species to utilise.

Frogs

Where remnant wetland habitats, dams and creeklines with ephemeral pools that would persist after significant rain occur within the site there are habitat opportunities for a variety of frog species. Adjacent wooded habitats are likely to provide foraging and shelter opportunities for a variety of tree-dwelling and terrestrial frog species. The site occurs on coastal foothills, which do not develop the permanent rocky creeklines that suit *Mixophyes* species, and the geology of the site is not consistent with the sandstone plateau habitats that occur in the Watagan Mountains that support a range of threatened frog species. *Litoria aurea* historically occurred around the edges of the Hexham floodplain, which occurs to the northeast of the site, but recent records occurring in the Lower Hunter Region are from areas exhibiting a saline influence in proximity to the lower reaches of the Hunter River. With these habitat constraints in mind it is unlikely that the site would provide significant habitat for more than common frog species.

Reptiles

Habitat within the site has moderate shelter and foraging opportunities for a diversity of common reptile species. The majority of understorey strata across the site contains only moderately diverse habitat, which is unlikely to provide abundant opportunities for habitat specific reptile species. Those areas of greatest habitat complexity occur on south facing slopes, within riparian corridors containing ATMF and vegetated edges of dams and watercourses.

Semi-permanent to permanent wetlands are likely to provide year-round habitat, whereas creeklines and drainage lines with ephemeral ponds within the site provide intermittent foraging opportunities for common snake and turtle species. Wooded areas are likely to represent habitat for common lizard and snake species.

Avifauna

The wooded areas provide suitable foraging resources (e.g. invertebrate habitat and blossom) and nesting and roosting opportunities for a variety of sedentary and breeding-migrant bird species. Hollow-bearing trees may provide nesting habitat for hollow dependant birds such as Forest Owls, Treecreepers, Parrots, Kingfishers and Woodswallows.

The site is represented by an undulating topography, encompassing ridges, which are colonised by dry forest communities, with intervening gullies that provide moist and sheltered conditions for wet sclerophyll plant communities. This diversity of forest habitat provides an extensive mosaic of habitat providing abundant habitat for a wide range of common forest avifauna. The site has areas containing *Allocasuarina* tree species, which are the favoured food source of *Calyptorhynchus lathami* (Glossy Black-Cockatoo), but there are only limited occurrences of hollow-bearing trees of sufficient size to provide this species with breeding opportunities within the Development Estate.

ATMF occurring within the site's gullies provide roosting habitat for Forest Owl species and the low to moderate incidence of hollow-bearing trees within the site suggest that the site is capable of supporting sufficient arboreal mammals to provide *Ninox strenua* (Powerful Owl) with foraging opportunities. Terrestrial mammal species are present within the site and may be present in sufficient numbers to provide hunting opportunities for *Tyto novaehollandiae* (Masked Owl). However, the site has only limited occurrences of hollow-bearing trees of sufficient size to provide these species with breeding opportunities, species abundant hunting opportunities within open forest and woodland areas.

4.4 Habitat Mapping

Habitat condition mapping (Figure 4-9) has been undertaken based on the results of field assessment coupled with the results of floristic investigations and RPS HSO Ecology staff combined observations and experience. To optimise the habitat mapping for display and analysis, habitat quality has been divided into the five categories outlined below, based on the habitat assessment elements discussed previously. The habitat assessment elements are; hollow bearing tree density, Eucalypt diversity, Allocasuarina species density, Proteaceae species density, structural diversity and fallen timber density.

Note: The habitat quality has been delineated with reference to but does not follow the delineated vegetation community boundaries.

High – Quality habitat with native flora showing no significant disturbance with old growth elements, intact understorey and year round foraging opportunities preferable to significant and threatened fauna species that includes forest owls, arboreal mammals, avifauna (includes EEC with no weed incursion and areas perceived to have regionally unique floristic representations or fauna habitat).

Above average – Quality habitat with native flora showing little to no disturbance with moderate level of key elements. These areas are likely to be utilised by native fauna species, including threatened species, as part of a larger home range (includes EEC with minor weed incursion).

Average quality – Habitat with dominant native community with low – moderate disturbance levels within elements, and includes areas of recent fire disturbance where understorey diversity is low with long term natural regeneration likely (also includes EEC with moderate weed incursion).

Below average – Habitat representing a native vegetation community with high weed incursion and other disturbances and low level of foraging opportunities (includes EEC with severe weed incursion and disused tracks with signs of native regeneration).

Low – Cleared land dominated by exotic flora species and representing preferred habitat for exotic fauna species (includes highly disturbed and frequently used tracks).

WARNING

No part of this plan should be used for critical design dimensions. Confirmation of critical positions should be obtained from Harper Somers O'Sullivan Pty Ltd.

Note that this Vegetation Community Map depicts clearly defined boundaries between vegetation communities that are the product of individual interpretation and are not distinguished by clearly defined boundaries 'on the ground'.

Therefore, this map should only be treated as an indication of approximate peripheries between delineated vegetation communities. Caution should therefore be exercised when using this data for purposes requiring high levels of accuracy. Furthermore, no account for intergrading areas between delineated vegetation communities has been made.

LEGEND

Development Estate Boundary

Habitat Category

- 1 - High
- 2 - Above Average
- 3 - Average
- 4 - Below Average
- 5 - Low

0 0.5 1km

TITLE: Figure 4-9 Habitat Condition Mapping

CLIENT: Coal & Allied Operations Pty Ltd

SCALE: 1: 13000 at A3 Size **DRAWN:** A. Richardson **APPROVED:** M. Doherty

DATUM: MGA Zone 56 (GDA 94) **DATE:** 18/11/2008

LAYOUT REF: J:\JOBS\24k\24530 Hunter Valley\PDF\Ecological\ Northern Lands\Link Road\Figures

CONTOUR INTERVAL: N/A

JOB REF: 24530-2

PLANNING SURVEYING ECOLOGY

HARPER SOMERS O'SULLIVAN

241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303

T: 02 4961 6500 F: 02 4961 6794 E: survey@hso.com.au W:www.hso.com.au ABN 11 093 343 858

5 DEVELOPMENT & CONSERVATION OUTCOMES

The Lower Hunter Region's vegetation is of bio-geographic significance as it supports a transition between the northern and southern plant and animal assemblages. This north-south link is not evident elsewhere in the Hunter Valley. The Region also forms an east-west migratory pathway and a drought refuge for inland species.

The preservation of large vegetated areas that are linked to other similar areas has been recognised as fundamentally important to achieving long term regional biodiversity outcomes in the Lower Hunter region. The two most valued of these areas in the Lower Hunter contain large land areas owned and controlled by C&A. Firstly, is the green corridor that links the Watagans and Yengo National Parks with the coastal plains of the Tomago Sandbeds, Stockton Bight and Port Stephens. Secondly, the Wallarah Peninsula lands provide a regionally significant break between urban areas, and contain areas of high biodiversity, scenic amenity and heritage value.

The C&A lands to be dedicated form both large vegetated areas in their own right, and complete linkage of identified regional corridors in key areas.

In addition to their important strategic location in a wider landscape context, the Conservation Estates contain valuable biodiversity resources. They contain and will conserve a range of important vegetation communities, including areas of Endangered Ecological Communities (EEC) and other vegetation types that have been depleted in the region. Several threatened plant species have been recorded within the Conservation Estates, including *Arthropteris palisotii, Tetratheca juncea* (Black-eyed Susan), *Grevillea parviflora* subsp. *parviflora*, *Eucalyptus nicholii, Rutidosis heterogama, Syzygium paniculatum* and *Callistemon linearifolius*. Two of the threatened flora species recorded in the Conservation Estates are considered to be planted specimens and not naturally occurring, being *Eucalyptus nicholii* and *Syzygium paniculatum*, although *S. paniculatum* may have been transported to its position in a disturbed area by natural means. In addition to these threatened species two rare (ROTAP) species *Callistemon shiressii* and *Eucalyptus fergusonii* subsp. *dorsiventralis* were also identified within the Conservation Estates. Refer to Table 5-1: Vegetation Removal / Retention for a complete breakdown of the vegetation retention and removal within both the Development Estates and the Conservation Estates.

The diverse nature of both the landform settings, varying from coastal ranges forests and woodlands to coastal heath to wetlands, provides a diverse array of habitats and resources for native fauna. The Conservation Estates are known to contain important populations of numerous threatened fauna species, including birds, mammals and herpetofauna. The conservation of these lands will provide secure regional biodiversity gene pools, and also through linkages facilitate valuable genetic material exchange and other key processes associated with sustainable ecological population dynamics. Refer to Table 5-2: Habitat Removal / Retention.

In summary, the C&A conservation dedications provide outcomes that contribute to meeting the Environmental Protection goals outlined in the Sustainability Criteria contained within the Lower Hunter Regional Strategy. Such includes:

- Outcomes consistent with the Draft Lower Hunter Regional Conservation Plan;
- Maintains / improves areas of regionally significant biodiversity;Maintains environmental areas for air & water quality; and
- Protects areas of Aboriginal cultural heritage value and historical heritage value.

These outcomes:

- Conserve in perpetuity key strategic parcels of land that complete long sought after regional biodiversity conservation corridors and buffer areas;
- Provide large intact areas of conserved habitat that will function as regional biodiversity gene pools;
- Protect an important array of vegetation communities, flora and fauna species, and natural landscape assets, including threatened species and EEC's;
- Contribute significantly to the successful implementation of the Lower Hunter Regional Conservation Plan; and
- Achieve additional conservation benefits within Development Estates via appropriate urban design and management practices.

The following Table 5-1 depicts the vegetation removal and retention associated with the proposal. The following headings have been utilised within the Vegetation Removal Tables.

'Vegetation Community' – Name of Vegetation Community which may be impacted upon by the proposal.

'TSC Act' – Provides the status of the species / community / population described with relation to the *TSC Act.*

'Potential KTP' – Lists the Key Threatening Processes (KTP), which are listed within the *TSC Act*, that have the potential to occur as a consequence of the proposal. Descriptions of potential KTP's and the likelihood of their occurrence within the proposal are presented in Section 6. These are as follows:

1. Loss of Hollow-bearing trees;
2. Clearing of native vegetation;
3. Human-caused climate change;
4. Infection of native plants by *Phytophthora cinnamomi;*
5. Invasion of native plant communities by exotic perennial grasses;
6. Removal of dead wood and dead trees;
7. Predation by the Feral Cat;
8. Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands;
9. Invasion of Native Plant Communities by Bitou and Boneseed;

10. Exotic Vines and Scramblers; and
11. Lantana camara.

'Area in Development Estate (Ha / %)' – Displays the area of vegetation that will be removed as part of the Development Estate.

'Area Conservation Estate (Ha / %)' – Displays the area of vegetation that will be conserved for each of the delineated vegetation communities.

'Total Area' – Represents the total area of each vegetation community within the both the Development Estate and the Conservation Estates, thus the sum of the preceding two columns.

'Comments' – Provides a brief discussion on the key characteristic of the vegetation where relevant.

Table 5-1: Vegetation Removal / Retention

Vegetation Community	1. TSC Act 2. EPBC Act 3. Other	Potential KTP	Vegetation Outcome (ha)			
			Area in Black Hill Development Estate	Area in Link Rd-Minmi Development Estate	Area in Conservation Estate	Total Area
Alluvial Tall Moist Forest		1-9	17.61 (8%)	30.58 (14%)	174.48 (78%)	222.67
Coastal Foothills Spotted Gum-Ironbark Forest		1-7, 9	0	170.21 (12%)	1,209.13 (88%)	1379.34
Coastal Plains Smooth-Barked Apple Woodland		1-7, 9	0	22.98 (8%)	260.15 (92%)	283.13
Dam		8	0	1.31 (72%)	0.52 (28%)	1.83
Freshwater Wetland Complex	**1. EEC - Freshwater Wetlands**	1-7, 9	0	0.37 (3%)	11.90 (97%)	12.27
Hunter Lowland Redgum Forest	**1. EEC - HLRF**	1-9	0	0.39 (2%)	19.84 (98%)	20.23
Hunter Valley Moist Forest		1-9	0	21.94 (14%)	139.42 (86%)	161.36
Lower Hunter Spotted Gum Ironbark Forest	**1. EEC - LHSGIF**	1-7, 9	132.92 (20%)	136.82 (20%)	408.16 (60%)	677.9
Sub-tropical Rainforest	**1.EEC - Lowland Rainforest**	1-9	0	0	21.52 (100%)	21.52
Swamp Mahogany – Paperbark Forest	**1. EEC - SSF**	1-9	0	0	0.23 (100%)	0.23
Swamp Oak Rushland Forest	**1. EEC - SOFF**	5, 7-9,	0	0	0.58 (100%)	0.58
Weeds And Cleared Areas		3-9	32.98 (8%)	141.68 (34%)	241.64 (58%)	416.3

Table 5-2: Habitat Removal / Retention

Habitat	Area in Minmi Link Road (ha)	Area in Black Hill (ha)	Area in Conservation Estates (ha)
1 – High	84	0	486
2 – Above Ave	230	147	1687
3 – Average	71	3	142
4 – Below Ave	13	33	2.8
5 – Low	130	0	190
TOTALS	**528**	**183**	**2507.8**

6 ENVIRONMENTAL IMPACT ASSESSMENT

6.1 Identification of Threatened Species, Populations & Ecological Communities

Those threatened flora and fauna species (listed under the *TSC Act* and the *EPBC Act*) that have been gazetted / recorded from within the vicinity of the site have been considered within this assessment. EEC's and Endangered Populations known from the broader area have also been addressed. Each species / community / population is considered for its potential to occur within the study area and the likely level of impact as a result of the overall proposal. This assessment deals with each species / community / population separately and identifies the ecological parameters of significance associated with the overall proposal.

Those species / communities that have been identified as having either a moderate level of impact (or greater) as a result of the proposed Development Estate or that have been recorded within the site during field investigations have been subject to further assessment within Section 6.2 herewith.

'Species' or **'EEC / Population'** – Lists each threatened species / EEC / population known from the vicinity of the site. The status of each threatened species under the *TSC Act* and *EPBC Act* is also provided.

'Habitat Description and Known Populations' or **'Habitat Description and Known Stands / Populations'** – Provides a brief account of the species / community / population and the preferred habitat attributes required for the existence / survival of each species / community / population.

'Chance of Occurrence within Site'– Assesses the likelihood of each species / community / population to occur within the site in terms of the aforementioned habitat description and taking into account local habitat preferences, results of recent field investigations, data gained from various sources and previously gained knowledge via fieldwork undertaken within other ecological assessments in the locality.

'Likely Level of Impact within Development Estate'– Assesses the likely level / significance of impacts to each species / community / population that would result from the proposed Development Estate, taking into account both short and long-term impacts. This assessment is largely based on the chance of occurrence of each species / community with due recognition to other parameters such as home range, habitat use, connectivity etc. It also considers the scope of the proposal, including the likely 'ecological footprint', duration of construction works, proposed remediation works etc. All impact assessment is undertaken with due consideration to the Conservation Estates forming part of the proposal.

Table 6-1: Threatened Species Assessment

Species	Habitat Description and Known Populations	Chance of Occurrence within Development Estate	Likely Level of Impact within Development Estate
Plants			
Acacia bynoeana Bynoe's Wattle (E, V*)	Small, prostrate shrub found in low heath and open woodland, generally on loamy clays and sand. Occurs from the Lower Hunter south to the Southern Highlands. Within the Hunter Sub-bioregion it has been found in several locations within the Cessnock LGA where it has been found growing in Kurri Sand Swamp Woodland (KSSW). Has also been recently recorded as isolated populations within Yellow Bloodwood Woodland and Blue-leaved Stringybark Woodland near Ellalong. Locally, it is known to occur with Coastal Plains Scribbly Gum Woodland.	**Low** The survey did not record this species within the proposed development area. Habitat within the Development Estate can be considered sub-optimal at best, as this species prefers woodland habitats. Thus it is unlikely that this species will occur due to the lack of suitable habitat.	**Low** Considered unlikely to be adversely affected by the proposal due to the lack of habitat within the development estate and thus unlikely to be effected by the proposal.
Arthropteris palisotii Lesser Creeping Fern (E)	Occurs in North-eastern NSW and also in Queensland. The Lesser Creeping Fern grows on trees. Its creeping stem is branched and wiry and covered with dark scales. Spores are borne on the underside of the leaflets in circular clumps. Occurs in rainforest, mainly on tree trunks.	**Low** The survey did not record this species within the proposed development area. The Development Estate lacks potential habitat (rainforest) suitable for this species.	**Low** It is considered that better habitat is present within the Subtropical Rainforest which will be conserved as part of the Conservation Estates at Stockrington to the south west of the Development Estate will be conserved within the current proposal. Thus it is considered unlikely that this species will be adversely affected by the proposal due to the lack of suitable habitat within the Development Estate.
Angophora inopina Charmhaven Apple (V, V*)	Small to medium tree found in shallow sandy soils in open woodland, swamp woodland and wet heath. The main occurrences of this species are in the Wyong and Lake Macquarie LGA's (from Charmhaven to Wyee and Morisset, and north to near Toronto), with disjunct populations also in Port Stephens LGA (south of Karuah).	**Low** The survey did not record this species within the proposed development area. The site lacks potential habitat of open woodland and swamp woodland which is suitable for this species.	**Low** No potential habitat is present within the site and thus this species is unlikely to be effected by the proposed development.
Callistemon linearifolius (V)	Shrub that grows in dry sclerophyll forest on the coast and adjacent ranges. Significant populations recently found within the Lower Hunter, including Werakata National Park. Re-sprouting/juvenile specimens difficult to distinguish from other *Callistemon* species such as *C. rigidus* or *C. linearis* without the aid of flowering parts. Locally this species has been recorded where dry forest habitats interface with salt tolerant vegetation communities, such as Swamp Oak Rushland Forest and Riparian Melaleuca forest.	**Moderate** The survey did not record this species within the proposed development area. However, a large area potential habitat is present within the development estate in the form of Lower Hunter Spotted Gum Ironbark Forest. A large population of at least 200 specimens were located within the Conservation Estates to the west of the Development Estate.	**Low** Considered unlikely to be adversely affected by the proposal due to the conservation of a large population of this species and large areas of potential habitat for this species within the Tank Paddock and proposed Conservation Estates. Furthermore, the species was not recorded within the Development Estate during targeted surveys.

Species	Habitat Description and Known Populations	Chance of Occurrence within Development Estate	Likely Level of Impact within Development Estate
Caladenia tessellata Tessellated Spider Orchid (E, V*)	A small terrestrial orchid, which regrows its single leaf on an annual basis. It is known to occur in grassy woodland and locally it has potential to occur within Coastal Plains Scribbly Gum Woodland. It has been recorded within Munmorah State Recreation Area to the south of the Development Estate.	**Moderate** Flora surveys were conducted within the flowering season for this species and it was not recorded within the Development Estate. However, habitat assessment suggests that there is potential for this species to occur in habitats with a heathy to grassy understorey of which those in the best condition occur within the Conservation Estates. Habitat does exist within the development estate within the grassy areas located in the southern portion of the Development Estate. Potential habitats for *Caladenia tessellata* include dry sclerophyll forests such as Lower Hunter Spotted Gum-Ironbark Forest, Coastal Plains Smooth-barked Apple Woodland, Coastal Foothills Spotted Gum-Ironbark Forest and Hunter Valley Moist Forest. However, some of the vegetation communities contain sub-optimal micro-habitat and other factors such as aspect and topography would also influence the suitability of habitat for this cryptic orchids. Due to the cryptic nature of this species, it is relatively difficult to locate in the field and as such its presence within the Development Estate cannot be discounted.	**Low - Moderate** No individuals of this species were recorded during the targeted surveys and although there is potential for this species within the development estate lands, large areas of potential habitat (over 2016ha) for this species will be conserved within the Conservation Estates as part of the current proposal.
Cryptostylis hunteriana Leafless Tongue Orchid (V, V*)	A cryptic Saprophytic orchid species that flowers between December and February. Distribution limits N-Gibraltar Range S- south of Eden. Grows in a variety of habitats from tall open forests to swamp heath on sandy soils	**Moderate** The survey did not record this species within the proposed development area, however surveys were undertaken outside the flowering period for this species. The preferred habitat for this species is Coastal Plains Scribbly Gum Woodland, however this species has been recorded within Coastal Plains Smooth Barked Apple Forest at Freemans Waterhole (Bell, 2004), which is present within the development estate. This species generally occurs with other species of the same genus such as *Cryptostylis subulata* and *Cryptostylis erecta.* Neither of these species were recorded within the Minmi Link Road Development Estate. Thus the habitat present within the Development Estate and Conservation Lands is considered to be sub-optimal.	**Low - Moderate** No individuals of this species were recorded during the targeted surveys, however surveys were undertaken outside the flowering period for this species and although there is potential for this species within the development estate lands, large areas of potential habitat (over 260ha) for this species will be conserved within the Conservation Estates as part of the current proposal.
Cynanchum elegans White-flowered Wax Plant (E, E*)	Occurs scattered along the NSW Northern Coast south to Wollongong usually in dry, littoral or subtropical rainforest and occasionally Melaleuca scrub or woodland. A climbing or twining plant species that flowers from August to May with peak flowering in November. One record within the Atlas of NSW Wildlife data occurs within the Lower Hunter Region and Central Coast at Green Point to the north of Belmont.	**Low** The survey did not record this species within the proposed development area. The site lacks potential habitat of rainforest for this species.	**Low** It is considered that no potential habitat is present within the Development Estate. Habitat in the form of Subtropical Rainforest will be conserved as part of the Conservation Estates at Stockrington to the south west of the site will be conserved within the current proposal. Thus it is considered unlikely that this species will be adversely affected by the proposal due to the lack of suitable habitat within the development estate.

Species	Habitat Description and Known Populations	Chance of Occurrence within Development Estate	Likely Level of Impact within Development Estate
Dendrobium melaleucaphilum Spider Orchid (E)	Epiphytic orchid growing mostly growing on *Melaleuca styphelioides*, but occasionally on rainforest trees or rocks. Extends from south of the Blue Mountains to Queensland. Preferred habitat is coastal swamp forests.	**Low – Moderate** Although the favoured host plant for this orchid, *Melaleuca styphelioides*, was recorded within the Development Estate during flora surveys, there are no known records for this orchid species in the Newcastle area and it was not recorded during flora surveys. The majority of the habitat of Alluvial Tall Moist Forest will be conserved within the Development Estate as part of the proposal. Nevertheless, due to the occurrence of potential habitat its presence within the Development Estate cannot be totally discounted.	**Low** Unlikely to be adversely affected by the current proposal as the majority of the habitat will be conserved both within the development estate and within the Conservation Estates and the species was not recorded within the site during surveys.
Diuris praecox Newcastle Doubletail (V, V*)	Found predominantly in coastal Eucalypt forests on hilltops or slopes. This species has been recorded at a number of dry forest locations to the southeast of Lake Macquarie.	**Moderate** There is opportunity for this species to occur within open forest habitats within the Development Estate. However, targeted searches within the flowering period of this species failed to locate any specimens within the development estate. Potential habitats for *Diuris praecox* include dry sclerophyll forests such as Lower Hunter Spotted Gum-Ironbark Forest, Coastal Plains Smooth-barked Apple Woodland, Coastal Foothills Spotted Gum-Ironbark Forest and Hunter Valley Moist Forest (approximately 351.9ha). Due to the cryptic nature of this species, it is relatively difficult to locate in the field and as such its presence within the Development Estate cannot be discounted.	**Low** No individuals of this species were recorded during the targeted surveys and although there is potential for this species within the development estate lands, large areas of potential habitat (over 2016ha) for this species will be conserved within the Conservation Estates as part of the current proposal.
Eucalyptus camfieldii Camfield's Stringybark (V, V*)	Tree or mallee to 10m high, but often less. Rare and localised, in coastal shrub heath on sandy soils on sandstone, often restricted drainage. Records from the Hunter Sub-bioregion are largely in near-coastal areas from the Port Stephens LGA to the Central Coast. An isolated stand of trees consistent with this species has been recorded near Kurri Kurri (K. Hill pers. comm.). A local record to the east of the site is reported in the Atlas of NSW Wildlife data.	**Low** The survey did not record this species within the proposed development area. The Development Estate lacks potential habitat (sandy soils and shrub heath) suitable for this species.	**Low** No potential habitat is present within the Development Estate and thus this species is unlikely to be effected by the proposed development.
Eucalyptus glaucina Slaty Red Gum (V, V*)	Red Gum species that grows in grassy woodland on deep, fertile and moist soils. Recorded within Hunter Lowland Redgum Forest and Central Hunter Ironbark Spotted Gum Grey Box Forest communities in the lower Central Hunter. Interbreeding known to occur between this species and *E. tereticornis*.	**Moderate** The survey did not record this species within the proposed Development Estates despite careful checking for *Eucalyptus glaucina*. However, potential habitat of Hunter Lowland Redgum Forest does occur within the northern portion of the Development Estate adjoining Minmi. This vegetation community is highly disturbed with high weed incursions.	**Low** No individuals of this species were recorded during the targeted surveys and although there is potential for this species within the development estate lands, large areas of potential habitat (over 19ha) for this species will be conserved within the Conservation Estates as part of the current proposal.

Species	Habitat Description and Known Populations	Chance of Occurrence within Development Estate	Likely Level of Impact within Development Estate
Eucalyptus parramattensis ssp. decadens Drooping Red Gum (V, V*)	Red Gum species that grows in dry sclerophyll woodland on sandy soils, often in low damp sites. Locally, this species occurs almost exclusively in association with Kurri Sand Swamp Woodland and Tomago Sand Swamp Woodland and ecotonal areas, but a small disjunct stand of stunted individuals have been recently recorded within coastal heath in the Lake Macquarie LGA (RPS HSO pers. obs.).	**Low** The survey did not record this species within the proposed development area. The Development Estate lacks potential habitat suitable for this species.	**Low** No potential habitat is present within the site and thus this species is unlikely to be effected by the proposed development
Grevillea parviflora subsp*. parviflora* Small Flowered Grevillea (V, V*)	Occurs in light, clayey soils in woodlands and open forests. Most plants appear capable of suckering from a rootstock. Relatively widespread within the Cessnock LGA where it has been recorded in LHSGIF. Occurs within Werakata National Park. Much confusion surrounds the taxonomy of this species and other similar *Grevillea* taxa (S. Bell *pers. comm.*), and a NPWS-funded study of the species is currently in progress.	**Moderate** The survey was unable to locate this species within the proposed Development Estate. The Development Estate has potentially suitable habitat for this species in the form of Lower Hunter Spotted Gum Ironbark Forest. However, a small population of this species was located within the Lower Hunter Spotted Gum - Ironbark vegetation community in the western portion of the Conservation Estates.	**Low** Considered unlikely to be adversely affected by the proposal due to the conservation of areas of potential habitat for this species within the Tank Paddock proposed Conservation Estates. Furthermore, the species was not recorded within the Development Estates during surveys.
Melaleuca biconvexa Biconvex Paperbark (V, V*)	A shrub to small tree, which grows in poorly drained areas from Jervis Bay to Port Macquarie. Records in the Hunter Region are confined to western Lake Macquarie (Atlas of NSW Wildlife data).	**Low - Moderate** The majority of records of this species occur to the west of Lake Macquarie and the Central Coast, with some scattered records also occurring at Wallsend and Cardiff. Whilst potential habitat exists in the Alluvial Tall Moist Forest vegetation community within the Development Estate, the species was not recorded during flora surveys.	**Low** Considered unlikely to be adversely affected by the proposal due to the conservation of areas of potential habitat for this species within the Tank Paddock proposed Conservation Estates.
Microtis angusii Angus's Onion Orchid (E, E*)	Record from the Terry Hill's district of Sydney. Occurs upon disturbed soil horizons that were originally ridgetop lateritic soils supporting a distinctive open to low open forest community, Duffy's Forest Vegetation Community, which is listed as an EEC. Suspected occurrences in the southern Lake Macquarie hinterland are derived from a tentative record by Bell (1998) in the Lake Macquarie State Recreation area, which occurs to the south of Gwandalan.	**Low - Moderate** The presence of records within the central coast area and the occurrence of habitat, as described from other locations where this species has been recorded, suggests that this species may have sub-optimal habitat within both the Conservation Estates and the development estate within the site.	**Low** Considered unlikely to be adversely affected by the current proposal due to suitable habitat existing within the Conservation Estates.
Rulingia prostrata Dwarf Kerrawang (E, E*)	A prostrate shrub forming mats greater than 1m in width and occurring within heath, dry sclerophyll and coastal sands around Tomago.	**Low** The survey did not record this species within the proposed development area. The site lacks potential habitat (coastal sands) suitable for this species.	**Low** No potential habitat is present within the site and thus this species is unlikely to be effected by the proposed development.

Species	Habitat Description and Known Populations	Chance of Occurrence within Development Estate	Likely Level of Impact within Development Estate
Rutidosis heterogama Heath Wrinklewort (V, V*)	Small Asteraceous herb occurring in the Hunter Region growing in disturbed areas and adjacent parcels of bushland within the Cessnock LGA. This species is also noted as occurring within coastal heathland habitats between Wyong and Evans Head on sandy substrates or moist areas within open forest.	**Moderate** The targeted survey did not detect this species within the proposed development estate. Potentially suitable habitat exists within the Lower Hunter Spotted Gum Ironbark forest community. However a moderate population of this species was located within the Lower Hunter Spotted Gum - Ironbark vegetation community in the western portion of the Conservation Estates.	**Low** No individuals of this species were recorded during the targeted surveys and although there is potential for this species within the development estate lands, large areas of potential habitat for this species will be conserved within the Conservation Estates as part of the current proposal.
Syzygium paniculatum Magenta Lilly Pilly (V, V*)	A shrub to small tree found in sub-tropical and littoral rainforest on sandy soils or sheltered gullies mostly near water courses. Distribution between Bulahdelah and Jervis Bay. Hunter Region records confined to the Lake Macquarie hinterland (Atlas of NSW Wildlife data).	**Low** The survey did not record this species within the proposed Development Estate. Whilst one specimen was recorded within ATMF within the Conservation Estates, the Development Estate contains sub-optimal potential habitat for this species.	**Low** It is considered that better habitat is present within the Subtropical Rainforest which will be conserved as part of the Conservation Estates at Stockrington to the south west of the Development Estate will be conserved within the current proposal. One specimen of this species was located at Stockrington within a disturbed area. Thus it is considered unlikely that this species will be adversely affected by the proposal due to the lack of suitable habitat within the Development Estate.
Tetratheca juncea Black-eyed Susan (V, V*)	Occurs in a variety of forested and heathy habitats. Locally found in Open Forests and Woodlands with dense, undisturbed understorey, often in association with *Angophora costata* / *Corymbia gummifera* on slopes with south-easterly aspects. A number of records exist from the local area including several records from the proposed Conservation Estates within the Tank Paddock Development Estate (Atlas of NSW Wildlife data).	**Moderate – High** Ten plant clumps of this species were recorded in Coastal Plains Smooth-barked Apple Woodland to the south of the Link Road within the Development Estate. However, larger populations of over 350 plant clumps have been recorded within the Conservation Estates to the west of the development estate.	**Low - Moderate** Although a small population of this species will be removed as part of the proposal a large proportion will be retained within the Conservation Estates. It is considered that the numbers estimated within the Conservation Estates to be a extreme underestimate of the population as no targeted searches have been conducted and approximately 185 ha of habitat exists within the Conservation Estates. The occurrence of *T. juncea* within the Minmi-Link Road Development Estates is not considered likely to form part of the same population as the Stockrington Conservation Estate, but is likely to function as a small sub-population. The Minmi-Link Road sub-population occurs between the known sub-population within Northlakes to the west and areas of potential habitat (Coastal Plains Smooth-barked Apple Woodland mapped by the Lower Hunter Central Coast Regional Environmental Management Strategy) with scattered records to the east. Due to the positioning of the Minmi-Link Road sub-population in the middle of two other sub-populations it is likely to form a 'stepping stone' for buzz pollinators and may be required to maintain further sub-populations to the east. The viability of sub-populations to the east is uncertain in the long-term due to existing vegetation fragmentation resulting from urban development. Thus this species is discussed in further detail in the Section 6.2 Assessment of Threatened Species.

Species	Habitat Description and Known Populations	Chance of Occurrence within Development Estate	Likely Level of Impact within Development Estate
Zannichellia palustris (E)	A submerged monoecious weakly rhizomatous aquatic annual or perennial plant. Within Australia it is known only from the Murray River estuary in South Australia and the Lower Hunter region in NSW. This species occurs in fresh to brackish, still to slow moving waters. *Z. palustris* has been collected from Ironbark Creek (Shortland), Black Creek (Cessnock), Kooragang Island and from near Belmont. None of the known sites of this species are formally protected and none are managed in any way for the conservation of the species. This species is ROTAP-coded 3R+, indicating that the species occurs overseas.	**Moderate** The survey did not record this species within the proposed development estate. However, potential habitat does occur within the Freshwater Wetland Complex within the northern portion of the Development Estate adjoining Minmi.	**Low** The Freshwater Wetland Complex located within the northern portion of the development estate will retained as part of the proposal and additional Freshwater Wetlands are located within Conservation Estates at Tank Paddock. It is considered unlikely that this species will be adversely affected by the proposal as no potential habitat will be removed.
Herpetofauna			
Litoria aurea Green and Golden Bell Frog (E, V*)	Inhabits swamps, lagoons, streams and ponds as well as dams, drains and storm water basins. Thought to be displaced from more established sites by other frog species, thus explaining its existence on disturbed sites. Previously widespread within the Sydney Basin Bio-region, but now sparsely distributed within the Lower Hunter and Central Coast areas.	**Low** The survey did not record this species within the proposed development estate. Although there is habitat occurring around dams and along lower watercourses within the site, this species only persists in the region within sites exhibiting a saline influence.	**Low** Considered unlikely to be adversely affected by the proposal due to the lack of suitable habitat within the site.
Litoria brevipalmata Green-thighed Tree Frog (V)	Occurs in isolated localities from the NSW Central coast to south-east Queensland. They occur in a range of habitats from rainforest and moist Eucalypt forest to dry eucalypt forest and heath. Breeding occurs following heavy rainfall events in late spring and summer, with frogs congregating around large, temporary pools where males generally only call for one or two nights. This species has been recorded from only one location in the Hunter River catchment, being along creekline habitat within the HEZ study area (Harper Somers O'Sullivan 2004a). Populations of this species are also known to exist regionally within the Watagan National Park (Ehmann, 1997) and Cooranbong (Atlas of NSW Wildlife data).	**Low – Moderate** Riparian and wetland habitats within the site are commensurate with potential habitat for this species, although the survey did not record this species within the proposed Development Estate. However, its presence within the site cannot be discounted since surveys may not have encompassed the most suitable time to detect the species.	**Low** Considered unlikely to be adversely affected by the proposal, due to more extensive areas of habitat retained as Conservation Estates with the proposal.
Varanus rosenbergi Heath Monitor (V)	Inhabits a range of habitats, including coastal heaths, woodland and sclerophyll forests. It shelters in self-made burrows or in hollow logs and rock crevices and is known to be semi-arboreal. Its range extends from southern Western Australia through South Australia. The Victorian and NSW populations are isolated from these western populations and from each other. Within NSW, populations are known from the Canberra region north to Wondabyne.	**Low** The survey did not record this species within the proposed development estate. Unlikely to occur due to its more southerly occurrence.	**Low** Considered unlikely to be adversely affected by the proposal due to the lack of suitable habitat within the site.
Avifauna			
Botaurus poiciloptilus Australian Bittern (V)	The Australasian Bittern is confined to Australia and New Zealand. Within Australia this species occurs in the southeast and southwest with the occasional vagrant in the northwest of Australia. It favours permanent fresh-waters dominated by sedges, rushes, reeds or cutting grasses (e.g. Phragmites, Scirpus, Eleocharis, Juncus, Typha, Baumea and Gahnia). Feeds on insects, small fish, eels, frogs and other aquatic life, sometimes in ricefields. It is partly nocturnal in habits, and, keeping as it does to the depths of reedy swamps, is seldom seen during the day. There is an anecdotal record for this species within the proposed Conservation Estates of Tank Paddock.	**Low** The survey did not record this species within the proposed development estate. Habitat within the proposed development estate lands considered unsuitable for this species due to the lack of permanent wetlands with emergent sedges and rushes.	**Low** The occurrence of this species within the site is unlikely; however, habitats within which this species might potentially occur will be retained within areas dedicated to Conservation Estates within the Tank Paddock site under the proposal.

Species	Habitat Description and Known Populations	Chance of Occurrence within Development Estate	Likely Level of Impact within Development Estate
Lophoictinia isura Square-tailed Kite (V)	Inhabits open forests and woodlands, particularly those on fertile soils with abundant passerines. They may also range in nearby open habitats but not into extensive treeless regions. This species is notably absent from alpine regions and small isolated remnant woodlands in large open areas. Records exist from the Cessnock and Maitland LGA's and there are records for this species from Cooranbong in the southwest of the Lake Macquarie LGA (Atlas of NSW Wildlife data; HBOC records). Records for this species within the Lower Hunter are generally limited to Autumn.	**Low – Moderate** Due to the generalist habitat requirements of this species, it could potentially occur within the site on a seasonal basis. Records in the Hunter Sub-bioregion are generally sparse and it would be difficult to locate during targeted surveys.	**Low** Given that those areas most suitable as hunting habitat for this species will be retained within proposed conservation areas it is unlikely that the proposal will represent a significant threat to this species.
Callocephalon fimbriatum Gang-gang Cockatoo (V)	Occurs in forests and woodlands where it forages on the seed capsules of Eucalypts. Sedentary, seasonally nomadic or part-migratory, this species shows a general trend to leave highland habitats in winter for more lowland districts. Requires large Eucalypt tree hollows for nesting. Records exist from the Watagan Mountains and adjacent lowlands and foot hills (Atlas of NSW Wildlife data).	**Low – Moderate** Most local records for this species occur from the Watagan Mountains and their adjacent lowlands, to the south-west of the site. However, due to seasonal movements of this species and the occurrence of potential *Eucalyptus* feed trees, there is the chance that this species may use habitat within the development estate on at least an intermittent basis.	**Low** Given that those areas most suitable as foraging habitat for this species will be retained within proposed conservation areas at Stockrington and Tank Paddock it is unlikely that the current proposal will represent a significant threat to this species.
Calyptorhynchus lathami Glossy Black-Cockatoo (V)	Occurs in forests and woodlands where it forages predominantly on *Allocasuarina* cones. Requires large Eucalypt tree hollows for nesting. Records within the Hunter Sub-bioregion predominantly from relatively undisturbed forested areas on the ranges such as the Watagan Forests, with isolated records from the valley floor remnants.	**Moderate** This species was not recorded within the site during fauna surveys; however, the known feed tree *Allocasuarina littoralis* occurs widely within the site. Therefore, this species may use habitat within the development estate on at least an intermittent basis.	**Low** The area of potential habitat that will be affected under the current proposal is small in comparison to the area of potential habitat being conserved within the proposed Conservation Estates within Stockrington and Tank Paddock lands. Therefore, it is unlikely that the current proposal will represent a significant threat to this species.
Melanodryas cucullata subsp. *cucullata* Hooded Robin (V)	Ranges from about Mundubbera, Qld, to the Spencer Gulf, SA, intergrading with other subspecies through the northern Murray-Darling Basin (Garnett *et al*, 2000). They occupy drier Eucalypt forest, woodland and scrub as well as grasses and low shrubs. The species is a quiet, shy and largely sedentary bird, most often observed in pairs or small groups. The size of territories throughout Australia has been estimated to be between 5 to 50 hectares. Established pairs keep to their territory year round, banding into family groups only briefly after breeding. (Schodde and Tidemann, 1986).	**Low** This species was not recorded within the site during fauna surveys. Although a record for this species occurs within the site (Atlas of NSW Wildlife data), habitat within the site is not considered suitable for this species and occurs outside its current distribution within the Hunter Valley. Therefore, chance of occurrence is considered low.	**Low** Considered unlikely to be adversely affected by the proposal due to the lack of suitable habitat within the site.
Stagonopleura guttata Diamond Firetail (V)	Small Finch occupying open woodlands / forests and associated habitats with grassy understorey. Generally found west of the Divide or in drier semi-coastal areas such as the upper Hunter Valley. Appears unable to persist in remnants less than 200ha. Local records for this species are rare, but it has been recorded in the Cessnock LGA during sustained dry periods.	**Low** This species was not recorded within the Development Estate during fauna surveys. Despite occurrences within the Lower Hunter Region (Atlas of NSW Wildlife data) this species occurs sparsely across the western to central Hunter, and as such it is unlikely to occur in the Lower Hunter on more than a rare occasion.	**Low** Considered unlikely to be adversely affected by the proposal due to the Development Estate occurring outside of its normal known range.

Species	Habitat Description and Known Populations	Chance of Occurrence within Development Estate	Likely Level of Impact within Development Estate
Pomatostomus temporalis temporalis Grey-crowned Babbler (V)	Ranges from SA to Cape York Peninsula, Qld, generally in areas receiving an average annual rainfall between 250 and 1000 mm. The Grey-crowned Babbler inhabits open Eucalypt woodlands with a grassy groundcover and sparse, tall shrub layer. Also be observed along streams in cleared areas and grassy road verges (Morcombe, 2000). Forages mainly on insects and spiders in leaf litter and soil, but also venturing into vegetation. Within the Lower Hunter Valley, this species is known from Werakata National Park (University of Newcastle 2001). It has been recorded in Wollemi, Goulburn River and Yengo National Parks (Atlas of NSW Wildlife 2005; authors pers. obs.).	**Low** This species was not recorded within the site during fauna surveys and there are no records for this species within the locality of the site. The site is dominated by eucalypt forests and lacks this species' preferred open woodland habitat. Therefore, the chance of occurrence is considered low.	**Low** The occurrence of this species within the site is unlikely; however, habitats within which this species might potentially occur will be retained within areas dedicated to Conservation Estates within the Tank Paddock site under the proposal.
Chthonicola sagittatus Speckled Warbler (V)	Occurs in South-Eastern Australia, from South-West Victoria through eastern New South Wales to Central Queensland, mostly on the western slopes and tablelands of the Great Dividing Range, and in the drier areas of coast. Lives in a wide range of Eucalypt dominated vegetation that has a grassy and shrubby understorey often on rocky ridges or gullies (Garnett *et al*, 2000). Within the Lower Hunter Valley, this species is known from Werakata National Park, the HEZ, Elderslie and North Rothbury (Harper Somers O'Sullivan 2004). Records also exist from Wollemi, Goulburn River, Dharug and Yengo National Parks (Atlas of NSW Wildlife 2005).	**Low** This species was not recorded within the site during fauna surveys. Habitat within the site is considered sub-optimal for this species and Lower Hunter records for this species do not occur further east than the Sugarloaf Range. Records occur at the western extremity of lands to be retained for conservation purposes at Stockrington (Atlas of NSW Wildlife data).	**Low** Considered unlikely to be adversely affected by the proposal due to the lack of records within the vicinity of the development estate. Habitat will retained within the proposed Conservation Estates at Stockrington.
Climacteris picumnus subsp. *victoriae* Brown Treecreeper (V)	Occurs through central NSW on the western side of the Great Dividing Range and sparsely scattered to the east of the Range in drier areas such as the Cumberland Plain of Western Sydney, and in parts of the Hunter, Clarence, Richmond and Snowy River valleys. Frequents drier forests and woodlands, particularly open woodland lacking a dense understorey, but also grasslands where there are sufficient logs, stumps and dead trees nearby. Within the Lower Hunter Valley, this species is known from Werakata National Park, Rothbury, the HEZ and Ellalong (Atlas of NSW Wildlife 2005).	**Low** This species was not recorded within the site during fauna survey. Although this species is known to occur within Lower Hunter Spotted Gum Ironbark Forest in the Cessnock LGA, birds east of the Sugarloaf population are rare. Nevertheless, records occur at the western extremity of lands to be retained for conservation purposes at Stockrington (Atlas of NSW Wildlife data).	**Low** Considered unlikely to be adversely affected by the proposal due to the lack of records within the vicinity of the development estate. Habitat will retained within the proposed Conservation Estates at Stockrington.
Melithreptus gularis gularis Black-chinned Honeyeater (V)	Occurs in eastern Australia, along the inland slopes of the Great Dividing Range, extending to the coast between Sydney and Newcastle, NSW, and north to Rockhampton, Qld. Occupies dry Eucalypt woodland within an annual rainfall range between 400-700 mm, particularly within associations containing Ironbark and Box species (Garnett *et al*, 2000). Within the Lower Hunter Valley, this species is known from Werakata National Park the HEZ and Ellalong lagoon (Harper Somers O'Sullivan 2004). Additionally, substantial and regular records of this species were noted from the Spotted Gum / Ironbark associations in the Cessnock / Kurri Kurri area during 2005 (HSO Ecologists pers. obs.).	**Low – Moderate** This species was not recorded within the site during fauna survey. Although this species is known to occur within Lower Hunter Spotted Gum Ironbark Forest in the Cessnock LGA, birds east of the Sugarloaf population are rare. Records occur at the south-western extremity of lands to be retained for conservation purposes at Stockrington (Atlas of NSW Wildlife data) and this species was recorded during associated fauna surveys to the west of Stockrington.	**Low** Considered unlikely to be adversely affected by the proposal due to the lack of records within the vicinity of the development estate. Habitat will retained within the proposed Conservation Estates at Stockrington.

Species	Habitat Description and Known Populations	Chance of Occurrence within Development Estate	Likely Level of Impact within Development Estate
Anthochaera phrygia Regent Honeyeater (E, E*)	Nomadic Honeyeater that disperses to non-breeding areas, including the coast, in winter, where flowering trees are sought. Within the Lake Macquarie LGA this species is generally associated with *Eucalyptus robusta* (Swamp Mahogany). Local occurrences are during winter months when this species flowers, although their stronghold is west of the great divide and it appears that movements to the coast only occur when foraging resources fail in the west and, to some extent, the Central to Lower Hunter Valley.	**Low** This species was not recorded within the site during fauna surveys, but a single record occurs near riparian vegetation at Holmesville 4km to the site's southwest. Most sitings within the Lower Hunter are from lowland riparian habitats containing winter-flowering canopy trees. These habitat attributes do not occur within the site, hence the chance of occurrence is considered low.	**Low** Considered unlikely to be adversely affected by the proposal due to the lack of suitable habitat within the site. Potential habitat for this species will retained within the proposed Conservation Estates at Stockrington.
Lathamus discolor Swift Parrot (E, E*)	On the mainland this species frequents Eucalypt forests and woodlands with large trees having high nectar production during winter. Mainland winter foraging sites often vary from year to year. Nests only in Tasmania. When recorded within the Lake Macquarie LGA this species is often associated with winter flowering eucalypt species such as *E. robusta* and *E. tereticornis* (Author pers. obs.), but they are known to forego nectar resources for lerps, which occur on a variety of eucalypt species. Locally this species has been recorded on Point Wollstonecraft and Nord's Wharf to the west (Atlas of NSW Wildlife data).	**Moderate** This species was not recorded within the site during fauna survey. Due to the occurrence of records within the wider locality of the site, its high mobility and the presence of a wide variety of canopy tree species representing a potential food source, the likelihood of this species using the site on an intermittent basis cannot be discounted.	**Low** Considered unlikely to be adversely affected by the proposal due to the conservation of considerably larger areas of potential foraging habitat within the Stockrington and Tank Paddock proposed Conservation Estates.
Neophema discolor Turquoise Parrot (V)	Turquoise Parrot is typically recorded west of the Great Divide on the tablelands and western slopes, extending to the coastal districts through the dry forest corridor of the Hunter Valley (Crome & Shields, 1992). The species occurs in eucalypts woodlands and open forests, with a ground cover of grasses and low understorey of shrubs (NPWS, 2002). This species forages primarily on the seeds of shrubs, grasses and herbs, both native and introduced, and the spore cases of mosses. Breeding pairs nest in small hollow branches of Eucalypts.	**Low** This species was not recorded within the site during fauna survey. Within the Hunter Region this species occurs sparsely across the western to central Hunter, and as such it is unlikely to occur east of the Sugarloaf Range.	**Low** Considered unlikely to be adversely affected by the proposal due to the development estate not occurring within its known range.
Ninox connivens Barking Owl (V)	Occurs in forests, woodlands, and savannah and riverine woodland although more open country is favoured for foraging and large hollow-bearing eucalypts for breeding. The Barking Owl is widespread within New South Wales, with records from coastal areas along with the slopes, plains, tablelands, and far western plains. Hollands (1991) regards the habitat of this species as open country with a choice of large trees for roosting and nesting. Prey species taken includes arrange of mammals and birds, as well as invertebrates (Readers Digest 1982). Usually occupies permanent territories, generally greater than 100 ha.	**Low** Not recorded during owl call back and nocturnal spotlighting surveys. A number of widely scattered records for this species occur within the Lower Hunter, both to the east and to the west of the site, and as such the chance of its occurrence on a rare occasion cannot be discounted. However, the possibility that the site is part of the home range of individuals or pairs is considered unlikely.	**Low** Considered unlikely to be adversely affected by the proposal due to the development estate occurring outside of its normal known range.
Ninox strenua Powerful Owl (V)	Occurs in sclerophyll forests and woodlands where suitable prey species occur (being predominantly arboreal mammals). Requires large hollows, usually in Eucalypt trees, for nesting. Roosts in dense vegetation within such areas. Records from the Hunter Sub-bioregion are fairly widespread (HBOC records; HSO ecologists pers. obs.).	**Moderate – High** Not recorded within the development estate during fauna surveys. However, habitat within the site is considered suitable, and records occur within the locality, including a roosting bird within the Tank Paddock Conservation Estate during associated fauna surveys. Hollows of sufficient size to represent potential breeding sites for this species were noted during habitat assessment within the Development Estate.	**Low** Although it is likely that a small amount of potential habitat for this species may be lost during the process of development. Extensive areas of high quality foraging and nesting habitat for this species will be retained as Conservation Estates at Stockrington and Tank Paddock under the current proposal.

Species	Habitat Description and Known Populations	Chance of Occurrence within Development Estate	Likely Level of Impact within Development Estate
Tyto novaehollandiae Masked Owl (V)	Found in a range of habitats, locally within sclerophyll forests and woodlands where appropriate / preferred prey species occur (being predominantly terrestrial mammals). Requires large Eucalypt hollows for nesting and prefers to roost in these hollows as well. Records from the Hunter Sub-bioregion are fairly widespread within the sub-coastal districts and often of road kill birds (HBOC records; HSO ecologists pers. obs.).	**Moderate** Not recorded during the survey, however, habitat within the site is considered potentially suitable, and there are anecdotal records of sightings within the proposed Conservation Estates of Tank Paddock (Green Corridor Coalition). Hollows of sufficient size to represent potential breeding sites for this species were noted during habitat assessment within the Development Estate.	**Low** Although it is likely that a small amount of potential habitat for this species may be lost during the process of development. Those areas containing the highest quality foraging habitat and nesting habitat for this species will be retained as Conservation Estates at Stockrington and Tank Paddock under the current proposal.
Tyto tenebricosa *Sooty* Owl (V)	Occurs in wet Eucalypt forest and rainforest with tall emergent trees, often in easterly facing gullies. Within these areas this species hunts for a range of mainly mammalian prey at all levels of the forest strata. Roosts in tree hollow or dense canopy vegetation. Also nests in large Eucalypt tree hollows. Most Hunter records exist from the Watagan mountains (Atlas of NSW Wildlife data), but this species has also been observed to the southwest of Awaba (HSO ecologist pers. obs.).	**Low** Despite the presence of mesic vegetation assemblages within the forested drainage lines of the site, these communities cannot be classified as wet sclerophyll and are not considered to be of sufficient extent or structural complexity to support this species.	**Low** The current proposal is unlikely to impact upon this species due to a lack of suitable habitat within the development estate, however other areas that are more suited to this species will be retained as Conservation Estates at Stockrington and Tank Paddock within the current proposal.
Ptilinopus magnificus Wompoo Fruit Dove (V)	Ranges from Cape York (Qld.) along the coast and ranges south to the Hunter River (NSW.), with the southern end of the range decreasing having once extended to Nowra. This Fruit-Dove is a frugivorous rainforest specialist inhabiting the canopy of sub-tropical, warm-temperate and depauperate rainforests. Occasionally it will stray to fruiting trees outside of rainforest areas. Breeding occurs between July and December and is linked to the fruiting cycles of favoured feed trees including figs, laurels, myrtles and native tamarind. This species prefers relatively undisturbed to completely undisturbed rainforest	**Low** This species was not recorded within the development estate during fauna survey. Habitat within the site is not considered suitable for this species due to the lack of rainforest habitats. Therefore, the chance of occurrence is considered low. Atlas of NSW Wildlife records occur within proposed Conservation Estates west of Stockrington.	**Low** Considered unlikely to be adversely affected by the proposal due to the lack of suitable habitat within the development estate.
Ptilinopus regina Rose-crowned Fruit Dove (V)	Ranges through Eastern Australia, from Cape York south to the vicinity of Port Stephens. Occasionally it extends into Victoria. The Rose-crowned Fruit Dove generally lives in rainforest, though it also frequents brushes of coastal districts as well as forests and mangroves. It usually feeds on figs or other fruit and berry-bearing trees.	**Low** This species was not recorded within the development estate during fauna survey. Habitat within the site is not considered suitable for this species (rainforest). Therefore, the chance of occurrence is considered low.	**Low** Considered unlikely to be adversely affected by the proposal due to the lack of suitable habitat within the development estate.
Ptilinopus superbus Superb Fruit Dove (V)	Occurs from north-eastern rainforest, forest and mangroves north of Cardwell, Qld; becoming uncommon nomads or non-breeding migrants further south to the Hunter River, with rare sightings recorded south to Tasmania. It is mainly a rainforest inhabitant but will feed in adjacent mangroves or Eucalypt forest, venturing into coastal brushes also at various times of the year. It usually feeds on figs or other fruit and berry-bearing trees.	**Low** This species was not recorded within the development estate during fauna survey. Habitat within the site is not considered suitable for this species (rainforests). Therefore, the chance of occurrence is considered low.	**Low** Considered unlikely to be adversely affected by the proposal due to the lack of suitable habitat within the development estate.

Species	Habitat Description and Known Populations	Chance of Occurrence within Development Estate	Likely Level of Impact within Development Estate
Mammals			
Dasyurus maculatus Spotted-tailed Quoll (V, V*)	Found sparsely across a relatively wide variety of habitats from coastal heathland to rainforest habitats. This species creates a den in fallen hollow logs or among rocky outcrops. Generally, it does not occur in otherwise suitable habitats that are in close proximity to urban development. Local records for this species only occur with a level of regularity within large tracts of undisturbed forest as occurs in ranges surrounding the region.	**Low** This species was not recorded within the site during fieldwork. Potential habitat for this species within the site is not considered as highly favourable, due to the lack of extensive areas of high quality habitat. This species is not tolerant of human disturbance and is known to occur within extensive tracts of undisturbed habitat, which do not occur within the site. Furthermore, the site has only distant connectivity to extensive areas of more suitable habitat to the west. Therefore, the chance of occurrence is considered low.	**Low** Considered unlikely to be adversely affected by the proposal due to the lack of habitat resources and proximity to human disturbances.
Phascogale tapoatafa Brush-tailed Phascogale (V)	Inhabits dry open forest and woodlands, often in areas with sparse groundcover. It is one of the most arboreal Dasyurids and mainly hunts invertebrates, although some vertebrate prey is taken on occasion. Utilises small tree hollows for nesting and refuge sites.	**Low** This species was not recorded within the site during fieldwork. Much of the habitat within the site is of limited maturity and as such is not considered highly ideal for this species due to limited nesting and refuge sites. Previous records of this species are limited to areas north of the Hunter river (Atlas of NSW Wildlife data). Therefore, the chance of occurrence is considered low.	**Low** Considered unlikely to be adversely affected by the proposal due to the lack of habitat resources and records of this species within the Development Estate and its locality.
Petaurus australis Yellow-bellied Glider (V)	Usually associated with tall, mature wet Eucalypt forest. Also known from tall dry open forest and mature woodland. The diverse diet of this species is primarily made up of Eucalypt nectar, sap, honey dew, manna and invertebrates found under decorticating bark and pollen. Tree hollows for nest sites are essential, as are suitable food trees in close proximity. Most records in the Lower Hunter Region occur in the Watagan Mountains and other areas exhibiting significant stands of forest (Atlas of NSW Wildlife data).	**Low – Moderate** Not recorded during the survey. Some habitat within the development estate is considered as containing potential foraging opportunities and potential breeding hollows were noted during habitat assessment. Atlas of NSW Wildlife records occur within proposed Conservation Estates west of Stockrington.	**Low** The current proposal is likely to remove some potential habitat for this species within the development estate, however, habitat areas highly suited to this species will be retained as Conservation Estates at Stockrington and Tank Paddock within the current proposal.
Petaurus norfolcensis Squirrel Glider (V)	Occurs in Eucalypt forests and woodlands where it feeds on sap exudates and blossoms. In these areas tree hollows are utilised for nesting sites. Also requires winter foraging resources when the availability of normal food resources may be limited, such as winter-flowering shrub and small tree species. Widely distributed across the lower Hunter Sub-bioregion, few records from the Upper Hunter (Atlas of NSW Wildlife data).	**High** Two individuals recorded during arboreal trapping surveys within Alluvial Tall Moist Forest in the southern section of the Link Road proposed development estate lands.	**Low – Moderate** Although the current proposal represents a small incremental loss of habitat for this species, larger areas containing abundant foraging and roosting habitat will be retained as Conservation Estates at Stockrington and Tank Paddock under the current proposal.

Species	Habitat Description and Known Populations	Chance of Occurrence within Development Estate	Likely Level of Impact within Development Estate
Phascolarctos cinereus Koala (V)	Occurs in forests and woodlands where it requires suitable feed trees (particularly *Eucalyptus* spp.) and habitat linkages. Will occasionally cross open areas, although it becomes more vulnerable to predator attack and road mortality during these excursions. Records from the Hunter Sub-bioregion are generally scarce, with a small number of records from Cessnock, Singleton and Muswellbrook LGA's. Within the Greater Hunter Region it is largely confined to the Port Stephens area, the Lake Macquarie hinterland and the Watagan Mountains (Atlas of NSW Wildlife data).	**High** This species was recorded within the proposed Development Estate ofLink Road Minmi during nocturnal fauna surveys.	**Low – Moderate** Whilst one male Koala was recorded within the site, further targeted Koala surveys including SAT plots and transects and spotlighting did not locate any further Koala activity such as scats or scratches within the Development Estates. Therefore, the site does not support a Koala population, and the lack of Koala activity recorded here indicates that this area is not core Koala habitat. The individual recorded within the site is considered to be transient and moving through, rather than a resident. The provision of corridors for fauna including Koalas will be maintained within the proposed Conservation Estates to the west and north at Stockrington and Tank Paddock respectively. Therefore, it is unlikely that the current proposal will represent a significant threat to local populations of this species.
Pteropus poliocephalus Grey-headed Flying-fox (V, V*)	Forages over a large area for nectar / fruits etc. Seasonally roosts in communal base camps situated within wet sclerophyll forests or rainforest. Frequently observed to forage in flowering Eucalypts. May occur anywhere within the Hunter Sub-bioregion where food or roosting resources are available.	**High** Recorded within the proposed development estate site at Link Road. There are no roosting camps for this species in the vicinity of the Development Estate. Extensive foraging habitats and potential roosting camp sites occur within the proposed Stockrington Conservation Estates.	**Low** Although the current proposal represents a small incremental loss of habitat for this species, larger areas containing abundant foraging and roosting habitat will be retained as Conservation Estates at Stockrington and Tank Paddock under the current proposal.
Miniopterus schreibersii subsp. *oceanensis* Eastern Bentwing-Bat (V)	This species utilises a range of habitats for foraging, including rainforest, wet and dry sclerophyll forests, woodlands and open grasslands. Requires caves or similar structures for roosting habitat. Widely distributed across the Hunter Sub-bioregion, particularly in sub-coastal districts (Atlas of NSW Wildlife data). A number of records for this species occur within the vicinity of the site.	**Moderate – High** Not recorded within the development estate during fauna surveys; however, there are records occurring within and in its immediate vicinity (Atlas of NSW Wildlife). Due to the high mobility of this species and the presence of potential foraging habitat within the development estate, it is likely that this species occurs within the site on at least an intermittent basis. No known potential roosting sites exist within the site. Recorded within proposed Conservation Estates at Stockrington, which also contains potential roosting habitat.	**Low** Although the current proposal represents a small incremental loss of foraging habitat for this species, larger areas containing abundant foraging habitat will be retained as Conservation Estates at Stockrington and Tank Paddock with potential roosting habitat occurring with Stockrington under the current proposal.
Miniopterus australis Little Bentwing-bat (V)	Prefers to forage in well-vegetated areas, such as within wet and dry sclerophyll forests and rainforests. Requires caves or similar structures for roosting habitat. Largely confined to more coastal areas in the Hunter region. A number of records for this species occur within the local area (Atlas of NSW Wildlife data).	**High** This species was recorded within the proposed development estate during fauna surveys and it is likely that this species may use the site on at least and intermittent basis. No known potential roosting sites exist within the site. Recorded within proposed Conservation Estates at Stockrington, which also contains potential roosting habitat.	**Low** Although the current proposal represents a small incremental loss of habitat for this species, larger areas containing abundant foraging and roosting habitat will be retained as Conservation Estates at Stockrington and Tank Paddock under the current proposal.

Species	Habitat Description and Known Populations	Chance of Occurrence within Development Estate	Likely Level of Impact within Development Estate
Mormopterus norfolkensis Eastern Freetail-bat (V)	This species forages predominantly in dry forests and woodlands east of the divide. It roosts in tree hollows, under bark and within man-made structures. Found within a scattered distribution across the Lower Hunter Region. Locally it occurs within the Lake Macquarie hinterland (Atlas of NSW Wildlife data).	**High** This species was recorded within the proposed Development Estate near Minmi and there are records occurring within its immediate vicinity (Atlas of NSW Wildlife). Due to the high mobility of this species the presence of potential foraging habitat within the development estate, it is likely that this species occurs within the site on at least an intermittent basis. Hollow-bearing trees within the Development and Conservation Estates represent potential roosting habitats for the species.	**Low** Although the current proposal represents a small incremental loss of habitat for this species, larger areas containing abundant foraging and roosting habitat will be retained as Conservation Estates at Stockrington and Tank Paddock under the current proposal.
Saccolaimus flaviventris Yellow-bellied Sheathtail-bat (V)	Occurs in a range of habitats from rainforest to arid shrubland, roosts in tree-hollows. Near coastal records occur to the south in the Wyong and Gosford LGAs (Atlas of NSW Wildlife data).	**Moderate** Not recorded within the proposed development estate, however, there are records occurring within its locality (Atlas of NSW Wildlife). Due to the high mobility of this species and the presence of potential foraging habitat within the development estate, it is likely that this species occurs within the site on at least an intermittent basis. Hollow-bearing trees within the Development and Conservation Estates represent potential roosting habitats for the species.	**Low** Although the current proposal represents a small incremental loss of habitat for this species, larger areas containing abundant foraging and roosting habitat will be retained as Conservation Estates at Stockrington and Tank Paddock under the current proposal.
Falsistrellus tasmaniensis Eastern False Pipistrelle (V)	This species is found in a variety of forest types such as open forests, woodlands and wetter sclerophyll forests (usually with trees >20m). This species roosts in tree hollows. Few records occur within the Hunter Sub-bioregion.	**Moderate** Not recorded within the proposed development estate, however, there are records occurring within its wider locality (Atlas of NSW Wildlife). Due to the high mobility of this species and the presence of potential foraging and roosting habitat within the Development Estate, it is likely that this species occurs within the site on at least an intermittent basis.	**Low** Although the current proposal represents a small incremental loss of habitat for this species, larger areas containing abundant foraging and roosting habitat will be retained as Conservation Estates at Stockrington and Tank Paddock under the current proposal.
Chalinolobus dwyeri Large-eared Pied Bat (V)	This species forages in tall open forests, including dry forests and the edges of rainforest. It roosts in mine shafts and similar structures. Hunter Region records for this species are largely confined to the Watagan Mountains (Atlas of NSW Wildlife data).	**Moderate** Not recorded within the proposed development estate, however, there are records occurring within its locality (Atlas of NSW Wildlife). Due to the high mobility of this species and the presence of potential foraging habitat within the development estate, it is likely that this species occurs within the site on at least an intermittent basis. No known potential roosting sites exist within the site.	**Low** Although the current proposal represents a small incremental loss of habitat for this species, larger areas containing abundant foraging and roosting habitat will be retained as Conservation Estates at Stockrington and Tank Paddock under the current proposal.

Species	Habitat Description and Known Populations	Chance of Occurrence within Development Estate	Likely Level of Impact within Development Estate
Myotis adversus Large-footed Myotis (V)	Usually found near bodies of water, including estuaries, lakes, reservoirs, rivers and large streams, often in close proximity to their roost site. Roosts in colonies of between a dozen and several hundred individuals in caves, mines and disused railway tunnels (Atlas of NSW Wildlife data).	**Moderate** Not recorded within the proposed development estate, however, there are records occurring within its wider locality (Atlas of NSW Wildlife). Due to the high mobility of this species and the presence of potential foraging habitat along riparian areas within the development estate, it is likely that this species occurs within the site on at least an intermittent basis. No known potential roosting sites exist within the site.	**Low** The proposed development estate will result in a loss of potential foraging habitat. However no known potential roosting habitat will be lost, and larger areas of potential foraging habitat will be retained as Conservation Estates under the current proposal.
Scoteanax rueppellii Greater Broad-nosed Bat (V)	Forages in moister gullies and wet sclerophyll forests as well as in lightly wooded areas and open spaces / ecotones. This species roosts in tree hollows and is relatively widespread within the Lower Hunter Region (Atlas of NSW Wildlife data).	**Moderate** Not recorded within the proposed development estate, however, there are records occurring within its wider locality (Atlas of NSW Wildlife). Due to the high mobility of this species and the presence of potential foraging and roosting habitat within the development estate, it is likely that this species occurs within the site on at least an intermittent basis.	**Low** Although the current proposal represents a small incremental loss of habitat for this species, larger areas containing abundant foraging and roosting habitat will be retained as Conservation Estates at Stockrington and Tank Paddock under the current proposal.
Vespadelus troughtoni Eastern Cave Bat (V)	A cave dweller, known from wet sclerophyll forest and tropical woodlands from the coast and Dividing Range to the drier forests of the semi-arid zone. It has been found roosting in small groups in sandstone overhangs, in mine tunnels and occasionally in buildings. In all situations, the roost sites are frequently in reasonably well-lit areas. The distribution of this species is largely to the north of the Hunter (Strahan 1995), with one record at Windermere Park in south-western Lake Macquarie (Atlas of NSW Wildlife data).	**Moderate** Not recorded within the proposed development estate, however, there are records occurring within its locality (Atlas of NSW Wildlife). Due to the high mobility of this species and the presence of potential foraging habitat within the development estate, it is likely that this species occurs within the site on at least an intermittent basis. No known potential roosting sites exist within the site.	**Low** The proposed development estate will result in an incremental loss of potential foraging habitat. However no known potential roosting habitat will be lost, and larger areas of potential foraging and roosting habitat will be retained as Conservation Estates under the current proposal.
Endangered Ecological Communities			
Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bio-regions	Associated with periodic or semi-permanent inundation by freshwater, although there may be minor saline influence in some wetlands. They typically occur on silts, muds or humic loams in depressions, flats, drainage lines, backswamps, lagoons and lakes associated with coastal floodplains. Wetlands or parts of wetlands that lack standing water most of the time are usually dominated by dense grassland or sedgeland vegetation, often forming a turf less than 0.5 metre tall and dominated by amphibious plants including *Paspalum distichum*, *Leersia hexandra* and *Carex appressa*. Wetlands or parts of wetlands subject to regular inundation and drying may include large emergent sedges over 1 metre tall, such as *Baumea articulata, Eleocharis equisetina* and *Lepironia articulata*. Correlates with LHCCREMS Map Unit (MU) 46 – 'Freshwater Wetland Complex'.	**High** The geomorphological characteristics and the species composition of this vegetation community were found to occur within a small wetland present in the northern portion of the development estate.	**Low - Moderate** This community will be retained as part of the development proposal. Furthermore, this vegetation community also occurs within Tank Paddock and will be retained as Conservation Estates within the current proposal. However, indirect threats to the long-term retention of this community may potentially exist without appropriate sediment and water control measures that have been recommended to be incorporated into the planning and construction phases of the development. Thus, it is unlikely that the proposal will have a significant effect upon this EEC.

Species	Habitat Description and Known Populations	Chance of Occurrence within Development Estate	Likely Level of Impact within Development Estate
Hunter Lowland Redgum Forest in the Sydney Basin and NSW Coast Bioregions	Fund on gentle slopes arising from depressions and drainage flats on Permian sediments of the Hunter Valley floor in the Sydney Basin and NSW North Coast Bioregions. Recorded from the local government areas of Maitland, Cessnock and Port Stephens (in the Sydney Basin Bioregion) and Muswellbrook and Singleton (in the NSW North Coast Bioregion) but may occur elsewhere in these bioregions. Common canopy tree species are *Eucalyptus tereticornis* (Forest Red Gum) and *E. punctata* (Grey Gum). Other frequently occurring canopy species are *Angophora costata*, *Corymbia maculata*, *E. crebra* and *E. moluccana*. The mid-storey is open and characterised by sparse shrubs such as *Breynia oblongifolia*, *Leucopogon juniperinus*, *Daviesia ulicifolia* and *Jacksonia scoparia*. The ground cover typically comprises grasses and herbs. Correlates with LCCREMS Map Unit (MU) 19 'Hunter Lowland Redgum Forest'.	**High** The geomorphological characteristics and the species composition of this vegetation community were found to occur to the north of the Alluival Tall Moist Forest in the northern portion of the Development estate.	**Low – Moderate** This community will be removed for the construction of Sporting Fields as part of the development proposal. This vegetation community occurs within Tank Paddock and Stockrington Conservation Estates and will be retained within the current proposal. The area of this community which occurs within the development estate is degraded due to past clearing and agricultural practices and has little native diversity. Thus due to the retention of 19 ha of this good quality example of this EEC within the proposed conservation estates, the removal of a small degraded (0.38ha) within the proposed development represents a small incremental loss.
Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion.	This community is dominated by *Corymbia maculata* (Spotted Gum) and *Eucalyptus fibrosa* (Broad-leaved Ironbark) with occasional occurrences of *E. punctata* (Grey Gum) and *E. crebra* (Grey Ironbark). Several distinctions have been noted within the LHCCREMS community profiles between this community and other Spotted Gum / Ironbark associations, often characterised by the dominant canopy composition, range, soil type and topography (NPWS 2000). Within the Lower Hunter, the peak of distribution occurs within the forested areas between Beresfield and Cessnock. On the basis of revised vegetation mapping conducted in 2002, a total of 32,366ha of LHSGIF has been mapped within the LHCCREMS study area boundary. Correlates with LCCREMS Map Unit (MU) 17.	**High** The geomorphological characteristics and the species composition of this vegetation community were found to occur over most of the Development Estate.	**Low - Moderate** Whilst this community comprises the greater proportion of this Development Estate, due the widespread occurrence of this community on a regional basis, and the retention of large areas of this EEC within the proposed Conservation Estates, the proposed development represents a small incremental loss.
Lowland Rainforest of the NSW North Coast and Sydney Bioregion	Lowland Rainforest, in a relatively undisturbed state, has a closed canopy, characterised by a high diversity of trees whose leaves may be mesophyllous and encompass a wide variety of shapes and sizes. Typically, the trees form three major strata: Emergents, canopy and sub-canopy which, combined with variations in crown shapes and sizes results in an irregular canopy appearance. The trees are taxonomically diverse at the genus and family levels, and some may have buttressed roots. A range of plant growth forms are present in Lowland Rainforest, including palms, vines and vascular epiphytes. In disturbed stands of this community the canopy cover may be broken, or the canopy may be smothered by exotic vines. The Hawkesbury River notionally marks the southern limit of Lowland Rainforest in the NSW North Coast and Sydney Basin bioregions.	**Low** This community was not found to occur within the Development Estate.	**Low** This vegetation community occurs within the Conservation Estates to the west of the Development Estate and will be retained as Conservation Estates within the current proposal. Thus, it is unlikely that the proposal will have a significant effect upon this EEC.
Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bio-regions	This community is associated with periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains, typically occurring on grey-black clay-loams and sandy loams. Usually occurring below 20 m altitude.	**Low** This community was not found to occur within the Development Estate.	**Low** This vegetation community occurs within Tank Paddock and will be retained as Conservation Estates within the current proposal. Thus, it is unlikely that the proposal will have a significant effect upon this EEC.

Species	Habitat Description and Known Populations	Chance of Occurrence within Development Estate	Likely Level of Impact within Development Estate
Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bio-regions	The community is associated with humic clay or sandy loams on waterlogged or episodically flooded alluvial flats and drainage lines within coastal floodplains. It is generally characterised by an open to dense canopy of Eucalypts and / or Paperbarks. Canopy heights generally vary from 8m to 25m depending on species composition. In the Hunter Region the canopy often contains *Eucalyptus robusta* and / or *Melaleuca quinquinervia* although other species, such as *Casuarina glauca*, *Eucalyptus resinifera* subsp. *hemilampra* and *Livistona australis* may be present.	**Low** This community was not found to occur within the site.	**Low** This vegetation community occurs within Tank Paddock and will be retained as Conservation Estates within the current proposal. Thus, it is unlikely that the proposal will have a significant effect upon this EEC.

Notes: (V) = Vulnerable Species listed under the *Threatened Species Conservation Act 1995*.
(E) = Endangered Species listed under the *Threatened Species Conservation Act 1995*.
(V*) = Vulnerable Species listed under the *Commonwealth EPBC Act 1999*.
(E*) = Endangered Species listed under the *Commonwealth EPBC Act 1999*.
(M*) = Migratory Species listed under the *Commonwealth EPBC Act 1999*

6.2 Assessment of Threatened Species, Populations & Ecological Communities

As per the assessment carried out within Table 6-1, the following species / communities have been deemed appropriate to be applied further detailed assessment due to projected potential levels of impacts likely to result from the proposal.

Flora

- *Caladenia tessallata*
- *Callistemon linearifolius*
- *Cryptostylis hunteriana*
- *Diuris praecox*
- *Grevillea parviflora* subsp. *parviflora*
- *Eucalyptus glaucina*
- *Rutidosis heterogama*
- *Tetratheca juncea* Black-eyed Susan
- *Zannichellia palustris*

Endangered Ecological Communities

- Freshwater Wetlands on Coastal Floodplains in the NSW North Coast, Sydney Basin and South East corner Bioregions;
- Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions; and
- Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregions.

Fauna

- *Calyptorhynchus lathami* Glossy Black-Cockatoo
- *Xanthomyza phrygia* Regent Honeyeater
- *Lathamus discolor* Swift Parrot
- *Ninox strenua* Powerful Owl
- *Tyto novaehollandiae* Masked Owl
- *Petaurus norfolcensis* Squirrel Glider
- *Phascolarctos cinereus* Koala
- *Pteropus poliocephalus* Grey-headed Flying-fox
- *Miniopterus schreibersii* Eastern Bentwing-bat
- *Miniopterus australis* Little Bentwing-bat
- *Mormopterus norfolkensis* Eastern Freetail-bat
- *Saccolaimus flaviventris* Yellow-bellied Sheathtail-bat
- *Falsistrellus tasmaniensis* Eastern False Pipistrelle
- *Chalinolobus dwyeri* Large-eared Pied Bat

- *Myotis adversus* Large-footed Myotis
- *Scoteanax rueppellii* Greater Broad-nosed Bat
- *Vespadelus troughtoni* Eastern Cave Bat

6.2.1 Threatened Flora

It should be recognised (as alluded to below) that potential habitat for unrecorded species does exist within the site, including in areas that were not intensively surveyed during these investigations. The following species are considered to have potential habitat within the Minmi - Link Road site, with the exception of *Tetratheca juncea* which was recorded within the Development Estate.

Caladenia tessellata

Caladenia tessellata was not recorded, despite targeted surveys within the Development Estates. However, the cryptic nature of this orchid, combined with sporadic flowering makes it difficult to detect. Suitable habitat for this species exists within the Development Estates and as such it has been addressed here even though it was not recorded.

As a precautionary approach, areas of vegetation communities that have been known to support this cryptic orchid have been included in calculations of potential habitat within the Development Estates. Potential habitats for *Caladenia tessellata* include dry sclerophyll forests such as Lower Hunter Spotted Gum-Ironbark Forest, Coastal Plains Smooth-barked Apple Woodland, Coastal Foothills Spotted Gum-Ironbark Forest and Hunter Valley Moist Forest (approximately 351.9ha). However, some of the vegetation communities contain sub-optimal micro-habitat and other factors such as aspect and topography would also influence the suitability of habitat for this cryptic orchid. As such, the potential habitat calculations given above are likely to be an overestimate.

Considering the cryptic nature of this species, it is not known whether any *C. tessellata* individuals would be removed as a result of the proposal. An incremental loss of 351.9ha of potential *C. tessellata* habitat in the locality would occur. Moreover, the proposal will result in the conservation 'in perpetuity' of 2016.9ha of potential habitat for this species.

Given that over 2016ha of habitat for this species will be reserved within the Conservation Estate, it is considered highly unlikely that removal of habitat within the conservation estate will significantly impact upon this species.

Callistemon linearifolius

Targeted searches for this species within the Minmi-Link Road Development Estate did not locate any individuals of this species. However, suitable habitat for the species exists within the Lower Hunter Spotted Gum Ironbark Forest.

An incremental loss of approximately 136.8ha of suitable habitat in the locality would occur as a result of the proposal. However, this species was not recorded during the survey period and approximately 408.2ha of suitable habitat will be protected within the Stockrington and Tank Paddock Conservation Estates. A population of this

species was located within northern portion of the Stockrington Conservation Estates and will be protected in perpetuity.

Given that over 408.2ha of habitat for this species will be reserved within the Conservation Estate, it is considered highly unlikely that removal of habitat within the conservation estate will significantly impact upon this species.

Cryptostylis hunteriana

The proposal would remove approximately 23.0ha of Coastal Plains Smooth-barked Apple Woodland habitat within the Development Estate. Whilst this species has previously been located within this community at Freeman's Waterhole (Bell, 2004) this species habitat is generally woodland habitats and it occurs with other species of the same genus such as *Cryptostylis subulata* and *Cryptostylis erecta.* Neither of these species were recorded within the Minmi Link Road Development Estate. Thus the habitat present within the Development Estate and Conservation Estates is considered to be sub-optimal. Targeted surveys have been undertaken for this species within the Minmi Link Road development estates during the flowering period of this species.

Considering the cryptic nature of this species, it is not known whether any *C. hunteriana* individuals would be removed as a result of the proposal. An incremental loss of 23.0ha of potential *C. hunteriana* habitat in the locality would occur. Moreover the proposal will result in the conservation 'in perpetuity' of 260.1ha of potential habitat for this species.

Given that over 260.1ha of habitat for this species will be reserved within the Conservation Estate, is considered highly unlikely that removal of habitat within the conservation estate will significantly impact upon this species.

Diuris praecox

Diuris praecox was not recorded, despite targeted surveys within the Development Estates. However, the cryptic nature of this orchid, combined with sporadic flowering makes it difficult to detect. Suitable habitat for this species exists within the Development Estates and as such it has been addressed here even though it was not recorded.

As a precautionary approach, areas of vegetation communities that have been known to support this cryptic orchid have been included in calculations of potential habitat within the Link Road Minmi Development Estate. Potential habitats for *Diuris praecox* include dry sclerophyll forests such as Lower Hunter Spotted Gum-Ironbark Forest, Coastal Plains Smooth-barked Apple Woodland, Coastal Foothills Spotted Gum-Ironbark Forest and Hunter Valley Moist Forest (approximately 351ha). However, some of the vegetation communities contain sub-optimal micro-habitat and other factors such as aspect and topography would also influence the suitability of habitat for this cryptic orchid. As such, the potential habitat calculations given above are likely to be an overestimate.

A number of records of this species occur to the east of the Northern Estates, along the coast between Merewether and Tingira Heights. The species was not recorded within the Development Estates despite targeted surveys.

Notably, approximately 2016.9ha of potential habitat will be protected within the Stockrington and Tank Paddock Conservation Estates. However, approximately 351ha of potential habitat will be removed as part of the proposal within the Minmi-Link Road Development Estates, representing an incremental local loss of habitat in the locality.

Given that over 2016ha of habitat for this species will be reserved within the Conservation Estate, it is considered highly unlikely that removal of habitat within the conservation estate will significantly impact upon this species.

Grevillea parviflora* subsp. *parviflora

This species was not recorded during surveys within the Development Estate. However, potential habitat for this species occurs throughout the Lower Hunter Spotted Gum-Ironbark Forest, Coastal Plains Smooth-barked Apple Woodland, Coastal Foothills Spotted Gum-Ironbark, Forest and Hunter Lowland Redgum Forest vegetation communities (Approximately 330.1ha) within the Develoment Estates. A population of this species was located within the Coastal Plains Smooth-barked Apple vegetation community in the western portion of the Stockrington Conservation Estates.

Given that over 1897.3ha of habitat for this species will be reserved within the Conservation Estate, it is considered highly unlikely that removal of habitat within the conservation estate will significantly impact upon this species.

Eucalyptus glaucina

An incremental loss of approximately 0.4ha of suitable habitat in the locality would occur as a result of the proposal. However, this species was not recorded during the survey period and approximately 19.8ha of suitable habitat will be protected within the Stockrington and Tank Paddock Conservation Estates.

Since the species was not recorded within the Development Estates during surveys it is considered unlikely to be impacted as a result of the proposal. The proposal would represent an incremental loss of only 0.4ha of potential *Eucalyptus glaucina* habitat in the locality. Therefore, the proposal is not considered likely to have a significant impact on the species.

Rutidosis heterogama

Targeted searches for this species within the Minmi-Link Road Development Estate did not locate any individuals of this species. However, suitable habitat for the species exists within the Lower Hunter Spotted Gum Ironbark Forest.

An incremental loss of approximately 136.8ha of suitable habitat in the locality would occur as a result of the proposal. However, this species was not recorded during the survey period and approximately 408.2ha of suitable habitat will be protected within the Stockrington and Tank Paddock Conservation Estates. In addition a large population of this species was located within the western portion of the Stockrington conservation estates and will be conserved in perpitituy.

Given that over 408.2ha of habitat for this species will be reserved within the Conservation Estate, it is considered highly unlikely that removal of habitat within the conservation estate will significantly impact upon this species.

Zannichellia palustris

This species was not detected within the habitat of Freshwater Wetland Complex located in the northern portion of the Development Estate. The Freshwater Wetland Complex located within the northern portion of the development estate will retained as part of the proposal and additional Freshwater Wetlands are located within Conservation Estates at Tank Paddock.

Whilst the habitat for this species will be retained as part of the proposal indirect impacts of the proposal may occur from stormwater runoff. Thus if nutrient and sediment control measures are put in place to mitigate runoff, prior to and during the construction phase, then this will ensure that any adverse impacts from the development will be avoided and thus a significant impact will not result.

Given that habitat for this species will be retained as part of the proposal and over 11.9ha of habitat for this species will be reserved within the Tank Paddock Conservation Estate, it is considered highly unlikely that removal of habitat within the conservation estate will significantly impact upon this species.

Tetratheca juncea

A total of 10 *Tetratheca juncea* plant clumps were located during the targeted surveys in August 2007 within the Minmi-Link Road Development Estates (Figure 5 shows the distribution). At least 352 plant clumps have been identified within the Conservation Estates. Furthermore, it is estimated that 256 ha of habitat within the Conservation Estates remains to be surveyed. Thus, it is considered that the population within the Conservation Estates will be significantly larger in size than the population within the Development Estate.

The occurrence of *T. juncea* within the Minmi - Link Road Development Estates is not considered likely to form part of the same population as the Stockrington Conservation Estate, but is likely to function as a small sub-population. The Minmi-Link Road sub-population occurs between the known sub-population within Northlakes to the west and areas of potential habitat (Coastal Plains Smooth-barked Apple Woodland mapped by the Lower Hunter Central Coast Regional Environmental Management Strategy) with scattered records to the east. Due to the positioning of the Minmi-Link Road sub-population in the middle of two other sub-populations it is likely to form a 'stepping stone' for buzz pollinators and may be required to maintain further sub-populations to the east. The viability of sub-populations to the east is uncertain in the long-term due to existing vegetation fragmentation resulting from urban development.

It is unknown if the small population within Minmi Link Road Development Estate will be a stepping stone for gene flow, further targeted searches are required to ascertain the distribution of the population to the east of the Development Estate. Therefore the removal of the population may have a significant impact upon this species in the locality of Cameron Park. However, a large population of this species to be retained within the Stockrington Conservation Estate will ensure the survival of the species within the region.

6.2.2 Endangered Ecological Communities

Three of the EEC's listed in Section 5 are present within the Development Estates, being Lower Hunter Spotted Gum Ironbark Forest, Hunter Lowland Redgum Forest and Freshwater Wetlands. The impacts upon extant EEC's within the Development Estate are discussed below.

Lower Hunter Spotted Gum – Ironbark Forest

This vegetation community encompasses the majority of the Development Estate. It was noted that within this community there seemed to be a particularly young cohort of canopy trees. This could indicate forest regrowth resulting from previous disturbance. This young cohort of *Eucalyptus* sp. was found in the area adjoining Blue Gum Reserve in the north east and to the south of the Link Road. Thus, the habitat which is available for flora and fauna within this area of young cohort is considered to be of lower quality than the habitat found within the Conservation Estates. The differences in disturbance regime between the Development and Conservation Estates may be a result of more difficult access into the Conservation Estates. The Conservation Estates are largely composed of mature forests which have a high diversity of flora, this is evidenced by the large number of habitats and the number of different threatened flora and fauna found within these lands.

Approximately 134 ha (20%) of extent may be removed as part of the Link Road Minmi Development Estate and approximately 132 ha (20%) as part of the Black Hill Development Estate. However, 408 ha (60%) will be conserved within the Conservation Estates to the west of the Development Estate. Of the area to be removed it is expected that further portions of this vegetation community will be retained within the development layout, due to other constraints on development such as topography. Given that over 400 ha of this EEC will be reserved within the Conservation Estate, it is considered highly unlikely that removal of such a small area of this EEC will significantly compromise the viability of the local stand. The LHCCREMS mapping project has mapped over 31,000 ha of this vegetation community within the LHCCREMS study area. Thus, the removal of 0.4% of this community within the Lower Hunter Valley as a consequence of the proposal is unlikely to have a significant impact upon this EEC on a regional basis, particularly as the proposal will result in the retention of large significant areas (1-3% of the community) of this EEC and other native vegetation communities within Conservation Estates.

Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions

This vegetation community encompasses 0.38 ha and occurs along a creekline which is a tributary to Minmi Creek and flows into Hexham Swamp in the north of the development estate. This example of HLRF is highly disturbed with weed incursions as it adjoins urban development to the west with cleared agricultural land present to the east of the community. The HLRF will be removed for sporting fields as part of the proposal. . LHCCREMS mapping project has mapped over 7,000 ha of this vegetation community within the LHCCREMS study area. Thus, the removal of 0.005% of this community within the Lower Hunter Valley as a consequence of the proposal is unlikely to have a significant impact upon this EEC on a regional basis, particularly as the proposal will result in the retention of over 19ha of this EEC and other native vegetation communities within Conservation Estates. Therefore, it is unlikely that the development proposal will have a significant impact upon this EEC.

Freshwater Wetlands on Coastal Floodplains in the NSW North Coast, Sydney Basin and South East corner Bioregions

This vegetation community encompasses 0.4 ha and occurs in the northern portion of the development estate adjoining Minmi. This wetland has been subjected to grazing for a number of years and has high weed incursions of pasture grasses and Blackberry along the edges of the community. The water flowing through this wetland enters the floodplain below and continues into Hexham Swamp. Water from Hexham Swamp then flows into Ironbark Creek and subsequently into the Hunter River. This extends through to the internationally significant Hunter Estuary Wetland (Ramsar Wetland 24).

The Freshwater Wetland complex will be retained as part of the proposal, however, urban development may occur to the south east of this community as a result of the proposal. If nutrient and sediment control measures are put in place to mitigate runoff prior to and during the construction phase, then this will ensure that any adverse impacts from the development will be avoided and thus a significant impact will not result.

In addition to this 11.90 ha of this vegetation community will be retained within the Conservation Estates.

6.2.3 Threatened Fauna

Glossy Black-Cockatoo

Potential foraging habitat for this species, in the form of *Allocasuarina* sp., occurs within Coastal Plains Smooth-barked Apple Woodland to the south of the Link Road. This species has been recorded on a number of occasions in the past from the Sugarloaf Range to the west of the Development Estate (HBOC). Other records within the region occur within the Hunter Valley's adjacent ranges with records from the valley floor relatively sparse. Habitat within the site is considered of marginal quality for this species due to the protracted occurrence of its favoured food items and the low incidence of large hollow-bearing trees (outside of gullies), which this species requires for breeding purposes. Greater areas of more suitable habitat occur within proposed Conservation Estates at Stockrington, where *Allocasuarina* sp. trees occur as a mid-storey component of Coastal Foothills Spotted Gum Ironbark Forest. It is considered that the current proposal will ensure that locally occurring individuals or family groups of Glossy Black Cockatoos will benefit due to increases in conserved habitat. Therefore, it is unlikely that the current proposal will threaten the viability of the local population of this species.

Swift Parrot

This species does not occur in the Lower Hunter Region on a continuous basis, as it only moves from Tasmania into south-eastern Australia during the winter months and migrates back to Tasmania in the summer, where the population breeds. Regional records for this species occur at western Lake Macquarie, Raymond Terrace, Maitland and widely within the Cessnock LGA. Regional habitat preferences for this species are for Swamp Sclerophyll Forests containing *E. robusta* (Swamp Mahogany), Spotted Gum – Ironbark dominated vegetation communities, *E. tereticornis* (Forest Red Gum) occurrences across the Lower Hunter Region and *E. tereticornis* on the lower drainage flats and lower lakeside slopes adjacent to Lake Macquarie and Port Stephens.

No Swift Parrots were observed within either the Conservation or Development Estates during the 2008 surveys. The widespread occurrence of *Corymbia maculata* (Spotted Gum) across large areas of both proposed Development and Conservation Estates suggests that these lands have the potential to attract Swift Parrots during those seasons when Spotted Gum is an important winter flowering species within the central to lower Hunter Valley. Investigation of forests containing Spotted Gum during 2008 surveys found that there were only occasional Spotted Gums flowering, which were attracting small widespread parties of Noisy Friarbirds.

Although no Swift Parrots were observed within the C&A lands during the 2008 survey these results are not considered to be a representative indication of the capacity of these lands to support the Swift Parrot or Regent Honeyeater. Overall the Conservation Estates exhibit greater habitat opportunities for these species, due to the greater extent of widespread habitat, predominantly Spotted Gum-Ironbark assemblages, ATMF, and the inclusion of riparian Forest Red Gum communities, which are likely to represent focal habitat points for these species during seasons when they occur within the locality. The absence of both of these species from the site during the winter of 2008 is consistent with the paucity of coastal and Lower Hunter records for both of these species during the 2008 season. There have been few Swift Parrot records within the region compared with previous years and no Regent Honeyeaters during the 2008 winter period. Evaluation of potential habitats within Conservation Estates suggests that there is a good probability that both of these species would use the site during favourable years within the region. However, the same assumptions are not considered to apply to the Development Estates, due to the smaller amounts of suitable habitat, lack of Forest Red Gum habitats and the somewhat isolated and to some extent fragmented nature of these lands in comparison with the extent of the Conservation Estates and their continuity to large significant forest areas in the regional context. On this basis it is concluded the prpopsoal will benefit this species by securing local habitat in the proposed conservation eastes and thus a deleterious impact on the long term viability of this transent population as a direct result of this proposal is unlikely. Nevertheless it is recommended that preferred forage tree species for *Lathamus discolor* (Swift Parrot) be included within landscaping plant schedules.

Powerful Owl

This species was not recorded within potential habitats occurring within the development estate and adjacent lands, despite the occurrence of records to the immediate south of the site (Atlas of NSW Wildlife data) and fauna surveys. This species was observed to the north of the Development Estate within the Tank Paddock Conservation Estate during associated fauna surveys. Forest habitats within the site provide suitable habitat for arboreal mammal populations, which are an important component of the suite of prey species targeted by *Ninox strenua* (Powerful Owls). Furthermore, the gullies within the Development Estate contain trees of sufficient maturity to provide hollows suitable for the breeding requirements of this species. Due to the presence of potential foraging and breeding habitat within the site it is considered that the proposed Development Estate is likely to incrementally reduce habitat for this species in the locality. However, a greater abundance of more suitable *Ninox strenua* (Powerful Owl) habitat at Stockrington and Tank Paddock are to be retained as Conservation Estates under the proposal. Therefore, it is considered that the current proposal will benefit this species by securing local habitat.

Masked Owl

Although this species was not recorded within the site during nocturnal fauna surveys, there is a single Atlas of NSW Wildlife record for this species within the north-eastern section of the Development Estate. Other records (Atlas of NSW Wildlife data) occur within lands to be retained as Conservation Estates at Stockrington (three records) and Tank Paddock (one record). Although some potentially occupied habitat for this species will be lost within the Development Estate, much greater areas of potentially occupied habitat will be retained as Conservation Estates at Stockrington and Tank Paddock. Therefore, it is considered that the current proposal will benefit this species by securing local habitat.

Squirrel Glider

This species was recorded along a drainage line in Alluvial Tall Moist Forest within the southeast extremity of the Development Estate during nocturnal spotlighting fauna surveys and was captured to the south of the Link Road. At least one male and one female were recorded (a total of two female captures and two male captures). Other records from the locality occur to the northeast, the south and within Stockrington Conservation Estate. Suitable foraging habitat for this species occurs throughout the Development Estate, although, most of the open forest habitats occurring upon the site's ridge tops contain low incidences of hollow-bearing trees, which limits their potential to support this species. While any loss of habitat must be regarded as an incremental loss of habitat for this species within the locality, much greater areas of suitable habitat for this species is to be retained as Conservation Estates at Stockrington and Tank Paddock under the current proposal. Therefore, it is considered that the current proposal will benefit this species by securing local habitat.

Koala

A single Koala was recorded within Lower Hunter Spotted Gum Ironbark Forest to the north of the Link Road within the Development Estate. This record is considered to be unusual within the known distribution of the species within the region. Apart from those records occurring to the north of the Hunter River, the nearest records for this species occur more than 10 km away at Buchanan and Freeman's Waterholes, with sparse records occurring with the Watagan Mountains and western Lake Macquarie (Atlas of NSW Wildlife data). Detailed Koala searches targeting feed tree species within potential habitat were conducted across the Development Estate to determine the status of Koalas on the site. No further sign of Koalas including individual animals, scats or tree bark scratches were observed during these targeted surveys. Results from these targeted surveys, when assessed together with regional occurrences, suggest that the individual observed within the Development Estate is not likely to be indicative that an extant population occurs within the vicinity of the site, but is likely an unattached individual moving between sub-populations. Despite the loss of potential habitat for this species within the Development Estate, much greater areas of habitat suited to this species are to be retained as Conservation Estates at Stockrington and Tank Paddock under the current proposal including the conservation of the important Watagan to Stockton corridor. Therefore, it is considered that the current proposal will benefit this species by securing local habitat.

Grey-headed Flying Fox

This species was recorded within the Development Estate lands in Lower Hunter Spotted Gum Ironbark Forest, although there is no indication that there are roosting camps for this bat in the vicinity of the site. Potential foraging habitat for this species occurs widely across the Development Estate and bushland areas within the wider locality, which is not surprising in light of the mobility of this species. A large established population of this species is known form Blackbutt Reserve in Newcastle, as such a high probability exists that the individuals observed were members of this population. Although an incremental loss of potential foraging habitat for this species will occur within the Development Estate, much greater areas of suitable foraging habitat will be retained as Conservation Estates under the current proposal, including potential roosting habitat opportunities within Stockrington lands. Therefore it is considered that the current proposal will benefit this species by securing local habitat.

Eastern Bentwing-Bat

This species was not recorded within the Development Estate during fauna surveys. However, it has been previously recorded within the site, the immediate vicinity and the wider locality, including lands to be retained for conservation purposes at Stockrington. Being a species that utilises a diverse range of open forest and woodland habitats for foraging, it is likely that the Development Estate lands may be regularly used as part of its local foraging range. No potential cave roosting sites for this species exist within the Development Estate, although caves occur locally on the Sugarloaf Range and railway tunnels occur within lands to be retained as Conservation Estates at Stockrington. It is also possible that locally culverts under the Link Road offer cave roosting habitat to this species; however, these were not part of the Development Estate. Although it is likely that an incremental loss of foraging habitat for this bat will be removed as a result of the proposal, large areas of suitable foraging habitat will be retained as Conservation Estate at Stockrington and Tank Paddock under the current proposal. Furthermore, potential roosting habitat will be retained within the Conservation Estate. Therefore, it is considered that the current proposal will benefit this species by securing local habitat.

Little Bentwing-Bat

This species was recorded within the Development Estate during fauna surveys and other records occur within the vicinity and wider locality of the site, including lands to be retained for conservation purposes at Stockrington. Being a species that utilises a diverse range of open forest and woodland habitats for foraging, it is likely that the Development Estate lands may be regularly used as part of its local foraging range. No potential roosting sites for this species exist within the Development Estate, although caves occur locally on the Sugarloaf Range and railway tunnels occur within lands to be retained as Conservation Estates at Stockrington. It is also possible that locally culverts under the Link Road offer cave roosting habitat to this species; however, these are not part of the Development Estate. Although it is likely that an incremental loss of foraging habitat for this bat will be removed during the as a result of the proposal, large areas of suitable foraging and roosting habitat will be retained as Conservation Estate at Stockrington and Tank Paddock under the current proposal. It is therefore, unlikely that the current proposal will represent a significant threat to this species.

East Coast Freetail-Bat

This species was recorded within the Development Estate during fauna surveys and it has been previously recorded within the site, it's immediate vicinity and the wider locality. Being a species that utilises a diverse range of open forest and woodland habitats for foraging and roosting purposes, it is likely that the Development Estate lands may be used as part of its local foraging range and may be used for roosting purposes. Although it is likely that an incremental loss of foraging and roosting habitat for this bat will occur as a result of the proposal, large areas of suitable foraging and roosting habitat will be retained as Conservation Estate at Stockrington and Tank Paddock under the current proposal. Therefore, it is considered that the current proposal will benefit this species by securing local habitat.

Yellow-bellied Sheathtail-Bat

This species was not recorded within the Development Estate during fauna surveys although it has been previously recorded within the wider locality of the site. Records from the wider locality are scarce, but onsite habitats represent continuous open forest and woodland habitat, which provide both foraging and roosting opportunities for this species. As such the Development Estate lands may be used on at least an intermittent basis as part of its local foraging range and may be used for roosting purposes. Although it is likely that an incremental loss of foraging and roosting habitat for this bat will occur as a result of the proposal, large areas of suitable foraging and roosting habitat will be retained as Conservation Estate at Stockrington and Tank Paddock under the current proposal. Therefore, it is considered that the current proposal will benefit this species by securing local habitat.

Large-eared Pied Bat

This species was not recorded within the Development Estate during fauna surveys although it has been previously recorded within the immediate vicinity of the site and its wider locality. Being a species that utilises a diverse range of open forest and woodland habitats for foraging, it is likely that the Development Estate lands may be used on at least an intermittent basis as part of its local foraging range. No potential roosting habitat cave overhangs is known within the site, but potential cave roosting sites occur within the Sugarloaf Range to the southwest. Although it is likely that an incremental loss of foraging habitat for this bat will occur as a result of the proposal, large areas of suitable foraging and roosting habitat will be retained as Conservation Estate at Stockrington and Tank Paddock under the current proposal. Therefore, it is considered that the current proposal will benefit this species by securing local habitat.

Eastern False Pipistrelle

This species was not recorded within the Development Estate during fauna surveys although it has been previously recorded within the wider locality of the site. Records from the wider locality are scarce, but onsite habitats represent continuous open forest and woodland habitat, which provide both foraging and roosting opportunities for this species. As such the Development Estate may be used on at least an intermittent basis as part of its local foraging range and may be used for roosting purposes. Although it is likely that an incremental loss of foraging and roosting habitat for this bat will occur as a result of the proposal, large areas of suitable foraging and roosting habitat will be retained as Conservation Estate at Stockrington and Tank Paddock under the current proposal. Therefore, it is considered that the current proposal will benefit this species by securing local habitat.

Large-footed Myotis

This bat was not recorded within the Development Estate, but records occur within the wider locality of the site and there are foraging opportunities within dams occurring within disturbed areas of the site. No potential roosting sites for this species exist within the Development Estate, although caves occur locally on the Sugarloaf Range and railway tunnels occur within lands to be retained as Conservation Estates at Stockrington. It is also possible that locally culverts under the Link Road offer cave roosting habitat to this species; however, these are not part of the Development Estate. Although potential foraging habitat such as dams within the Development Estate may be modified as a result of the proposal, large areas containing both foraging and roosting opportunities will be retained as Conservation Estate at Stockrington under the current proposal. Therefore, it is considered that the current proposal will benefit this species by securing local habitat.

Eastern Cave Bat

This species was not recorded within the Development Estate during fauna surveys although it has been previously recorded within the wider locality of the site. Being a species that utilises open forest and woodland habitats for foraging, it is likely that the Development Estate may be used on at least an intermittent basis as part of its local foraging range. No potential roosting sites for this species exist within the Development Estate, although caves occur locally on the Sugarloaf Range and railway tunnels occur within lands to be retained as Conservation Estates at Stockrington. It is also possible that locally culverts under the Link Road offer cave roosting habitat to this species; however, these are not part of the Development Estate. Although it is likely that an incremental loss of foraging habitat for this bat will occur as a result of the proposal, large areas of suitable foraging habitat will be retained as Conservation Estate at Stockrington and Tank Paddock under the current proposal. Therefore, it is considered that the current proposal will benefit this species by securing local habitat.

6.2.4 Additional Threatened Fauna Species

The list of threatened species generated from the 10 km search included a number of species that are considered to have a low chance of occurrence within the Development Estate based on the lack of suitable habitat within the Development Estate. The requirements of these species include specific coastal, wetlands or inland habitats. For this reason, the following species were omitted from the Assessment of Significance Table 6-1.

Anseranas semipalmata	Magpie Goose
Stictonetta naevosa	Freckled Duck
Charadrius leschenaultia	Greater Sand-plover
Calidris tenuirostris	Great Knot
Chelodina mydas	Green Turtle
Charadrius mongolus	Lesser Sand-plover
Pterodroma leucoptera	Gould's Petrel
Pterodroma solandri	Providence Petrel
Sterna albifrons	Little Tern

Haematopus longirostris	Pied Oystercatcher
Irediparra gallinaceae	Comb-crested Jacana
Pandion cristatus	Osprey
Hamirostra melanosternon	Black-breasted Buzzard
Ephippiorhynchus asiaticus	Black-necked Stork
Ixobrychus flavicollis	Black Bittern
Limicola falcinellus	Broad-billed Sandpiper
Limosa limosa	Black-tailed Godwit
Oxyura australis	Blue-billed Duck
Rostratula australis	Australian Painted Snipe
Xenus cinerius	Terek Sandpiper

6.3 Key Threatening Process (KTP)

A Key Threatening Process (KTP) is defined in the *TSC Act (1995)* as a process that threatens, or could threaten, the survival or evolutionary development of species, populations or ecological communities. Something can be a threat if it:

- adversely affects two or more threatened species, populations or ecological communities; or
- could cause species, populations or ecological communities that are not currently threatened to become threatened.

KTPs are listed in Schedule 3 of the *TSC Act 1995*. Those potentially applicable to the proposal are as follows:

- Loss of Hollow-bearing trees;
- Clearing of native vegetation;
- Human-caused climate change;
- Infection of native plants by *Phytophthora cinnamomi;*
- Invasion of native plant communities by exotic perennial grasses;
- Removal of dead wood and dead trees;
- Predation by the Feral Cat;
- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands; and
- *Lantana camara*.

Loss of Hollow-bearing trees

The proposed development will require the removal of some hollow-bearing trees and as such is considered as contributing to the KTP "Removal of Hollow-bearing Trees". It is expected that low to moderate numbers of hollow-bearing trees will be removed, depending on the vegetation community. This is due to the general low age cohort of trees which were found to be present throughout the Development

Estate. LHSGIF has the lowest incidence of hollow-bearing trees, due to the relatively low age cohort of most trees throughout this community. CPSBAW contains a low to moderate incidence of hollow-bearing trees, due to the presence of tree species such as *Angophora costata*, which has a greater potential for developing hollows that other tree species. ATMF contains some large mature trees, which have the potential for carrying a range of different sized hollows. Those guilds of threatened fauna that may potentially be affected by this KTP are threatened Microchiropteran bats, forest owls and arboreal mammals including gliders.

Although hollow-dwelling Microchiropteran bats may use hollows on the site for shelter, the securing of large areas of potential roosting habitat within lands to be retained as Conservation Estates at Stockrington and Tank Paddock will ensure that significant areas of local habitat for these species will be protected.

Petaurus norfolcensis (Squirrel Glider) was recorded within the southern portion of the Development Estate and may be adversely affected by the removal of hollow-bearing trees, due to their use of this habitat resource for nesting purposes. However, large areas of suitable habitat for this species including areas with numerous hollow-bearing trees will be secured within lands to be retained as Conservation Estates at Stockrington and Tank Paddock.

There are low numbers of large hollow-bearing trees within the Development Estate that are suitable for the breeding purposes of forest owl species. The removal of these resources could adversely affect *Ninox strenua* (Powerful Owl) and *Tyto novaehollandiae* (Masked Owl) that might potentially use the site for breeding purposes. However, large areas of suitable breeding habitat for these species will be secured within lands to be retained as Conservation Estates at Stockrington and Tank Paddock.

It is considered that although the proposal is likely to represent a loss of locally occurring hollow-bearing trees, these losses are more than adequately compensated for by a greater abundance of similar and greater quality habitat that will be secured as Conservation Estates at Stockrington and Tank Paddock.

Clearing of Native Vegetation

The proposed development will require the removal of native vegetation and as such is considered to contribute to the KTP "Clearing of Native Vegetation". Vegetation that will be removed for the Development Estate will include the following native vegetation communities, LHCCREMS MU 17 Lower Hunter Spotted Gum Ironbark Forest, MU 15 Coastal Foothills Spotted Gum Ironbark Forest, MU 30 Coastal Plains Smooth-barked Apple Woodland, MU 5 Alluvial Tall Moist Forest. Approximately 292 ha of LHSGIF EEC occurs within the Development Estate and will be removed as part of the proposal. However, approximately 408 ha of LHSGIF will be secured outside the Development Estate as part of Conservation Estates within the proposal.

A number of threatened fauna guilds potentially use the Development Estate for foraging, including, insectivorous Microchiropteran bats, nectivorous species such as flying-foxes, birds and arboreal mammals and forest owls. As such, removal of native vegetation within the Development Estate has the potential to impact upon local populations of dependant species. Those threatened species, which may be affected by the proposal include, *Petaurus norfolcensis* (Squirrel Glider), *Pteropus poliocephalus* (Grey-headed Flying-fox), Microchiropteran bats and *Lathamus discolor* (Swift Parrots). It is considered that although the proposal is likely to represent a loss of locally occurring native vegetation, these losses are more than

adequately compensated for by a greater abundance of similar and greater quality habitat that will be secured as Conservation Estates at Stockrington and Tank Paddock.

One threatened flora species, *Tetratheca juncea* (Black-eyed Susan), is considered likely to have individuals displaced by the Development Estate. However, there is abundant habitat of much greater quality throughout the Northern Estates Conservation offsets for this species that will be secured in perpetuity.

For all of these species and communities, it is considered that the removal of vegetation from within the Development Estate will not represent a significant impact upon locally occurring entities, in light of the much greater areas of similar or higher quality habitat that will be secured as Conservation Estates within the current proposal, although vegetation removal must be viewed as an incrementally contributing to the action of this KTP in the locality.

Human caused climate change

The proposal is likely to contribute to the KTP "Human Caused Climate Change" as a result of clearing vegetation. It is considered that clearing and modification of the landscape would constitute only a minor incremental increase in the effects of this KTP. Thus, the extent to which the proposal could contribute to this process is considered unlikely to be significant.

Infection of native plants by Phytophthora cinnamomi

Phytophora cinnamomi is a water mould (like a fungus) that attacks the roots of susceptible plants, in many cases killing the plants. In some native plant communities, epidemic disease can develop causing death of large numbers of plants. This water mould has recently been discovered in the Sydney region and within the Barrington Tops and is becoming more widespread within NSW.

P. cinnamomi may spread with the movement of infected soil or plant material by people, animals and may be transported by percolating through the soil, in creeks or stormwater runoff. People can also transport the fungus to new areas on dirt adhering to vehicles, items they are carrying or footwear.

Humans have the capacity to spread the fungus long distances and across barriers which sets us apart from the natural mechanisms which normally spread this water mould. Due to the use of heavy machinery that will be used for construction of the Development Estate there is opportunity for the KTP "Infection of native plants by *Phytophthora cinnamomi*" to operate. The transportation of *Phytophthora cinnamomi* from other areas may occur by the movement of soils attached to earth moving machinery. Precautionary measures such as cleaning of machinery prior to clearing can help to limit the potential for this KTP to occur, and should be addressed in Environment Management plans generated for Development Estate construction activities.

Invasion of native plant communities by exotic perennial grasses

There is opportunity for the KTP "Invasion of native plant communities by exotic perennial grasses" to occur within the Development Estate due to the removal of vegetation and the exposure of underlying soils. For the most part, this KTP already occurs within weeds and cleared areas of the Development Estate. It is expected that those measures employed to reduce potential sediment and erosional impacts to

surrounding areas will contribute to minimising the potential for this KTP to impact upon surrounding lands.

Removal of dead wood and dead trees

During the clearing of vegetation within the site a number of dead trees are likely to be removed and this may represent opportunity for the KTP "Removal of dead trees and dead wood". Within the Development Estate land there is a relatively low incidence of these habitat attributes and it is unlikely that this KTP will represent a significant threat to threatened species occurring within the site, provided an ecologist is present during clearing works. Consideration should be given to selective relocation of dead trees and logs into Conservation Estates.

Predation by feral cats

The increase of residential development within the area has the potential to increase opportunities for the KTP "Predation by feral cats". This KTP is unlikely to significantly impact upon local wildlife provided responsible pet ownership is encouraged and adopted.

Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands

The displacement of natural vegetation communities as a result of the proposal is likely to increase the opportunity for the KTP "Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands". This is due to increased water flows and runoff potentials as a consequence of water falling upon manmade surfaces. Of greatest risk with regard to this KTP are downstream wetland vegetation assemblages including EEC's and fauna associated with these communities such as threatened waterbird species and other aquatic fauna. Impact to these threatened entities will be minimised through the implementation of sediment and water management plans during the planning and construction phases of development and suitable stormwater runoff treatment and control, coupled with riparian vegetation retention.

Lantana camara

There is a small opportunity for *Lantana camara* to establish, due to the removal of canopy vegetation and the exposing of underlying soils. This exotic plant species already occurs within the Development Estate in relatively high densities in the Alluvial Tall Moist Forest in the centre of the Development Estate. It is likely that the development will considerably reduce the incidence of Lantana within the Development Estate. Nevertheless, there will still be opportunities for this KTP at the edges of the development without appropriate management. It is expected that those measures employed to reduce potential sediment and erosional impacts to surrounding areas will contribute to minimising the potential for this KTP.

No other KTP's are believed to be relevant to the current proposal.

6.4 SEPP 44 (Koala Habitat Protection)

This Policy aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline.

6.4.1 First Consideration – Is the Land 'Potential Koala Habitat'?

Schedule 2 of State Environmental Planning Policy (SEPP) No. 44 – 'Koala Habitat Protection' lists 10 tree species that are considered indicators of 'Potential Koala Habitat'. The presence of any of the species listed on a site proposed for development triggers the requirement for an assessment for 'Potential Koala Habitat'. SEPP 44 defines potential Koala Habitat as:

> *"areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component".*

One tree species listed in Schedule 2 of SEPP No. 44 – 'Koala Habitat Protection' occurs on site, namely, *Eucalyptus punctata* (Grey Gum), and was found to occur within the Development Estate. Another grey gum species, *E. propinqua* (Small-fruited Grey Gum), also occurs widely across the Development Estate, and this species provides similar Koala foraging resources as *E. punctata* (Phillips *et al*. 2000). In addition to these species a further 10 tree species listed within the LHCCREMS fauna survey guidelines (Murray *et al*. 2002) as Koala feed and browse trees, occur within the site including, *Angophora costata* (Smooth-barked Apple), *Corymbia gummifera* (Red Bloodwood), *C. maculata* (Spotted Gum), *E. acmenoides* (White Mahogany), *E. capitellata* (Brown Stringybark), *E. grandis* (Flooded Gum), *E. paniculata* (Grey Ironbark), *E. piperita* (Sydney Peppermint), *E. resinifera* (Red Mahogany) and *E. umbra* (Broad-leaved White Mahogany).

A. costata, *C. gummifera* and *E. umbra* occur widely within Lower Coastal Plains Smooth-barked Apple Woodland (CPSBAW) at individual densities greater than 15% with *E. resinifera E. capitellata* and *E. punctata* occurring in a more patchy distribution at densities > 15% in some areas.

C. maculata, *E. propinqua*, *E. punctata* and *E. umbra* occur widely within LHSGIF at a density greater than 15% of total canopy cover.

E. capitellata occurs in CPSBAW adjacent to the Newcastle Link Road at a density lower than 15% total canopy cover.

E. acmenoides, *E. grandis*, *E. paniculata*, *E. propinqua* and *E. punctata* occur within ATMF at individual densities greater than 15% of total canopy cover. *E. grandis* is limited to gullies at the northern extremity of the site at the northern end of Minmi.

Based upon the occurrence of *E. punctata* alone LHSGIF, ATMF and to a lesser extent CPSBAW within the site can be regarded as 'Potential Koala Habitat' according to the provisions of SEPP 44. Additionally, based upon locally occurring Koala feed trees, as listed within regional fauna survey guidelines (Murray *et al*. 2002), CPSBAW, LHSGIF and ATMF widely represent 'Potential Koala Habitat', due to the widespread occurrence of potential foraging trees within the Development Estate.

6.4.2 Second Consideration – Is the Land 'Core Koala Habitat'?

A single immature male Koala was observed in LHSGIF on the northern side of the Newcastle Link Road during nocturnal fauna surveys. Due to the presence of this individual within the site, targeted searches (in line with the methodology outlined within Section 3.12) were conducted across the site where feed tree species occurred at densities greater than 15% total canopy cover. These surveys were conducted in addition to general searches for any secondary indications of Koalas on the site including scats, scratches on tree trunks, scent markings on tree trunks, tracks in the soil and audible noises including territorial or mating calls, fighting and movement in the trees. Searches for direct observations of Koalas were also conducted during diurnal fauna surveys in addition to spotlighting during nocturnal surveys. No secondary Koala evidence could be found to suggest that the individual observed within the Development Estate might be an indicator that an extant population occurs within the Development Estate.

Apart from those records that occur north of the Hunter River and the onsite record, Koala records in the Lower Hunter Valley are very sparse; the nearest record to the Development Estate being a record some 10.5 km to the northwest of the Development Estate, the only other occurring some 12.5 km to the southwest in the Watagan Mountains. Due to the absence of evidence to suggest otherwise, the recent observation within the Development Estate is considered to be transitory movements by an unattached individual and not that of a sedentary animal representing a part of an in-situ population. Despite the occurrence of 'Potential Koala Habitat' within the site, the lack of secondary indications during searches within the Development Estate suggest that Koalas are not using the Development Estate as part of the range within a local population. As such, it is considered that no further provisions of this policy apply to the site.

6.5 SEPP 14 (Coastal Wetlands)

Mapping of SEPP 14 'Coastal Wetlands' was consulted to determine if vegetation within the vicinity of the site might be deemed as Coastal Wetlands under the SEPP. A SEPP 14 Wetland is designed to protect wetlands from ad hoc clearing, draining, filling and levee construction. Where a development is proposed to involve any of these actions, preparation of an environmental assessment is required.

There is one SEPP 14 "Coastal Wetland" being Hexham Swamp situated to the north east, approximately 1.3km from the proposed development site.

Due to an ongoing history of disturbance and human interference, Hexham Swamp wetland has become significantly degraded. Changes to the natural flow regime have been caused by clearing, surrounding development and construction of flood gates. Much of the diverse wetland community that once exhibited in the swamp has been reduced to a monospecific community. Although the wetland is degraded many birds, frogs, reptiles and aquatic life still depend on the ecosystem for survival.

The water that flows into Hexham Swamp is generated by rainfall and runoff from surrounding suburbs. This becomes important during heavy rainfall when the swamp acts as temporary storage for excessive amounts of water. A wetland located in the northern part of Minmi has linkages with a low-lying wetland that feeds into Hexham Swamp. The area surrounding the wetland has been used for stock grazing and as such is highly degraded and exhibits an array of weed species. Water from Hexham

Swamp then flows into Ironbark Creek and subsequently into the Hunter River. This extends through to the internationally significant Hunter Estuary Wetland (Ramsar Wetland 24). Ramsar is designed to promote and protect wetlands throughout the world. Due to the ecological and hydrological connectivity of on site swamps to Hunter Estuary Wetland, any potential impacts from the proposed development must also consider impacts upon Ramsar Wetland 24.

There is potential for alterations in the flow regimes of onsite watercourses to change water flow characteristics where onsite water enters other wetlands. Impact to these threatened entities will be minimised through the implementation of sediment and water management strategies during the planning and construction phases of development by incorporating suitable stormwater runoff treatment and control, coupled with riparian vegetation retention and rehabilitation.

Therefore, no further provisions of this policy apply to the site.

6.6 Groundwater Dependant Ecosystem's

The estuarine soils which have been mapped by Matthei (1995) within the north of the proposed Development Estate are expected to contain unconfined aquifers perched above the less permeable underling residual soils and rock. This low-lying area's source of recharge to the aquifers is from surface runoff and direct rainfall. The upslope area to the south will contribute to the recharge of these aquifers will include the Development Estate. Thus, it is important that surface runoff flows are maintained at the current level to ensure that adequate recharge to the aquifers will occur post-development. To the north of the Development Estate further wetlands and GDEs are present, these include Hexham Swamp. It is vital that these ecosystems are protected from any runoff from the development estate.

If existing surface water flow rates are maintained there will be minimal impact upon the GDE's present within the Link Road Minmi Development Estate. This can be achieved by appropriate water sensitive design via the provision of surface water detention basins or swales to limit peak flows.

In conclusion, three of the vegetation communities within the Link Road Minmi Development Estate have been classed as GDE's. If the above recommendations are implemented the impact of the development proposal on GDE's will be minmal.

6.7 Corridors

Within the Lower Hunter region there are numerous reports, strategies, policies and stakeholder expectations surrounding corridor form, function, establishment and management all of which are of key relevance to Greenfield release sites. Of key relevance to the Coal and Allied Lower Hunter Lands Project are the following:

- MoU that forms the foundation of an assessment framework for this commission;
- Lower Hunter Regional Strategy;
- Draft Lower Hunter Regional Conservation Plan;
- Western Corridors Study (WCS);
- In principle the Water Management Act; and

- Plans of Management associated with local conservation reserves.

The proposed land dedication at Stockrington as a component of this proposal and Tank Paddock that will be dedicated to the NSWG in consideration for development rights at Coal and Allied's Black Hill estate, will consolidate a long sought after regional corridor for the Lower Hunter running from the Watagan Range to Stockton Bight. Further to its corridor function, the size of the Stockrington land holding will provide an area of vast habitat opportunities for regional flora and fauna.

In addition to the aforementioned land dedication, environmental provisions have been made in and around the proposed development estates. Firstly the WCS seeks to provide west to east corridor opportunities within all new developments for the locality to cater for regional faunal movements. While these corridors will generally be linear in nature, they will also provide further habitat for resident fauna. At a local scale, the Newcastle Link Road reserve currently provides such a habitat corridor.

To provide further corridor surety, and to offset any possible Newcastle Link Road widening to accommodate for future population growth or from the F3 to Branxton Link, the current proposal allows for a vegetated corridor within the northern boundary of the Link Road south development estate. This will tie into the extensive bushland situated to the east and the existing corridor associated with the Cameron Park, Northlakes development situated to the west which in turn is linked to the Stockrington land via a series of vegetation patches adjacent to and within the F3.

In addition, the Minmi-Link Road Development Estate is designed to accommodate, a matrix of interconnecting vegetated areas and riparian corridors similar to that proposed within the Blue Gum Hills Regional Park Plan of Management (as graphically demonstrated in Figure 3.6 Page 3.7). This matrix serves several purposes in providing for stormwater management, ecological enhancement, corridor, habitat, heritage and visual values.

The proposal seeks to encompass the intent of the *Water Management Act* where riparian corridors have been established based on the developments stormwater management requirements coupled with the need to provide a diversity of habitat types for terrestrial and aquatic flora / fauna and to contribute towards connectivity between wildlife habitats. Furthermore, secondary uses within these areas have been minimised, as such bushfire Asset Protection Zones and public open space have been provided for outside the riparian corridors.

At a landscape scale, it is considered the proposal delivers a sound development and conservation outcome where the built environment has made way for the biophysical, thus greatly assisting in the maintenance of local ecological character and faunal movements.

6.8 Environmental Management & Impact Mitigation

This section of the report has been included to provide the reader with an 'in principle' elucidation of the Statement of Commitment (SoC) outlined within the overarching EA report. Specifically C&A's intent to manage the retained open spaces and riparian corridors within the development areas and conservation land edge zones adjacent to the development areas for predetermined periods. C&A proposes entering into a Voluntary Planning Agreement (VPA) with Newcastle City Council to manage all local open space and other areas proposed to be dedicated to Council for 5 years or until the adjacent development is completed whichever the

later. C&A will also enter into a Statement of Interim Management Intent (SIMI) with DECC to manage the immediately adjacent conservation land up to 100m of the development land boundary again for a period of 5 years or until development in the adjacent development areas is complete whichever the later. The SIMI will specifically cover the management and impact mitigation at the interface between development and conservation land.

While each of the end user agencies (Newcastle Council and State Government – DECC/NPWS) future management will be in line with their internal practices a VPA and SIMI will provide a 'stepping stone' for the environmental management during construction periods. On completion of the VPA periods the lands will be dedicated to Newcastle Council in the case of the open space associated with the development area. The areas of conservation land the subject of the SIMI will revert back to DECC/NPWS for their ongoing management.

Generally the proposed VPA and SIMI will cover issues such as biodiversity maintenance, stormwater management both permanent and temporary, ecological and bushfire management, cultural and natural heritage which will be consistent with other related Plans of Management that the SoC sets out and strategies for the region. This should not necessarily be construed as a comprehensive list.

The SIMI will specifically cover the management and impact mitigation at the interface between regional conservation reserves. The following brief discussion on Blue Gum Hills Regional Park and the Hunter Estuary National Park cover the aforementioned heads of consideration.

Blue Gum Hills Regional Park

This park adjoins the Minmi Link Road Development Estate and several measures have been implemented to mitigate impacts which may be caused by the proposed residential development. These include the installation of Bio-retention basins, erosion and sediment control devices to mitigate any runoff which may occur within the park. Bushfire Asset Protection Zones have been kept wholly within the boundary of the development estate. Responsible pet ownership will be encouraged and adopted within the proposed Development Estate. Landscaping within the development estate will involve the use of locally occurring native species. Boundary fencing between the development estate and Blue Gum Regional Park is recommended to be fauna friendly fencing with no razor barbed wire to protect fauna species.

Hunter Estuary National Park Hexham Swamp Nature Reserve and Pambalong Swamp Nature Reserve.

There is potential for alterations in the flow regimes of onsite watercourses to change water flow characteristics where onsite water enters other wetlands. Impact to these National Parks and Nature Reserves will be minimised through the implementation of sediment and water management strategies during the planning and construction phases of development by incorporating suitable stormwater runoff treatment and control, coupled with riparian vegetation retention and rehabilitation. Fencing of the boundaries between these conservation reserves and the proposed residential estate will also help mitigate any edge effects from the urban development.

7 KEY THRESHOLDS ASSESSMENT (PART 3A)

As required by the Draft *Guidelines for Threatened Species Assessment* for Part 3A applications (DEC / DPI 2005), the following assessment of Key Thresholds (four in total) is provided for the proposed Development Estate at Link Road - Minmi.

1. Whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts will maintain or improve biodiversity values.

It is considered that the information presented within this document, and in particular the proposal that includes the proposed land dedication to NPWS for the site as detailed within the MoU, concept plan and this EAR, is likely to result in a maintained if not an improved outcome for biodiversity values within the region.

2. Whether or not the proposal is likely to reduce the long-term viability of a local population of the species, population or ecological community.

The threatened species, populations and ecological communities considered within the report occurring within the proposed Development Estate are well represented in the proposed dedication lands and wider locality, and are also represented or have potential habitat within other conservation offset lands and considered unlikely to reduce the long-term viability of a local population of species or endangered ecological community.

3. Whether or not the proposal is likely to accelerate the extinction of the species, population or ecological community or place it at risk of extinction.

The threatened species, populations and ecological communities considered within the report occurring within the proposed Development Estate are well represented in the proposed Conservation Estates and wider locality, and are also represented or have potential habitat within other conservation reserves and are considered unlikely to be placed at risk of extinction.

4. Whether or not the proposal will adversely affect critical habitat.

There is no declared “Critical Habitat” within the Development Estate locality, and as such the proposal will not adversely affect any such habitat.

8 RECOMMENDATIONS

The following recommendations have been outlined to ensure that the ecological impact of the proposed Development Estate is minimised as far as possible.

- Foremost, the management of the Development is critical to ensure that no direct or indirect impacts occur in the short and long term on dedicated Conservation Estates. As such, appropriate management plans should be prepared and implemented within the development framework in consultation with the NSW NPWS.

- The minimum amount of clearing should take place as a general objective of the project, particularly within those areas that currently contain identified native vegetation communities. These areas have been described within this report. This is especially important within or near those areas identified as containing vegetation consistent with EEC's or riparian areas.

- It is recommended that a *Tetratheca juncea* management plan be prepared to ensure the conservation and long term survival of this threatened species within the Conservation Estates.

- Mature and / or hollow-bearing trees should be retained wherever feasible within the development framework.

- Pre-clearing inspections should be undertaken by an ecologist in wooded areas where threatened fauna species have been recorded or are considered likely to occur. This is particularly important in areas where threatened fauna have been noted during recent surveys either breeding or nest-building. No breeding attempts should be disrupted during the course of the project, particularly by threatened fauna.

- During the construction phase, for any tree removal within forested areas, and in particular where hollow-bearing trees may be removed, all works should be supervised by an ecologist to recover any native fauna that are potentially displaced. Furthermore, where such risks occur, site-specific ecological advice should be sought to minimise impacts during the entire process. A clearing protocol should be adopted for the removal of trees containing suitable habitat hollows as follows (this is considered as a guideline, variations on the methods employed may be required to accommodate site specific factors):
    - All hollow-bearing trees are to be flagged by an ecologist prior to the commencement of works on Development Estate.
    - Underscrubbing of the entire site should be carried out by a 4x4 tractor with a slashing deck, this will minimise the establishment of degradation processes and leave a layer of mulch to aid in soil retention in the event of adverse weather. At this time felling of non habitat trees can take place, however a matrix of trees *must* be maintained to allow animal movement into the designated refuge area.
    - After a period of two weeks, clearing of habitat trees should commence. Clearing must be carried out moving from the fringe of the matrix towards the refuge area. Trees should be 'soft felled' and inspected immediately by an ecologist for displaced fauna. All trees must be left for a minimum

of two nights prior to being moved to a stockpile, to allow resident fauna to vacate tree hollows.

<u>Note:</u> Clearing should ideally take place outside of the dominant breeding seasons of resident fauna, preferably during late autumn and winter.

- Species selection for future landscaping works and seed stock for revegetation should be limited to locally occurring native species to maintain local genetic diversity. This should include regionally significant species and preferred Swift Parrot / Koala foraging habitat trees should be incorporated into future landscaping design where possible.

- Appropriate vegetation, habitat and bushfire management plans should be included under an overarching Environmental Management Plan for the retained natural features within the development estate.

- Where possible, earthworks (and certainly all works in the vicinity of drainage lines) should be undertaken during appropriate (i.e. dry) weather conditions. This will ensure that any potential erosion events will be intercepted and that downstream impacts are minimised within any of the drainage lines. This will help to maintain existing habitat characteristics for native fauna in those areas, including those for threatened species.

- Nutrient and sediment control devices should be erected pre-clearing and post-construction works in sensitive areas where degradation processes may be triggered such as areas adjacent to watercourses until suitable rehabilitation has occurred to maintain surface integrity. Furthermore, stockpiles should be subject to individual sediment and nutrient control devices.

9 CONCLUSION

The outcomes for the site as per the MoU were formulated on existing ecological information available at that time. The detailed studies undertaken herewith have confirmed that development of a small portion of the site as a whole will provide a mechanism for adequate ecological outcomes within the proposed conservation lands for the vast majority of species and communities contained therein. The quantum of the offset lands, when viewed holistically with proximate existing and proposed conservation reserve areas, provides a robust long-term outcome for all species and communities. Furthermore, suitable actions are proposed to minimise potentially deleterious permanent and ongoing impacts to the conservation lands.

The field and desktop studies have recorded the following parameters of ecological significance within both the Conservation and the Development Estates:

- native vegetation commensurate with those listed as EEC's;
- threatened flora species recorded within and adjacent to the proposed development;
- threatened fauna species recorded within and adjacent to the proposed development;
- habitat for threatened flora and fauna species known from within and adjacent to the proposed development; and
- other areas containing native vegetation with varying degrees of modification / degradation.

With these potential ecological issues noted, a series of recommendations have been outlined previously in this report, to aid in the reduction of potential impacts associated with the proposal.

Given that the measures have been taken to avoid ecological impacts and that where native vegetation may be affected, efforts have been made to avoid particularly sensitive areas where practical, it is considered unlikely that any significant impacts would occur upon threatened species, communities or populations. The large areas of Conservation Estates at Stockrington and Tank Paddock that will be set aside as part of the development provide excellent ecological outcomes across the site. The Stockrington Conservation Estates will contribute a large portion of land to conservation in perpetuity, which will in essence formalise the Watagan to Stockton Corridor. The importance of the conservation of Tank Paddock as part of the Conservation Estates will result in maintaining a vegetation corridor from Hexham Swamp and the Hunter Estuary to the Watagan Mountains and the Sugarloaf Range. This large tract of native vegetation will provide protected habitat for a wide variety of native flora and fauna.

Therefore, due to the location of the proposed Development Estate within more disturbed portions of the Northern Estates and the dedication of much larger tracts of vegetation within strategic regional corridors, it has been concluded that the proposed development should not significantly impact upon threatened or regionally significant flora and fauna, ecological communities or populations. The implementation of operative environmental management practices and the detailed design phase of the project should also ensure that the ecological impact of the project is minimised.

10 BIBLIOGRAPHY

Anderson, R.H. (1961). Introduction. *Flora series No'.s 1-18: 1-16*. Contributions from the New South Wales National Herbarium. Royal Botanic Gardens, Sydney.

Auld, B.A. and Medd, R.W. (1996). *Weeds: An Illustrated Botanical Guide to the Weeds of Australia.* Inkata Press, Sydney.

Atlas of NSW Wildlife (last accessed December 2007). *New South Wales National Parks and Wildlife Service – Flora and Fauna Database.*

Barker, J., Grigg, G.C. and Tyler, M.J. (1995). *A Field Guide to Australian Frogs*. Surrey, Beatty & Sons, New South Wales.

Barrett, G.W., Ford, H.A. and Recher, H.F. (1994). *Conservation of woodland birds in a fragmented rural landscape*. *Pacific Conservation Biology* 1, 245-256.

Barrett, G., Silcocks, A., Barry, S., Cunningham, R. and Poulter, R. (2002). *The Atlas of Australian Birds (1998-2001).* Environment Australia Natural Heritage Trust Fund and Birds Australia, Hawthorn East, Victoria.

Bartier F.V., Gross C.L., Bellairs S.M., Mulligan D.R. and Bowen D. (2001), *Understanding the biology and ecology of vulnerable plant species – a case study with Tetratheca juncea occurring over coal leases. ACARP Project C8012.* Report prepared for Australian Coal Research by the Centre for Mined Land Rehabilitation, The University of Queensland and Ecosystem Management, University of New England. Australian Coal Association Research Program, Brisbane.

Beadle, N.C.W. (1981) *The Vegetation of Australia.* Cambridge University Press, Cambridge.

Bedward, M., Keith D.A. and Pressy L., (1992) Homogeneity analysis: Assessing the utility of classifications and maps of natural resources. *Australian Journal of Ecology, 17, 133-130.*

Belbin L., (2003) *PATN A revised User's Guide*. Blatant Fabrications Pty Ltd, Tasmania, October 2003.

Belbin, L., (2008) *Marine Benthic Community Example*, Accessed from PATN Web Site http://patn.com.au.

Bell, S.A.J. (1998) *Lake Macquarie State Recreation Area, Pulbah Island Nature Reserve (NR) and Tingira Heights NR Vegetation Survey – A Fire Management Document,* Volumes 1 and 2. Unpublished Report prepared for NSW National Parks and Wildlife Service, Hunter District by Eastcoast Flora Survey.

Bell S.A.J. & Murray (2001) *LMCC Flora and Fauna Survey Guidelines, Version 2.* Prepared for Lake Macquarie City Council by Forest Fauna Surveys Pty Ltd, Eastcoast Flora Surveys.

Bellairs S.M., Bartier F.V., Gravina A.J. and Baker K. (2006) Seed Biology implications for the maintenance and establishment of *Tetratheca juncea* (Tremandraceae), a vulnerable Australian species. *Australian Journal of Botany* 54(1) 35-41.

Bishop, T. (2000). *Field Guide to the Orchids of New South Wales and Victoria*. University of NSW Press, Sydney. Second Edition.

Braun-Blanquet, J. (1982). *Plant Sociology: The Study of Plant Communities.* McGraw Hill Publishers, New York.

Briggs, J. D. and Leigh, J. H. (1996). *Rare or Threatened Australian Plants*. CSIRO, Collingwood, Victoria.

Christidis, L. and Boles, W.E. (2008). *Systematics and Taxonomy of Australian Birds.* CSIRO Publishing, Collingwood, Vic, Australia.

Churchill, S. (1998). *Australian Bats.* Reed New Holland Publishers, Sydney, Australia.

Cogger, H.G. (1996). *Reptiles and Amphibians of Australia*. Fifth edition. Reed International, Chatswood, N.S.W.

Conacher Travers (2006a) *EPBC Referral for the Coastal Sector Wallarah Peninsula NSW.*

Conacher Travers (2006b) *EPBC Referral for the Lake Sector Wallarah Peninsula NSW.*

Conacher Travers (2006c) *EPBC Referral for the Northern Sector Wallarah Peninsula NSW.*

Cronquist, A. (1981). *An Integrated System of Classification of Flowering Plants*. Columbia Univ. Press, N.Y.

Cropper, S. (1993). *Management of Endangered Plants.* CSIRO Publications, East Melbourne, Victoria.

DECC (2005) Draft *Guildlines for Threatened Species Assessment*. July 2005.

DEC (2004) *Threatened Biodiversity Survey and Assessment Guildlines for Developments and Activities Working Draft November 2004.* Department of Environment and Conservation. NSW.

Driscoll C. (2003) The pollination Ecology of *Tetratheca juncea* (Tremandraceae): Finding the Pollinators. *Cunninghamia* **8(1) 133-140.**

Duncan, A., Baker, B., and Montgomery, N. (eds) (1999). *Action Plan for Australian Bats*. Biodiversity Group, Environment Australia.

Eby, P. (2001). *Surveys for roost sites/camps for the Grey-headed Flying Fox* (excel file). Surveys commissioned by the Northern Directorate of NPWS.

EcoBiological (2006) *Abel Underground Mine Part 3A Environmental Assessment Appendix J Flora and Fauna Lists and Descriptions.* A report prepared for Donaldson Coal Pty Limited.

Ehmann, H. (Ed) (1997). *Threatened Frogs of New South Wales: Habitats, Status and Conservation.* Frog and Tadpole Study Group of NSW.

Environment Australia (2001). *A Directory of Important Wetlands in Australia*, Third Edition. Environment Australia, Canberra.

Forest Fauna Surveys (2002). *Current Status of the Squirrel Glider (Petaurus norfolcensis) in the Eleebana Area.* Draft Report (version no.4) to Lake Macquarie City Council, November 2002.

Freudenberger, D. (2001). *Bush for the birds: Biodiversity enhancement guidelines for the Saltshaker Project, Boorowa, NSW.* Report commissioned by Greening Australia ACT & SE NSW, Inc. CSIRO Sustainable Ecosystems.

Garnett, S.T. and Crowley, G.M. (2000). *The Action Plan for Australian Birds 2000.* Environment Australia.

Geoscience Australia (2004) *Vegetation – Pre-European Settlement (1788).* National Mapping Division, Geoscience Australia, Canberra

Gibbons, P. and Lindenmayer, D. (2002). *Tree Hollows and Wildlife Conservation in Australia*. CSIRO Publishing Collingwood, Victoria.

Gross C.L., Bartier F.V & Mulligan D.R. (2003), *Floral Structure, Breeding System and Fruit-set in the Threatened Sub-shrub Tetratheca juncea* Smith (Tremandraceae). *Annuals of Botany* **92 771-777.**

Gunninah Environmental Consultants (2003) *Wyong Ground Orchid Survey Wyong Shire.* A report prepared for Wyong Shire Council.

Harden, G. (ed) (1992). *Flora of New South Wales, Volume 3.* New South Wales University Press, NSW.

Harden, G. (ed) (1993). *Flora of New South Wales, Volume 4.* New South Wales University Press, NSW.

Harden, G. (ed) (2000). *Flora of New South Wales, Volume 1.* Revised edition. New South Wales University Press, NSW.

Harden, G. (ed) (2002). *Flora of New South Wales, Volume 2.* Revised edition. New South Wales University Press, NSW.

HBOC – *Hunter Bird Observers Club (1994-2005). Hunter Region of New South Wales: Annual Bird Reports.* Numbers 1-12 (1993-2004).

Higgins, P.J. & Davies, S.J.J.E. (eds). (1996). *Handbook of Australian, New Zealand and Antarctic Birds. Volume 3. Snipe to Pigeons.* Oxford University Press, Melbourne.

Higgins, P.J. (ed). (1999). *Handbook of Australian, New Zealand and Antarctic Birds. Volume 4. Parrots to Dollarbird.* Oxford University Press, Melbourne.

Higgins,P.J., Peter, J.M. & Steele, W.K. (eds) (2001). *Handbook of Australian, New Zealand and Antarctic Birds. Volume 5 Tyrant-flycatchers to Chats.* Oxford University Press, Melbourne.

Higgins,P.J. & Peter, J.M. (eds) (2002). *Handbook of Australian, New Zealand and Antarctic Birds. Volume 6 Pardalotes to Shrike-thrushes.* Oxford University Press, Melbourne.

Higgins,P.J., Peter, J.M. & Cowling, S.J. (eds) (2006). *Handbook of Australian, New Zealand and Antarctic Birds. Volume 7 Boatbill to Starlings*. Oxford University Press, Melbourne.

Hilton-Taylor, C. (compiler) (2000). *2000 IUCN Red List of Threatened Species.* IUCN, Gland, Switzerland and Cambridge, UK.

House, S (2003). *Lower Hunter & Central Coast Regional Biodiversity Conservation Strategy, Technical Report, Digital Aerial Photo Interpretation & Updated Extant Vegetation Community Map.* Report to Lower Hunter & Central Coast Regional Environmental Management Strategy, Callaghan, NSW, May 2003.

HSO (2005) *Phase One Vegetation Assessment Report, Over various holdings in the Lower Hunter / Central Coast, NSW.* Report prepared for Coal & Allied.

Kavanagh, R. (2002). *Comparative Diets of the Powerful Owl (Ninox strenua), Sooty Owl (Tyto tenebricosa) and Masked Owl (Tyto novaehollandiae) in South-eastern Australia*. In: Newton, I., Kavanagh, R., Olsen, J. and Taylor, I. (eds)(2002). Ecology and Conservation of Owls, pp 175-188.

Keith D, (2004) *Ocean Shores to Desert Dunes, The Native Vegetation of New South Wales and the ACT.* Department of Environment and Conservation (NSW).

Keith, D.A (2000). Sampling designs, field techniques and analytical methods for systematic plant population surveys. *Ecological Management & Restoration*. **1(2): 125-139.**

Keith D.A. and Bedward M., (1999). Native vegetation of the South East Forests region, Eden, New South Wales, *Cunninghamia* **6(1) 1-60.**

Krebs, C.J. (1998) *Ecological Methodology*. 2nd Ed. Addison Wesley Longman.

Lamp, C.A., Forbes, S.J. and Cade, J.W. (1990). *Grasses of Temperate Australia.* Inkata Press, Melbourne.

Lower Hunter and Central Coast Regional Environmental Management Strategy (LHCCREMS) (2002). Lower Hunter and Central Coast Extant Vegetation 2002. Draft report.

Marchant, S. & Higgins, P.J. (eds). (1990). *Handbook of Australian, New Zealand and Antarctic Birds. Volume 1. Ratites to Ducks.* Oxford University Press, Melbourne.

Marchant, S. & Higgins, P.J. (eds). (1993). *Handbook of Australian, New Zealand and Antarctic Birds. Volume 2. Raptors to Lapwings.* Oxford University Press, Melbourne.

Maxwell, S., Burbidge, A.A., and Morris, K. (eds) (1996). *Action Plan for Australian Marsupials and Monotremes. Prepared for the Australasian Marsupial and Monotreme Specialist Group, IUCN Species Survival Commission.* December 1996.

Murray, M., Bell, S. and Hoye, G. (2002). *Fora and fauna survey Guidelines: Lower Hunter Central Coast Region 2002*. Lower Hunter & Central Coast Regional Environmental Management Strategy, Callaghan.

NPWS (2002) *Munmorah State Conservation Area and Bird Island Nature Reserve, Plan of Management.* Department of Environment and Conservation. NSW.

NPWS (2005) *Lake Macquarie State Conservation Area, Pulbah Island Nature Reserve and Moon Island Nature Reserve, Plan of Management.* Department of Environment and Conservation. NSW.

NPWS – NSW National Parks and Wildlife Service (2000). *Vegetation Survey, Classification and Mapping, Lower Hunter and Central Coast Region, Version 1.2.* Lower Hunter and Central Coast Regional Environmental Management Strategy, Thornton, NSW.

NPWS – NSW National Parks and Wildlife Service (2003b). *The Bioregions of New South Wales: their Biodiversity, Conservation and History.* NSW NPWS, Hurstville, NSW.

NSW NPWS *Comprehensive Regional Assessment (CRA) Verterbrate Fauna Surveys.*

Payne R.J. (1993) Predication of the Habitat for Tetratheca juncea in the Lake Munmorah Area near Wyong NSW*. Cunninghamia* **3(1) 147-154.**

Payne R. J. (2000) *Lake Macquarie Tetratheca juncea Conservation Management Plan, Robert Payne Ecological Surveys and Management.* An unpublished Report Prepared for Lake Macquarie City Council.

Payne R.J. (2001) *Addendum to the Final November 2000 Tetratheca juncea Conservation Management Plan.* Robert Payne Ecological Surveys and Management and Lake Macquarie City Council.

Payne R.J., Stevenson D. And Wellington R. (2002) *A Standardised Method for Counting Black-eyed Susan Populations.* A Technical Note.

Phillips, S., Callaghan, J. and Thompson, V. (2000) The tree species preferences of Koalas (*Phascolarctos cinereus*) inhabiting forest and woodland communities on Quaternary deposits in the Port Stephens area, New South Wales. *Wildlife Research* 27(1): 1-10.

Pizzey, G. and Knight, F. (2003). *Field Guide to the Birds of Australia*. Angus and Robertson, Sydney.

Recher, H.F (1995) *The conservation and management of Eucalypt forest birds: resource requirements for nesting and foraging.* Conservation of Australia's Forest Fauna. Royal Zoological Society of NSW, Mosman.

Robinson, L. (2003). *Field Guide to the Native Plants of Sydney (3rd edn.).* Kangaroo Press Pty. Ltd., New South Wales.

RPS Harper Somers O'Sullivan (2007a) *Ecological Constraints Investigations, Phase 1, Over Various Holdings in the Lower Hunter/Central Coast NSW.* January 2007.

RPS Harper Somers O'Sullivan (2007b) *Ecological Constraints Investigations, Phase 1, Over Various Holdings in the Lower Hunter/Central Coast NSW. – Addendum* Report. April 2007.

RPS Harper Somers O'Sullivan (2007c) *Ecological Assessment Report for Southern Lands at Catherine Hill Bay.* A report to Coal & Allied, November 2007.

RPS Harper Somers O'Sullivan (2007d) *Ecological Assessment Report for Southern Lands at Nords Wharf.* A report to Coal & Allied, November 2007.

RPS Harper Somers O'Sullivan (2007e) *Ecological Assessment Report for Southern Lands at Gwandalan.* A report to Coal & Allied, November 2007.

RPS Harper Somers O'Sullivan (2008) *Ecological Assessment Report for Northern Lands at Black Hill.* A report to Coal & Allied, August 2008.

Quin, D.G. (1993). *Sociology of the Squirrel Glider and the Sugar Glider. PhD Thesis, Department of Ecosystem Management*, University of New England.

Shortland Wetlands Consultancy (1996). *Eleebana Local Squirrel Glider Study*. Report to Lake Macquarie City Council, February 1996.

Smith, A., Watson, G. and Murray, M. (2002). *Fauna Habitat Modelling and Wildlife Linkages in Wyong Shire.* Report to Wyong Shire Council by Austeco Environmental Consultants.

Smith, A. (1998). *Effects of Residential Subdivision on the Squirrel Glider: Apollo Drive, Lake Macquarie City Council LGA.* Prepared by Austeco Environmental Consultants.

Smith, A. P. (2002). *Squirrel Glider (Petaurus norfolcensis) Conservation Management Plan: Wyong Shire*. Wyong Shire Council. Wyong.

Specht R.L., Specht A., Whelan M.B. & Hegarty E.E. (1995) *Conservation atlas of plant communities in Australia.* Centre for Coastal Management, Southern Cross University Press, Lismore.

Strahan, R. (Ed) (1995). *The Mammals of Australia.* Reed Books, Chatswood, NSW.

Thackway, R. and Creswell, I.D. (1995). *An Interim Biogeographic Regionalisation for Australia: a framework for setting priorities in the National Reserves System Cooperative Program - Version 6.1.* Australian Nature Conservation Agency, Canberra.

Tierney D.A. (2004) Towards an understanding of population change for the long lived resprouting tree *Angophora inopina* (Myrtaceae). *Australian Journal of Botany* **52(1) 31-38.**

Triggs, B. (1996). *Tracks, Scats and Other Traces: a Field Guide to Australian Mammals.* Oxford University Press, Australia.

Umwelt Environmental Consultants (2003) *Minmi corridors Assessment – Maintaining and Enhancing Natural and Cultural Heritage Values.* An unpublished report prepared for Newcastle City Council, August 2003.

WBM Oceanics Australia (2001) *Review of Rezoning Proposal for the Tank Paddock, Lenaghans Drive, Minmi.* An unpublished report prepared for Newcastle City Council, December 2001.

Wells R.W. (2007) A Review of Threatened Species Considerations for the Proposed Rezoning of Lot 2 DP 534168 and Lot 11 DP 1044935 Minmi Road, Fletcher, New South Wales for Northwest Residential Pty Ltd. *Australian Biodiversity Record* **(10): 1-72.**

Wheeler, D.J.B., Jacobs, S.W.L. & Norton, B.E. (1994) *Grasses of New South Wales* University of New England.

Williams, J.B., Harden, G.J. & McDonald, W.J.F. (2004) *Trees and Shrubs in Rainforests of New South Wales & Southern Queensland* University of New England.

Young, J. (1999). *Northlakes Forest Owl Project*. Report to Lake Macquarie City Council, January 1999.

APPENDIX A Memorandum of Understanding

THE MINISTER FOR THE ENVIRONMENT

and

THE MINISTER FOR PLANNING

and

THE MINISTER FOR LANDS

and

COAL AND ALLIED INDUSTRIES LTD

MEMORANDUM OF UNDERSTANDING

I V KNIGHT
Crown Solicitor
60-70 Elizabeth Street
SYDNEY NSW 2000

200600938 D2006/178441

Table of Contents

1. Definitions and interpretation 1

2. Implementation 3

3. The Environmental Land Offset Scheme 3

4. Agreement 5

5. Term 6

SCHEDULE 1 – Potential Development Lands

SCHEDULE 2 – Environmental Lands Offsets

MEMORANDUM OF UNDERSTANDING

THIS MOU is made on _____ of _____ 2006.

Between

1. **THE MINISTER FOR THE ENVIRONMENT** of Level 36, Governor Macquarie Tower, 1 Farrer Place, Sydney in the State of New South Wales; and

2. **THE MINISTER FOR PLANNING** of Level 34, Governor Macquarie Tower, 1 Farrer Place, Sydney in the State of New South Wales

3. **THE MINISTER FOR LANDS** of Level 34, Governor Macquarie Tower, 1 Farrer Place, Sydney in the State of New South Wales

(together, the "Government"); and

4. **COAL AND ALLIED INDUSTRIES LTD** (the "Landholder").

Background

A. The New South Wales Government intends to implement an Environmental Land Offset Scheme for the Lower Hunter region to complement and support the Lower Hunter Regional Strategy and the Lower Hunter Regional Conservation Plan.

B. The Environmental Land Offset Scheme aims to:

(i) increase public ownership of certain land in the Lower Hunter region for dedication as a conservation reserve; and

(ii) recognise the development potential of certain other land in the Lower Hunter region.

C. The purpose of this MOU is to set out the parties' intentions with respect to the implementation of the Environmental Land Offset Scheme, insofar as it concerns the Landholder.

1. Definitions and interpretation

1.1 In this MOU, unless the context otherwise requires:

"**Conservation reserve**" means any land intended to be reserved or dedicated under the NPW ***Act*** and includes references to a national park, nature reserve, state conservation area or regional park, as those terms are defined under that Act

"Development potential of Schedule 1 land" means the development potential specified in Schedule 1 for each parcel of Schedule 1 land (either hectares or dwellings or both).

"Dwelling" has the same meaning as in the *Standard Instrument —Principal Local Environmental Plan.*

"Environmental Land Offset Scheme" insofar as it concerns the Landholder means the Environmental Land Offset Scheme described in clause 3 of this MOU.

"EP&A Act" means the *Environmental Planning and Assessment Act 1979,* as amended from time to time.

"Lower Hunter Regional Conservation Plan" means the Lower Hunter Regional Conservation plan released by the NSW Department of Environment and Conservation, published on that Department's website and as amended from time to time.

"Lower Hunter Regional Strategy" means the Lower Hunter Regional Strategy released by the NSW Department of Planning, published on that Department's website and as amended from time to time.

"Map" means the maps titled *"Northern Area –Aerial',* and *"Southern Area – Aerial'* as prepared by UrbisJHD and *"Catherine Hill Bay – Middle Camp Urban Area"* as prepared by Allen Jack + Cottier, *"Plan of Hunter Valley Operations & Warkworth Mt Thorley Roads"* and *"Plan of MTP Roads"* prepared by Coal and Allied Land and Property Department that are incorporated into this MOU by reference.

"MOU" means this Memorandum of Understanding which includes the Schedules and maps that are incorporated into this MOU by reference

"NPW Act" means the *National Parks and Wildlife Act 1974* as amended from time to time.

"Rezoning" means the mechanism of changing the landuse zone for a parcel of land contained in a environmental planning instrument (as defined by the EP&A Act), noting that this change in landuse zone may be effected by the gazettal of a State Environmental Planning Policy or a local environmental plan.

"Schedule 1 land" means the land identified in Schedule 1

"Schedule 2 land" means the parcels of land owned by the Landholder and identified in Schedule 2, or part thereof.

"**TSC Act**" means the ***Threatened Species Conservation Act 1995*** as amended from time to time.

"**Transferred Schedule 2 land**" means Schedule 2 land, or part thereof, transferred to the Minister for the Environment in accordance with clause 3.2.

2. Implementation

2.1 The parties are committed to using their best endeavours to implement this MOU.

2.2 The parties acknowledge and agree that:

2.2.1 this MOU is intended to express the parties' objectives and firm intentions with regard to those matters with which it deals, but is not intended to create enforceable or binding legal obligations between them;

2.2.2 nothing in this MOU shall be taken to fetter the discretion of the Minister for Planning in exercising functions under the *EP&A Act* or the Minister for the Environment in exercising functions under the NPW Act or the TSC Act or the discretion of the Landholder in negotiating a commercial acceptable outcome; and

2.2.3 nothing in this MOU is intended to constitute a representation, warranty or guarantee by or on behalf of the Government, the Minister for Planning or the Minister for the Environment or the Landholder.

2.3 All parties acknowledge and agree that they have not relied or acted or forborne from acting in any way as a result of any statement made by any of the parties in this MOU or in discussions leading up to this MOU.

3. The Environmental Land Offset Scheme

3.1 The Parties have agreed that the Schedule 1 Land has the Development Potential as identified by Schedule 1 and a Rezoning application will be submitted to the Minister for Planning.

3.2 The Minister for Planning intends to use reasonable endeavours to allow the Landholder to achieve the development potential of Schedule 1 land by either:

3.2.1 Rezoning the land through an amendment to State Environmental Planning Policy 2005 (Major Projects) and approval of any concept plan submitted under Part 3A of the EP&A Act ; and/or

3.2.2 Facilitating the rezoning of the land through the gazettal of a Local Environmental Plan prepared by the relevant local government authority and made by the Minister for Planning and approval of any concept plan submitted under Part 3A of the EP&A Act; and/or

3.2.3 Any other means that achieves the development potential of Schedule 1 Lands;

in accordance with, the Lower Hunter Regional Conservation Plan and subject to the requirements of the *EP&A Act.*

3.3 The Landholder intends to transfer ownership of Schedule 2 land to the Minister for the Environment upon the rezoning of Schedule 1 land and approval to the concept plan(s) being obtained on reasonably acceptable terms.

3.4 The Minister for the Environment intends to ensure Transferred Schedule 2 land is dedicated as part of the national park estate or as a conservation reserve.

3.5 The Landholder intends not to undertake any action or activity, pending transfer of Schedule 2 land or rezoning of Schedule 1 land that will have detrimental effect on the conservation or Aboriginal heritage values of Schedule 2 lands except where the Landholder is

3.5.1 directed to undertake such an action or activity by another Government agency or instrumentality (such as the Rural Fire Service), or

3.5.2 is otherwise required by law to undertake such an action or activity, or

3.5.3 continuing any existing use (including those approved to commence) action or activity

3.6 Notwithstanding clause 3.5 the Landholder, in the context of discussions with the Roads & Traffic Authority on its proposed compensatory habitat requirements for 299 hectares of Stockrington land for a Proposed Highway Link between the F3 and Branxton, intends to continue to negotiate the sale of 24.3 hectares of land to Newcastle Coal Company Pty Limited for the purposes of surface mining facilities on the following basis:

3.6.1 that the Landholder's negotiations with Newcastle Coal Company Pty Limited are to specify that an alternative area of land shall be transferred by Newcastle Coal to the Minister for the Environment that is at least 24.3 hectares in size,

3.6.2 the land to be transferred by Newcastle Coal is to meet the obligations for compensatory habitat identified in conditions 48, 49 and 50 of the Approval granted by the Minister for Planning under section 115B(2) of the EP&A Act in relation to the *Proposed Highway Link Between the F3 and Branxton* dated November 2001, and

3.6.3 the Minister for the Environment agreement to the transfer of land by Newcastle Coal Company Pty Limited.

3.7 The Minister for Lands intends to use his best endeavours to enable the Landholder, to acquire title to the Crown Roads for mining purposes as described in the maps titled *"Plan of Hunter Valley Operations and Warkwotth Mt Thorley Roads"* and *"Plan of MTP Roads"* adjacent or within the existing or proposed coal mine developments known as Hunter Valley Operations, Warkworth Mt Thorley and Mount Pleasant, subject to an agreed value being negotiated which recognises the land to be transferred by the Landholder to the Minister for the Environment as identified in Schedule 2.

4. Agreement

4.1 Notwithstanding clause 3, the details of the Environmental Land Offset Scheme described in clause 3 are the subject of ongoing negotiation by the parties, which they propose will form part of a legally enforceable agreement to be entered into by them.

4.2 All parties are to use their best endeavours to enter into such an agreement referred to in clause 4.1 as soon as possible noting a target date of three months for this to occur.

4.3 The parties acknowledge that the proposed agreement referred to in clause 4.1 will include a schedule of commitments that set out the sequencing and staging of Schedule 1 land and the dedication for conservation of Schedule 2 lands.

4.4 The parties acknowledge that:

4.4.1 If there is any reduction in Schedule 2 Land to be transferred then a proportional reduction will result for the development potential of Schedule 1 Land. This clause will apply separately to the Northern and Southern Coal & Allied lands.

4.4.2 If the development potential of Schedule 1 Land in relation to the number of dwellings or lots to be achieved is reduced then a proportional reduction will occur in the amount of Schedule 2 Land to be transferred to the Minister for the Environment. This clause will apply separately to the Northern and Southern Coal & Allied lands

5. Term

5.1 This MOU starts on the date it is signed by both parties and continues until the parties enter into an agreement of the type referred to in clause **4,** or 1 year, whichever is the later.

This Memorandum of Understanding is signed on 17 October **2006.**

The Honourable Bob Debus MP
The Minister for the Environment

The Honourable Frank Sartor MP
The Minister for Planning

The Honourable Tony Kelly MLC
The Minister for Lands

Doug Ritchie, Managing Director Coal & Allied for and on behalf of
[The Landholder]

SCHEDULE 1 – POTENTIAL DEVELOPMENT LANDS

This Schedule forms part of the MOU.

Schedule 1 Land

Property description	Map reference	Development potential
	Southern Lands – Catherine Hill Bay – nominated as 'blue land' on the Map prepared by Urbis JHD	• Residential development covering up to **50** hectares to achieve **300** dwellings • Residential development to be in accordance with the development footprint on the map titled "Catherine Hill Bay – Middle Camp Urban Area" as prepared by Allen Jack + **Cottier**
	Southern Lands – Nords Wharf – nominated as 'blue land' on the Map prepared by Urbis JHD	Residential development covering up to **9** hectares to achieve **90** dwellings
	Southern Lands – Gwandalan – nominated as 'blue land' on the Map prepared by Urbis JHD	Residential development covering up to **80** hectares to achieve **700** dwellings
	Northern Lands – Minmi and Newcastle Link Roads – nominated as 'blue lands' on the Map prepared by Urbis JHD	Residential development covering up to 526 hectares with a density of up to an average of **12** dwellings per hectare subject to detailed planning and constraints analysis
	Northern Lands – Black Hill – nominated as 'blue lands' on the Map prepared by Urbis JHD	Employment lands development covering up to **183** hectares

SCHEDULE 2 – ENVIRONMENTAL LANDS OFFSETS

This Schedule forms part of the MOU.

Schedule 2 Land

Property description	Map reference	Area
	Southern Lands – Catherine Hill Bay and Wallarah Peninsular – nominated as 'green lands'	657 hectares
	Southern Lands – Gwandalan and Cranagan Bay – nominated as 'green lands'	192 hectares
	Northern Lands – Stockrington – nominated as 'green lands'	2326 hectares
	Northern Lands – Tank Paddock – nominated as 'green lands'	147 hectares
		Total 3322 hectares

APPENDIX B DGEAR's

NSW GOVERNMENT
Department of Planning

Contact: Nyambura Mwaniki
Phone: (02) 9228 6408
Fax: 02 9228 6570
Email: nyambura.mwaniki@planning.nsw.gov.au

Keith Dedden
Project Director – Land Development
Coal & Allied Operations Pty Ltd
Level 3, West Tower,
410 Ann Street,
Brisbane QLD 4000

Our ref:
File: S07/00406-1

Dear Mr Dedden,

Subject: Link Road North, Link Road South and Minmi – Director General's Requirements

I refer to your letter dated 15 March 2007 requesting that the Minister list Coal and Allied Pty Ltd's land known as Link Road North, Link Road South and Minmi as a State Significant Site and also authorise the preparation of a Concept Plan for the subject site. In addition, a request for the issue of the Director-General's Requirements (DGRs) for the Environmental Assessment of the subject land was also made.

As previously advised, the Minister agreed on 30 November 2007 that the development proposal for urban and conservation purposes is of State or regional environmental planning significance and that Part 3A of the *Environmental Planning & Assessment (EP&A) Act* applies. The Minister also agreed to authorise the submission of a Concept Plan for the site.

In this regard, and based on the information provided by Coal and Allied Pty Ltd, please find attached, the DGRs for your Environmental Assessment for the subject land. These requirements have been prepared in consultation with the relevant Government authorities and also taking into consideration the strategic land use context for the Lower Hunter as set out in the Lower Hunter Regional Strategy 2006. This includes the rationale for the provision of housing within the Lower Hunter Region over the next twenty five years.

The Concept Plan should provide an environmental assessment regime for development on the subject land that is based on relevant, contemporary studies. It should also address the future planning for Stockrington for conservation purposes in keeping with applicable legislation and environmental planning instruments and also the *Lower Hunter Regional Strategy 2006.*

As part of the agreement that Part 3A of the *EP&A Act* applies to the development proposal for the subject land, the Minister required that a Study be prepared for the Western Corridor Lands (which include the subject land and the land to be dedicated for environmental conservation), in order to provide a sub-regional structure plan for these lands. Preparation of the Study is underway and any development proposed on the Link Road north, Link Road South and Minmi site will be required to also be consistent with this Study.

In terms of infrastructure provision, there will need to be a commitment to contribute to State infrastructure either in kind or through contributions to works where development of the site results in demand for additional State infrastructure. Required State infrastructure (which may include State and regional roads, bus interchanges and bus lanes, land required for regional open space and land required for social infrastructure and facilities), will need to be provided to the satisfaction of the State Government and formalised by a Voluntary Planning Agreement when the first project application is lodged. It is therefore crucial that consultation with the relevant State Government agencies including the Roads and Traffic Authority and the Ministry

for Transport, be undertaken early in the process. Consultation with the local councils should also be undertaken in order to determine requirements for local infrastructure that may potentially be generated by proposed development.

It should also be noted that the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* may be relevant to the subject site. The EA should therefore demonstrate compliance with this statute if applicable.

Concerning fees, the assessment will be determined on the basis of the capital investment value of the proposed development based on the estimated construction value of development set out in the concept plan. It is expected that this will be higher than the capital investment value of 400 million dollars set out in the documents submitted by Coal and Allied Pty Ltd. A Quantity Surveyor's report indicating the capital investment value of the proposal will therefore also need to be submitted when lodging the Environmental Assessment Report for the Concept Plan.

Once the Environmental Assessment Report has been lodged, it will then be the subject of a test of adequacy to determine whether the DGRs have been addressed adequately. Should the Environmental Assessment be considered inadequate, the assessment will need to b e revised.

Should you have any enquiries, please contact Nyambura Mwaniki, Senior Planner – Strategic Assessment on (02) 9228 6408.

Yours sincerely

Jason Perica
Executive Director 10/4/08
Strategic Sites and Urban Renewal

CONCEPT PLAN – LINK RD NORTH, LINK RD SOUTH & MINMI – S07/00406-1 ENVIRONMENTAL ASSESSMENT REQUIREMENTS UNDER PART 3A OF THE ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

Project Description	Concept Plan for Link Rd North, Link Rd South and Minmi including the: • Rezoning of land to allow 6312 residential allotments (526 ha) • Rezoning of land to allow associated infrastructure including roads, sewerage, water, electricity and telecommunications, • Dedication of land for education, community facilities and other social/recreational needs, • Dedication of 2473 ha of regionally significant conservation land to complete the Watagan to Stockton green corridor.
Capital Investment Value	Over $400 million (to be confirmed based on estimated cost of future development)
Site	Lot 71 DP 1065169; Lot 35 DP 800036; Lot 6 DP 1044574; Lot 2 DP 877349; Lot 3 DP 877349 (known as Link Road North, Link Road South and Minmi) and Lots and Deposited Plans set out in attached Table (known as Stockrington).
Proponent	Coal and Allied Operations Pty Ltd.
Date of Issue	April 2008
Date of Expiration	April 2010
Special Provision	The Minister for Planning formed the opinion that the development described is of State or regional environmental planning significance and authorised the submission of a concept plan for the project pursuant to section 75M(1) of the *EP&A Act*. The Minister also declared that development described was a project to which Part 3A of the *EP&A Act* would apply, and that such development would be required to be consistent with a structure plan to be prepared for the wider area.
General requirements	The Environmental Assessment (EA) for the **Concept Plan** must include: (1) an executive summary; (2) a description of the project including: (a) need for the project; (b) alternatives considered; (c) various components and staging of the project; and, (d) map indicating the footprint of the proposed work (3) a thorough site analysis and description of the existing environment; (4) justification of the project, taking into consideration the environmental impacts of the proposal, the suitability of the site and whether or not the project is in the public interest; (5) a consideration of all relevant statutory and non-statutory provisions and identification of any non-compliance with such provisions (especially the *SEPP (Major Projects) 2005, SEPP 44, SEPP 55, Draft SEPP 66, SEPP (Infrastructure) 2007, SEPP (Mining, Petroleum Production & Extractive Industries) 2007, Planning Circular PS 07-018 (Infrastructure Contributions), Newcastle LEP 2003, Hunter Regional Environmental Plan 1989, Lake Macquarie LEP 2004, Hunter Regional Environmental Plan 1989 (Heritage), Lower Hunter Regional Strategy, The Western Corridor Lands Study* that is currently being prepared, and *Planning for Bushfire Protection, 2006*); (6) a draft Statement of Commitments outlining commitments to public benefits, environmental management, mitigation and monitoring measures (especially in relation to flooding, biodiversity and stormwater) to be established on site and clear identification of who is responsible for these measures; (7) a signed statement from the author of the EA certifying that the information contained in the report is neither false nor misleading; and (8) the likely scope of developer contributions between: (a) the proponent and Newcastle City Council and Lake Macquarie City Council and (b) the proponent

	and State Government agencies for provision of community, regional and local infrastructure, public transport provision, social infrastructure and facilities etc. (9) A report from a quantity surveyor identifying the capital investment value of the Concept Plan including the estimated cost of future development (see covering letter).
Key Assessment Requirements	**Uses** (1) Demonstrate the suitability of the site for the proposed land uses. (2) Demonstrate consistency of the proposed uses with relevant planning documents including the Lower Hunter Regional Strategy, the Western Corridor Study that is currently being prepared, Lake Macquarie LEP 2004 and Newcastle LEP 2003. (3) Demonstrate that proposed uses include an adequate level of social infrastructure to meet the needs of the future population arising from proposed development of the land. **Urban Design, development controls and land uses** (1) Propose development controls for the site based on a comprehensive site analysis of constraints and opportunities. The resulting development controls must satisfy the objects of the *EP&A Act* and the aims and objectives of relevant planning instruments. (2) Demonstrate that development controls will complement surrounding existing land uses and the dedicated conservational lands. (3) Provide a detailed contour plan to identify the finished contour levels of the site, with details provided on the earthworks required to achieve the finished contours. (4) Provide an assessment of the impacts of any site preparation works required to accommodate the construction of any proposed physical infrastructure. (5) Assess the visual impact of the proposal, particularly in regard to the heritage significance and recreational amenity of the area. (6) Identify the footprint for urban development including the envisaged urban form for development on the subject land and assess the visual impacts of proposed development when viewed from public vantage points in the surrounding environs. **Staging of Development** (1) Provide details of the staging of development including a Staging Plan that sets out the sequencing of land release. Include relevant maps. (2) Identify the staging process for infrastructure provision commensurate with proposed staging of development and land release. **Conservation lands** (1) Identify the extent, locations, and timing of dedication of proposed conservation lands. (2) Discuss any edge effects between the development area, and the conservational and surrounding lands. Commit to an ongoing management program for edge effects – assess the provision of a buffer zone. (3) Explore linkages, access and integration of the recreational and conservational lands to the proposed development as well as beyond the site. **Biodiversity** (1) Assess the impact of the proposed rezoning and land clearing on existing native flora and fauna, on the site and surrounding areas (including Blue Gum Hills Regional Park, Pambalong Nature Reserve, Hexham Swamp, Hunter Estuary National Park and the dedicated conservation areas). The assessment must be conducted in accordance with the Guidelines for *Threatened Species Assessment (DEC July 2005)* and include a field study. (2) Describe the actions that would be taken to avoid or mitigate impacts on biodiversity, threatened species, their habitat and ecological corridors. (3) Identify proposed riparian areas and future management options for these lands. (4) Demonstrate the linkages between proposed conservation lands and adjoining lands and the benefits in providing biodiversity habitats in these locations.

Air Quality

(1) Assess the odour and air quality impacts of the nearby existing development and any proposed development including sewerage treatment plants on the site and in light of potential coal mining and coal-bed methane extraction on the subject land. The assessment must be consistent with the *Technical Framework Assessment and management of odour from stationary sources in NSW (DECC November 2006)* and the *Technical Notes Assessment and management of odour from stationary sources in NSW (DECC November 2006)*.

Geotechnical

(1) Assess the capability of the land for the proposed development including with respect to erosion potential, slope stability, sodicity and salinity and the presence of potential and actual acid sulphate soils if any.

(2) Identify the potential for subsidence, hazards associated with subterranean gases and contamination and other associated risks for development and propose restrictions and limitations for building in areas that are geotechnically sub-optimal.

(3) Identify the impacts of the development of the proposal and conservation offsets on the future recovery of resources of coal and coal-seam methane below the site.

(4) Outline actions, management and mitigation measures required and address contamination issues associated with the project if any, in accordance with *SEPP 55* and other relevant legislation and guidelines.

Sustainability

(1) The EA should outline commitments to sustainability including water reuse, waste minimisation, the minimisation of energy use and car dependency etc.

Traffic/Transport

(1) Include a traffic study in accordance with the *RTA Guide to Traffic Generating Developments*, which addresses:

- (a) Impacts on regional road networks during construction and operation.
- (b) Opportunities to minimise traffic on sensitive road frontages during construction and operation;
- (c) Efficiency of emergency vehicle access/egress;
- (d) Proposed access from the wider road network as well as the opportunities and constraints of alternative vehicular access points;
- (e) Measures to introduce and promote public transport usage and mode share;
- (f) Proposed pedestrian and cycle access within and to the site that connects to all relevant transport services and key off-site locations;
- (g) Traffic signal and intersection upgrades underpinned by an intersection analysis and micro-simulation model; and
- (h) Road design that is responsive to the proposed land use and associated urban form including proposed transport linkages between the subject land and surrounding key destination points such as existing centres, recreational areas and employment/industrial centres.

Noise Impact

(1) Demonstrate that the proposal will be designed, constructed, operated and maintained so that there are no unacceptable impacts from noise (including traffic noise).

Heritage

(1) Assess in accordance with the *Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation DEC (July 2005)* the heritage significance of the area.

(2) Provide detail of how the development will incorporate and not negatively impact on site setting, landscapes, landmark elements, heritage items, views and vistas.

(3) Assess the impact of potential development on the historic setting and visual catchment of Minmi and demonstrate how proposed development is to be integrated with the existing development in Minmi.

Surface water and groundwater quality

(1) Assess any potential impact of proposed development on hydrology and hydrogeology of the site and adjacent areas in terms of impact on water quality in keeping with the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000).*

(2) Identify drainage and stormwater management issues, including: on site detention of stormwater; water sensitive urban design (WSUD); and drainage infrastructure.

(3) Provide details in relation to the short and long term management of water quality and ecosystem health during construction and the life of the development, including the formation of buffer zones.

(4) Develop suitable Flood Planning Levels for the development and demonstrate consistency with the *NSW Floodplain Development Manual: the management of flood liable land (2005)* and the *DECC Floodplain Risk Management Guideline – Practical Consideration of Climate Change*.

Bushfire Risk Assessment

(1) Provide an assessment against the current version of *Planning for Bush Fire Protection 2006*, section 100B of the *Rural Fires Act 1997* and Section 79BA of the *EP&AA 1979*.

(2) Identify the ongoing management arrangements of proposed Asset Protection Zones.

Ownership/Maintenance of Public Domain

(1) Provide details of the proposed ownership arrangements for publicly accessible land including roads, parks, riparian areas etc.

Utilities Infrastructure

(1) Prepare a utility and infrastructure servicing report and plan for the site – This must:

- (a) identify existing utilities and infrastructure such as the supply of water, sewerage, stormwater, gas, electricity and telephone services.
- (b) assess the capacity of utility infrastructure to service the proposed development in conjunction with existing uses, proposed uses and potential future uses (including fire suppression).
- (c) demonstrate compliance with the requirements of any public authorities in regard to the connection to, relocation and/or adjustment of services affected by the development proposal.
- (d) Detail technologies which may reduce the demand or need for servicing or provide for the supply of sustainable services (such as water sensitive urban design measures and sediment control measures.
- (e) Identify the types of infrastructure and community facilities required for proposed development and assess the adequacy of the existing level of infrastructure services and community facilities for each stage of proposed development.
- (f) Justify any staging of proposed infrastructure works.

Ecologically Sustainable Development (ESD)

(1) The EA should demonstrate that all aspects of the concept plan satisfy the principles of ESD including compliance with BASIX.

Developer contributions

(1) Provide details of the likely scope of developer contributions between the proponent and the State Government (via agencies including the Roads and Traffic Authority and the Ministry of Transport). This should be based on the estimated cost of future development and an agreed schedule of infrastructure funding for the land.

(2) Provide details of the likely scope of developer contributions between the proponent and both Newcastle City Council and Lake Macquarie City Council. This should be based on the estimated cost of future development.

(3) Provide a social impact analysis of surrounding communities including a gap analysis relating to community and sporting facilities, provision of aged housing, community health facilities and a diverse housing range.

Consultation Requirements	During the preparation of the EA, the proponent must undertake an appropriate and justified level of consultation with relevant parties. A Communication Strategy should be included that identifies opportunities for existing communities in the surrounding areas to provide input. The Strategy should include timing for the carrying out of proposed consultation processes. If consultation has already been undertaken or will be undertaken during exhibition, this needs to be documented. Relevant agencies must include, but not be limited to: • Newcastle City Council • Lake Macqaurie City Council • Department of Environment and Climate Change • Roads and Traffic Authority • Ministry of Transport • Mine Subsidence Board • NSW Heritage Council • Department of Health • Department of Education • Hunter-Central Rivers CMS • Hunter Water • Commonwealth Department of Environment and Heritage • Local Aboriginal Land Council • Utility and infrastructure providers • Emergency Services, including the Ambulance Service of NSW, the State Emergency Services, Rural Fire Service and NSW Fire Brigades. • Sydney Gas Operations (Holder of Petroleum Exploration Licence 267) • Newcastle Wallsend Coal Company Pty ltd (holder of Consolidated Coal Lease 731). If the Director-General considers that significant changes are proposed to the nature of the project, the Director-General may require the proponent to make the preferred project available to the public.
Deemed refusal period	120 days (see Clause 8E of the Environmental Planning & Assessment Regulation)
Landowners Information	The consent of the landowner is to be provided in accordance with s8F of the *Environmental Planning and Assessment Regulation 2000*.

Table of Lots and DP for Stockrington

1/83/DP 755260	1/71/DP1065169	1/2/DP551917	1/2/DP34957
1/30/DP1051995	1/2/DP250339	1/2/DP844313	1/1/DP250339
1/84/DP755260	1/2/DP124209	2/96/DP755260	2/82/DP755260
1/1/DP726037	1/1/DP155446	1/3/DP250339	1/1DP877416
2/8/DP755260	1/1/DP503566	1/24/DP1051995	1/31/DP1051995
1/5/DP977096	1/3/DP977096	1/79/DP755260	1/26/DP1051995
1/32/DP1051995	1/2/DP877416	1/2/DP1039968	1/1/DP505578
1/89/DP755260	1/23/DP1051995	1/25/DP1051995	1/4/DP877416
1/77/DP755260	1/1/DP1039968	1/1/DP123945	1/126/DP755262
1/72/DP755260	1/8/DP807908	1/5/DP250339	1/20/DP1051995
1/1/DP433355	1/4/DP977096		
1/125/DP755260	1/1/DP119630		
1/1/DP124209	1/101/DP881099		

APPENDIX C Conservation Estate Ecological Inventory Report

APPENDIX D Flora Species List

FLORA SPECIES LIST

The following list includes all species of vascular plants observed on site during fieldwork. It should be noted that such a list couldn't be considered comprehensive, but rather indicative of the flora present on the site. It can take many years of flora surveys to record all of the plant species occurring within any area, especially plant species that are only apparent in some seasons such as Orchids.

A number of species cannot always be accurately identified during a brief survey, generally due to a lack of suitable flowering and/or fruiting material. Any such species are identified as accurately as possible, and are indicated in the list as indicated:

- specimens that could only be identified to genus level are indicated by the generic name followed by the abbreviation "sp.", indicating an unidentified species of that genus;
- specimens for which identification of the genus was uncertain are indicated by a question mark ("?") placed in front of the generic, which is followed by the abbreviation "sp." and;
- specimens that could be accurately identified to genus level, but could be identified to species level with only a degree of certainty are indicated by a ("?") placed in front of the epithet.

Authorities for the scientific names are not provided in the list. These follow the references outlined below.

> Harden, G. (ed) (2000). *Flora of New South Wales, Volume 1*. Revised edition. UNSW, Kensington, NSW.
>
> Harden, G. (ed) (2002). *Flora of New South Wales, Volume 2*. Revised edition. UNSW, Kensington, NSW.
>
> Harden, G. (ed) (1992). *Flora of New South Wales, Volume 3.* UNSW, Kensington, NSW.
>
> Harden, G. (ed) (1993). *Flora of New South Wales, Volume 4*. UNSW, Kensington, NSW. Names of families and higher taxa follow a modified Cronquist System (1981).

Introduced species are indicated by an asterisk "*".

Threatened species listed under the Threatened Species Conservation Act 1995 (TSC Act 1995) or the Environmental Protection of Biodiversity and Conservation (EPBC Act 1999) and / or Rare or Threatened Australian Plant (ROTAP) listed species are indicated in bold font and marked as:

(V) = Vulnerable Species listed under the TSC Act
(E) = Endangered Species listed under the TSC Act
(EE) = Species listed under the Commonwealth EPBC Act 1999 as Endangered
(EV) = Species listed under the Commonwealth EPBC Act 1999 as Vulnerable
(R) = ROTAP as per Briggs and Leigh (1996)

The following standard abbreviations are used to indicate subspecific taxa:

ssp. - subspecies
var.- variety
agg. aggregate
× - hybrid between the two indicated species

Table D-1: Flora List for Link Road - Minmi

Class / Subclass	Family	Scientific Name	Common Name
Coniferopsida	Pinaceae	*Pinus radiata**	Radiata or Monterey Pine
Filicopsida	Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair
Filicopsida	Adiantaceae	*Adiantum formosum*	Giant Maidenhair
Filicopsida	Azollaceae	*Azolla pinnata*	Ferny Azolla
Filicopsida	Blechnaceae	*Blechnum indicum*	-
Filicopsida	Blechnaceae	*Blechnum nudum*	-
Filicopsida	Blechnaceae	*Doodia aspera*	Rasp Fern
Filicopsida	Dennstaedtiaceae	*Pteridium esculentum*	Bracken
Filicopsida	Dicksoniaceae	*Calochlaena dubia*	False Bracken
Filicopsida	Sinopteridaceae	*Cheilanthes sieberi* subsp. *sieberi*	Poison Rock Fern
Filicopsida	Sinopteridaceae	*Pellaea falcata*	Sickle Fern
Filicopsida	Sinopteridaceae	*Pellaea paradoxa*	-
Magnoliidae	Acanthaceae	*Brunoniella australis*	Blue Trumpet
Magnoliidae	Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower
Magnoliidae	Acanthaceae	*Thunbergia alata**	Black-eyed Susan
Magnoliidae	Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed
Magnoliidae	Amaranthaceae	*Nyssanthes diffusa*	Barbwire Weed
Magnoliidae	Apiaceae	*Centella asiatica*	Swamp Pennywort
Magnoliidae	Apiaceae	*Hydrocotyle bonariensis**	Kurnell Curse / Pennywort
Magnoliidae	Apiaceae	*Hydrocotyle peduncularis*	Pennywort
Magnoliidae	Apiaceae	*Hydrocotyle tripartita*	Pennywort
Magnoliidae	Apiaceae	*Trachymene incisa* subsp. *incisa*	Native Parsnip
Magnoliidae	Apocynaceae	*Parsonsia straminea*	Common Silkpod
Magnoliidae	Araliaceae	*Polyscias sambucifolia*	Elderberry Panax
Magnoliidae	Asclepiadaceae	*Marsdenia rostrata*	Common Milk Vine
Magnoliidae	Asclepiadaceae	*Marsdenia suaveolens*	Scented Marsdenia
Magnoliidae	Asclepiadaceae	*Tylophora barbata*	Bearded Tylophora
Magnoliidae	Asteraceae	*Ageratina adenophorum**	Crofton Weed
Magnoliidae	Asteraceae	*Bidens pilosa**	Cobbler's Pegs
Magnoliidae	Asteraceae	*Cirsium vulgare**	Spear Thistle
Magnoliidae	Asteraceae	*Conyza bonariensis**	Flax-leaf Fleabane
Magnoliidae	Asteraceae	*Gnaphalium americanum**	Cudweed

Class / Subclass	Family	Scientific Name	Common Name
Magnoliidae	Asteraceae	*Hypochaeris radicata**	Flatweed
Magnoliidae	Asteraceae	*Lagenifera stipitata*	-
Magnoliidae	Asteraceae	*Ozothamnus diosmifolius*	Ball Everlasting
Magnoliidae	Asteraceae	*Senecio hispidulus* var. *hispidulus*	Fireweed
Magnoliidae	Asteraceae	*Senecio linearifolius*	Fireweed
Magnoliidae	Asteraceae	*Senecio madagascariensis**	Fireweed
Magnoliidae	Asteraceae	*Sigesbeckia orientalis*	Indian Weed
Magnoliidae	Asteraceae	*Vernonia cinerea* var. *cinerea*	-
Magnoliidae	Bignoniaceae	*Pandorea pandorana*	Wonga Vine
Magnoliidae	Campanulaceae	*Wahlenbergia gracilis*	Australian Bluebell
Magnoliidae	Carophyllaceae	*Cerastium glomeratum**	Mouse-ear Chickweed
Magnoliidae	Caryophyllaceae	*Stellaria media**	Common Chickweed
Magnoliidae	Casuarinaceae	*Allocasuarina littoralis*	Black She-oak
Magnoliidae	Casuarinaceae	*Allocasuarina torulosa*	Forest Oak
Magnoliidae	Celastraceae	*Cassine australis var. australis*	Red Olive Plum
Magnoliidae	Celastraceae	*Maytenus silvestris*	-
Magnoliidae	Cesalpinioideae	*Senna pendula* var. *glabrata**	-
Magnoliidae	Chenopodiaceae	*Einadia hastata*	Berry Saltbush
Magnoliidae	Commelinaceae	*Commelina cyanea*	Scurvy Weed
Magnoliidae	Commelinaceae	*Tradescantia fluminensis**	Wandering Jew
Magnoliidae	Convolvulaceae	*Dichondra repens*	Kidney Weed
Magnoliidae	Convolvulaceae	*Polymeria calycina*	Bindweed
Magnoliidae	Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower
Magnoliidae	Dilleniaceae	*Hibbertia empetrifolia*	-
Magnoliidae	Dilleniaceae	*Hibbertia pedunculata*	-
Magnoliidae	Dilleniaceae	*Hibbertia scandens*	Climbing Guinea-flower
Magnoliidae	Eleocarpaceae	*Elaeocarpus reticulatus*	Blueberry Ash
Magnoliidae	Epacridaceae	*Epacris pulchella*	NSW Coral Heath
Magnoliidae	Escallionaceae	*Abrophyllum ornans*	Native Tamarind
Magnoliidae	Euphorbiaceae	*Breynia oblongifolia*	Coffee Bush
Magnoliidae	Euphorbiaceae	*Claoxylon australe*	Brittlewood
Magnoliidae	Euphorbiaceae	*Glochidion ferdinandii*	Cheese Tree

Class / Subclass	Family	Scientific Name	Common Name
Magnoliidae	Euphorbiaceae	*Omalanthus populifolius*	Bleeding Heart
Magnoliidae	Euphorbiaceae	*Phyllanthus gunnii*	Spurge
Magnoliidae	Euphorbiaceae	*Phyllanthus hirtellus*	Thyme Spurge
Magnoliidae	Euphorbiaceae	*Poranthera microphylla*	-
Magnoliidae	Fabaceae	*Daviesia squarrosa*	-
Magnoliidae	Fabaceae	*Daviesia ulicifolia*	Gorse Bitter Pea
Magnoliidae	Fabaceae	*Desmodium rhytidophyllum*	-
Magnoliidae	Fabaceae	*Desmodium varians*	-
Magnoliidae	Fabaceae	*Dillwynia retorta* var. *retorta*	Eggs and Bacon
Magnoliidae	Fabaceae	*Erythrina X sykesii**	Coral Tree
Magnoliidae	Fabaceae	*Glycine clandestina*	Twining Glycine
Magnoliidae	Fabaceae	*Glycine tabacina*	Twining Glycine
Magnoliidae	Fabaceae	*Gompholobium grandiflorum*	Golden Glory Pea
Magnoliidae	Fabaceae	*Gompholobium latifolium*	Broad-leaf Wedge-pea
Magnoliidae	Fabaceae	*Hardenbergia violacea*	False Sarsparilla
Magnoliidae	Fabaceae	*Hovea linearis*	-
Magnoliidae	Fabaceae	*Indigofera australis*	Native Indigo
Magnoliidae	Fabaceae	*Jacksonia scoparia*	Dogwood
Magnoliidae	Fabaceae	*Kennedia rubicunda*	Dusky Coral Pea
Magnoliidae	Fabaceae	*Mirbelia rubiifolia*	-
Magnoliidae	Fabaceae	*Pultenaea cunninghamii*	-
Magnoliidae	Fabaceae	*Pultenaea daphnoides*	Large-leaf Bush Pea
Magnoliidae	Fabaceae	*Pultenaea elliptica*	-
Magnoliidae	Fabaceae	*Pultenaea paleacea* var. *paleacea*	-
Magnoliidae	Fabaceae	*Pultenaea retusa*	-
Magnoliidae	Fabaceae	*Pultenaea villosa*	-
Magnoliidae	Fabaceae	*Trifolium dubium**	Yellow Suckling Clover
Magnoliidae	Fabaceae	*Trifolium repens**	White Clover
Magnoliidae	Fabaceae	*Vicia sativa* subsp. *sativa**	Common Vetch
Magnoliidae	Gentianaceae	*Centaurium tenuiflorum**	Common Century
Magnoliidae	Geraniaceae	*Geranium homeanum*	Northern Cranesbill
Magnoliidae	Goodeniaceae	*Goodenia heterophylla* subsp. *heterophylla*	Variable Leaved Goodenia

Class / Subclass	Family	Scientific Name	Common Name
Magnoliidae	Haloragaceae	*Gonocarpus tetragynus*	Poverty Raspwort
Magnoliidae	Haloragaceae	*Gonocarpus teucrioides*	Raspwort
Magnoliidae	Haloragaceae	*Myriophyllum aquaticum**	Brazilian Water Milfoil
Magnoliidae	Lamiaceae	*Plectranthus parviflorus*	Cockspur Flower
Magnoliidae	Lamiaceae	*Prostanthera incisa*	-
Magnoliidae	Lamiaceae	*Scutellaria mollis*	Soft Skull Cap
Magnoliidae	Lauraceae	*Cassytha glabella* forma *glabella*	Slender Devil's Twine
Magnoliidae	Lauraceae	*Cassytha pubescens*	Common Devil's Twine
Magnoliidae	Lauraceae	*Cinnamomum camphora**	Camphor Laurel
Magnoliidae	Lauraceae	*Cryptocarya glaucescens*	Jackwood
Magnoliidae	Lauraceae	*Cryptocarya microneura*	Murrogun
Magnoliidae	Lobeliaceae	*Pratia purpurascens*	Whiteroot
Magnoliidae	Loranthaceae	*Muellerina eucalyptoides*	Mistletoe
Magnoliidae	Malvaceae	*Hibiscus heterophyllus*	Native Rosella
Magnoliidae	Malvaceae	*Malva parviflora**	Small-flowered Mallow
Magnoliidae	Malvaceae	*Sida rhombifolia**	Paddy's Lucerne
Magnoliidae	Meliaceae	*Melia azedarach* var. *australasica*	White Cedar
Magnoliidae	Meliaceae	*Synoum glandulosum*	Scentless Rosewood
Magnoliidae	Menispermiaceae	*Sarcopetalum harveyanum*	Pearl Vine
Magnoliidae	Menispermiaceae	*Stephania japonica* var. *discolor*	Snake Vine
Magnoliidae	Mimosaceae	*Acacia binervata*	Two-veined Hickory
Magnoliidae	Mimosaceae	*Acacia falcata*	Sickle Wattle
Magnoliidae	Mimosaceae	*Acacia floribunda*	Sally Wattle
Magnoliidae	Mimosaceae	*Acacia implexa*	Hickory
Magnoliidae	Mimosaceae	*Acacia irrorata* subsp. *irrorata*	Green Wattle
Magnoliidae	Mimosaceae	*Acacia longifolia* var. *longifolia*	Sydney Golden Wattle
Magnoliidae	Mimosaceae	*Acacia maidenii*	Maiden's Wattle
Magnoliidae	Mimosaceae	*Acacia myrtifolia*	Red Stem Wattle
Magnoliidae	Mimosaceae	*Acacia suaveolens*	Sweet Scented Wattle
Magnoliidae	Mimosaceae	*Acacia terminalis*	Sunshine Wattle
Magnoliidae	Mimosaceae	*Acacia ulicifolia*	Prickly Moses

Class / Subclass	Family	Scientific Name	Common Name
Magnoliidae	Monimiaceae	*Wilkiea heugeliana*	Wilkiea
Magnoliidae	Moraceae	*Ficus coronata*	Sandpaper Fig
Magnoliidae	Moraceae	*Ficus rubiginosa*	Port Jackson Fig
Magnoliidae	Moraceae	*Ficus watkinsiana*	Strangler Fig
Magnoliidae	Moraceae	*Streblus brunonianus*	Whalebone Tree
Magnoliidae	Myrsinaceae	*Rapanea howittiana*	Brush Muttonwood
Magnoliidae	Myrsinaceae	*Rapanea variabilis*	Muttonwood
Magnoliidae	Myrtaceae	*Acmena smithii*	Lillypilly
Magnoliidae	Myrtaceae	*Angophora costata*	Smooth-barked Apple
Magnoliidae	Myrtaceae	*Angophora floribunda*	Rough-barked Apple
Magnoliidae	Myrtaceae	*Babingtonia similis*	-
Magnoliidae	Myrtaceae	*Backhousia myrtifolia*	Grey Myrtle
Magnoliidae	Myrtaceae	*Callistemon linearis*	Narrow-leaved Bottlebrush
Magnoliidae	Myrtaceae	*Callistemon salignus*	Willow Bottlebrush
Magnoliidae	Myrtaceae	*Corymbia gummifera*	Red Bloodwood
Magnoliidae	Myrtaceae	*Corymbia maculata*	Spotted Gum
Magnoliidae	Myrtaceae	*Eucalyptus acmenoides*	White Mahogany
Magnoliidae	Myrtaceae	***Eucalyptus fergusonii* subsp. *dorsiventralis* (R)**	
Magnoliidae	Myrtaceae	*Eucalyptus fibrosa*	Broad Leaved Ironbark
Magnoliidae	Myrtaceae	*Eucalyptus globoidea*	White Stringybark
Magnoliidae	Myrtaceae	*Eucalyptus grandis*	Flooded gum
Magnoliidae	Myrtaceae	*Eucalyptus paniculata* subsp. *paniculata*	Grey Ironbark
Magnoliidae	Myrtaceae	*Eucalyptus piperita* subsp. *piperita*	Sydney Peppermint
Magnoliidae	Myrtaceae	*Eucalyptus propinqua* var. *propinqua*	Small Fruited Grey Gum
Magnoliidae	Myrtaceae	*Eucalyptus punctata*	Grey Gum
Magnoliidae	Myrtaceae	*Eucalyptus resinifera* subsp. *resinifera*	Red Mahogany
Magnoliidae	Myrtaceae	*Eucalyptus robusta*	Swamp Mahogany
Magnoliidae	Myrtaceae	*Eucalyptus siderophloia*	Northern Grey Ironbark
Magnoliidae	Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum
Magnoliidae	Myrtaceae	*Eucalyptus umbra* subsp. *umbra*	Broad-leaved White Mahogany

Class / Subclass	Family	Scientific Name	Common Name
Magnoliidae	Myrtaceae	*Kunzea ambigua*	Tick Bush
Magnoliidae	Myrtaceae	*Leptospermum parvifolium*	Small-leaved Tea-tree
Magnoliidae	Myrtaceae	*Leptospermum polygalifolium* subsp. *cismontanum*	Lemon Scented Tea-tree
Magnoliidae	Myrtaceae	*Leptospermum polygalifolium* subsp. *polygalifolium*	Lemon Scented Tea-tree
Magnoliidae	Myrtaceae	*Leptospermum trinervium*	Flaky-barked Tea-tree
Magnoliidae	Myrtaceae	*Melaleuca lineariifolia*	Snow in Summer
Magnoliidae	Myrtaceae	*Melaleuca nodosa*	Ball Honey Myrtle
Magnoliidae	Myrtaceae	*Melaleuca stypheloides*	Prickly-leaved Tea Tree
Magnoliidae	Myrtaceae	*Rhodamnia rubescens*	Brush Turpentine
Magnoliidae	Myrtaceae	*Syncarpia glomulifera*	Turpentine
Magnoliidae	Ochnaceae	*Ochna serrulata**	Mickey Mouse Plant
Magnoliidae	Oleaceae	*Ligustrum sinense**	Small-leaved Privet
Magnoliidae	Oleaceae	*Notelaea longifolia*	Mock Olive
Magnoliidae	Oleaceae	*Notelaea ovata*	Mock Olive
Magnoliidae	Onagraceae	*Ludwigia peploides* subsp. *montevidensis*	Water Primrose
Magnoliidae	Oxalidaceae	*Oxalis latifolia**	Pink Fishtail
Magnoliidae	Oxalidaceae	*Oxalis perennans*	-
Magnoliidae	Passifloraceae	*Passiflora herbertiana*	Native Passionfruit
Magnoliidae	Piperaceae	*Piper novae-hollandiae*	Pepper Vine
Magnoliidae	Pittosporaceae	*Billardiera scandens* var. *scandens*	Apple Dumplings
Magnoliidae	Pittosporaceae	*Bursaria spinosa* var. *spinosa*	Blackthorn
Magnoliidae	Pittosporaceae	*Citriobatus pauciflorus*	Orange Thorn
Magnoliidae	Pittosporaceae	*Pittosporum revolutum*	Yellow Pittosporum
Magnoliidae	Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum
Magnoliidae	Plantaginaceae	*Plantago debilis*	Slender Plantain
Magnoliidae	Plantaginaceae	*Plantago lanceolata**	Ribwort
Magnoliidae	Polygalaceae	*Comesperma sphaerocarpum*	-
Magnoliidae	Polygonaceae	*Persicaria decipiens*	Slender Knotweed
Magnoliidae	Polygonaceae	*Persicaria lapathifolia*	Pale Knotweed

Class / Subclass	Family	Scientific Name	Common Name
Magnoliidae	Primulaceae	*Anagallis arvensis**	Scarlet Pimpernel
Magnoliidae	Proteaceae	*Banksia spinulosa*	Hairpin Banksia
Magnoliidae	Proteaceae	*Banksia spinulosa* var. *collina*	Hairpin Banksia
Magnoliidae	Proteaceae	*Grevillea robusta*	Silky Oak
Magnoliidae	Proteaceae	*Hakea sericea*	Needlebush
Magnoliidae	Proteaceae	*Persoonia levis*	Broad-leaved Geebung
Magnoliidae	Proteaceae	*Persoonia linearis*	Narrow-leaved Geebung
Magnoliidae	Ranunculaceae	*Clematis aristata*	Old Man's Beard
Magnoliidae	Rhamnaceae	*Alphitonia excelsa*	Red Ash
Magnoliidae	Rosaceae	*Prunus persica**	Peach Tree
Magnoliidae	Rosaceae	*Rubus moluccanus var. trilobus*	Broad-leaf Bramble
Magnoliidae	Rosaceae	*Rubus parvifolius*	Native Raspberry
Magnoliidae	Rosaceae	*Rubus ulmifolius**	Blackberry
Magnoliidae	Rubiaceae	*Galium binifolium*	-
Magnoliidae	Rubiaceae	*Galium proquinquum*	Bedstraw
Magnoliidae	Rubiaceae	*Morinda jasminoides*	-
Magnoliidae	Rubiaceae	*Opercularia aspera*	Common Stinkweed
Magnoliidae	Rubiaceae	*Opercularia diphylla*	-
Magnoliidae	Rubiaceae	*Pomax umbellata*	Pomax
Magnoliidae	Rubiaceae	*Richardia brasiliensis**	White Eye
Magnoliidae	Rutaceae	*Acronychia oblongifolia*	Common Acronychia
Magnoliidae	Rutaceae	*Boronia ledifolia*	Sydney Boronia
Magnoliidae	Rutaceae	*Boronia polygalifolia*	Milkwort Boronia
Magnoliidae	Rutaceae	*Correa reflexa*	Native Fuschia
Magnoliidae	Rutaceae	*Melicope micrococca*	White Euodia
Magnoliidae	Santalaceae	*Exocarpos strictus*	Pale Ballart
Magnoliidae	Sapindaceae	*Dodonaea triquetra*	Hop Bush
Magnoliidae	Sapindaceae	*Guioa semiglauca*	Guioa
Magnoliidae	Scrophulariaceae	*Veronica persica**	Creeping Speedwell
Magnoliidae	Scrophulariaceae	*Veronica plebia*	Creeping Speedwell
Magnoliidae	Solanaceae	*Physalis peruviana**	Cape Gooseberry
Magnoliidae	Solanaceae	*Solanum mauritianum**	Wild Tobacco
Magnoliidae	Solanaceae	*Solanum nigrum**	Black Nightshade
Magnoliidae	Solanaceae	*Solanum prinophyllum*	Forest Nightshade

Class / Subclass	Family	Scientific Name	Common Name
Magnoliidae	Solanaceae	*Solanum pungetium*	Eastern Nightshade
Magnoliidae	Solanaceae	*Solanum stelligerum*	Devil's Needles
Magnoliidae	Sterculiaceae	*Commersonia fraseri*	Brush Kurrajong
Magnoliidae	Stylidiaceae	*Stylidium graminifolium*	Trigger Plant
Magnoliidae	Tremandraceae	***Tetratheca juncea* (V,V)**	Black-eyed Susan
Magnoliidae	Verbenaceae	*Clerodendrum tomentosum*	Hairy Clerodendrum
Magnoliidae	Verbenaceae	*Lantana camara**	Lantana
Magnoliidae	Verbenaceae	*Verbena bonariensis**	Purpletop
Magnoliidae	Verbenaceae	*Verbena rigida**	Veined Verbena
Magnoliidae	Violaceae	*Hybanthus stellarioides*	Spade Flower
Magnoliidae	Violaceae	*Viola betonicifolia*	-
Magnoliidae	Violaceae	*Viola hederacea*	Ivy-leaved Violet
Magnoliidae	Vitaceae	*Cayratia clematidea*	Slender Grape
Magnoliidae	Vitaceae	*Cissus antarctica*	Native Grape
Magnoliidae	Vitaceae	*Cissus hypoglauca*	Water Vine
Magnoliidae	Winteraceae	*Tasmannia insipida*	-
Liliidae	Anthericaceae	*Arthropodium milleflorum*	Pale Vanilla Lily
Liliidae	Anthericaceae	*Arthropodium minus*	Small Vanilla Lily
Liliidae	Anthericaceae	*Caesia parviflora* var. *parviflora*	Pale Grass Lily
Liliidae	Anthericaceae	*Thysanotus tuberosus*	Fringed Lily
Liliidae	Anthericaceae	*Tricoryne elatior*	Yellow Rush Lily
Liliidae	Araceae	*Gymnostachys anceps*	Settlers Flax
Liliidae	Asteliaceae	*Cordyline stricta*	Narrow-leaf Palm Lily
Liliidae	Cyperaceae	*Baumea articulata*	Jointed Twig-Rush
Liliidae	Cyperaceae	*Carex appressa*	Tall Sedge
Liliidae	Cyperaceae	*Carex inversa*	Knob Sedge
Liliidae	Cyperaceae	*Carex longebrachiata*	Bergalia Tussock
Liliidae	Cyperaceae	*Carex sp.*	-
Liliidae	Cyperaceae	*Cyperus brevifolius**	Mullumbimby Couch
Liliidae	Cyperaceae	*Cyperus polystachyos*	-
Liliidae	Cyperaceae	*Eleocharis sphacelata*	Tall Spike-rush
Liliidae	Cyperaceae	*Gahnia clarkei*	Tall Saw-sedge
Liliidae	Cyperaceae	*Gahnia melanocarpa*	Black-fruit Saw-sedge
Liliidae	Cyperaceae	*Gahnia radula*	-

Class / Subclass	Family	Scientific Name	Common Name
Liliidae	Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge
Liliidae	Cyperaceae	*Ptilothrix deusta*	-
Liliidae	Cyperaceae	*Schoenus melanostachys*	Black Bog Rush
Liliidae	Dioscoreaceae	*Dioscorea transversa*	Native Yam
Liliidae	Doryanthaceae	*Doryanthes excelsa*	Gymea Lily
Liliidae	Hypoxidaceae	*Hypoxis hygrometrica*	Golden Star
Liliidae	Iridaceae	*Libertia paniculata*	-
Liliidae	Juncaceae	*Juncus cognatus**	-
Liliidae	Juncaceae	*Juncus mollis*	-
Liliidae	Juncaceae	*Juncus pallidus*	-
Liliidae	Juncaceae	*Juncus usitatus*	Common Rush
Liliidae	Juncaginaceae	*Triglochin microtuberosum*	Water Ribbons
Liliidae	Lomandraceae	*Lomandra cylindrica*	-
Liliidae	Lomandraceae	*Lomandra filiformis* subsp. *coriacea*	Wattle Mat-rush
Liliidae	Lomandraceae	*Lomandra filiformis* subsp. *filiformis*	Wattle Mat-rush
Liliidae	Lomandraceae	*Lomandra glauca* subsp. *glauca*	-
Liliidae	Lomandraceae	*Lomandra longifolia*	Spiky-headed Mat-rush
Liliidae	Lomandraceae	*Lomandra multiflora*	Many-flowered Mat-rush
Liliidae	Lomandraceae	*Lomandra obliqua*	Twisted Mat-rush
Liliidae	Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry
Liliidae	Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily
Liliidae	Orchidaceae	*Acianthus fornicatus*	Pixie Caps
Liliidae	Orchidaceae	*Caladenia catenata*	White Finger Orchid
Liliidae	Orchidaceae	*Caladenia carnea*	Pink Fingers
Liliidae	Orchidaceae	*Calochilus campestris*	Copper Beard Orchid
Liliidae	Orchidaceae	*Calochilus robertsonii*	Purple Beard Orchid
Liliidae	Orchidaceae	*Glossodia major*	Wax Lip Orchid
Liliidae	Orchidaceae	*Pterostylis baptistii*	King Greenhood
Liliidae	Orchidaceae	*Pterostylis curta*	Blunt Greenhood
Liliidae	Orchidaceae	*Pterostylis longifolia*	-
Liliidae	Orchidaceae	*Pterostylis erecta*	Upright Maroonhood
Liliidae	Orchidaceae	*Pterostylis nutans*	Nodding Greenhood

Class / Subclass	Family	Scientific Name	Common Name
Liliidae	Orchidaceae	*Pterostylis longifolia*	-
Liliidae	Orchidaceae	*Pterostylis obtusa*	Blunt-tongue Greenhood
Liliidae	Phormiaceae	*Dianella caerulea* var. *producta*	Blue Flax Lily
Liliidae	Phormiaceae	*Dianella longifolia*	-
Liliidae	Phormiaceae	*Dianella revoluta* var. *revoluta*	Spreading Flax Lily
Liliidae	Poaceae	*Andropogon virginicus**	Whisky Grass
Liliidae	Poaceae	*Aristida calycina*	Wire Grass
Liliidae	Poaceae	*Aristida ramosa*	Wire Grass
Liliidae	Poaceae	*Aristida vagans*	Three-awn Speargrass
Liliidae	Poaceae	*Austrodanthonia linkii* var. *fulva*	Wallaby Grass
Liliidae	Poaceae	*Austrodanthonia tenuior*	Wallaby Grass
Liliidae	Poaceae	*Avena fatua**	Wild Oats
Liliidae	Poaceae	*Axonopus affinis**	Narrow-leaved Carpet Grass
Liliidae	Poaceae	*Bothriochloa decipiens*	Redleg Grass
Liliidae	Poaceae	*Bothriochloa macra*	-
Liliidae	Poaceae	*Briza maxima**	Quaking Grass
Liliidae	Poaceae	*Briza minor**	Shivery Grass
Liliidae	Poaceae	*Briza subaristata**	-
Liliidae	Poaceae	*Bromus molliformis**	Soft Brome
Liliidae	Poaceae	*Chloris gayana**	Rhodes Grass
Liliidae	Poaceae	*Cortaderia selloana**	Pampas Grass
Liliidae	Poaceae	*Cymbopogon refractus*	Barbwire Grass
Liliidae	Poaceae	*Cynodon dactylon*	Common Couch
Liliidae	Poaceae	*Dichelachne micrantha*	Short-hair Plume Grass
Liliidae	Poaceae	*Digitaria parviflora*	Small-flowered Finger Grass
Liliidae	Poaceae	*Echinopogon caespitosus* var. *caespitosus*	Tufted Hedgehog Grass
Liliidae	Poaceae	*Echinopogon ovatus*	Forest Hedgehog Grass
Liliidae	Poaceae	*Ehrharta erecta**	Panic Veldtgrass
Liliidae	Poaceae	*Entolasia marginata*	Bordered Panic
Liliidae	Poaceae	*Entolasia stricta*	Wiry Panic
Liliidae	Poaceae	*Eragrostis brownii*	Brown's Lovegrass
Liliidae	Poaceae	*Eragrostis curvula**	African Lovegrass

Class / Subclass	Family	Scientific Name	Common Name
Liliidae	Poaceae	*Eragrostis tenuifolia*	Elastic Grass
Liliidae	Poaceae	*Imperata cylindrica* var. *major*	Blady Grass
Liliidae	Poaceae	*Joycea pallida*	Silvertop Wallaby grass
Liliidae	Poaceae	*Melinus repens**	Red Natal Grass
Liliidae	Poaceae	*Microlaena stipoides* var. *stipoides*	Weeping Rice Grass
Liliidae	Poaceae	*Oplismenus aemulus*	Basket Grass
Liliidae	Poaceae	*Oplismenus imbecillis*	-
Liliidae	Poaceae	*Panicum maximum**	Guinea Grass
Liliidae	Poaceae	*Panicum simile*	Two Colour Panic
Liliidae	Poaceae	*Paspalidium distans*	-
Liliidae	Poaceae	*Paspalum dilatatum**	Paspalum
Liliidae	Poaceae	*Paspalum distichum*	Water Couch
Liliidae	Poaceae	*Pennisetum clandestinum**	Kikuyu
Liliidae	Poaceae	*Phragmites australis*	Common Reed
Liliidae	Poaceae	*Poa affinis*	-
Liliidae	Poaceae	*Poa labillardieri* var. *labillardieri*	Tussock Grass
Liliidae	Poaceae	*Poa sieberiana*	Tussock Grass
Liliidae	Poaceae	*Setaria gracilis**	Slender Pigeon Grass
Liliidae	Poaceae	*Setaria pumila**	Pale Pigeon Grass
Liliidae	Poaceae	*Sporobolus africanus**	Parramatta Grass
Liliidae	Poaceae	*Themeda australis*	Kangaroo Grass
Liliidae	Smilacaceae	*Smilax australis*	Lawyer Vine
Liliidae	Smilacaceae	*Smilax glyciphylla*	Sarsaparilla
Liliidae	Typhaceae	*Typha australis*	Cumbungi
Liliidae	Typhaceae	*Typha orientalis*	Cumbungi
Liliidae	Xanthorrhoaceae	*Xanthorrhoea latifolia*	-

Table D-2: Flora Quadrat Data for Link Road – Minmi

Scientific Name	Q1	Q2	Q3	Q4	Q5	Q6	Q6a	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q17a	Q18	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40	Q41	Q42	Q43	Q44	Q45	Q46	Q47	Q48	Q49	Q50	Q51	Q52
Acacia binervata	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acacia falcata	0	1	2	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
Acacia fimbriata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	0	0	0	0
Acacia floribunda	2	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	2	0	3	0	0	0	0	0	0	0	1	0	0	2	0
Acacia implexa	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Acacia irrorata subsp. *irrorata*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	2
Acacia longifolia var. *longifolia*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Acacia maidenii	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0
Acacia myrtifolia	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acacia suaveolens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acacia ulicifolia	2	2	2	0	1	2	3	0	1	3	0	0	1	1	0	0	1	0	0	0	0	0	0	1	2	0	2	0	0	0	0	0	1	1	1	0	0	0	0	0	3
Acianthus fornicatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	2	0	0	0	0	0	0	0	0	2	0	0	1
Acmena smithii	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acronychia oblongifolia	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adiantum aethiopicum	0	1	0	0	0	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	1	0	5	0	0	0	0	0	0	0	0	2	3	0	2	0
Adiantum formosum	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
*Ageratina adenophorum**	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	3	0	0	0	0	0	0	0	3	0	0	0	1	0	0	0	0	0	1	0	1	0
Allocasuarina littoralis	0	0	0	0	0	0	2	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Allocasuarina torulosa	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	1	3	3	0	2	2	2	0	3	0	0	0	0	3	0	0	2	0
Alphitonia excelsa	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Anagallis arvensis**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Andropogon virginicus**	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Angophora costata	0	3	0	0	0	0	0	0	0	0	4	3	2	3	0	0	0	0	0	0	0	0	0	2	4	0	0	0	0	0	0	2	2	3	3	0	0	0	0	0	0
Angophora floribunda	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aristida vagans	4	0	1	0	0	1	0	0	0	2	3	0	0	0	0	0	0	0	0	0	0	1	2	3	3	0	0	0	0	0	0	0	1	2	0	1	1	0	0	0	0
Arthropodium milleflorum	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Arthropodium minus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	0	0	0	0	1	0	0	0	0	0	0
Austrodanthonia tenuior	2	2	3	2	1	1	4	0	0	0	2	3	1	0	0	0	0	3	0	0	0	0	2	0	0	0	0	0	0	3	0	0	3	1	0	0	0	0	0	0	0
Babingtonia similis	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Backhousia myrtifolia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Banksia spinulosa var. *collina*	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
*Bidens pilosa**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Billardiera scandens var. *scandens*	0	2	2	0	1	1	2	0	0	0	2	0	0	1	0	1	2	0	0	0	0	0	0	0	0	0	0	0	2	0	1	1	0	0	0	0	0	0	0	0	0
Blechnum nudum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Boronia polygalifolia	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0

Scientific Name	Q1	Q2	Q3	Q4	Q5	Q6	Q6a	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q17a	Q18	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40	Q41	Q42	Q43	Q44	Q45	Q46	Q47	Q48	Q49	Q50	Q51	Q52
Bothriochloa decipiens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Breynia oblongifolia	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	1	0	0	2	1	1	0	3	1	0	0	1	0	0	0	0	0	0
*Briza minor**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Briza subaristata**	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brunoniella australis	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bursaria spinosa var. *spinosa*	2	2	1	0	0	2	0	0	0	3	0	0	1	0	0	0	0	0	0	0	2	1	1	3	3	0	0	0	0	3	0	0	1	0	0	0	0	0	1	0	0
Caladenia catenata	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Callistemon linearis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
Callistemon salignus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Calochlaena dubia	0	0	0	1	0	0	0	2	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
Carex appressa	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Carex inversa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carex longebrachiata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cassine australis var. australis	0	0	0	1	0	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cassytha glabella forma *glabella*	2	0	1	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Cassytha pubescens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cayratia clematidea	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0	2	2	0	2	3	0	0	0	1	0	3	0	2	0
Centella asiatica	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	3	0	0	1	2	0	0	0	0	0	4	0	0	0	0	0	0	0	1	0	2	0	0	0
Cheilanthes sieberi subsp. *sieberi*	1	0	1	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	3	2	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	2	1	0
*Cinnamomum camphora**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cissus antarctica	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cissus hypoglauca	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Claoxylon australe	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clematis aristata	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	3	0	0	0	0	0	0	0	2	0	1	1	0
Clerodendrum tomentosum	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	2	1	0	0
Commelina cyanea	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commersonia fraseri	0	0	0	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Conyza bonariensis**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cordyline stricta	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Correa reflexa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corymbia gummifera	0	3	0	0	0	0	0	0	0	0	3	0	1	2	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	1	2	2	2	0	0	0	0	0	0
Corymbia maculata	4	0	3	2	2	2	3	0	3	4	0	0	2	0	2	3	5	3	2	1	0	4	3	4	2	1	3	4	4	4	3	3	2	3	3	4	3	2	3	2	3
Cryptocarya glaucescens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cryptocarya microneura	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cymbopogon refractus	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	2	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Cynodon dactylon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0

Scientific Name	Q1	Q2	Q3	Q4	Q5	Q6	Q6a	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q17a	Q18	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40	Q41	Q42	Q43	Q44	Q45	Q46	Q47	Q48	Q49	Q50	Q51	Q52
*Cyperus brevifolius**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Daviesia squarrosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	0	0	0	0	0	0	0	0	1	2	1	0	0	0	0	0	0
Daviesia ulicifolia	3	0	2	0	0	0	3	0	3	1	2	2	2	0	0	0	0	2	0	0	0	3	2	3	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
Desmodium gunii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Desmodium rhytidophyllum	2	1	1	0	1	0	0	0	1	2	0	0	0	0	0	1	2	2	1	0	0	0	2	3	1	0	2	0	0	1	2	2	0	0	0	1	0	1	0	0	1
Desmodium varians	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	1	3	0	0	0	0	0	0	0	2	0	3	0	2	0	0	0	2	3	0	0	2	0
Dianella caerulea var. *producta*	1	1	2	1	1	1	2	0	1	0	0	1	2	0	0	1	2	0	3	0	1	0	1	2	1	0	0	0	1	2	1	2	2	1	2	1	3	0	0	1	1
Dianella revoluta var. *revoluta*	1	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Dichelachne micrantha	0	2	2	0	0	2	2	0	2	2	0	0	0	0	0	0	0	1	0	0	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dichondra repens	0	0	0	1	0	0	0	2	0	2	0	0	0	0	0	2	0	2	2	0	3	1	0	0	0	3	1	0	2	0	1	1	1	0	0	1	0	0	2	0	2
Digitaria parviflora	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	1	0	3	0	0	0	1	2	0	0	0	0	1	1	0	1	0
Dillwynia retorta var. *retorta*	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Dioscorea transversa	0	1	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	3	0	0	2	0	0	0	0	0	0	0	2	3	2	1	0
Dodonaea triquetra	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	3	0	0	0	0	0	0
Doodia aspera	0	0	0	3	0	0	0	3	0	0	0	0	0	0	3	0	0	0	2	1	0	0	0	0	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0	2	0
Echinopogon caespitosus var. *caespitosus*	1	1	1	0	1	0	0	0	0	2	0	0	1	0	0	1	0	0	2	0	0	2	2	0	0	0	0	0	0	2	0	0	1	1	1	0	0	0	0	0	0
Echinopogon ovatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	2	0	0	0	0	0	0	1	0	1	1	1	0
*Ehrharta erecta**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elaeocarpus reticulatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Entolasia marginata	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Entolasia stricta	3	0	2	0	3	4	2	0	4	4	3	4	4	3	0	3	2	2	1	0	0	1	3	3	4	0	3	0	0	3	3	4	4	1	3	3	0	3	3	0	2
Epacris pulchella	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0
Eragrostis brownii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Erythrina X sykesii**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eucalyptus acmenoides	0	2	0	2	0	0	0	0	0	0	0	2	1	0	2	0	0	0	0	2	0	0	0	0	0	3	4	2	3	3	4	4	3	0	0	2	0	3	2	3	0
Eucalyptus fergusonii subsp. dorsiventralis	3	0	3	0	3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	3	0	0	2	2	2	0	1	3	0	0	2	4	3	2	2	3	1
Eucalyptus fibrosa	1	0	2	0	2	2	3	0	3	3	0	0	2	0	0	0	2	4	0	0	0	2	3	1	2	0	0	0	0	3	0	0	1	2	0	1	1	0	0	0	3
Eucalyptus globoidea	0	2	0	0	0	0	0	0	0	0	2	2	0	2	0	2	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2	3	3	2	0	0	0	0	0	0
Eucalyptus grandis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eucalyptus paniculata subsp. *paniculata*	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	2	1	3	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Eucalyptus piperita subsp. *piperita*	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eucalyptus propinqua var. *propinqua*	1	0	2	2	2	2	0	3	1	2	0	0	1	0	2	0	0	2	0	0	0	0	0	0	0	0	0	4	4	0	0	0	0	0	0	0	0	0	2	3	4
Eucalyptus punctata	4	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	2	2	0	0	3	0	0	1	0	0	0	0	0	1	0	3	0	0	0
Eucalyptus resinifera subsp. *resinifera*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Scientific Name	Q1	Q2	Q3	Q4	Q5	Q6	Q6a	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q17a	Q18	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40	Q41	Q42	Q43	Q44	Q45	Q46	Q47	Q48	Q49	Q50	Q51	Q52
Eucalyptus siderophloia	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Eucalyptus tereticornis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eucalyptus umbra subsp. *umbra*	2	0	2	0	2	2	2	0	2	2	0	0	0	2	0	3	3	3	3	0	0	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	3
Eustrephus latifolius	2	3	0	1	1	1	2	0	2	1	0	0	0	0	2	1	0	1	1	0	1	0	0	0	0	1	3	2	2	2	2	2	0	0	1	1	3	2	2	1	1
Exocarpos strictus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ficus coronata	0	0	0	2	0	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ficus rubiginosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ficus watkinsiana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gahnia clarkei	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gahnia melanocarpa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Galium binifolium	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	1	0	0
Galium proquinquum	2	0	0	0	0	1	2	0	0	2	0	0	0	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Geitonoplesium cymosum	0	0	0	1	0	0	0	2	0	0	0	0	1	0	1	0	0	0	0	2	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Geranium homeanum	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	1	0	0	1	2	0
Glochidion ferdinandii	0	0	0	0	0	0	0	4	1	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Glycine clandestina	2	2	1	0	0	1	0	0	0	2	0	0	0	2	1	0	1	0	1	1	0	0	1	2	0	0	3	2	2	2	2	2	2	1	1	1	0	0	1	1	2
Glycine tabacina	0	2	1	0	0	1	0	0	0	0	0	0	0	0	1	1	2	1	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
*Gnaphalium americanum**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gompholobium grandiflorum	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gonocarpus tetragynus	2	0	2	0	0	1	2	0	0	0	2	2	2	0	0	0	0	0	1	0	0	0	1	0	1	0	2	2	2	1	0	0	1	2	1	0	0	0	0	0	3
Goodenia heterophylla subsp. *heterophylla*	2	2	0	0	0	4	0	0	0	0	0	0	0	0	1	1	1	0	1	0	0	0	3	0	0	0	1	0	0	2	0	0	2	2	0	0	0	1	0	0	2
Guioa semiglauca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnostachys anceps	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	2	1	2	3	0	0	0	0	0	0	0	2	2	0	0	0
Hakea sericea	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hardenbergia violacea	2	0	0	0	0	2	2	0	1	0	0	0	0	1	1	1	1	0	1	0	0	0	2	2	1	0	3	2	0	0	1	1	0	1	1	1	0	1	1	1	2
Hibbertia aspera	0	1	0	0	0	1	3	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	4	1	3	0	0	0	1	3	0	1	0	3	0	0	0
Hibbertia empetrifolia subsp. uncinata	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hibbertia pedunculata	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Hibbertia scandens	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	2	0	0	0
Hibiscus heterophyllus	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Hydrocotyle bonariensis**	0	0	0	1	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrocotyle peduncularis	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2	2	3	0	0	0	0	0	0	0	0	3	0	0	0
Hydrocotyle tripartita	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
*Hypochaeris radicata**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hypoxis hygrometrica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Imperata cylindrica var.	2	4	1	0	1	0	2	0	1	0	4	1	2	2	0	3	2	2	2	0	0	0	1	2	0	0	0	3	2	2	3	3	0	1	3	3	1	3	3	2	0

Scientific Name	Q1	Q2	Q3	Q4	Q5	Q6	Q6a	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q17a	Q18	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40	Q41	Q42	Q43	Q44	Q45	Q46	Q47	Q48	Q49	Q50	Q51	Q52
major																																								
Indigofera australis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	3	0	0	0	0	0
Joycea pallida	3	2	3	0	2	2	2	0	1	0	0	0	2	1	0	0	4	4	2	3	0	0	5	3	0	0	0	0	0	5	0	0	2	3	1	0	0	0	0	0	0
Juncus usitatus	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kennedia rubicunda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
Lagenifera stipitata	0	0	0	0	0	1	0	0	0	2	0	0	2	0	0	2	0	0	0	0	0	0	2	0	0	0	1	0	2	3	0	0	1	0	0	0	0	0	0	0	0
*Lantana camara**	1	1	1	5	0	0	0	1	1	2	0	0	0	0	5	0	0	3	1	6	4	6	1	2	3	6	0	0	0	0	0	0	0	0	0	3	4	4	2	3	0
Lepidosperma laterale	0	3	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0
Leptospermum polygalifolium subsp. *polygalifolium*	0	3	0	0	0	0	0	0	0	0	3	4	3	2	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0
Leptospermum trinervium	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Libertia paniculata	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lomandra confertifolia var. pallida	0	0	0	0	0	0	2	0	2	1	0	0	0	0	0	0	2	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0
Lomandra cylindrica	0	0	1	0	0	0	1	0	0	0	0	0	1	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Lomandra filiformis subsp. *coriacea*	1	0	2	0	3	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Lomandra filiformis subsp. *filiformis*	1	2	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	2	0	0	0	1	1	0	0	0	1	0	0
Lomandra glauca subsp. *glauca*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Lomandra longifolia	3	2	3	0	3	1	0	0	3	1	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	3	2	0	2	0	0	0	0	4	0	3	3	2	4	0
Lomandra multiflora	1	3	0	0	0	0	2	0	1	2	0	1	1	1	0	1	2	0	0	0	0	0	1	1	0	0	0	0	0	3	0	2	0	1	0	1	1	0	0	0	0
Lomandra obliqua	0	0	0	0	0	0	0	0	0	0	1	2	4	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	3	3	1	0	0	0	0	0	0
Macrozamia reducta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Marsdenia rostrata	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
Marsdenia suaveolens	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maytenus silvestris	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	3	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Melaleuca nodosa	0	0	0	0	0	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Melaleuca styphelioides	0	0	0	1	1	0	0	3	1	0	0	0	1	0	1	0	0	0	0	2	0	0	0	0	0	5	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Melia azedarach var. *australasica*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Melicope micrococca	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Microlaena stipoides var. *stipoides*	1	0	1	0	0	1	0	1	0	1	2	0	1	1	0	2	0	0	0	4	3	2	2	0	0	0	0	0	0	3	1	0	0	0	1	2	3	0	0	0	0
Mirbelia rubiifolia	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Morinda jasminoides	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Muellerina eucalyptoides	0	0	2	1	1	2	2	0	1	2	2	1	2	1	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Notelaea longifolia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	1	0	0	0	0	0	2	0	2	2	0	0	0	0	0	0	0	0	2	0	1	0
Notelaea ovata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Ochna serrulata**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Omalanthus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Scientific Name	Q1	Q2	Q3	Q4	Q5	Q6	Q6a	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q17a	Q18	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40	Q41	Q42	Q43	Q44	Q45	Q46	Q47	Q48	Q49	Q50	Q51	Q52
populifolius																																									
Opercularia aspera	1	1	2	1	1	2	1	0	1	0	0	0	1	1	0	2	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oplismenus aemulus	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	5	3	3	3	0	2	0	0	0	0	0	3	1	2	2	0
Oplismenus imbecillis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	1	1	2	0	0
Oxalis perrenans	0	2	0	1	0	0	0	0	0	2	0	0	0	0	0	2	0	1	1	0	0	1	0	0	0	0	1	2	1	1	0	0	1	0	0	0	1	0	1	0	1
Ozothamnus diosmifolius	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pandorea pandorana	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	2	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
Panicum simile	2	0	1	0	0	0	2	0	0	0	0	1	0	1	0	2	0	1	0	0	0	0	1	2	0	0	3	1	0	2	3	0	2	1	2	0	2	0	1	0	1
Parsonsia straminea	0	0	0	2	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Paspalidium distans	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	3	3	0	0	1	0	0	0	0	0	0	1	0	0	2	0	0	0	0
*Paspalum dilatatum**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Passiflora herbertiana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
Pellaea falcata	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Pellaea paradoxa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
*Pennisetum clandestinum**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Persoonia linearis	0	1	2	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	2	0	0	0	0
Phyllanthus hirtellus	2	2	0	0	0	0	2	0	1	0	2	2	0	0	0	2	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Piper novae-hollandiae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pittosporum multiflorum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pittosporum revolutum	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	2	0	0	0	0	0	0	1	1	0	0
Pittosporum undulatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Plantago debilis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Plantago lanceolata**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Plectranthus parviflorus	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	3	0
Poa affinis	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	2	0	0	0	0	0	0	0	0	0	0	4	2	5	0	0	0	0	0	0	0	0	0	0	2	0
Poa labillardieri var. *labillardieri*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Polymeria calycina	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	1	0	0	2	0	2	1	0	1	1	0	1	0	0	0	0	0	1	0	0
Polyscias sambucifolia	0	2	0	0	0	0	2	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	2	0	0	1	1	0	1	0	0	0
Poranthera microphylla	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Pratia purpurascens	2	2	2	0	1	1	0	0	2	3	2	2	2	0	0	3	0	3	1	1	2	3	1	3	3	0	4	2	2	2	3	2	1	1	0	2	0	0	1	0	2
Prostanthera incisa	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pseuderanthemum variabile	2	0	1	0	1	1	2	0	0	0	2	0	0	1	0	2	2	1	0	0	0	0	0	2	3	0	3	2	1	0	1	2	1	1	0	1	0	3	1	1	0	2
Pteridium esculentum	0	3	0	0	0	0	2	0	1	0	3	1	0	0	0	0	0	0	0	3	0	0	0	1	3	0	0	3	4	0	4	4	0	1	0	0	0	4	0	3	0
Pterostylis nutans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ptilothrix deusta	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0
Pultenaea daphnoides	0	2	0	0	0	2	0	0	2	0	0	2	1	1	0	1	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	3	2	0	0	0	0	0	0	0
Pultenaea paleacea var. *paleacea*	0	0	0	0	0	0	0	0	0	0	2	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pultenaea retusa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Scientific Name	Q1	Q2	Q3	Q4	Q5	Q6	Q6a	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q17a	Q18	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40	Q41	Q42	Q43	Q44	Q45	Q46	Q47	Q48	Q49	Q50	Q51	Q52
Pultenaea villosa	1	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	3	0	0	1	0	0	0	0	0	0	0	3
Rapanea howittiana	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3	2	0	0	0
Rapanea variabilis	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	2	0	0	2	0
Rhodamnia rubescens	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	3	0	2	2	0	0	0	0	0	0	0	0	3	0	0	0
Rubus moluccanus var. trilobus	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
Rubus parvifolius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
*Rubus ulmifolius**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sarcopetalum harveyanum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Scutellaria mollis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Senecio linearifolius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0
*Senecio madagascariensis**	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Senna pendula var. *glabrata**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
*Sida rhombifolia**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0
Sigesbeckia orientalis	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	2	2	1	0	1	0	0	0	0	0	0	0	1	0	0
Smilax australis	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	2	0	3	0	0	0	0	0	0	0	0	3	0	0	0	0
Smilax glyciphylla	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Solanum prinophyllum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Solanum pungetium	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Solanum stelligerum	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	2	0	0	0	0
*Sporobolus africanus**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stellaria flaccida	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
Stephania japonica var. *discolor*	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Streblus brunonianus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stylidium graminifolium	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Syncarpia glomulifera	0	0	0	2	0	0	0	3	1	0	0	0	0	0	2	1	0	0	1	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	3	3	0	3	0
Synoum glandulosum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0
Tasmannia insipida	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Themeda australis	3	0	4	0	4	0	3	0	4	0	4	0	4	5	0	4	2	1	0	0	0	5	3	0	2	0	0	1	2	3	4	5	5	5	4	4	0	5	4	3	5
Thysanotus tuberosus	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Tradescantia fluminensis**	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tricoryne elatior	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Trifolium repens**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tylophora barbata	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Verbena rigida**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vernonia cinerea var. *cinerea*	0	0	1	0	0	1	0	0	0	3	0	0	0	0	0	0	0	1	1	0	2	1	2	0	0	0	2	0	1	1	2	1	1	2	1	1	1	1	0	0	0
Veronica plebia	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0
Viola betonicifolia	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Scientific Name	Q1	Q2	Q3	Q4	Q5	Q6	Q6a	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q17a	Q18	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40	Q41	Q42	Q43	Q44	Q45	Q46	Q47	Q48	Q49	Q50	Q51	Q52
Viola hederacea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Wahlenbergia gracilis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wilkiea heugeliana	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Xanthorrhoea latifolia subsp. *latifolia*	0	0	0	0	0	0	0	0	0	0	2	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

** PLEASE NOTE THE EXOTICS HAVE BEEN REMOVED FOR STATISTICAL ANALYSES

APPENDIX E Fauna Species List

EXPECTED FAUNA SPECIES LIST

Below is a list of fauna species that could be *reasonably* expected to be found within the study area at some occurrence. Such an approach has been taken given the unlikelihood to record *all* potentially occurring species within an area during formal fauna surveys (due to seasonality, climatic limitations, crypticism etc).

Family sequencing and taxonomy follow for each fauna class:

Birds – Christidis and Boles (1994).

Herpetofauna - Cogger (1996).

Mammals - Strahan (ed) (1995) and Churchill (1998).

KNOWN AND EXPECTED BIRD LIST

Appendix Key:
✓ = Species Detected
* = Introduced species
(E) = Species listed under NSW TSC Act 1995 as Endangered.
(V) = Species listed under NSW TSC Act 1995 as Vulnerable.
(V*) = Species listed under the Commonwealth EPBC Act 1999 as Vulnerable
(E*) = Species listed under the Commonwealth EPBC Act 1999 as Endangered
(M*) = Species listed under the Commonwealth EPBC Act as Migratory
Species indicated in **BOLD** font are those threatened species known from within 10km of site (Atlas of NSW Wildlife 2008)

Data Source:
1 = Species recorded within the Wallsend Link Road South
2 = Species recorded within the Wallsend Link Road North

Family Name	Scientific Name	Common Name	1	2
Megapodiidae (Mound Builders)	*Alectura lathami*	Australian Brush-turkey		
Phasianidae (True Quails, Pheasants and Fowls)	*Coturnix ypsilophora*	Brown Quail		
Anseranatidae (Magpie Goose)	***Anseranas semipalmata***	**Magpie Goose (V)**		
Anatidae (Swans, Geese and Ducks)	*Dendrocygna arcuata*	Wandering Whistling-duck		
	Anas castanea	Chestnut Teal		
	Anas gracilis	Grey Teal		
	Anas superciliosa	Pacific Black Duck		✓
	Aytha australis	Hardhead		
	Chenonetta jubata	Australian Wood Duck		
	Oxyura australis	**Blue-billed Duck (V)**		
	Stictonetta naevosa	**Freckled Duck (V)**		

Family Name	Scientific Name	Common Name	1	2
Podicipedidae (Grebes)	*Tachybaptus novaehollandiae*	Australasian Grebe		
	Podiceps cristatus	Great Crested Grebe		
Anhingidae (Darters)	*Anhinga melanogaster*	Darter		
Phalacrocoracidae (Cormorants)	*Phalacrocorax carbo*	Great Cormorant		
	Phalacrocorax melanoleucos	Little Pied Cormorant		
	Phalacrocorax sulcirostris	Little Black Cormorant		✓
	Phalacrocorax varius	Pied Cormorant		
Pelecanide (Pelicans)	*Pelecanus conspicillatus*	Australian Pelican		
Podicipedidae (Grebes)	*Tachybaptus novaehollandiae*	Australasian Grebe		
Ardeidae (Herons, Bitterns and Egrets)	*Ardea alba*	Great Egret		
	Ardea ibis	Cattle Egret		
	Ardea intermedia	Intermediate Egret		
	Ardea pacifica	White-necked Heron		
	Botaurus poiciloptilus	**Australasian Bittern (V)**		
	Ixobrychus flavicollis	**Black Bittern (V)**		
	Butorides striatus	Striated Heron		
	Egretta garzetta	Little Egret		
	Egretta novaehollandiae	White-faced Heron		✓
	Nycticorax caledonicus	Nankeen Night Heron		
Threskiornithidae (Ibises and Spoonbills)	*Threskiornis molucca*	Australian White Ibis		✓
	Threskiornis spinicollis	Straw-necked Ibis		
Ciconiidae (Storks)	***Ephippiorhynchus asiaticus***	**Black-necked Stork (E)**		
Accipitridae (Hawks, Kites and Eagles)	*Accipiter fasciatus*	Brown Goshawk		✓
	Accipiter cirrhocephalus	Collared Sparrowhawk		
	Accipiter novaehollandiae	Grey Goshawk		✓
	Aquila audax	Wedge-tailed Eagle		
	Aviceda subcristata	Pacific Baza	✓	✓

Family Name	Scientific Name	Common Name	1	2
	Circus approximans	Swamp Harrier		
	Circus assimilis	Spotted Harrier		
	Elanus axillaris	Black-shouldered Kite		
	Haliaeetus leucogaster	White-bellied Sea-Eagle		✓
	Haliastur sphenurus	Whistling Kite		
	Hamirostra melanosternon	**Black-breasted Buzzard (V)**		
	Hieraaetus morphnoides	Little Eagle		
	Lophoictinia isura	**Square-tailed Kite**		
	Pandion haliaetus	**Osprey (V)**		
Falconidae (Falcons)	*Falco berigora*	Brown Falcon		
	Falco cenchroides	Nankeen Kestrel		
	Falco longipennis	Australian Hobby		
Rallidae (Crakes, Rails an Gallinules)	*Fulica atra*	Eurasian Coot		
	Gallinula philippensis	Buff-banded Rail		
	Gallinula tenebrosa	Dusky Moorhen		
	Porphyrio porphyrio	Purple Swamphen		
	Porzana fluminea	Australian Spotted Crake		
	Porzana pusilla	Baillon's Crake		
	Porzana tabuensis	Spotless Crake		
	Rallus pectoralis	Lewin's Rail		
	Gallinula philippensis	Buff-banded Rail		
Turnicidae (Button-Quails)	*Turnix varia*	Painted Button-quail		✓
Rostratulidae (Painted Snipe)	***Rostratula benghalensi***	**Painted Snipe (V)**		
Jacanidae (Jacanas)	***Irediparra gallinacea***	**Comb-crested Jacana (V)**		
Burhinidae (Stone-curlews)	***Burhinus grallarius***	**Bush Stone-curlew (E)**		
Charadriidae (Lapwings, Plovers and Dottrels)	***Charadrius mongolus***	**Lesser Sand Plover (M*, V)**		
	Vanellus miles	Masked Lapwing		✓
Haematopodidae (Oystercatchers)	***Haematopus longirostris***	**Pied Oystercatcher (V)**		
	Vanellus miles	Masked Lapwing		

Family Name	Scientific Name	Common Name	1	2
Laridae (Gulls and Terns)	*Larus novaehollandiae*	Silver Gull		
	Sterna albifrons	**Little Tern (E)**		
Columbidae (Pigeons and Doves)	**Columba livia*	Rock Dove		
	Chalcophaps indica	Emerald Dove		
	Geopelia humeralis	Bar-shouldered Dove		✓
	Geopelia striata	Peaceful Dove		
	Leucosarcia melanoleuca	Wonga Pigeon		✓
	Macropygia amboinensis	Brown Cuckoo-Dove		✓
	Lopholaimus antarcticus	Topknot Pigeon		
	Ocyphaps lophotes	Crested Pigeon	✓	✓
	Phaps chalcoptera	Common Bronzewing		
	Phaps elegans	Brush Bronzewing		
	Ptilinopus magnificus	**Wompoo Fruit-dove (V)**		
	Ptilinopus regina	**Rose-crowned Fruit-Dove (V)**		
	Superb Fruit-Dove	**Ptilinopus superbus (V)**		
	**Streptopelia chinensis*	Spotted Turtle-Dove		✓
Cacatuidae (Cockatoos)	*Calyptrohynchus funereus*	Yellow-tailed Black-Cockatoo		✓
	Calyptorhynchus lathami	**Glossy Black-Cockatoo (V)**		
	Callocephalon fimbriatum	**Gang-Gang Cockatoo (V)**		
	Cacatua roseicapilla	Galah		✓
	Cacatua tenuirostris	Long-billed Corella		
	Cacatua sanguinea	Little Corella		
	Cacatua galerita	Sulphur-crested Cockatoo		
Psittacidae (Parrots)	*Alisterus scapularis*	Australian King Parrot		
	Glassopsitta pusilla	Little Lorikeet		✓
	Lathamus discolor	**Swift Parrot (E, E*)**		
	Neophema pulchella	**Turquoise Parrot (V)**		
	Platycercus elegans	Crimson Rosella		
	Platycercus eximius	Eastern Rosella		✓
	Psephotus haematonotus	Red-rumped Parrot		

Family Name	Scientific Name	Common Name	1	2
	Trichoglossus chlorolepidotus	Scaly-breasted Lorikeet		✓
	Glossopsitta concina	Musk Lorikeet		
	Glossopsitta pusilla	Little Lorikeet		
	Trichoglossus haematodus	Rainbow Lorikeet		✓
Cuculidae (Old World Cuckoos)	*Cuculus saturatus*	Oriental Cuckoo (M*)		
	Cacomantis flabelliformi	Fan-tailed Cuckoo		✓
	Cacomantis variolosus	Brush Cuckoo	✓	
	Chrysococcyx basalis	Horsfield's Bronze-Cuckoo		
	Chrysococcyx lucidus	Shining Bronze-Cuckoo		✓
	Cuculus pallidus	Pallid Cuckoo		
	Eudynamys scolopacea	Common Koel		✓
	Scythrops novaehollandiae	Channel-billed Cuckoo	✓	✓
Centropodidae (Coucals)	*Centropus phasianinus*	Pheasant Coucal		
Strigidae (Hawk Owls)	***Ninox strenua***	**Powerful Owl (V)**		
	Ninox connivens	**Barking Owl (V)**		
	Ninox boobook	Southern Boobook		✓
Tytonidae (Barn Owls)	*Tyto alba*	Barn Owl		
	Tyto novaehollandiae	**Masked Owl (V)**		
Podargidae (Frogmouths)	*Podargus strigoides*	Tawny Frogmouth		
Caprimulgidae (Nightjars)	*Eurostopodus mystacali*	White-throated Nightjar		
Halcyonidae (Kingfishers and Kookaburras)	*Dacelo novaeguineae*	Laughing Kookaburra		✓
	Todiramphus sanctus	Sacred Kingfisher	✓	✓
Meropidae (Bee-eaters)	*Merops ornatus*	Rainbow Bee-eater (M*)		
Coraciidae (Typical Rollers)	*Eurystomus orientalis*	Dollarbird		✓
Climacteridae (Australo-Papuan Treecreepers)	*Cormobates leucophaeus*	White-throated Treecreeper	✓	✓
	Climacteris picumnus	**Brown Treecreeper (V)**		

Family Name	Scientific Name	Common Name	1	2
Maluridae (Fairy-Wrens and Emu-Wrens)	*Malurus cyaneus*	Superb Fairy-wren		✓
	Malurus lamberti	Variegated Fairy-wren	✓	✓
Pardalotidae (Pardalotes, Scrubwrens Thornbills)	*Pardalotus punctatus*	Spotted Pardalote	✓	✓
	Paradalotus striatus	Striated Pardalote		
	Sericornis frontalis	White-browed Scrubwren	✓	✓
	Sericornis citreogularis	Yellow-throated Scrubwren		
	Chthonicola sagittata	**Speckled Warbler (V)**		
	Gerygone mouki	Brown Gerygone	✓	✓
	Gerygone olivacea	White-throated Gerygone		
	Acanthiza pusilla	Brown Thornbill	✓	✓
	Acanthiza reguloides	Buff-rumped Thornbill		
	Acanthiza chrysorrhoa	Yellow-rumped Thornbill		
	Acanthiza nana	Yellow Thornbill	✓	✓
	Acanthiza lineata	Striated Thornbill	✓	✓
	Hylacola pyrrhopygia	Chestnut-rumped Heathwren		
Meliphagidae (Honeyeaters)	*Anthochaera carunculat*	Red Wattlebird		✓
	Plectrhyncha lanceolata	Striped Honeyeater		
	Anthochaera chrysopter	Brush Wattlebird		
	Philemon corniculatus	Noisy Friarbird	✓	✓
	Xanthomyza phrygia	**Regent Honeyeater (E, E*)**		
	Manorina melanophrys	Bell Miner	✓	✓
	Manorina melanocephal	Noisy Miner		
	Meliphaga lewinii	Lewin's Honeyeater	✓	✓
	Lichenostomus chrysops	Yellow-faced Honeyeater	✓	✓
	Lichenostomus melanops	Yellow-tufted Honeyeater		
	Lichenostomus penicillatus	White-plumed Honeyeater		
	Melithreptus brevirostris	Brown-headed Honeyeater	✓	✓
	Melithreptus lunatus	White-naped Honeyeater	✓	✓
	Melithreptus gularis	**Black-chinned Honeyeater (V)**		
	Lichmera indistincta	Brown Honeyeater		
	Phylidonyris novaehollandiae	New Holland Honeyeater		

Family Name	Scientific Name	Common Name	1	2
	Phylidonyris nigra	White-cheeked Honeyeater		
	Acanthorhynchus tenuirostris	Eastern Spinebill	✓	✓
	Myzomela sanguinolenta	Scarlet Honeyeater	✓	✓
Eopsaltriidae (Robins)	*Microeca fascinans*	Jacky Winter		
	Petroica rosea	Rose Robin		
	Eopsaltria australis	Eastern Yellow Robin	✓	✓
	Melanodryas cucullata	**Hooded Robin (V)**		
Pomatostomidae (Australo-Papuan Babblers)	***Pomatostomus temporalis***	**Grey-crowned Babbler (V)**		
Cinclosomidae (Quail-thrushes and allies)	*Psophodes olivaceus*	Eastern Whipbird	✓	✓
Neosittidae (Sittellas)	*Daphoenositta chrysoptera*	Varied Sittella		
Pachycephalidae (Whistlers, Shrike-tit, Shrike-thrushes)	*Falcunculus frontatus*	Crested Shrike-tit		
	Pachycephala pectoralis	Golden Whistler	✓	✓
	Pachycephala rufiventris	Rufous Whistler	✓	✓
	Colluricincla harmonica	Grey Shrike-thrush	✓	✓
Dicruridae (Monarchs, Fantails and Drongo)	*Monarcha melanopsis*	Black-faced Monarch	✓	✓
	Monarcha trivirgatus	Spectacled Monarch		
	Myiagra cyanoleuca	Satin Flycatcher		
	Myiagra rubecula	Leaden Flycatcher		✓
	Myiagra inquieta	Restless Flycatcher		
	Grallina cyanoleuca	Magpie-lark		✓
	Rhipidura rufifrons	Rufous Fantail	✓	✓
	Rhipidura fuliginosa	Grey Fantail	✓	✓
	Rhipidura leucophyrs	Willie Wagtail		✓
	Dicrurus bracteatus	Spangled Drongo		
Campephagidae (Cuckoo-shrikes and Trillers)	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	✓	✓
	Coracina tenuirostris	Cicadabird	✓	✓
	Lalage sueurii	White-winged Triller		

Family Name	Scientific Name	Common Name	1	2
Oriolidae (Orioles and Figbird)	*Oriolus sagittatus*	Olive-backed Oriole	✓	✓
	Sphecotheres viridis	Figbird		
Artamidae (Woodswallows, Butcherbirds,Currawongs)	*Artamus leucorynchus*	White-breasted Woodswallow		
	Artamus superciliosus	White-browed Woodswallow		✓
	Artamus cyanopterus	Dusky Woodswallow		
	Cracticus torquatus	Grey Butcherbird		✓
	Cracticus nigrogularis	Pied Butcherbird		
	Gymnorhina tibicen	Australian Magpie		✓
	Strepera graculina	Pied Currawong	✓	✓
Corvidae (Crows and allies)	*Corvus coronoides*	Australian Raven	✓	✓
Cororacidae (Mud-nesters)	*Corcorax melanorhamphos*	White-winged Chough		
Ptilinorhynchidae (Bowerbirds)	*Sericulus chysocephalus*	Regent Bowerbird		
	Ptilonorhynchus violaceus	Satin Bowerbird		✓
Motacillidae (Old World Wagtails,Pipits)	*Anthus novaeseelandiae*	Richard's Pipit		
Passeridae (Sparrows, Weaverbirds Waxbills)	**Passer domesticus*	House Sparrow		
	Taeniopygia guttata	Zebra Finch		
	Taeniopygia bichenovii	Double-barred Finch		
	Neochmia temporalis	Red-browed Finch		
	Lonchura castaneothora	Chestnut-breasted Mannikin		
Dicaeidae (Flowerpeckers)	*Dicaeum hirundinaceum*	Mistletoebird	✓	✓
Hirundinidae (Swallows and Martins)	*Hirundo neoxena*	Welcome Swallow		✓
	Hirundo nigricans	Tree Martin		
	Hirundo ariel	Fairy Martin		
Sylviidae (Old World Warblers)	*Acrocephalus stentoreus*	Clamorous Reed Warbler		
	Cincloramphus mathews	Rufous Songlark		
	Cisticola exilis	Golden-headed Cisticola		

Family Name	Scientific Name	Common Name	1	2
	Megalurus gramineus	Little Grassbird		
	Megalurus timorensis	Tawny Grassbird		
Zosteropidae (White-eyes)	*Zosterops lateralis*	Silvereye	✓	✓
Sturnidae (Starlings and allies)	**Sturnus vulgaris*	Common Starling		✓
	**Acridotheres tristis*	Common Myna		✓

KNOWN AND EXPECTED MAMMAL LIST

Appendix Key: ✓ = Species Detected
* = Introduced species
(E) = Species listed under NSW TSC Act 1995 as Endangered.
(V) = Species listed under NSW TSC Act 1995 as Vulnerable.
(V*) = Species listed under the Commonwealth EPBC Act 1999 as Vulnerable
(E*) = Species listed under the Commonwealth EPBC Act 1999 as Endangered
(M*) = Species listed under the Commonwealth EPBC Act as Migratory
Species indicated in **BOLD** font are those threatened species known from within 10km of site (Atlas of NSW Wildlife 2008)

Data Source: **1** = Species recorded within the Wallsend Link Road South
2 = Species recorded within the Wallsend Link Road North

Family Name	Scientific Name	Common Name	1	2
Tachyglossidae (Echidnas)	*Tachyglossus aculeatus*	Short-beaked Echidna		
Dasyuridae (Dasyurids)	*Antechinus stuartii*	Brown Antechinus	✓	✓
	Antechinus swainsonii	Dusky Antechinus		
	Dasyurus maculatus	**Tiger Quoll (V, V*)**		
	Planigale maculata	**Common Planigale (V)**		
Peramelidae (Bandicoots and Bilbies)	*Isoodon macrourus*	Northern Brown Bandicoot		
	Peremeles nasuta	Long-nosed Bandicoot		
Phascolarctidae (Koala)	***Phascolarctos cinereus***	**Koala (V)**		✓
Vombatidae (Wombats)	*Vombatus ursinus*	Common Wombat		
Petauridae (Wrist-winged Gliders)	*Petaurus breviceps*	Sugar Glider	✓	✓
	Petaurus norfolcensis	**Squirrel Glider (V)**	✓	
	Petaurus australis	**Yellow-bellied Glider (V)**		
Pseudocheiridae (Ringtail Possums, Greater Glider)	*Pseudocheirus peregrinus*	Common Ringtail Possum		✓
	Petauroides volans	Greater Glider		
Acrobatidae (Feathertail Glider)	*Acrobates pygmaeus*	Feathertail Glider	✓	
Phalangeridae (Brushtail Possums and Cuscuses)	*Trichosurus vulpecula*	Common Brushtail Possum	✓	✓
Potoroidae (Potoroos and Bettongs)	***Potorous tridactylus***	**Long-nosed Potoroo (V, V*)**		
Macropodidae (Wallabies and	*Macropus giganteus*	Eastern Grey Kangaroo		

Family Name	Scientific Name	Common Name	1	2
Kangaroos)				
	Macropus rufogriseus	Red-necked Wallaby		✓
	Wallabia bicolor	Swamp Wallaby	✓	✓
Pteropodidae (Flying-foxes, Blossom-bats)	***Pteropus poliocephalus***	**Grey-headed Flying-fox (V, V*)**	✓	✓
	Pteropus scapulatus	Little Red Flying-fox		
Rhinolophidae (Horseshoe-bats)	*Rhinolophus megaphyllus*	Eastern Horseshoe-bat		✓
Emballonuridae (Sheathtail-bats)	***Saccolaimus flaviventris***	**Yellow-bellied Sheathtail-bat (V)**		
Molossidae (Freetail-bats)	***Mormopterus norfolkensis***	**East Coast Freetail-bat (V)**	✓	
	Tadarida australis	White-striped Freetail-bat		✓
Vespertilionidae (Vespertilionid Bats)	***Miniopterus australis***	**Little Bentwing-bat (V)**	✓	✓
	Miniopterus schreibersii	**Common Bentwing-bat (V)**		
	Nyctophilus geoffroyi	Lesser Long-eared Bat		
	Nyctophilus gouldii	Gould's Long-eared Bat		
	Chalinolobus dwyeri	**Large-eared Pied Bat (V, V*)**		
	Chalinolobus gouldii	Gould's Wattled Bat	✓	
	Chalinolobus morio	Chocolate Wattled Bat		✓
	Falsistrellus tasmaniensis	**Eastern Falsistrelle (V)**		
	Myotis adversus	**Large-footed Myotis (V)**		
	Scoteanax rueppellii	**Greater Broad-nosed Bat (V)**		
	Scotorepens greyii	Little Broad-nosed Bat		
	Scotorepens orion	Eastern Broad-nosed Bat		
	Vespadelus darlingtoni	Large Forest Bat		✓
	Vespadelus regulus	Southern Forest Bat		
	Vespadelus pumilus	Eastern Forest Bat		
	Vespadelus vulturnus	Little Forest Bat	✓	✓
Muridae (Murids)	*Hydromys chrysogaster*	Water Rat		
	**Mus musculus*	House Mouse		
	Pseudomys novaehollandiae	New Holland Mouse		
	Rattus fuscipes	Bush Rat	✓	✓

Family Name	Scientific Name	Common Name	1	2
	Rattus lutreolus	Swamp Rat		
	**Rattus norvegicus*	Brown Rat		
	**Rattus rattus*	Black Rat	✓	
Canidae (Dogs)	**Canis familiaris*	Dog		✓
	Canis familiaris dingo	Dingo		
	**Vulpes vulpes*	Red Fox		✓
Felidae (Cats)	**Felis catus*	Feral Cat		
Leporidae (Rabbit and Hare)	**Oryctolagus cuniculus*	European Rabbit		✓
	**Lepus capensis*	Brown Hare		✓
Equidae (Horse and Donkey)	**Equus caballus*	Horse		
Suidae (Pigs)	**Sus scrofa*	Pig		
Bovidae (Horned Ruminants)	**Bos taurus*	Cow		
	**Capra hircus*	Goat		

KNOWN AND EXPECTED REPTILE LIST

Appendix Key: ✓ = Species Detected
(E) = Species listed under NSW TSC Act 1995 as Endangered.
(V) = Species listed under NSW TSC Act 1995 as Vulnerable.
(V*) = Species listed under the Commonwealth EPBC Act 1999 as Vulnerable
(E*) = Species listed under the Commonwealth EPBC Act 1999 as Endangered
(M*) = Species listed under the Commonwealth EPBC Act as Migratory
Species indicated in **BOLD** font are those threatened species known from within 10km of site (Atlas of NSW Wildlife data 2008)

Data Source: **1** = Species recorded within the Wallsend Link Road South
2 = Species recorded within the Wallsend Link Road North

Family Name	Scientific Name	Common Name	1	2
Chelidae (Tortoises)	*Chelodina longicollis*	Long-necked Tortoise		✓
Agamidae (Dragons)	*Amphibolurus muricatus*	Jacky Lizard	✓	✓
	Amphibolurus nobbi	Nobbi		
	Physignathus lesuerii	Eastern Water Dragon		✓
	Pogona barbata	Eastern Bearded Dragon		
Pygopodidae (Legless Lizards)	*Lialis burtonis*	Burton's Snake Lizard		
	Pygopus lepidopus	Common Scaly-foot		
	Delma plebeia	Leaden Delma		
Gekkonidae (Geckoes	*Diplodactylus vittatus*	Wood Gecko		
	Phyllurus platurus	Southern Leaf-tailed Gecko		
	Oedura lesueurii	Lesueur's Velvet Gecko		
	Underwoodisaurus milii	Thick-tailed Gecko		
Varanidae (Monitors)	*Varanus gouldii*	Gould's Monitor		
	Varan us varius	Lace Monitor	✓	✓
Scincidae (Skinks)	*Carlia tetradactyla*			
	Cryptoblepharus virgatus			
	Ctenotus taeniolatus	Copper-tailed Skink		
	Ctenotus robustus	Striped Skink		✓
	Cyclodomorphus casuarinae	She-oak Skink		
	Egernia cunninghamii	Cunningham's Skink		
	Egernia major	Land Mullet		
	Egernia modesta			
	Egernia striolata	Tree-crevice Skink		
	Egernia saxatilis	Black Rock Skink		

Family Name	Scientific Name	Common Name	1	2
	Egernia whitii	White's Skink		
	Eulamprus quoyii	Eastern Water Skink		
	Eulamprus tenuis			
	Lampropholis delicata	Grass Skink	✓	✓
	Lampropholis guichenoti	Garden Skink		
	Lygisaurus foliorum	Tree-base Litter-skink		
	Morethia boulengeri	South-eastern Morethia		
	Pseudomoia platynota	Red-throated Skink		
	Saiphos equalis			✓
	Saproscincus mustelinus	Weasel Skink		
	Tiliqua scincoides	Eastern Blue-tongued Lizar		
Typhlopidae (Blind Snakes)	*Ramphotyphlops bituberculatu*	Prong-snouted Blind Snake		
	Ramphotyphlops weidii	Brown-snouted Blind Snake		
	Ramphotyphlops nigrescens	Black Blind Snake		
Boidae (Pythons)	*Morelia spilota*	Diamond Python		
Colubridae (Tree Snakes)	*Boiga irregularis*	Brown Tree Snake		
	Dendralaphis punctulata	Green Tree Snake		
Elapidae (Venomous Snakes)	*Furina diadema*	Red-naped Snake		
	Cacophis krefftii	Dwarf Crowned Snake		
	Demansia psammophis	Yellow-faced Whip Snake	✓	✓
	Furina diadema	Red-naped Snake		
	Notechis scutatus	Eastern Tiger Snake		
	Pseudonaja textilis	Eastern Brown Snake		
	Rhinoplocephalus nigrescens	Eastern Small-eyed Snake		
	Vermicella annulata	Bandy Bandy		
	Hemiaspis signata	Black-bellied Swamp Snake		
	Pseudechis porphyriacus	Red-bellied Black Snake		

KNOWN AND EXPECTED FROG LIST

Appendix Key: ✓ = Species Detected
(E) = Species listed under NSW TSC Act 1995 as Endangered.
(V) = Species listed under NSW TSC Act 1995 as Vulnerable.
(V*) = Species listed under the Commonwealth EPBC Act 1999 as Vulnerable
(E*) = Species listed under the Commonwealth EPBC Act 1999 as Endangered
(M*) = Species listed under the Commonwealth EPBC Act as Migratory
Species indicated in **BOLD** font are those threatened species known from within 10km of site (Atlas of NSW Wildlife data 2008)

Data Source: **1** = Species recorded within the Wallsend Link Road South
2 = Species recorded within the Wallsend Link Road North

Family Name	Scientific Name	Common Name	1	2
Hylidae (Tree Frogs)	***Litoria aurea***	**Green and Golden Bell Frog (E, V*)**		
	Litoria brevipalmata	**Green-thighed Frog (V)**		
	Litoria caerulea	Green Tree Frog		
	Litoria chloris	Red-eyed Green Tree Frog		
	Litoria dentata	Bleating Tree Frog		
	Litoria fallax	Eastern Dwarf Tree Frog	✓	✓
	Litoria latopalmata	Broad-palmed Frog	✓	✓
	Litoria lesueuri	Lesueur's Frog		
	Litoria nasuta	Rocket Frog		
	Litoria peronii	Peron's Tree Frog	✓	✓
	Litoria phyllochroa	Green Leaf Tree Frog		
	Litoria tyleri	Tyler's Tree Frog	✓	✓
	Litoria verreauxii	Verreaux's Frog		
Myobatrachidae (Ground Frogs)	*Adelotus brevis*	Tusked Frog		
	Crinia signifera	Common Eastern Froglet	✓	✓
	Crinia tinnula	**Wallum Froglet (V)**		
	Limnodynastes dumerilli	Eastern Banjo Frog		
	Limnodynastes ornatus	Ornate Burrowing Frog		
	Limnodynastes peronii	Striped Marsh Frog	✓	
	Limnodynastes tasmaniensis	Spotted Grass Frog	✓	✓
	Mixophyes fasciolatus	Great Barred Frog		
	Pseudophryne coriacea	Red-backed Toadlet	✓	✓
	Pseudophryne bibronii	Brown Toadlet		
	Uperoleia fusca	Dusky Toadlet		✓
	Uperoleia laevigata	Smooth Toadlet		✓

APPENDIX F Vegetation Communities Photographs

Plate 1 Coastal Plains Smooth-barked Apple Woodland

Plate 2 Coastal Foothills Spotted Gum Ironbark Forest

Plate 3 Lower Hunter Spotted Gum Ironbark Forest

Plate 4 Alluvial Tall Moist Forest

Plate 5 Hunter Lowland Redgum Forest

Plate 6 Freshwater Wetlands Complex

Plate 7 Weeds and Cleared Areas

Plate 8 Dams

APPENDIX G Qualifications of Personnel

RPS HARPER SOMERS O'SULLIVAN

Curriculum Vitae

Name:	Craig Anderson
Office:	RPS Harper Somers O'Sullivan
Position in Company:	Director - Environment
Qualifications / Memberships:	Bachelor Applied Science (Environmental Assessment & Management) University of Newcastle, NSW (1994) Currently undertaking Graduate Diploma in Archaeological Heritage through UNE Ecological Consultants Association of NSW (ECA) Planning Institute of Australia (PIA) Frog and Tadpole Study Group (FATS) Hunter Birds Observers Club (HBOC) Committee Member 2008 Bird Observers Club of Australia (BOCA) Hunter Heritage Network (HHN) RFS/PIA NSW Consulting Planners Bushfire Training

Areas of Expertise:

- Production of complex ecological impact assessment documents
- Detailed understanding of environmental legislation
- Conflict resolution and environmental impact mediation
- Land and Environment Court hearings
- Flora, habitat, and fauna surveys including threatened species
- Bushfire Threat Assessment & Management reporting
- Project Management (including areas outside environmental concern)

Experience Includes:

Craig is the Director of the Environment Division at RPS HSO, and has over 14 years experience in a wide range of environmental consulting. He has undertaken and managed commissions for a diverse range of projects, including State Significant Developments such as the Hunter Economic Zone (HEZ).

Extensive background in ecological field surveys, encompassing all aspects of flora and fauna identification, targeted surveying and mapping. Involved in the initial formulation of an Association of Consulting Ecologists for NSW in 1998. Elected member on the Inaugural Council (served two terms). Has acted as an expert witness in several Land and Environment Court matters relating to ecology and bushfire assessment. An experienced negotiator of ecological / development outcomes, and has a detailed understanding of legislation related to ecological matters. Craig has been actively involved in representations to the Department of Environment on behalf of the NSW Urban Taskforce in regards to proposed changes to the NSW Threatened Species Conservation Act.

Craig has also been involved in submissions on bushfire legislation and represented industry groups such as the NSW Urban Taskforce and Urban Development Institute of Australia (UDIA) on matters relating to issues such as the proposed listing of the Lower Hunter Spotted Gum – Ironbark Forest (LHSGIF) as an endangered ecological community, and regional environmental biodiversity strategies. Craig has also recently provided advice and submission material to the UDIA in relation to the Native Vegetation Act 2003 and the operations of the Catchment Management Authority (CMA).

RPS HARPER SOMERS O'SULLIVAN

Curriculum Vitae

Name:	Matthew Doherty
Office:	RPS Harper Somers O'Sullivan
Position in Company:	Environmental & GIS Manager
Qualifications / Memberships:	BLMC (Land & Water Conservation Major) Bush Regeneration Cert II Spikeless Tree Climbing Techniques NSW Driver's Licence (Class C) OH&S Induction Training (Green Card) NPWS Scientific Investigation Licence NSW Animal Ethics Research Authority

Areas of Expertise:

- Project Design & Management
- Environmental Impact Assessment and Reporting
- Liaison and Mediation with Clients, Stakeholders & Governing Bodies
- Archaeological (European/ Aboriginal Heritage) coordination and negotiation
- Expert GIS/ GPS for Project Design and Mapping
- Ecological Flora, Fauna & Habitat Surveys (Terrestrial & Aquatic)
- Tree Climbing to Install, Monitor and Maintain Supplementary Habitat (Nestboxes)

Experience Includes:

Matthew has seven years experience in the environmental industry with key skills in project management, survey design and GIS. In his position as Environmental and GIS Manager, Matthew manages the day to day running of projects, verification of reports and other outputs and ensures clients are well informed of project progress and key findings. Matthew's background in local and state government and private consultancy gives him a high level of appreciation of the development sector and allows him to take a pragmatic approach to providing successful conservation and development outcomes.

RPS HARPER SOMERS O'SULLIVAN

Curriculum Vitae

Name: Toby Lambert

Office: RPS Harper Somers O'Sullivan

Position in Company: Senior Ecologist

Qualifications / Memberships:
Bachelor of Environmental Science
Ecological Consultants Association of NSW
NSW Driver's Licence (Class C)
OH&S Induction Training (Green Card)
NPWS Scientific Investigation Licence
NSW Animal Ethics Research Authority

Areas of Expertise:

- Environmental and ecological impact assessment reporting
- Flora, fauna and habitat survey methodology design and management
- Detailed understanding of threatened species legislation and issues
- Terrestrial fauna surveys
- Renewable energy assessment
- Bushland and vegetation management
- Complex holistic project management
- Local, State and Commonwealth project co-ordination
- Dispute resolution and mediation

Experience Includes:

Toby has over twelve years experience in undertaking and managing a diverse array of ecological and environmental surveys and assessments. Toby has produced ecological and environmental documentation for private and public projects ranging in complexity. These include a number of wind farms throughout Australia and New Zealand, coal mines and a range of infrastructure projects within the Hunter region. Toby has also managed ecological masterplanning for residential projects in Sydney, the Central Coast and the Hunter. Toby is also currently the project manager for the environmental component of the development of the Hunter Economic Zone industrial estate at Kurri Kurri, the largest industrial estate in NSW.

Toby's fields of special competence are Environmental Impact Assessment and mediation, flora, fauna and habitat survey method, design and identification, detailed understanding of legislation and threatened species issues, terrestrial fauna surveys and project management.

RPS HARPER SOMERS O'SULLIVAN

Curriculum Vitae

Name:	Deborah Landenberger
Office:	RPS Harper Somers O'Sullivan
Position in Company:	Ecologist/ Botanist
Qualifications / Awards	B. Sc (Hons – First Class) NSW Driver's Licence (Class C) OH&S Induction Training (Green Card) NPWS Scientific Investigation Licence NSW Animal Ethics Research Authority
Memberships:	Australian Plant Society Australian Network for Plant Conservation Australasian Native Orchid Society

Areas of Expertise:

- Flora identification and habitat assessment
- Targeted threatened flora surveys
- Delineation and mapping of vegetation communities
- Endangered Ecological Community (EEC) assessment
- Threatened Flora Management Plans
- Experience in PATN Statistical package
- Ecological Monitoring and Reporting
- Vegetation and Bushland Management Plans
- Project Management and quote preparation
- Experience with GPS/GIS for project design and mapping
- Detailed understanding of environmental legislation

Project Experience Includes:

Deborah Landenberger has broad range of Ecological Assessment reporting experience underpinned by over 10 years of ecological field experience. Experience within the consulting industry has primarily included a wide range of flora assessment disciplines as required by a wide range of public and private clients. Debbie has a strong grounding in threatened flora species ecology and vegetation mapping ranging from the South Coast of NSW to Guyra in the north west and Port Macquarie on the north coast of NSW.

Debbie's strong botanical interests have been central in a number of important projects, these include major vegetation mapping projects in the south of Lake Macquarie, Minmi to the west of Newcastle, Ben Lomond (near Guyra), Oberon, North Arm Cove, Singleton and Bulahdelah. Her knowledge of non-parametric statistics, such as PATN statistical program has enabled RPS HSO to undertake large mapping projects using sound scientific methodology. Her knowledge of threatened flora species includes 2 years research on the threatened flora species *Tetratheca juncea.* Debbie's wide ranging knowledge and experience of Australian flora is a vital part of RPS HSO's ability to meet the consultation and regulatory needs of the development community.

RPS HARPER SOMERS O'SULLIVAN

Curriculum Vitae

Name: Allan Richardson

Office: RPS Harper Somers O'Sullivan

Position in Company: Ecologist

Qualifications / Awards

B.Env.Sc. (Environmental Management)
B.Env.Sc. (Hons) (Biology) – Migratory Wading Bird Study
2002 Hunter Environmental Institute Scholarship
Waterways Authority Boating Licence
OH&S Induction Training (Green Card)
NSW Driver's Licence (Class C)
NPWS Scientific Licence
NSW Animal Ethics Research Authority

Memberships: Hunter Bird Observers Club

Areas of Expertise:

- Ornithological Surveys and Research
- Targeted and general Terrestrial flora and fauna surveys
- Threatened Flora & Fauna Assessment, Reporting and Legislation
- GPS Survey and GIS Mapping Projects
- High Level Nature Photography
- Tertiary and General Ecological Tutoring, Demonstrating and Presenting

Project Experience Includes:

Allan Richardson has broad range of Ecological Assessment reporting experience underpinned by over 25 years of ecological field experience. Project experience has primarily included a range of flora and fauna assessment disciplines as required by a wide range of corporate to domestic client requirements. Allan has a strong grounding in threatened species ecology in both coastal and western NSW regional areas, with specialist migratory wader studies expertise in Central NSW and Roebuck Bay in North Western Australia.

Allan's wide ranging interest across different ecological disciplines, has been a central part of important threatened species projects, including, the Critically Endangered North Rothbury Persoonia, Hunter Estuary Green and Golden Bell Frog populations, Migratory Wader habitat usage surveys and seasonal Swift Parrot movements. Allan's broad ecological experience also represents an important part of RPS HSO's threatened flora and vegetation community mapping, targeted fauna survey works and threatened species habitat assessments over both small and large spatial areas for a range of client needs. His depth of experience and a strong knowledge of Australian fauna and regional vegetation contribute strongly to RPS HSO's ability to meet the consultation and regulatory needs of the development community.

RPS HARPER SOMERS O'SULLIVAN

Curriculum Vitae

Name: Anna McConville

Office: RPS Harper Somers O'Sullivan

Position in Company: Ecologist

Qualifications / Memberships:
B.Env. Sc.
M.Phil. (Env. Sc.) Candidate
"The Ecology of the East Coast Freetail Bat (*Mormopterus norfolkensis*) in the Hunter Region"
Member of the Australasian Bat Society
Member of the Royal Zoological Society of Australia
Member of the Wildlife Preservation Society of Australia

Areas of Expertise:

- Terrestrial Flora and Fauna Surveys
- Targeted threatened flora and fauna surveys
- Ecological impact assessment and reporting
- Ecological condition and threatened species monitoring
- Geographic Information Systems mapping and analyses
- Detailed understanding of legislation and threatened species issues

Experience Includes:

Anna has over three years experience as an ecological consultant across the Hunter, Central Coast and North Coast regions of NSW. Anna is experienced in designing and conducting flora and fauna surveys for environmental impact assessment and ecological monitoring. Key experience includes large infrastructure projects such as Pacific Highway Upgrades, ecological constraints and opportunities investigations for local environmental studies and implementation of ecological monitoring programs. Anna has also recently undertaken Biodiversity Certification and BioBanking feasibility investigations in the Hunter.

Anna is also currently completing a research degree investigating the habitat preferences of the East Coast Freetail Bat (*Mormopterus norfolkensis*), a threatened species, in the Hunter Region. The project investigates landscape-scale habitat use, roost selection and diet and aims to provide essential information to develop management strategies for the species.

RPS HARPER SOMERS O'SULLIVAN

Curriculum Vitae

Name: Sam Bishop

Office: RPS Harper Somers O'Sullivan

Position in Company: Ecologist

Qualifications / Memberships: B. Env. Sc. (EAM)

Member of the Fire Protection Association Australia (FPA)
Society of Frogs & Reptiles (SOFAR)
Hunter Bird Observers Club (HBOC)
NSW Driver's Licence (Class C)
OH&S Induction Training (Green Card)
NPWS Scientific Investigation Licence
NSW Animal Ethics Research Authority

Areas of Expertise:

- Conducting Field Surveys for Flora, Fauna and Habitat Identification.
- Flora identification and targeted threatened flora species searches
- Geographical Information Systems project design and mapping
- Report Preparation including Threatened Species Assessment, Endangered Ecological Communities assessment, and Vegetation Management Plans
- Detailed understanding of environmental legislation and threatened flora species issues
- Bushfire Threat Assessment & Management reporting
- Bushfire Risk Management Plans
- Fuel Management Plans
- Tree Clearance Supervision and Fauna Handling
- Nestbox Installation & Maintenance

Experience Includes:

Sam has over 3 years experience as an ecological and bushfire consultant, working on projects across NSW. Sam has designed and undertaken flora and fauna surveys including targeted surveys for threatened flora species within the Hunter, Central Coast and Tablelands regions. Additionally, Sam has undertaken assessments of vegetation to meet Native Vegetation Act requirements. Key experience includes assessment of derelict mines for DPI for rehabilitation purposes.

Curriculum Vitae

Name: Alexandra Saddington

Office: RPS HARPER SOMERS O'SULLIVAN

Position in Company: Ecologist

Qualifications / Memberships: B. Applied.Science

Waterways Authority Boating Licence
NSW Driver's Licence (Class C)
OH&S Induction Training (Green Card)
Member ORRCA
Member Native Animal Trust Fund
Volunteer Landcare Merewether

Areas of Expertise:

- Geographical Information Systems project design and mapping
- Bushfire Threat Assessment & Management reporting
- Bushfire Risk Management Plans
- Conducting Field Surveys for Flora, Fauna and Habitat Identification.
- Report Preparation including Fauna & Flora Assessments
- Detailed understanding of environmental legislation

Experience Includes:

January 2008 – Current Ecologist
RPS Harper Somers O'Sullivan, Broadmeadow, NSW

February 2007 – December 2007 GIS Officer
The Department of Lands, Newcastle, NSW

RPS HARPER SOMERS O'SULLIVAN

Curriculum Vitae

Name: Shaun Corry

Office: RPS Harper Somers O'Sullivan

Position in Company: Ecologist

Qualifications / Memberships:
Dip Conservation and Land Mgt
NSW Driver's Licence (Class C)
Waterways Authority Boating Licence
OH&S Induction Training (Green Card)
NPWS Scientific Investigation Licence
NSW Animal Ethics Research Authority

Areas of Expertise:

- Flora and fauna identification and habitat assessment
- Targeted threatened flora and fauna surveys
- Delineation and mapping of vegetation communities
- Endangered Ecological Community (EEC) assessment
- Experience with GPS/GIS for project design and mapping
- Conducting Field Surveys for Flora, Fauna and Habitat Identification
- Report Preparation including Fauna & Flora Assessments
- Ecological Monitoring and Reporting
- Bushfire Threat Assessment & Management reporting
- Understanding of environmental legislation

Experience Includes:

Shaun has a broad range of Ecological Assessment reporting experience and ecological field experience. Experience within the consulting industry has primarily included a wide range of flora assessment disciplines as required by a wide range of public and private clients. Shaun has a strong grounding in threatened flora species, endangered ecological communities and populations throughout NSW. Shaun has undertaken flora and fauna surveys including targeted surveys for threatened flora species within the Blue Mountains, Hunter, Central Coast and Mid North Coast.