Species	Habitat Description and Known Populations	Chance of Occurrence within Site	Likely Level of Impact within Development Estate
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 well to the west of the site (Atlas of NSW Wildlife data).	**Low** Due to the absence of records from within the local area it is unlikely that this species would occur within the site.	**Low** Although this species is unlikely to occur within the site, suitable abundant potential foraging habitat will be retained as conservation areas within the current proposal and foraging opportunities will continue to exist within the Development Estate.
Myotis macropus 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. Local records for this species occur at Vales Point and Lake Munmorah (Atlas of NSW Wildlife data).	**Moderate – High** This species has been recorded within the locality of the site and there are foraging opportunities within creek reaches of Mangrove Gully in the south-eastern section of the site. No known roosting sites occur within the site for this species.	**Low - Moderate** Those areas representing potential foraging habitat for this species will be retained within 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 its relatively widespread within the Lower Hunter Region extends to a local record at the southern end of Ruttleys Road (Atlas of NSW Wildlife data).	**Moderate - High** Due to its mobility and the occurrence of records within the locality it is likely that this species uses the site on at least an intermittent basis. Potential roosting habitat for this species occurs within the site.	**Low - Moderate** Although it is likely that a small amount of foraging habitat for this species may be lost during the process of development, large areas containing foraging and roosting habitat will be retained as conservation lands under the current proposal and foraging opportunities will continue to exist within the Development Estate.
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 Sub-bioregion (Strahan 1995), with one record west of Muswellbrook just outside of the Sub-bioregion (Atlas of NSW Wildlife data). Windermere Park	**Low** Considered unlikely to occur within the site on more than a rare occasion.	**Low** Although this species is unlikely to occur within the site, suitable abundant foraging habitat will be retained as conservation areas within 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** This community occurs adjacent to Lake Macquarie within the lower reaches of Mangrove Gully within an open depression. Whilst the area of the wetland is small it would be periodically flooded and retain water for most of the year only drying out in drought periods.	**Low - Moderate** This vegetation community occurs within the Development Estate however, the drainage line will be retained as part of the proposal. However, indirect impacts from urban development may impact upon the proposal and proper sediment control needs to be put into place to mitigate any adverse impacts. As long as sediment control is put in place it is unlikely that the proposal will adversely impact 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, this community is generally dominated by *Casuarina glauca* (Swamp She-oak). Within the site this community correlates with LHCCREMS MU 40 'Swamp Oak – Rushland Forest'.	**High** This community occurs adjacent to Lake Macquarie within the lower reaches of Mangrove Gully and as a thin strip of vegetation along the shoreline or behind the mangroves where the site is bordered by Lake Macquarie in the east.	**Low -Moderate** Those areas of this EEC that occur within the site will be conserved as part of the current proposal. However, indirect impacts from urban development may impact upon the proposal and proper sediment control needs to be put into place to mitigate any adverse impacts. As long as sediment control is put in place it is unlikely that the proposal will adversely impact upon this EEC.

Species	Habitat Description and Known Populations	Chance of Occurrence within Site	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. Within the site this community correlates with LHCCREMS MU 42 'Riparian Melaleuca Swamp Woodland', MU 37 'Swamp Mahogany - Paperbark Swamp Forest'.	**High** This community occurs within the site in a number of areas. In the east it occurs within the drainage lines and flats of Strangers Gully and Mangrove Gully and in the west it is associated with the flats surrounding Tiembula Creek.	**Low - Moderate** A small portion of this EEC will be removed (12%) as part of the proposal. In addition, indirect impacts from urban development may impact upon this EEC and proper sediment control needs to be put into place to mitigate any adverse impacts. As 88% of this EEC will be conserved within the drainage reserve and within the conservation lands and so long as sediment control measures are put into place to control runoff it is considered that the impact upon this EEC will be kept to a minimum.

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*.
(CE*) = Critically Endangered Species listed under the *Commonwealth EPBC Act 1999*.
(M*) = Migratory Species listed under the *Commonwealth EPBC Act 1999*.

5.2 Assessment of Significant Species / Communities

As per the assessment carried out within Table 5 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

- *Angophora inopina* Charmhaven Apple
- *Tetratheca juncea* Black-eyed Susan

Endangered Ecological Communities

- Freshwater Wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner Bio-regions
- Swamp Oak Floodplain Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions
- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions
- River Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions

Fauna

- *Crinia tinnula* Wallum Froglet
- *Hoplocephalus bitorquatus* Pale-headed Snake
- *Hoplocephalus stephensii* Stephen's Banded Snake
- *Pandion haliaetus* Osprey
- *Ixobrychus flavicollis* Black Bittern
- *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
- *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
- *Myotis adversus* Large-footed Myotis
- *Scoteanax rueppellii* Greater Broad-nosed Bat

5.2.1 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 were confirmed to exist during the studies either in or within close proximity to the Development Estate.

Angophora inopina

A. inopina was identified on both the east and west side of Kanangra Drive within this site. Targeted surveys, whilst not complete, mapped the extent of the population within the site. The highest density of this species was located on the western side of Kanangra Drive within the conservation estate. The numbers for the Development Estate have been completely mapped and total 698. A total 2411 individuals were located to the west of Kanangra Drive within the conservation lands. This represents a conservation of 98% of this population.

Whilst, a small part of this population 54 (0.02%) will require removal as part of the proposal, the majority of the population occurs adjoining the Kanangra Drive and this area will be retained within landscape buffer setbacks that will form part of the Development Estate. This is supported by DECCW (refer to Appendix 7).

Tetratheca juncea

A large population (over 6,000 individuals) of this species was located within the Development Estate during the targeted surveys undertaken in September 2007. The main distribution of this species is restricted to the Coastal Plains Scribbly Gum Woodland vegetation community

Whilst a large population will be removed as part of the proposal over 6,000 (76%) individuals of this species will be reserved with the conservation lands within the Gwandalan site. Larger populations are currently conserved within Wallarah National Park to the north east of the site (over 9,900 individuals) and with further populations located by RPSHSO (2010a, 2010b) within Coal & Allied lands in the Catherine Hill Bay and Nords Wharf area which will be conserved in conservation reserves the number conserved is likely to increase. Thus, in the Wallarah peninsula the total number of Tetratheca juncea totals over 49,000. Of these over 29,000 are to be conserved in conservation reserves. Such a large number of known plants protected in several disjunct but proximate conservation areas bode well for the long term security of the species within the locality. Therefore, it is considered that the development proposal will not have a significant impact upon the population.

Other threatened flora species

Several threatened flora species have potential habitat within the site and are considered as having at least a moderate potential to occur. No populations of these species could be found during targeted searches, the majority of these cryptic orchids were in flower at the time of the *Tetratheca juncea* surveys, which were performed in September 2007. However, many of the orchids are either undescribed or do not flower each year and therefore it is possible that stands of these species may have not been detected within the proposed Development Estate. One species, which was not in flower at the time of the survey, was *Cryptostylis hunteriana* and future targeted searches planned for December 2007 to target this species.

It is unlikely that this species should be significantly impacted upon by the proposed development given the large tracts of similar habitat that is to be retained as conservation lands in perpetuity.

5.2.2 Endangered Ecological Communities

All of the EEC's listed in Section 5 are present within the site. In some cases, only a very small amount of vegetation will be affected and any long-term discernable impacts are considered likely to be quite minimal. The impacts upon extant EEC's within the Development Estate are summarised below.

Freshwater Wetlands on Coastal Floodplains

Only a very small mapped area of this vegetation community (0.27 ha) of this EEC was identified within the Development Estate. If nutrient and sediment control measures are put in place to mitigate runoff then this will ensure that any adverse impacts from the development will be avoided. Whilst, this EEC is located within the Development Estate, it will be conserved as part of a drainage reserve proposed for this location. Therefore it is unlikely that the development proposal will have a significant impact upon this EEC.

Swamp Oak Floodplain Forest

This EEC occurs on the foreshore of Lake Macquarie along the eastern border of the site. It is a highly degraded community in many places with high weed and rubbish incursions. The foreshore will be reserved as open space and the remainder of this community occurs within the conservation lands. If nutrient and sediment control measures are put in place to mitigate runoff then this will ensure that any adverse impacts from the development will be avoided. Therefore, it is unlikely that the development proposal will have a significant impact upon this EEC.

Swamp Sclerophyll Forest

This EEC occurs as Riparian Melaleuca Swamp Woodland within Strangers Gully and the northern drainage lines of the development area. It is proposed to retain these two drainage lines as part of a drainage reserve within the Development Estate. Approximately 4 ha (12%) of this EEC occurs within the Development Estate and approximately 28.35 ha (88%) occurs within the conservation lands within the Gwandalan site. If nutrient and sediment control measures are put in place to mitigate runoff then this will ensure that any adverse impacts from the development will be avoided. Given that

the majority of this EEC (88%) will be reserved within the conservation lands, and the majority of the EEC, which does exist within the Development Estate, will be retained it is considered highly unlikely this EEC will be significantly impacted upon by the development proposal.

River Flat Eucalypt Forest on Coastal Floodplains

This community delineated as Redgum Rough-barked Apple Swamp Forest within the Gwandalan site is representative of the EEC of River Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bio-regions. This community occurs within the site upon narrow linear lakeside benches perched above the direct influence of estuarine and freshwater communities. A narrow band of *Casuarina glauca* occurs on the immediate edge of the lake with *E. tereticornis* occurring immediately behind this band, often within a couple of metres of the lake's edge. The landward edge of the community abuts Coastal Sheltered Apple – Peppermint Forest with Angophora floribunda mixing with this community to form an ecotonal edge between the respective canopies. A small area (0.14ha) representing 4% of this community will be displaced by the Development Estate where it occurs up slope of the majority of its onsite occurrence. Understorey strata in the majority of cases within the site are degraded by the presence of weed species, unformed tracks, rubbish dumping and in some cases evidence of unauthorised camping. Impacts to this community will be largely represented by the small loss in area to the Gwandalan Development Estate.

Due to its lakeside position this community may be at risk from indirect impacts as a consequence of its proximity to residential development and subsequent pedestrian usage by local residents. Therefore, the community may require protective measures such as well-defined pathways to prevent further degradation to understorey strata. The south eastern portion of the vegetation community adjoins the development area and therefore has a small risk of potential impact from urban runoff. 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.

Freshwater Wetlands on Coastal Floodplains

Douglas Partners (2008) have undertaken groundwater and soil studies within the Gwandalan Development Estate (Douglas Partners 2008) and have identified the Freshwater Wetland complex as being a Groundwater Dependent Ecosystem reliant on surface runoff and direct rainfall.

Whilst no Freshwater Wetlands complex would be removed as a result of the Gwandalan Development Estate, potential exists for indirect impacts associated with alterations to surface runoff and groundwater recharge. Potential indirect impacts on this community have been specifically addressed and minimised through:

- the redesign of the Gwandalan Concept Plan to retain vegetation to the south of Strangers Gully, effectively reducing the water reliant areas affected by the proposal; and

- the incorporation of best practice Water Sensitive Urban Design for the Development Estate, that will provide effective post development surface runoff treatment and allow for groundwater recharge.

5.2.3 Threatened Fauna

Wallum Froglet

This species was recorded within wetlands habitats associated with Strangers Gully and Mangrove Gully within swamp sclerophyll and wetland vegetation communities. Those lands within which this species is likely to occur will be retained within the current proposal as conservation lands. However, due to the downstream location of Wallum Froglet Habitat in Strangers Gully, with respect to the proposed Development Estate, there is potential for stormwater runoff from construction works to increase sediment loads to downstream wetland habitats and for the displacement of vegetation by manmade surfaces to increase water-flows, which may alter drainage channel profiles of wetland habitats. This combination of potential water derived impacts is likely to represent the Key Threatening Process (KTP) "Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands". Therefore, sediment and water management strategies will need to be incorporated into the planning, construction and occupation phases of the proposed Development Estate to ensure that impacts to downstream wetland habitats are prevented.

Pale-headed Snake

The Development Estate will displace a relatively small area of habitat within which this species might potentially occur. However, it is considered that the retention of a much greater area of similar or better quality potential habitat, as conservation lands within the current proposal, will ensure that the viability of potential local populations remains secure. Therefore it is unlikely that the current proposal will threaten the viability of any potential local population of this species.

Stephen's Banded Snake

The Development Estate will displace a relatively small area of habitat within which this species might potentially occur. However, it is considered that the retention of a much greater area of similar or better quality potential habitat, as conservation lands within the current proposal, will ensure that the viability of potential local populations remains secure. Therefore it is unlikely that the current proposal will threaten the viability of any potential local population of this species.

Osprey

Although this species was not recorded within the site there is moderate potential for it to use the site for roosting and nesting purposes due to the proximity of potential foraging habitat within Crangan Bay. Large areas of open forest within which this species might roost or nest will be retained within the current proposal as conservation lands, therefore it is considered that sufficient roosting / nesting habitat will be retained to secure habitat for local individuals or pairs. However, due to the downstream location of potential foraging habitat, there is potential for stormwater runoff from construction works to increase sediment loads to estuarine habitats and for the displacement of vegetation by manmade

surfaces to increase runoff water-flows, which may impact upon estuarine community characteristics. As a consequence there is potential for Osprey hunting habitat to be indirectly impacted upon by the current proposal. Therefore, sediment and water management strategies will need to be incorporated into the planning, construction and occupation phases of the proposed Development Estate to ensure that potential impacts to downstream estuarine habitats are prevented.

Black Bittern

Although this species was not recorded within the site there is moderate potential for it to use the site for foraging and nesting purposes in the lower reaches of Mangrove Gully and Tiembula Creek where they enter Lake Macquarie. Those areas that are potential habitat for this species will be retained as conservation lands, within the current proposal, and as such will increase secured habitat for local individuals or pairs. However, due to the downstream location of estuarine habitats, with respect to the proposed Development Estate, there is potential for stormwater runoff from construction works to increase sediment loads to estuarine habitats and for the displacement of vegetation by manmade surfaces to increase water-flows, which may impact upon estuarine and associated wetland community characteristics. As a consequence there is potential for Black Bittern hunting habitat to be indirectly impacted upon by the current proposal. Therefore, sediment and water management strategies will need to be incorporated into the planning, construction and occupation phases of the proposed Development Estate to ensure that potential impacts to downstream estuarine habitats are prevented.

Glossy Black-Cockatoo

Potential foraging habitat for this species, in the form of *Allocasuarina sp.*, is widespread within the site. Although individuals were not observed during fauna surveys, records occur elsewhere on the Gwandalan peninsula. Furthermore, the site contains trees of sufficient size to provide nesting hollows for this species. The proposed Development Estate will displace relatively small areas of potential forging habitat, but much greater areas of abundant and higher quality habitat will be secured as conservation lands within the current proposal. 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 any potential local population of this species.

Regent Honeyeater

This species does not occur in the Central Coast and Lower Hunter Region on a continuous basis, as its stronghold is the western slopes of the Great Dividing Range. Nevertheless, Regent Honeyeaters are recorded in Swamp Sclerophyll vegetation communities and associated woodlands on an intermittent seasonal basis in the Lake Macquarie LGA when resources in the west or Lower Hunter are scarce. Potential foraging habitat for this species, in the form of *Eucalyptus robusta* and *E. tereticornis*, occurs along the lower reaches of drainage lines and lake edges within the site. Those areas that represent potential foraging habitat for this species within the site will be retained within the current proposal, thereby securing coastal foraging habitat for this species.

Swift Parrot

This species does not occur in the Central Coast and Lower Hunter Region on a continuous basis, as it only moves into South-eastern Australia during the winter months and spends the summer in Tasmania. There are local records for this species at Nord's Wharf and elsewhere on the Gwandalan peninsula. Potential foraging habitat for this species, in the form of *Eucalyptus robusta* and *E. tereticornis*, occurs along the lower reaches of drainage lines and lake edges within the site.

Those areas that represent potential foraging habitat for this species within the site will be retained within the current proposal, thereby securing local foraging habitat for this species.

Powerful Owl

Although this species was not recorded within the site during nocturnal fauna surveys, other records occur within the vicinity of the site to the south. Furthermore, there are other records for this species on the Wallarah peninsula to the east of the site. The Development Estate within the current proposal will displace potential Powerful Owl foraging habitat. However, much greater areas of similar and higher quality foraging and potential nesting habitat for this species will be retained as conservation lands within the site. Therefore it is considered that the current proposal will benefit this species by securing local habitat.

Masked Owl

A record for this species occurs within the Mangrove Gully in the southeast of the site. Furthermore, there are other records for this species on the Wallarah peninsula to the east of the site. Within the current proposal the Development Estate will displace Masked Owl foraging habitat. However, much greater areas of higher quality foraging and potential nesting habitat for this species will be retained as conservation lands within the site. Therefore it is considered that the current proposal will benefit this species by securing local habitat.

Squirrel Glider

This species was recorded during nocturnal surveys in the Stranglers Gully area on the eastern and western sides of Kanangra Drive. Here, animals were observed feeding on the sap of Bloodwood trees. Feeding scars were recorded on Bloodwoods in this area, indication that this habitat is a foraging area for this marsupial, although Sugar Gliders were also observed feeding on sap of these trees in this area. Even though it is likely that a small amount of Squirrel Glider feeding and nesting habitat will be lost during the land development process, large areas containing potential foraging and nesting habitat are to be retained as conservation lands under the current proposal. This offset of good quality habitat for gliders will significantly reduce any threat to local populations of this species.

Grey-headed Flying Fox

There was no indication of roosting camps for this bat in the vicinity of the Gwandalan site, although it was observed on-site at a number of locations where it is associated with flowering *Eucalyptus robusta*. This species is a generalist feeding on flowering Eucalypt and other species during specific flowering periods, though *E. robusta* would constitute a

key winter foraging tree for this species. Those areas of *E. robusta* that represent potential foraging sites for this species are to be retained under the current proposal. It is therefore unlikely that the current proposal will represent a significant threat to this species.

Eastern Bentwing-Bat

This species utilises a diverse range of woodland habitats for foraging, and it is likely that this site will be regularly used as part of its foraging range, however being a cave-roosting species, no caves or artificial roosting habitat is known within the site. Although it is likely that foraging habitat for this bat will be modified during the development process, large areas of suitable foraging habitat will be retained as conservation land under the current proposal and foraging opportunities will continue to exist within the Development Estate. It is therefore unlikely that the current proposal will represent a significant threat to this species.

Little Bentwing-Bat

The survey recorded this bat within the site and it is likely to use areas of the site regularly as part of its foraging range however no roosting habitat is known within the site. Although it is likely that foraging habitat for this bat will be modified during the development process, large areas of suitable foraging habitat will be retained as conservation lands under the current proposal, and foraging opportunities will continue to exist within the Development Estate. It is therefore unlikely that the current proposal will represent a significant threat to this species.

Eastern Freetail-Bat

This bat was recorded within the site, and being a species that forages predominantly in dry woodlands and forests, it is likely to use this site regularly as part of its foraging range, and may use the abundant tree hollows as roosting habitat. Even though it is likely that foraging habitat for this bat will be modified during the development process, large areas of suitable foraging habitat will be retained as conservation lands under the current proposal, and foraging opportunities will continue to exist within the Development Estate. It is therefore unlikely that the current proposal will represent a significant threat to this species.

Yellow-bellied Sheathtail-Bat

This species was not recorded during the survey but is known to occur in the Central Coast Region within a range of woodland habitats. Due to its mobility and occurrence in the near-coastal districts to the south, it is likely that this species uses the site on at least an intermittent basis. Although it is likely that foraging and roosting habitat for this bat will be modified during the development process, large areas of suitable foraging habitat will be retained as conservation lands under the current proposal, and foraging opportunities will continue to exist within the Development Estate. It is therefore unlikely that the current proposal will represent a significant threat to this species.

Eastern False Pipistrelle

This bat was not recorded during the survey but a record from Pulbah Island in Lake Macquarie strongly suggests that it is likely to use the site on at least an intermittent basis. The occurrence of suitable woodland within the site provides potential roosting habitat. Although it is likely that foraging and roosting habitat for this bat will be modified during the development process, large areas of suitable foraging habitat will be retained as conservation lands under the current proposal, and foraging opportunities will continue to exist within the Development Estate. It is therefore unlikely that the current proposal will represent a significant threat to this species.

Large-footed Myotis

This bat has been recorded within the locality of the site and there are foraging opportunities within areas of standing water within the site although no known roosting sites for this species exist within the site. Those areas representing potential foraging habitat will be retained within the current proposal, and it is therefore unlikely that the proposal will represent a significant threat to local populations of this species.

Greater Broad-nosed bat

Although not recorded during this survey, this species is relatively widespread in a broad range of habitats within the Lower Hunter Region. Due to its mobility and local occurrence at the southern end of Ruttleys Road, it is likely that this species uses the site on at least an intermittent basis. Although it is likely that foraging and roosting habitat for this bat will be modified during the development process, large areas of suitable foraging habitat will be retained as conservation lands under the current proposal, and foraging opportunities will continue to exist within the Development Estate. It is therefore unlikely that the current proposal will represent a significant threat to this species.

5.3 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.*

Key Threatening Processes are listed in Schedule 3 of the *TSC Act 1995*. Those potentially applicable to the proposal, 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. *Lantana camara*; and
11. Predation by the European Fox

1. Loss of Hollow-bearing trees

The proposed development requires the removal of some hollow-bearing trees and as such is considered as contributing to the Key Threatening Process "Removal of Hollow-bearing Trees". A number of trees to be removed will contain hollows and due to their potential use by threatened fauna, particularly arboreal fauna, forest owls and Microchiropteran bats, removal has the potential to impact upon local populations of dependant species. Habitats within the site regarded as most likely to be impacted upon are open woodland habitats.

Within the Development Estate a number of species potentially utilise hollow-bearing trees as habitat, namely, hollow dwelling Microchiropteran bats, Squirrel Gliders and Masked Owls. Generally there exists abundant and higher quality habitat for each of these species elsewhere within the site that will be retained as conservation lands. Microchiropteran bats are least likely to be impacted upon, due to their mobility, and Squirrel Gliders within the site appear to favour habitat bordering drainage lines, which is likely to be retained as part of riparian buffer zones within the Development Estate. Masked Owl usage of the site is not well understood, but it is likely that they would favour larger trees in open forest, the bulk of which will be retained within the proposal as conservation lands.

The proposal is likely to represent a relatively small cumulative impact, with regard to this KTP, due in large part, to the greater abundance of higher quality habitat that will be secured as conservation lands elsewhere within the site and over time these lands will provide additional hollows.

2. Clearing of Native Vegetation

The proposed development will require the removal of native vegetation and as such is considered to contribute to the Key Threatening Process "Clearing of Native Vegetation". Vegetation that will be removed for the Development Estate is largely LHCCREMS MU 31 Coastal Plains Scribbly Gum Woodland (CPSGW), representing 30% (60.88ha) of this community. This community dominates the site, outside of the lakeside and riparian habitats. CPSGW within the site varies in structural diversity and its capacity to represent habitat for threatened flora and fauna species. Other vegetation communities that will experience some clearing are 4ha (12% of total) of Riparian Melaleuca Swamp Woodland, which is included within the final determination of the EEC, Swamp Sclerophyll Forest on Coastal Floodplains and 0.14ha (14% of total) Coastal Wet Cyperoid Heath, which is noted as being a regionally significant vegetation community by Bell (2002) due to its

restricted distribution. Much of the area where vegetation will be removed is of moderate habitat value due to a lower density of trees, a high frequency of motorcycle tracks and a relatively depauperate understorey diversity, which directly limits its shelter and foraging potential for small bird species, terrestrial mammals, Microchiropteran bats and those arboreal mammals that supplement their diet with proteaceous plants such as Banksia sp.. Threatened fauna that may utilise the land to be displaced by the Development Estate are Microchiropteran bats, Squirrel Gliders and Masked Owls. The proposed Development Estate lands represent moderate foraging and roosting habitat for each of these species although some stands of *Corymbia gummifera* (Red Bloodwood), largely adjacent to riparian vegetation, were noted as feed trees for gliders; within which a Squirrel Glider was observed feeding. Furthermore, foraging opportunities for many species of Microchiropteran bats will continue to exist within the Development Estate. Those habitat attributes likely to be most important for threatened fauna species occur in greater abundance and quality within lands that will be secured as conservation lands elsewhere within the site.

Two threatened flora species *Angophora inopina* and *Tetratheca juncea* will be removed as part of the development proposal. However the removal of *Angophora inopina* will be minimal 0.02%, and the removal of *Tetratheca juncea* will be 34%. Other species, where potential habitat exists within the Development Estate that are likely to be displaced under the proposal are *Acacia bynoeana, Caladenia tessellata, Cryptostylis hunteriana, Microtis angusii* and *Genoplesium insignis*. Whilst removal of these species and habitat will occur, extensive lands will be conserved within the conservation lands to the south and west of the Development Estate.

3. Human caused climate change

The proposal is likely to contribute to the Key Threatening Process "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.

4. Infection of native plants by *Phytophthora cinnamomi*

Phytophthora 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.

P. cinnamomi may spread with the movement of infected soil or plant material by people, animals and may be transport by percolating through the soil, in creeks or storm 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. Therefore, not a lot can be done to control the natural spread of the water mould or to destroy it, in native plant communities. 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*". 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 Environmental Management Plans generated for site construction activities.

5. 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 site due to the removal of vegetation and the exposing of underlying soils. For the most part, this KTP already occurs along tracks and road verges within the site. 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 Conservation Lands.

6. 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 lands 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 lands.

7. 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 adopted.

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

The displacement of natural vegetation communities within residential development 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 wetland vegetation assemblages including EEC's and fauna associated with these communities such as *Crinia tinnula* (Wallum Froglet). Impact to these threatened entities will be prevented by 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.

9. Invasion of Native Plant Communities by Bitou and Boneseed

This species is currently well established along the foreshore of Lake Macquarie. There is a small chance that this plant may spread further due to the removal of the canopy layer and exposing of underlying soils. There is an opportunity to reduce the area of occupancy of this species within the Development Estate. As the area adjoining the Lake foreshore is to be retained as open space it is recommended that a weed management program be

undertaken targeting this species to ensure that the development proposal does not increase the area of occupancy. It is recommended that any topsoil which is removed from the vicinity of any Bitou plants not be used for any of the landscaping areas and be disposed of appropriately. 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.

10. 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 site in relatively low densities in some areas. 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.

11. Predation by the European Fox

The removal of vegetation and hence habitat for this species has the potential to increase habitat competition within retained areas and the Conservation Estates. As such this may contribute to an increase in the KTP "Predation by the European Fox". If appropriate management measures are employed by the land manager (currently Coal & Allied and DECCW in the long term) this KTP should not have a significant impact on the local wildlife.

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

5.4 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.

5.4.1 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"*

Four tree species listed in Schedule 2 of SEPP No. 44 – 'Koala Habitat Protection' occur

on site, namely *Eucalyptus haemastoma* (Broad-leaved Scribbly Gum), *E. robusta* (Swamp Mahogany), *E. signata* (Scribbly Gum) and *E. tereticornis* (Forest Red Gum).

E. haemastoma occurs widely across the site within Coastal Plains Scribbly Gum Woodland (CPSGW), large areas of which characterise the dry ridges upslope of riparian and lake edge vegetation communities within the site. *E. haemastoma* occurs within CPSGW at a density higher than 15% of total canopy area within the community and as such areas of CPSGW can be considered as 'Potential Koala Habitat' according to the provisions of SEPP 44 (see Figure 4-1).

E. robusta occurs as the dominant canopy species within Swamp Mahogany – Paperbark Forest (SMPF), which is associated with the lower drainage lines of the site particularly where they flatten out into broad alluvial flats. As the dominant canopy species *E. robusta* occurs within SMPF at a density higher than 15% of total canopy area within the community and as such areas of SMPF can be considered as 'Potential Koala Habitat' according to the provisions of the SEPP. *E. robusta* also occurs occasionally as the dominant canopy component of Riparian Melaleuca Swamp Woodland (RMSW), and thus at greater canopy densities than 15%, particularly in the southeast of the site in the lower reaches of Mangrove Gully. These areas also constitute 'Potential Koala Habitat' according to the provisions of SEPP 44 (see Figure 4-1).

E. signata is a component of Coastal Sheltered Apple – Peppermint Forest (CSAPF), and which occurs as a strip of vegetation on the lower eastern slopes of the site between Swamp Oak Rushland Forest (SORF) and CPSGW. *E. signata* does not occur within CSAPF at a density greater than 15% of total canopy cover and therefore is not considered to constitute 'Potential Koala Habitat' according to the provisions of SEPP 44 (see Figure 4-1). *E. signata* also occurs within Coastal Plains Smooth-barked Apple Woodland (CPSBAW) in the site's southeast at densities greater than 15% of total canopy cover and as such these areas are considered to constitute 'Potential Koala Habitat' according to the provisions of SEPP 44 (see Figure 4-1).

E. tereticornis occurs within SORF on the eastern boundary of the site where it meets Lake Macquarie and within this community it occurs at a density greater than 15% of total canopy cover and as such these areas are considered to constitute 'Potential Koala Habitat' according to the provisions of SEPP 44 (see Figure 4-1). *E. tereticornis* also occurs within CSAPF as an ecotonal influence of SORF on its eastern boundary (see Figure 4-1), although it does occurs within this community at a density less than 15% and as such is not considered to constitute 'Potential Koala Habitat' according to the provisions of SEPP 44.

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

Searches were made 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 a nocturnal survey. No animals were noted on site and no secondary evidence of the presence of Koalas could

be found. However, a Koala record exists within the site from 2003 to the south of Mangrove Gully and several other records for Koalas occur to the south of this section of the site outside of the proposed Development Estate. The position where a Koala has been previously recorded in the south of the site lies approximately a kilometre south of the proposed Development Estate. Nevertheless, given that no direct of secondary indication of Koala presence was observed it is considered that no further provisions of this policy apply to the site.

5.5 SEPP 14 (Coastal Wetland)

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. SEPP 14 Coastal Wetland No. 890 was located within the southeast corner of the site in the lower reaches of Mangrove Gully (Figure 4-1: Vegetation Map). Half of the mapped wetland occurs on the Gwandalan site and half on the adjoining lands. This area of SEPP 14 'Coastal Wetlands' occurs within lands to be zoned as conservation lands under the current proposal and, as such, will not be modified during the process of development. Furthermore, those areas of SEPP 14 'Coastal Wetlands' entering the site, occur within a different watershed as drains the Development Estate and as such no indirect impacts are expected due to water runoff or the potential movement of sediment off the Development Estate.

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

6 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 Coal & Allied. 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 Coal & Allied 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 lands 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 lands, including significant occurrences of *Tetratheca juncea* (Black-eyed Susan). Refer to Table 6-1 Vegetation Removal / Retention.

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 lands 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 6-2 Habitat Removal / Retention.

In summary, the Coal & Allied 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 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 the proposed Development Estate via appropriate urban design and management practices.

Table 6-1 below depicts the vegetation removal and retention associated with the Gwandalan proposal. Table 6-2 Habitat Removal / Retention outlines the quality of habitat that will be removed as part of the proposal and Figure 4-6 shows the habitat quality within the Nords Wharf site.

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 1995*.

'EPBC Act' – Provides the status of the species / community / population described with relation to the *EPBC Act 1999*.

'Potential KTP' – Lists the Key Threatening Processes (KTP), which are listed within the TSC Act 1995, 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 5. 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. Lantana camara

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

'Area Conservation Land (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 site, thus the sum of the preceding two columns.

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

Table 6-1: Vegetation Removal / Retention

Vegetation Community	1. TSC Act 2. EPBC Act 3. Other	Potential KTP	Vegetation Outcome (ha)		
			Area in Development Estate	Area in Conservation Land	Total Area
Coastal Sheltered Apple – Peppermint Forest		*1-4, 6,7,9,10*	*0.86 (4%)*	*18.65 (96%)*	*19.51*
Coastal Plains Scribbly Gum Woodland		*1-4, 6,7,9,10*	*45.71 (40%)*	*68.40 (60%)*	*114.11*
Narrabeen Snappy Gum Forest			*10.66 (12%)*	*76.47(88%)*	*88.13*
Swamp Oak Rushland Forest	1. EEC - SOFF	*7-9, 10*	*0*	*5.1 (100%)*	*5.1*
Swamp Mahogany - Paperbark Forest	1. EEC - SSF	*2-4, 6-10*	*0*	*3.92 (100%)*	*3.92*
Riparian Melaleuca Swamp Woodland	1. EEC - SSF	*2-4, 6-10*	*2.99 (9%)*	*29.32 (91%)*	*32.31*
Redgum Rough-barked Apple Swamp Forest	EEC - RFEF		*0.14 (4%)*	*3.82 (96%)*	*3.96*
Coastal Wet Cyperoid Heath		*2-4, 6-9*	*0.21 (7%)*	*2.78 (93%)*	*2.99*
Freshwater Wetland Complex	1. EEC - Freshwater Wetlands	*8*	*0*	*0.27 (100%)*	*0.27*
Mangrove Estuarine Complex	*3. Protected under the Fisheries Management Act 1994*	8, 9	0	0.59 (100%)	0.59
TOTALS			**60.57**	**209.32**	**269.89**

**NOTE: The 'Area in Development Estate" is based on the current masterplan, and should be viewed as a maximum figure. It is likely that some these figures will be reduced as a result of retention of areas of native vegetation within the final 'development area.*

Table 6-2: Habitat Removal / Retention

Habitat	Area in Development Estate (ha)	Area in Conservation Lands (ha)
1 – High	3.37	69.18
2 – Above Ave	57.47	138.19
3 – Average	0.07	0.94
4 – Below Ave	0	7.31
5 – Low	2.43	0.07
TOTALS	**63.34**	**215.69**

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

6.1 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 Gwandalan.

This EAR has determined that whilst there will be a direct impact upon some individual threatened species due to the removal of vegetation, habitat retention within larger tracts of conservation offsets would ensure threatened species within the locality would not be significantly impacted .

The proposal is fundamental to achieving the outcomes of the Lower Hunter Regional Strategy and Lower Hunter Regional Conservation Plan. These guiding policies have been developed in consultation with local and state government agencies along with the wider community. As such planning has taken into account the environmental, economic and social parameters operating in the Lower Hunter. Therefore on a landscape scale these strategies coupled with this proposal deliver a sound and strategic environment conservation outcome for the region.

Best practice urban design has been incorporated into the concept plan in order to acknowledge, where possible, the corridor requirements of local and state government agencies and the wider community. The result, a matrix of linear riparian corridors, green buffers, patches of retained vegetation and public open space is provided by the proposed concept plan. Furthermore a hierarchy of roads has been proposed with appropriate treatment of adjacent parks and riparian corridors. Refer to the landscape documentation for more information.

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 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 dedication lands and wider locality, and are also represented or have potential habitat within other conservation offset lands and 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 Gwandalan site locality, and as such the proposal will not adversely affect any such habitat.

6.2 Offsetting Principles (Lower Hunter Regional Conservation Plan: Appendix 1)

In order to comply with the broader biodiversity objectives of the DGEARs, an assessment against the Offsetting Principles outlined within Appendix 1 of the Lower Hunter Regional Conservation Plan has been undertaken herewith.

1. Impacts must be avoided first by using prevention and mitigation measures. Offsets are then used to address remaining impacts.

The Development Estates have been selected within areas of previous disturbance and/or areas that represent an extension of the existing urban framework. The scope of the estates were also subject to extensive discussions with NSW Government, consultations with the community, Federal and NSW Government environmental agencies, independent hearings under the EP&A Act, urban design charrettes and public exhibition and refinement of proposals. As a consequence, mitigation of the impacts of the proposed development at

Gwandalan was undertaken through a reduction of the proposed development area via the scaling back of the development estate within and adjacent to the ecologically sensitive Strangers Gully and retention of a vegetated buffer between Kanangra Drive and the development estate containing a significant population of the threatened Charmhaven Apple (*Angophora inopina*) coupled with the commitment to mitigate unavoidable edge effects through best practice sensitive urban design. The net result being an increase in the proposed transfers of Coal & Allied conservation areas (conservation offsets) at Gwandalan to extend the overall area of the proposed, 'Conservation Reserve – South Wallarah Peninsula' sought under the Lower Hunter Regional Conservation Plan (LHRCP).

All of the proposed development and conservation offsets are in accordance with the provisions of the Lower Hunter Regional Strategy (LHRS) and supporting LHRCP, noting here that the LHRCP cites the LHRS as a 'partner document', emphasising that the two should be considered together and that is precisely what the Coal & Allied proposals do. The proposals improve biodiversity protection through transfer of proposed conservation lands from private to NSW Government ownership. Such lands have been identified within these planning and conservation documents and are fundamental to the success and achievement of the objectives and benchmarks therein therein as detailed within Appendix 2 of the LHRS and succinctly captured within the LHRCP executive summary.

2. All regulatory requirements must be met.

The proposal has considered the regulatory and statutory frameworks associated with the NSW Part 3A assessment process and beyond. The Environmental Assessment Report identifies and assesses the impacts associated with the ecological constraints and opportunities of the proposal. Other accompanying Environmental Assessment Reports identify and assess the impacts on Cultural Heritage, European Heritage, Contamination, Water Sensitive Urban Design and other relevant environmental impacts. All recommend actions to be taken to mitigate or compensate for such impacts have been duly considered within the concept master planning process and represent additional project benefits that are separate from the offset proposal.

Notably Coal & Allied's proposal has been approved by the Federal Minister for the Environment under the Environment Protection and Biodiversity Conservation Act. Importantly the proposal assessed herewith is consistent with that provided to the Minister for his consideration and determination. Refer to Appendix 6.

3. Offsets must never reward ongoing poor performance.

The proposed Development Estate lands are part of lands owned by Coal and Allied that are not required for their current or future mining operations. In part these lands have been utilised previously for mining and related activities and as such clearing has occurred.

The lands have not been the subject of unnecessary clearing and where mining activity has been undertaken on parts of the site it has largely been underground and as a consequence the overlying high biodiversity surface and vegetative cover has been preserved. The lands have been (and continue to be) managed by Coal and Allied such that they do not become an environmental burden and/or degrade adjacent lands.

The proposed development seeks to use industry best practice urban design and will be tested through the Part 3A assessment process.

As such the offsets will not be rewarding poor land management practices or poorly designed development proposals as they are of high biodiversity value as identified through the ecological assessment process and the environmental audit.

4. Offsets will complement other government programs.

The proposed offsets represent a significant conservation opportunity that will secure environmental assets, in perpetuity, that have been highly sought after under the NSW Government Lower Hunter Regional Strategy (LHRS) and specifically identified as highly valued assets in the LHRCP and DECCW 25 year Biodiversity Investment Layer.

In summary, the Coal & Allied conservation dedications provide outcomes that contribute to meeting the Environmental conservation goals outlined in the Sustainability Criteria contained within the LHRS. Such includes:

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

These outcomes:

- Conserve in perpetuity key strategic parcels of land that complete long sought after regional biodiversity conservation corridors and buffer areas;
- Conserve in perpetuity significant areas of vegetation communities for which reservation targets have not been met in the Lower Hunter region;
- 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.

5. Offsets must be underpinned by sound ecological principles.

The Environmental Assessment as informed by this EAR has been underpinned by the DEC 2005 Draft Biodiversity Assessment Guidelines coupled with implementation of the precautionary principle of 'assumed presence' to ensure a holistic ecological assessment. Key principles in relation to the offset lands that have been considered include (but are not limited to):

- Issues of connectivity and fragmentation
- Landscape structure, species diversity, floristic composition, habitat type and availability
- Presence or absence of threatened species, population and ecological communities known from the region
- Biodiversity enhancement coupled with long term viability
- Ecosystem structure and function as it relates to patch size and influences of disturbance, fragmentation, isolation and issues surrounding potential island biogeography.
- Benchmarks of 'like for like' and 'maintain or improve'
- Site and situation of offsets, within the available surplus lands, in order to maximise environmental conservation gains at a landscape scale through to individual species level.

The resultant offset proposal as documented by this ecological assessment being that, based on development estate approval, the offsets will secure a public asset which provides significant conservation benefits overall and positive outcomes for each of the abovementioned key principles.

6. Offsets should aim to result in a net improvement in biodiversity over time.

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 Conservation Estates scheduled to be dedicated to the NSW Government by Coal and Allied under this proposal across the Wallarah Peninsula, provide a regionally significant break between urban areas, and contain areas of high biodiversity, scenic amenity and heritage value.

In addition to their important strategic location in a wider landscape context, the conservation lands 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 lands, including significant occurrences of *Tetratheca juncea* (Black-eyed Susan) and *Angophora inopina* (Charmhaven Apple). Refer to Table 6-1. Given patch size of each individual Conservation Estate, issues generally associated with smaller conservation patches such as edge effects, fragmentation, corridor viability, maintenance of biodiversity etc are not considered to be major deleterious factors to be associated with this proposal. Furthermore the offsets will be managed under a Statement of Interim Management Intent (SIMI) and the NSW NPWS thereafter.

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 lands 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.

7. Offsets must be enduring – they must offset the impact of the development for at least the period that the impact occurs.

The offset lands (Conservation Estates) will be dedicated to the NSW Government under the terms of a Voluntary Planning Agreement (VPA) that is legally enforceable and managed thereafter under NPWS Estate in perpetuity.

8. Offsets should be agreed prior to the impact occurring.

The nature and extent of the proposed offset has been subject to rigorous debate and assessment with the NSW Government, Community, Stakeholder Groups, Federal and NSW Government environmental agencies, independent hearings under the EP&A Act, urban design charrettes and public exhibition.

The offsets encompassed by the proposal will be formally agreed upon through the Part 3A process and form part of the overall approval. Thereafter the offsets will be dedicated to the NSW Government to become a public conservation asset under NPWS Estate. The offset land dedication will occur following registration of the Subdivision Plan which will occur three months after the SSS listing and Concept Plan approval.

9. Offsets must be quantifiable – the impacts and benefits must be reliably estimated.

- The ecological assessment has quantified the nature and extent of vegetation communities and floristic structures over the conservation estates notwithstanding the presence and/or potential presence of threatened species, populations and endangered ecological communities that will become a public conservation asset if the current proposal is approved.
- The offsets make a significant contribution to the achievement of conservation objectives sought under the LHRS and LHRCP.
- At Gwandalan 206 ha of high biodiversity offset lands (Conservation Estates) will be dedicated to the NSW Government through a voluntary planning agreement that is legally enforceable and managed thereafter under NPWS Estate in perpetuity. Development lands will be confined to 62 ha.
- The common edges of the development /conservation estates will be managed under a SIMI following land dedication for a period of up to 5 years prior to management hand over to the NSW NPWS who will have carriage of the lands thereafter.
- The conservation estates have been subject to an environmental audit that will along with the SIMI guide rehabilitation efforts over the offset.

10. Offsets must be targeted – they must offset impacts on a like-for-like or better basis.

The proposed conservation offsets:

- provide a like for like environmental outcome at a minimum (refer to Table 6-1 and Table 6-2);
- are situated within areas and contain vegetation communities that are identified by the LHRCP as extant having a reservation target that is not met;
- provide the single largest contribution to the South Wallarah Peninsula Conservation

Reserve sought by the LHRS and LHRCP;

- contain and will conserve a range of important vegetation communities, including areas of EECs and other vegetation types that have been depleted in the region;
- contain known threatened flora and fauna species of significance at the state and national level;
- provide a diverse array of habitats and resources for native fauna including coastal range forests, woodlands, heathlands and wetlands; and
- will provide secure regional biodiversity gene pools, and through linkages facilitate valuable genetic material exchange and other key processes associated with sustainable ecological population dynamics.

11. Offsets must be located appropriately – they must offset the impact in the same region.

The proposed offsets are:

- located within adjacent areas to the Development Estates;
- within the same IBRA Bio-region and sub-region as the Development Estate occurs;
- large patches of vegetated land contiguous with large vegetated areas extant from the locality;
- representative of the impact areas, hence providing a valuable biodiversity resource. 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; and
- not subject to edge effects, fragmentation, issues of corridor viability, maintenance of biodiversity realted to disturbance due to their individual patch size.

12. Offsets must be supplementary – they must be beyond existing requirements and not already be funded under another scheme.

The offsets represented by the Conservation Estates are currently private freehold lands that are not part of any existing NSW Government or other scheme. As stated in point 4 above the lands have been identified under several NSW Government conservation initiatives only.

13. Offsets and their actions must be enforceable – through development consent conditions, licence conditions, conservation agreements or a contract.

The offset lands (Conservation Estates) will be dedicated to the NSW Government through a voluntary planning agreement that is legally enforceable and managed thereafter under NPWS Estate in perpetuity.

The dedication will be supported by a SIMI (Statement of Interim Management Intent) that will focus on the mitigation and rehabilitation of existing edge effects and internal fragmentation for a period the lesser of 5 years form commencement of works or until all lots are sold relative to each development area precinct.

7 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 and conservation land interface is critical to ensure that no direct or indirect impacts occur in the short and long term on dedicated conservation lands. As such, appropriate management plans should be prepared and implemented within the development framework in consultation with the NSW National Parks and Wildlife Service.
- The minimum amount of clearing necessary to facilitate the proposed development 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.
- It is recommended that both an *Angophora inopina* and a *Tetratheca juncea* management plan be prepared to ensure the conservation and long term survival of these two threatened species within both the retained areas of the Development Estate and the conservation lands.
- 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.
- 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 only, 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 site.
  - » 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 *Eucalyptus robusta* and other regionally significant species.
- Appropriate vegetation, habitat and bushfire management plans should be included under an overarching Environmental Management Plan.
- 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.

8 Conclusion

The detailed studies undertaken herewith have confirmed that development of a portion of the Development Estate 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 lands and the Development Estate:

- 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 within 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 lands that have been set aside as part of the development provide sound ecological outcomes across the site. As a result of conservation of these offset lands, a large vegetation corridor will be conserved stretching from Gwandalan in the south and linking up with Wallarah National Park in the north. These conservation lands will link three state conservation areas of Lake Munmorah State Conservation Area, Lake Macquarie State Conservation Area and Wallarah National Park. This large tract of native vegetation will provide habitat for a wide variety of native flora and fauna.

Therefore, 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 should also ensure that the ecological impact of the project is minimised.

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Appendix 1

DGEAR's

Director-General's Requirements

Section 75F of the Environmental Planning and Assessment Act 1979

Project	**Concept Plan (MP10_0084)** for a residential subdivision of the Gwandalan site for up to 623 dwellings over approximately 62 hectares and the dedication of approximately 205 hectares for conservation.
Site	**Gwandalan** Lot 2 DP 1043151 and Lot 57 DP 755266
Proponent	Coal & Allied Industries Pty Ltd
Date of Issue	19 August 2010
Date of Expiration	(2 years from date of issue)
General Requirements	The Environmental Assessment (EA) must include: (1) An executive summary. (2) A detailed description of the project including the: (a) strategic justification for the project; (b) alternatives considered; and (c) various components and stages of the project in detail (and should include infrastructure staging). (3) A consideration of the following with any variations to be justified: (a) all relevant State Environmental Planning Policies, with particular regard to SEPP *Major Development 2005, SEPP 44, SEPP 55, SEPP 71* and *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*; (b) applicable planning instruments; and (c) relevant legislation and policies, including the *NSW Coastal Policy 1997*, *Lower Hunter Regional Strategy,* and *Lower Hunter Regional Conservation Plan*. (4) A consideration of the proposal and cumulative impacts in relation to the development of other future urban land identified in the Lower Hunter Regional Strategy. (5) A draft Statement of Commitments, outlining specific commitments to the project's management, mitigation and monitoring measures with a clear identification of the timing and responsibility for these measures. (6) A conclusion justifying the project, taking into consideration the environmental impacts of the proposal, mitigation measures to address these impacts, the cumulative impacts of the proposal, the suitability of the site, and whether or not the project is in the public interest. (7) Identify the development contributions applicable to the site between (a) the Proponent and Wyong Shire Council; (b) the Proponent and State Government agencies for State infrastructure in accordance with *Planning Circular PS 07-018;* and (c) if relevant, any public benefits to be provided with the development. (8) A signed statement from the author of the EA certifying that the information contained in the report is neither false nor misleading. (9) A report from a quantity surveyor identifying the correct capital investment value for the concept plan and the four project applications.
Key Assessment Requirements	**Urban design and built form** (1) Provide an assessment against the *Coastal Design Guidelines for NSW* and *NSW Coastal Policy (1997)*. (2) Propose development controls and design guidelines for the site which ensure that the future development responds to the site location appropriately. (3) Provide details of proposed treatment of all public domain areas. (4) Identify opportunities to link the proposed development to the existing village and surrounding areas, including through appropriate pedestrian and cycleway connections.

	(5) Address the principles of *Crime Prevention Through Environmental Design.* **Coastal Foreshore and Public Access** (1) Outline measures to protect and enhance existing public access through the site to and along the foreshore and provide, where appropriate, new opportunities for public access that is compatible with the natural attributes of the coastal foreshore. **Biodiversity impact** (1) Identify impacts of the development on threatened species and their habitats having regard to the draft *Threatened Species Assessment Guidelines* (DEC July 2005) and outline measures to avoid or mitigate impacts on threatened species and their habitat. (2) Demonstrate that biodiversity impacts can be appropriately offset in accordance with the NSW Government's policy for 'improvement or maintenance' of biodiversity values. (3) Consider and identify measures to manage interface impacts on land proposed to be dedicated for conservation., (4) Provide an assessment of the cumulative impacts on biodiversity of the proposed development, and other development proposed in the area. (5) Demonstrate consistency with the approval granted by the Commonwealth Department of Environment, Water, Arts and Heritage under the *Environmental Protection and Biodiversity Conservation Act 1999.* **Transport and Accessibility** (1) Prepare a Traffic Study in accordance with RTA's *Guide Traffic Generating Developments* that includes (but is not limited to) the following: (a) an identification of all relevant vehicular traffic routes and intersection for access to/from the area, (b) current traffic counts for all of the above traffic routes and intersections, (c) the anticipated vehicular traffic generated from the proposed development and associated trip distribution on the road network, (d) consideration of the traffic impact on the existing and proposed intersections and the capacity of the local and classified road network to safely and efficiently cater for the additional vehicular traffic generated, (e) an analysis of the cumulative traffic and transport impacts of the development taking into consideration other proposed developments, (f) details of necessary road network infrastructure upgrades required to maintain existing levels of service both on the local and classified road network, (g) an intersection analysis, using SIDRA or similar traffic model, as well as a micro simulation model to determine the need for intersection and mid block capacity upgrades and to ensure traffic signal co-ordination, (h) proposed pedestrian and cycleway access within and to the site that connects to all relevant transport services, nearby settlements, and other key off-site locations having regard to the *NSW Planning Guidelines for Walking and Cycling* (2004), and the *NSW Bike Plan* (2010), (i) Timing of delivery of proposed transport infrastructure including road and intersection upgrades, pedestrian and cycle paths, and public transport infrastructure, and (j) Consideration of impacts on existing property access. (2) Assess the proposal against the objectives of the Integrating Land Use and Transport policy package.

Mining Activities

(1) Identify the requirements of previous consents, approvals, lease arrangements, and current legal and financial responsibilities in relation to the mine operation and closure and the impact approvals will have on these arrangements.

(2) Provide a risk analysis examining the risk factors associated with the former mining use of the site and what effects it may have on future development, including mine subsidence.

(3) Identify measures that would that would be implemented to avoid, minimise or remediate potential mine subsidence issues encountered on the site.

(4) Investigate the impacts on future mining activities.

Heritage

(1) Provide an archaeological assessment and heritage impact statement in accordance with NSW Heritage Office guidelines. The statement should assess the impacts of the application on the area and any significant components of the site, including indigenous heritage.

(2) Provide an assessment in accordance with the d*raft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC 2005).

Water quality

(1) Provide appropriate detailed information on the drainage and stormwater management measures to be incorporated on site, including on site stormwater detention, water sensitive urban design measures, and drainage infrastructure.

(2) identify future management arrangements for proposed stormwater infrastructure including, where relevant, in consultation with Council.

(3) Assess the impact of the proposal on the hydrology of the site and surrounding areas including impacts on quality of surface water, groundwater, a coastal lake, a coastal creek or other similar body of water, or a rock platform) in accordance with the *NSW Groundwater Dependant Ecosystems Policy.*

Flooding

(1) Develop suitable flood planning levels for the proposed development and identify flood evacuation requirements for land up to the Probable Maximum Flood level. Demonstrate consistency with the *NSW Floodplain Development Manual: the management of flood liable land (2005)*, the *DECCW Floodplain Risk Management Guideline – Practical Consideration of Climate Change*, the *NSW Sea Level Rise Policy Statement (DECCW 2009),* and *Draft NSW Coastal Planning Guideline: Adapting to Sea Level Rise* (Department of Planning 2009).

Visual

(1) Assess and provide mitigation measures in response to the visual impacts of the project in the context of adjoining development, impact on any heritage items (on-site or in the vicinity) and the development as viewed from publicly accessible areas and the natural environment.

Bushfire

(1) Identify how the proposed concept plan addresses the requirements of *Planning for Bush Fire Protection* and *Australian Standard 3959 (Building in Bush Fire Prone Areas)*.

(2) Outline ongoing management arrangements of any proposed APZs, including through negotiation with relevant agencies where APZs are proposed to be located on land to be dedicated for a public purpose.

	Impact on Crown Land (1) Identify potential direct and indirect impacts arising from development on the adjacent Munmorah State Conservation Area, Point Wollstonecraft State Recreation Area and Lake Macquarie State Recreation Area. **Infrastructure and utilities** (1) Identify and address the impacts of additional demand created by the development on existing infrastructure including public transport, open space, and recreation facilities, retail facilities and other social and community facilities. Identify the need for additional facilities through negotiation with State or local government agencies. This should inform the scope of proposed State and local infrastructure contributions. (2) Prepare a utility and infrastructure servicing report and plan for the Site that includes (but is not limited to): (a) Identification and assessment of the capacity of existing utility and infrastructure servicing the site, and (b) Identification and assessment of all necessary augmentation works to service the site and whether these works can sustain this and others development foreshadowed for the Wallarah Peninsula shown in the *Lower Hunter Regional Strategy*. **Ecologically Sustainable Development (ESD)** (1) Demonstrate how the development will commit to ESD principles in design, construction and ongoing operation phases. (2) Demonstrate that the development is capable of achieving the requirements of BASIX. **Site preparation works** (1) Identify the likely extent of site preparation works with respect to cut and fill activities to cater for the proposed residential development. In particular, assess how the proposed built form will respond to final levels of the site and demonstrate consideration to minimise the extent of cut and fill required. **Subdivision** (1) Provide a subdivision plan to identify all covenants, easements and notations proposed for each title, for the proposed subdivision to facilitate transfer of lands to Government agencies. **Future Public Land** (1) Identify any proposed open space or conservation lands and outline arrangements for ownership and control, management and maintenance, funding, public access, revegetation and rehabilitation works, and bushfire management.
Consultation Requirements	An appropriate and justified level of consultation should be undertaken. Where consultation has already been undertaken this should be documented in the EA. Consultation must be undertaken with the following relevant agencies: • Wyong Shire Council • Hunter Water • Local Aboriginal Land Councils • Catchment Management Authority - Hunter – Central Rivers • NSW Department of Industry and Investment • NSW Department of Environment, Climate Change and Water • NSW Office of Water • Transport NSW • Roads and Traffic Authority

	• NSW Emergency Service agencies, namely NSW Police Department, the Ambulance Service of NSW, the State Emergency Service, NSW Rural Fire Service, and NSW Fire Brigades • Utility providers The consultation process and the issues raised should be described in the Environmental Assessment.
Deemed refusal period	60 days

Appendix 2

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 cannot 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

Community Represented

1 Coastal Plains Smooth-barked Apple Forest
2 Coastal Sheltered Apple – Peppermint Forest
3 Coastal Plains Scribbly Gum Woodland
4 **Swamp Oak – Rushland Forest (EEC – Swamp Oak Floodplain Forest)**
5 **Swamp Mahogany – Paperbark Forest (EEC – Swamp Sclerophyll Forest)**
6 **Riparian Melaleuca Swamp Woodland (EEC – Swamp Sclerophyll Forest)**
7 Coastal Wet Cyperoid Heath
8 **Freshwater Wetland Complex (EEC – Freshwater Wetlands on Coastal Floodplains)**
9 Mangrove Estuarine Complex

Scientific Name	**Common Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
CLASS LYCOPSIDA (CLUB MOSSES)										
SELLAGINELLACEAE										
Selaginella uliginosa			X	X		X	X	X		
CLASS FILICOPSIDA (FERNS)										
ADIANTACEAE										
Adiantum aethiopicum	Common Maidenhair Fern		X			X	X			
BLECHNACEAE										
Blechnum indicum	Swamp Water Fern					X	X		X	
Doodia aspera	Rasp Fern					X	X			
CYATHEACEAE										
Cyathea australis	Rough Tree Fern				X		X			
Cyathea cooperi	Straw Tree Fern		X		X		X			
DENNSTAEDTIACEAE										
Hypolepis muelleri	Harsh Ground fern		X			X				
Pteridium esculentum	Bracken Fern		X	X		X	X			
DICKSONIACEAE										
Calochlaena dubia	False Bracken Fern		X			X	X			
LINDSAEACEAE										
Lindsaea linearis	Screw Fern			X		X	X	X		
Lindsaea microphylla	Lacy Wedge-fern		X							
POLYPODIACEAE										
Platycerium bifurcatum ssp. *bifurcatum*	Elk Horn						X	X		
SCHIZACEAE										
Schizaea dichotoma	Branched Comb Fern			X						

Scientific Name	**Common Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
CLASS CYCADOPSIDA (CYCADS)										
ZAMIACEAE										
Macrozamia communis	Burrawang		X	X						
CLASS MAGNOLIOPSIDA (FLOWERING PLANTS)										
SUBCLASS MAGNOLIIDAE (Dicotyledons)										
ACANTHACEAE										
Pseuderanthemum variabile	Pastel Flower	X	X	X						
AIZOACEAE										
Carpobrotus glaucescens	Pig Face				X					
AMARANTHACEAE										
Alternanthera denticulata	Lesser Joyweed						X			
APIACEAE										
Actinotus minor	-			X						
Centella asiatica	Swamp Pennywort			X		X	X			
**Ciclospermum leptophyllum*	Slender Celery			X						
**Hydrocotyle bonariensis*	Kurnell Curse				X	X				
Hydrocotyle geraniifolia	Forest Pennywort		X				X			
Hydrocotyle peduncularis			X	X			X			
Platysace linearifolia	Carrot Tops			X						
Trachymene incisa				X		X	X			
Xanthosia tridentata	Rock Xanthosia			X						
APOCYNACEAE										
Parsonsia straminea var. *straminea*	Monkey Rope					X	X			
ARALIACEAE										
Polyscias sambucifolia	Elderberry Panax			X						
ASCLEPIADACEAE										
**Gomphocarpus fruticosus*	Narrow-leaf Cotton Bush			X						
Marsendia rostrata	Common Milk Vine		X				X			
ASTERACEAE										
**Bidens pilosa*	Cobbler's Pegs			X						
Cassinia uncata	Bent Cassinia			X						
**Chrysanthemoides monilifera* ssp. *Rotundata*	Bitou Bush		X	X	X	X	X			X
**Cirsium vulgare*	Spear Thistle			X						
**Conyza albida*	Tall Fleabane		X	X						
**Hypochoeris radicata*	Cat's Ear			X						
Lagenifera stipitata				X						
Senecio linearifolius			X							
**Senecio madagascariensis*	Fireweed			X						
**Sonchus oleraceus*	Common Sowthistle			X						
**Onopordum acanthium*	Scotch Thistle			X						
Olearia sp.		X	X							
Vernonia cinerea			X	X		X	X			

Scientific Name	**Common Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
AVICENNIACEAE										
Avicennia marina var. *australasica*	Grey Mangrove		X		X					
BIGNONIACEAE										
Pandorea pandorana	Wonga Wonga Vine		X	X			X			
CASUARINACEAE										
Allocasuarina littoralis	Black She-oak	X		X			X			
Allocasuarina torulosa	Forest Oak		X			X	X			
Casuarina glauca	Swamp She-oak				X	X	X			
CHENOPODIACEAE										
Suaeda australis	Austral Seablite				X					
CONVOLVULACEAE										
Dichondra repens	Kidney Weed		X			X	X			
Polymeria calycina	Swamp Bindweed					X	X			
CUNONIACEAE										
Ceratopetalum gummiferum	New South Wales Christmas Bush		X			X	X			
DILLENIACEAE										
Hibbertia aspera	Rough Guinea Flower		X	X						
Hibbertia dentata	Twining Guinea Flower		X				X			
Hibbertia empetrifolia	Trailing Guinea Flower			X						
Hibbertia obtusifolia						X	X			
Hibbertia scandens	Golden Guinea Flower		X	X						
DROSERACEAE										
Drosera peltata	Sundew	X		X		X	X			
ELAEOCARPACEAE										
Elaeocarpus reticulatus	Blueberry Ash		X			X	X			
EPACRIDACEAE										
Acrotriche divaricata	-		X	X			X			
Astroloma humifusum	Cranberry Heath			X						
Epacris pulchella	NSW Coral Heath	X		X		X				
Leucopogon juniperinus	Bearded Heath						X			
Leucopogon lanceolatus	Lance Beard-heath		X	X			X			
Leucopogon microphyllus				X						
Lissanthe strigosa	Native Cranberry			X						
Melichrus procumbens	Jam Tarts			X						
Monotoca scoparia		X								
Styphelia triflora				X						
EUPHORBIACEAE										
Breynia oblongifolia	Coffee Bush		X	X						
Glochidion ferdinandi	Cheese Tree		X			X	X			
Phyllanthus hirtellus	Thyme Spurge			X						
Poranthera microphylla	Small Poranthera		X							
FABOIDEAE										
Bossiaea heterophylla	Variable Bossiaea			X						
Bossiaea rhombifolia				X						

Scientific Name	**Common Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Daviesia mimosoides var. *mimosoides*		X								
Daviesia ulicifolia	Gorse Bitter-pea	X		X						
Desmodium rhytidophyllum			X	X		X	X			
Desmodium varians				X						
Dillwynia retorta	Heathy Parrot Pea	X		X						
Glycine clandestina	Love Creeper		X	X						
Glycine tabacina	Love Creeper		X	X		X	X			
Gompholobium latifolium	Broad-leaf Wedge-pea		X	X						
Gompholobium pinnatum	Pinnate Wedge Pea	X		X						
Hardenbergia violacea	False Sarsaparilla	X	X	X		X	X			
Hovea linearis				X						
Jacksonia scoparia	Dogwood		X				X	X		
Kennedia rubicunda	Dusky Coral Pea		X	X						
Mirbelia rubifolia		X		X						
Podolobium ilicifolium	Native Holly			X						
Podolobium scandens				X						
Pultenaea daphnoides			X	X		X	X			
Pultenaea elliptica				X						
Pultenaea paleacea				X			X			
Pultenaea retusa				X						
Pultenea villosa			X	X			X	X	X	
Sphaerolobium vimineum						X	X	X		
**Trifolium repens*	White Clover			X						
**Trifolium dubium*	Yellow Suckling Clover			X						
GERANIACEAE										
Geranium homeanum	Cranesbill		X	X						
Geranium solanderi var. *solanderi*	Native Geranium				X	X	X			
GOODENIACEAE										
Goodenia hederacea	Violet-leaved Goodenia			X						
Goodenia heterophylla	Variable-leaved Goodenia		X	X			X	X		
Goodenia ovata	Hop Goodenia		X		X		X			
Goodenia paniculata	Swamp Goodenia				X	X	X	X	X	
HALORAGACEAE										
Gonocarpus micranthus ssp. *Ramosissimus*						X	X	X	X	
Gonocarpus tetragynus	Poverty Raspwort						X	X		
Gonocarpus teucrioides	Germander Raspwort			X		X	X			
HYDROCHARITACEAE										
Ottelia ovalifolia	Swamp Lily					X		X		
LAMIACEAE										
Plectranthus parviflorus			X			X				
LAURACEAE										
Cassytha pubescens	Common Devil's Twine	X		X		X	X	X		
Endiandra sieberi	Corkwood					X	X			
LOBELIACEAE										
Pratia purpurascens	White Root		X	X		X	X			
MALVACEAE										

Scientific Name	**Common Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
**Sida rhombifolia*	Paddy's Lucerne			X						
MENISPERMACEAE										
Sarcopetalum harveyanum	Pearl Vine		X			X	X			
Stephania japonica var. *discolor*	Snake Vine		X	X		X	X			
MIMOSOIDEAE										
Acacia brownii	Brown's Wattle		X	X						
Acacia elongata	Swamp Wattle			X				X	X	
Acacia falcata	Falcate Wattle		X	X						
Acacia floribunda	White Sally		X	X		X	X			
Acacia implexa	Hickory						X			
Acacia longifolia var. *longifolia*	Sydney Golden Wattle		X	X			X			
Acacia longifolia var. *sophorae*	Coastal Wattle				X					
Acacia myrtifolia	Myrtle Wattle	X		X						
Acacia suaveolens	Sweet-scented Wattle			X			X			
Acacia terminalis subsp. augustifolia	Sunshine Wattle			X			X			
Acacia ulicifolia	Prickly Moses			X						
MYRTACEAE										
Acmena smithii	Lilly Pilly					X	X			
Angophora costata	Smooth-barked Apple		X	X		X	X			X
Angophora floribunda	Rough-barked Apple		X	X						
***Angophora inopina* (V) (EV)**	**Charmhaven Apple**			X						
Callistemon citrinus	Crimson Bottlebrush						X	X		
Callistemon linearis	Narrow-leaved Bottlebrush			X						
Callistemon salignus	Willow Bottlebrush						X			
Corymbia gummifera	Red Bloodwood	X	X	X						
Eucalyptus capitellata	Brown Stringybark	X		X						
Eucalyptus haemastoma	Scribbly Gum			X						
Eucalyptus piperita	Sydney Peppermint		X	X			X			
Eucalyptus racemosa	Snappy Gum			X			X			
Eucalyptus resinifera ssp *resinifera*	Red Mahogany		X	X		X	X			
Eucalyptus robusta	Swamp Mahogany		X		X	X	X	X		
Eucalyptus signata	Scribbly Gum	X	X	X		X	X			
Eucalyptus tereticornis	Forest Red Gum		X		X					
Leptospermum juniperinum	Prickly Tea-tree			X		X	X	X	X	
Leptospermum polygalifolium	Lemon-scented Tea-Tree		X	X		X	X			
Leptospermum trinervium	Paperbark Tea-tree			X						
Melaleuca ericifolia	Swamp Paperbark				X			X		
Melaleuca hypericifolia	Hillock Bush			X						
Melaleuca linearifolia	Snow-in-summer		X			X	X	X	X	
Melaleuca nodosa	Ball Honeymyrtle			X		X	X			
Melaleuca quinquenervia	Broad-leafed Paperbark				X	X	X		X	
Melaleuca sieberi	Sieber's Paperbark				X	X	X	X	X	
Melaleuca styphelioides	Prickly-leaved Paperbark		X			X	X			
Melaleuca thymifolia	Thyme Honey-myrtle			X		X	X	X		
OLEACEAE										
Notelaea longifolia	Mock Olive			X		X	X			
OXALIDACEAE										
**Oxalis latifolia*	Pink Shamrock		X	X						
Oxalis perennans				X						
PITTOSPORACEAE										

Scientific Name	**Common Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Billardiera scandens	Apple Berry	X	X	X		X	X			
Bursaria spinosa	Blackthorn		X	X			X			
Pittosporum revolutum	Rough-fruit Pittosporum		X			X	X			
Pittosporum undulatum	Sweet Pittosporum			X		X				
PLANTAGINACEAE										
**Plantago lanceolata*	Lamb's Tongues		X	X						
POLYGALACEAE										
Comesperma ericinum	Matchheads			X				X		
PROTEACEAE										
Banksia integrifolia	Coastal Banksia		X							
Banksia oblongifolia				X				X		
Banksia robur	Swamp Banksia					X	X	X	X	
Banksia serrata	Old Man Banksia			X						
Banksia spinulosa var. *collina*	Hair-pin Banksia	X		X						
Grevillea sericea	Pink Spider Flower			X						
Grevillea speciosa	Red Spider Flower			X						
Hakea bakeriana				X						
Hakea dactyloides	Broad-leaved Hakea			X						
Hakea teretifolia	Dagger Hakea			X				X		
Isopogon anemonifolius	Drumsticks			X						
Lambertia formosa	Mountain Devils			X						
Lomatia silaifolia	Crinkle Bush			X						
Persoonia lanceolata ssp. *lanceolata*	Lance-leaved Geebung			X						
Persoonia levis	Smooth Geebung	X		X						
Persoonia linearis	Narrow-leaved Geebung		X	X						
Petrophile pulchella	Conesticks			X			X			
RANUNCULACEAE										
Clematis aristata	Old Man's Beard		X			X	X			
Clematis glycinoides	Forest Clematis			X						
RHAMNACEAE										
Alphitonia excelsa	Red Ash					X				
Pomaderris ferruginea	Rusty Pomaderris						X			
ROSACEAE										
Rubus hillii	Broad-leaved Bramble					X	X	X		
Rubus parvifolius	Native Raspberry					X	X	X		
**Rubus ulmifolius*	Blackberry			X						
RUBIACEAE										
Morinda jasminoides	Jasmine Morinda		X			X	X			
Pomax umbellata	Pomax		X				X			
**Richardia brasiliensis*	Mexican Clover			X						
RUTACEAE										
Correa reflexa	Common Correa		X	X						
Zieria smithii	Sandfly Zieria		X				X			
SANTALACEAE										
Exocarpus strictus	Dwarf Currant		X	X						
SAPINDACEAE										

Scientific Name	**Common Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Dodonaea triquetra	Common Hop Bush		X	X			X			
SCROPHULARIACEAE										
Veronica plebeia	Speedwell					X	X			
SOLANACEAE										
Solanum prinophyllum	Forest Nightshade			X						
STYLIDIACEAE										
Stylidium graminifolium	Trigger Plant			X				X		
TREMANDRACEAE										
***Tetratheca juncea* (V) (EV)**	**Black-eyed Susan**	X	X	X						
THYMELAEACEAE										
Pimelea linifolia ssp. *linifolia*	Slender Rice Flower	X	X	X			X			
ULMACEAE										
Trema tomentosa	Native Peach					X	X			
VERBENACEAE										
Chloanthes stoechadis				X						
Clerodendrum tomentosum	Hairy Clerodendrum				X	X	X			
**Lantana camara*	Lantana			X			X			
**Verbena bonariensis*	Purple-Top			X						
VIOLACEAE										
Viola betonicifolia	Purple Violet		X							
Viola hederacea	Native Violet		X			X	X			
VITACEAE										
Cayratia clematidea	Slender Grape		X							
Cissus hypoglauca	Water Vine		X			X				
SUBCLASS LILIIDAE (Monocotyledons)										
ANTHERICACEAE										
Sowerbaea juncea	Vanilla Plant			X						
ARECACEAE										
Livistonia australis	Cabbage-tree Palm	X	X		X	X	X			
CYPERACEAE										
Baumea articulata	Jointed Twig-rush		X					X	X	
Baumea juncea	Slender Twig Rush				X	X				X
Baumea rubiginosa	Soft Twig Rush			X		X			X	
Baumea teretifolia	Wrinkle-nut Twig Rush		X			X		X		
Bolboschoenus caldwellii	Marsh Clubrush				X					
Carex appressa	Tall Sedge					X	X			
Cyperus difformis	Dirty Dora				X					
Gahnia clarkei			X	X		X	X		X	
Isolepis nodosa	Knobby Club-rush				X					
Lepidosperma laterale	Variable Sword-sedge	X	X	X			X		X	
Ptilothrix deusta		X		X			X	X		
Schoenus melanostachys						X	X	X		