# IMPACT ASSESSMENT

## West Horsley Pipelines

Prepared for
**Sydney Water**

January 2010

# Impact Assessment

## West Horsley Pipelines

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| **PREPARED FOR** | **Sydney Water** |
| **PROJECT NO** | **10NEWECO-0025** |
| **DATE** | **January 2011** |

## DOCUMENT TRACKING

| ITEM | DETAIL |
|---|---|
| Project Name | West Horsley Pipelines Flora and Fauna Impact Assessment |
| Project Number | 10NEWECO-0025 |
| File location | T:\Projects\10NEWECO\10NEWECO-0025\REPORT\FINAL\10NEWECO-0025 Horsley Pipelines FFA FINAL.doc |
| Prepared by | David Coombes |
| Reviewed by | David Bonjer |
| Status | FINAL |
| Version Number | 0.3 |
| Last saved on | 25 January 2011 |

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# 1 Introduction

Eco Logical Australia Pty Ltd (ELA) was engaged by Sydney Water to undertake a Flora and Fauna Assessment of the provision of a water and wastewater pipeline to service a proposed residential subdivision at West Horsley (Part Lot 60 DP 1063539 and Lot 601 DP 1054648 Bong Bong Road).

Separate pipeline routes for water supply and wastewater were assessed for the impacts on threatened and migratory species, populations and communities listed under the NSW *Threatened Species Conservation Act* 1995 (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act). Consideration has also been given to other relevant state and local legislation, policies and plans and previous flora and fauna studies. Surveys and assessment have been undertaken with reference to the Draft Guidelines for Threatened Species Survey and Assessment (DEC 2004) and the Guidelines for Threatened Species Assessment (Part 3A EPA Act) (DEC & DPI 2005).

## 1.1 PROJECT DESCRIPTION

The proposal involves the construction of approximately 2.5 km of pipelines to supply water and to remove wastewater from the proposed residential development at West Horsley, located south of Bong Bong Road (Part Lot 60 DP 1063539 and Lot 601 DP 1054648). Approximately 1.5 km of water pipeline will be constructed along the southern side of the Bong Bong Road easement, between Hayes Lane and Shone Avenue, and approximately 2 km of wastewater pipeline will be constructed between the southern boundary of Lot 61 DP 1063539 (currently Illawarra Gun Club) and the existing pumping station at the corner of Fairwater Drive and Riverpark Way (Figure 1).

Construction will involve the excavating of a trench up to 1.7m wide along the length of the pipeline routes. The depth of the trench will vary from 1.5m for the water pipeline and between 3 and 7m for the wastewater pipeline. After the pipes are in place, the trench will be backfilled and soil stabilised. Construction activities will include other temporary disturbances to an area of up to 10m wide along the length of the pipeline routes to allow for vehicle access, soil and material storage etc. Where the wastewater pipeline crosses ephemeral drainage lines in the south of the study area, the pipe will be trenched under the creek.

The pipeline routes have been designed to minimise impacts on native vegetation and habitats, based on initial fieldwork and identification of ecological constraints. The pipelines will be located entirely within heavily disturbed and previously cleared land. Apart from one hollow-bearing tree that may need to be removed, the proposal will not involve the removal of substantial trees, intact native vegetation or other important habitats.

## 1.2 THE STUDY AREA AND SUBJECT SITE

The study area is located in West Horsley, commencing on the southern and western edges of the existing residential development at Horsley in the Wollongong LGA. The study area comprises approximately 30 ha of land, generally based on a 25m buffer around each potential pipeline route investigated (Figure 2). A number of options were investigated for the wastewater pipeline to determine the route of least environmental impact through areas of higher value habitats, so the south eastern part of the study area is substantially larger than other parts and reflects the survey effort undertaken.

The subject site of 3.5 ha comprises a 10m wide zone along the final water and wastewater routes, where land may be directly disturbed by construction activities, although the actual excavation for the pipelines should not be more than about 3m wide.

The study area has been subject to substantial levels of disturbance, including clearing for grazing, dam construction and residential infrastructure including housing, roads and major electricity easements. The vast majority of the study area (and subject site) occurs within cleared land currently used for grazing or road easements. The remnant native vegetation in the general area has also been substantially disturbed, but larger patches generally constitute one or two endangered ecological communities listed on the TSC Act.

# Figure 1: The proposal

Water pipeline route

Recommended route for wastewater pipeline

0 0.1 0.2 0.4

Kilometres

Datum/Projection:
GDA 1994 MGA Zone 56

N

Data Sources:
Google Earth

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Project Number: 10NEWECO-0025

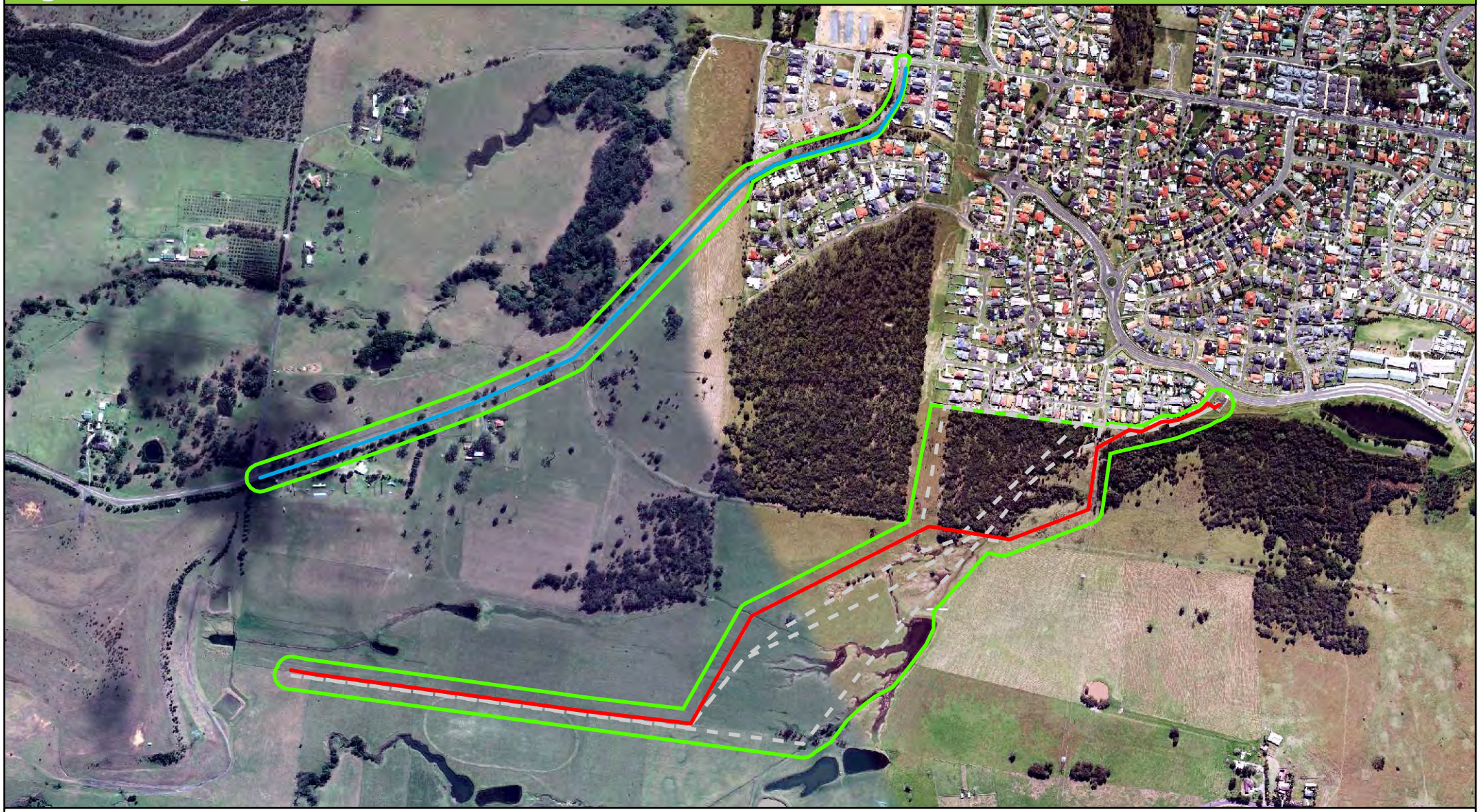
Prepared by: SE

Approved by: DC

Status: Final

Date: 24/01/11

# Figure 2: The study area



Study area

Water pipeline route

Recommended route for wastewater pipeline

Other route options investigated

0 0.125 0.25 0.5

Kilometres

Datum/Projection:
GDA 1994 MGA Zone 56

Data Sources:
Google Earth

N

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# 2 Relevant Legislation, Policies and Plans

## 2.1 COMMONWEALTH

### 2.1.1 Environmental Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a national scheme for protecting the environment and conserving biodiversity values.

Approval from the Commonwealth Environment Minister is required under the EPBC Act if the action (which can include a project, development, undertaking or activity) will, or is likely to, have a significant impact on matters considered to be of national environmental significance (NES matters). NES matters relevant to the proposal include species and ecological communities that are listed under the Act. The EPBC Act does not define significant impact but identifies matters that are necessary to take into consideration.

## 2.2 STATE

### 2.2.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is the principal planning legislation for NSW, providing a framework for the overall environmental planning and assessment of development proposals.

The EP&A Act places a duty on the determining authority to adequately address a range of environmental matters including maintenance of biodiversity and the likely impact to threatened species, populations or ecological communities (under the TSC Act – refer below).

### 2.2.2 Native Vegetation Act 2003

The *Native Vegetation Act 2003* (NV Act) aims to conserve and manage native vegetation through regulation of native vegetation clearing. It provides for the encouragement and promotion of the management of native vegetation on a regional basis in the social, economic and environmental interests of the state. Management of native vegetation must have regard to its contribution to water quality, biodiversity and land degradation. It also provides a mechanism to improve the condition of existing native vegetation. The NV Act does not apply in areas with residential zoning but does apply in areas of rural zoning (parts of wastewater pipeline). However, in rural zonings, the proposal only occurs in previously cleared land.

### 2.2.3 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) aims to protect and encourage the recovery of threatened species, populations and ecological communities listed under the Act. Obligations on Councils include consideration of threatened species, populations, ecological communities and recovery plans in fulfilling their statutory responsibilities under the EP&A Act.

### 2.2.4 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) provides for the protection, conservation and recovery of threatened species defined under the Act. It also makes provision for the management of threats to threatened species, populations and ecological communities defined under the Act, as well as the protection of fish and fish habitat in general. In particular, the FM Act has mechanisms for the protection of aquatic vegetation and other important fish habitats e.g. instream woody debris. Permits are required under Part 7 of this Act to undertake certain activities.

### 2.2.5 Water Management Act 2000

The *Rivers and Foreshores Improvement Act 1948* has been repealed and the controlled activity provisions in the *Water Management Act 2000* (WM Act) have now commenced. A controlled activity approval under the WM Act is required for certain types of developments and activities that are carried out in or within 40m of a river, lake or estuary.

The WM Act provides a number of mechanisms for protection of water sources via the water management planning process. If a 'controlled activity' is proposed on 'waterfront land', an approval is generally required under Section 91 (2) of the WM Act. 'Controlled activities' include; the construction of buildings or carrying out of works; the removal of material or vegetation from land by excavation or any other means; the deposition of material on land by landfill or otherwise. 'Waterfront land' is defined as 'the bed of any river or lake, and any land lying between the river or lake and a line drawn parallel to and 40 metres inland from either the highest bank or shore'.

However, an activity approval under section 91 of the Water Management Act 2000 (for works within 40 m of a first order stream) is not required for projects assessed under Part 3A of the EP&A Act. Instead, the intent of the Act, and the need to consult with the relevant agencies, is captured by the Part 3A approval process. Furthermore, as a public authority, Sydney Water is exempt from applying for permits under the Act.

### 2.2.6 SEPP 44 – Koala Habitat Protection

The *State Environmental Planning Policy No. 44 – Koala Habitat Protection* (SEPP 44) applies to all LGAs listed on Schedule 1 of the policy, except land dedicated under the *National Parks and Wildlife Act 1974* or the *Forestry Act 1916*. The identification of an area of land as SEPP 44 Potential Koala Habitat is determined by the presence and abundance of Koala feed tree species listed within Schedule 2 of the policy.

Potential Koala Habitat is defined as areas where one or more of the tree species listed under Schedule 2 constitutes at least 15% of the total number of trees in the upper or lower strata of the tree component. An area of land to which the policy applies must be at least one hectare in area (and may include adjoining land in the same ownership). If Potential Koala Habitat is present then it must be further assessed to determine whether it represents Core Koala Habitat. There are specific matters to be taken into consideration before development consent may be granted if Core Koala Habitat is present.

# 3 Methods

## 3.1 DATA AUDIT

The data audit was based on analysis of environmental database searches including the Atlas of NSW Wildlife, BioNet and the EPBC Act. Both searches included a 10 km radius around the site, centred on the study area, to determine the local occurrence of threatened fauna and listed migratory species, in accordance with state and federal statutory requirements. These searches were carried out on 25 November 2010.

An assessment of likelihood of occurrence was made for threatened and migratory species identified from the database search. This assessment was based on database or other records, presence or absence of suitable habitat within the study area, results of the field investigations and professional judgement. Marine fauna species have been excluded from this assessment due to an absence of available marine habitat.

The results of these searches and the likelihood of occurrence assessment can be found in Appendix A.

## 3.2 LITERATURE REVIEW

The literature review involved a review of ecological reports relating to the site and adjoining areas, such as the Bioregional Assessment Study (NPWS 2002a & 2002b), West Dapto Release Area Ecological Assessment (ELA 2004), the West Dapto Detailed Planning and Wastewater Options Study: Ecological Constraints (MWH+PB 2010), the West Dapto Biodiversity Study (ELA 2009) and the West Dapto Flora and Fauna Impact Assessment (ELA 2010).

## 3.3 FIELD SURVEY

Field investigations were carried out between 8 October 2010 and 3 December 2010. The flora and fauna surveys were based on the methods described below, and survey areas are shown in Figure 3.

### 3.3.1 Flora Surveys

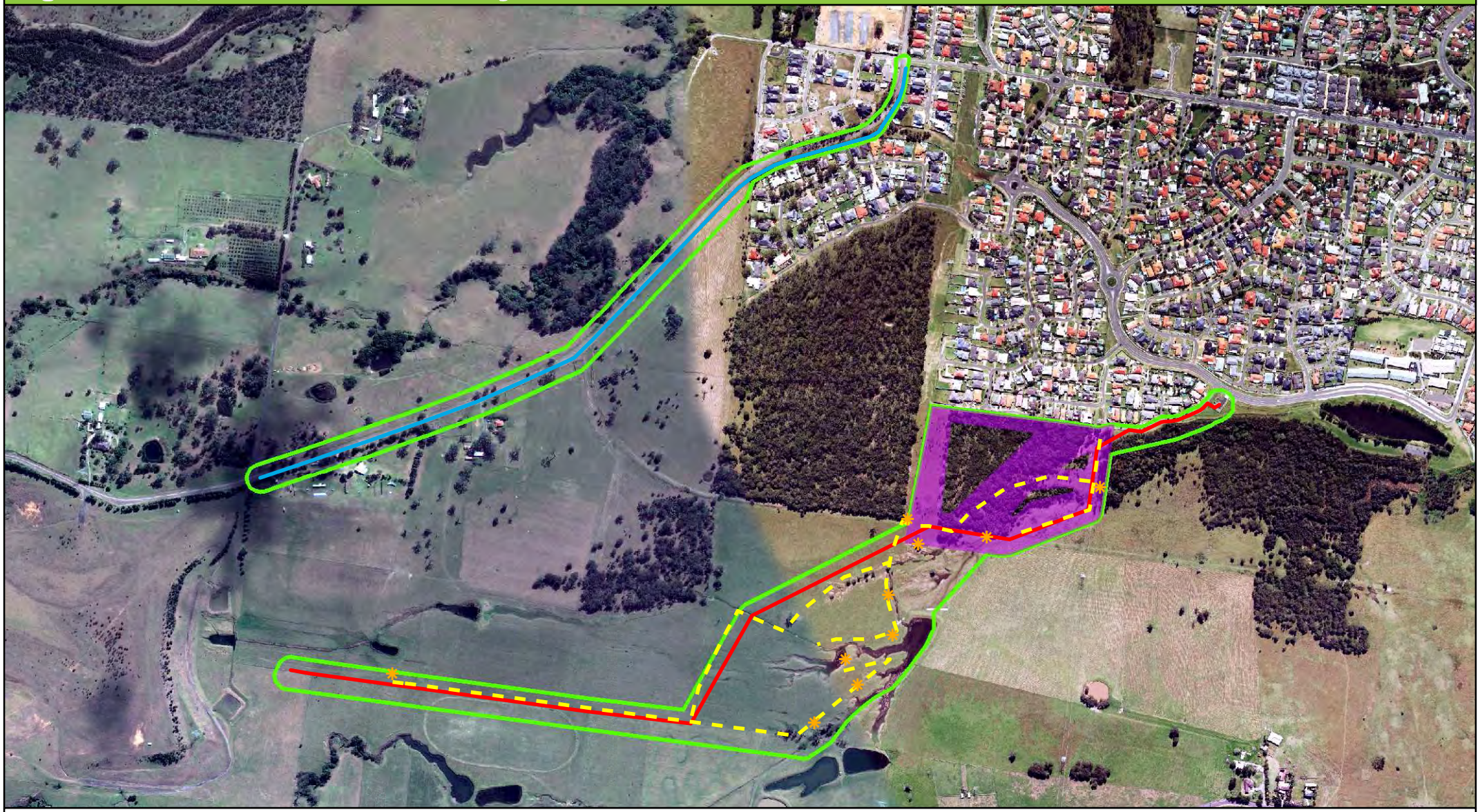
***Vegetation Community Validation***

Vegetation mapping by NPWS (2002a) and ELA (2004 & 2009) was used as the basis for initial vegetation mapping in the study area. Recent aerial photography and ground truthing of vegetation communities was used to verify and refine the type and extent of vegetation associations occurring within the study area.

***Vegetation Surveys***

Random meander transects were employed through the study area to sample flora species and to determine the composition and extent of vegetation communities. Opportunistic observations of flora species were recorded throughout the survey period.

# Figure 3: Flora, fauna and habitat surveys



Study area / General flora, fauna and habitat surveys

Water pipeline route

Recommended route for wastewater pipeline

Transects for Illawarra Greenhood

Spotlighting transects

Call playback for Green and Golden Bell Frog

0 0.1 0.2 0.4

Kilometres

Datum/Projection:
GDA 1994 MGA Zone 56

Data Sources:
Google Earth

N

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Status: Final

Date: 24/01/11

Targeted surveys for *Pterostylis gibbosa, Chorizema parviflorum, Lespedeza juncea* ssp*. exalata* and *Pimelea spicata* were undertaken on 8 October and 5 November 2010 in potential habitat in the south east of the study area (Figure 3). The species were searched for along systematic transects 5m apart for a total of 12 person hours. Random meander vegetation surveys, including searches for *Chorizema parviflorum, Lespedeza juncea* ssp*. exalata* and *Pimelea spicata,* in the northern part of the study area (Bong Bong Road easement) were undertaken on 26 November 2010 for five person hours. Opportunistic searches for these and other flora species of conservation significance were undertaken throughout the survey period.

***Flora Survey Effort***

The flora survey effort entailed a total of 22 person-hours as detailed in Table 1.

**Table 1: Flora survey effort**

| DATE | METHOD | EFFORT | TARGET SPECIES |
|---|---|---|---|
| 8 October 2010 | Random meander | 5 person hours | *All species, including aquatic and wetland species* |
| | Transect searches | 4.5 person hours | *Pterostylis gibbosa, Chorizema parviflorum, Lespedeza juncea ssp. exalata and Pimelea spicata* |
| 5 November 2010 | Transect searches | 7.5 person hours | *Pterostylis gibbosa, Chorizema parviflorum, Lespedeza juncea ssp. exalata and Pimelea spicata* |
| 26 November 2010 | Random meander | 5 person hours | *All species, including Chorizema parviflorum, Lespedeza juncea ssp. exalata, Pimelea spicata* |

### 3.3.2 Fauna Habitat

Assessment of fauna habitat type and condition was undertaken early in the survey period to allow potential habitat constraints to be identified as well as the need for targeted fauna surveys. All habitat suitable for threatened fauna species was sought, particularly hollow-bearing trees and water sources. All hollow-bearing trees were recorded using GPS and other important habitat features were mapped using GPS and/or aerial photography. Other information recorded included fauna species observed using hollows, scats and signs such as claw scratch marks and feeding sites indicative of species presence.

### 3.3.3 Fauna Surveys

The extent of fauna surveys undertaken was influenced by the type and quality of habitats present, the potential for threatened or significant fauna to utilise these habitats, and how the proposal would affect these habitats and species. The relatively minor scope of the proposal and its location within predominantly cleared land limits the potential for adverse impacts on threatened or otherwise significant fauna.

### *Bird Survey*

Diurnal bird surveys were conducted over four days, particularly in late afternoon, and focusing on the detection of threatened or otherwise significant woodland and wetland species, although all species were recorded. Surveys were undertaken throughout the study area, although emphasis was placed on surveys within intact woodland vegetation in the south east, artificial wetland habitats in the south east and hollow-bearing trees in the north. A total of 4 person hours was spent conducting bird surveys, which consisted of slowly walking through suitable habitats and periodically stopping to listen for calls or to scan water habitats or hollow-bearing trees with binoculars. The one hollow-bearing tree likely to be removed in the north east of the study area was monitored at dusk on 8 October 2010. All hollow-bearing trees in or near the northern section of study area were briefly monitored for evidence of use on four separate occasions between 8 October and 3 December 2010. Birds were also recorded opportunistically throughout the survey period, including during dusk and nocturnal surveys.

### *Frog Survey*

Frog surveys targeting the threatened Green and Golden Bell Frog *Litoria aurea* (GGBF) were undertaken in the south of the study area over four days between 8 October and 3 December 2010. Diurnal searches for frogs basking on emergent vegetation were undertaken on 8 October and 5 November 2010, for a total of 2 person hours during mid to late afternoon. Listening for calls at dusk was undertaken for 1 person hour in potential GGBF habitat in the south east of the study area on 26 November 2010. Call playback and spotlighting surveys during ideal weather conditions were undertaken on the 3 December 2010 for four person hours throughout all potential habitat in the south of the study area. Call playback was undertaken at 10 sites in the study area, consisting of intermittent call playback for up to five minutes, listening for calls for a further five minutes and searching for frogs along the waters edge and adjoining grassy areas with a 55W spotlight between call playback sites.

All frog species heard or observed during targeted surveys were recorded, and opportunistic recording of frogs was undertaken through the entire survey period.

### *Opportunistic Observations and Indirect Evidence*

Fauna species were recorded opportunistically throughout the survey period, in all habitats in and adjacent to the study area. Indirect evidence of fauna, such as scats, burrows, feeding signs and nests were sought throughout the survey period.

### *Survey Conditions*

Fauna survey conditions throughout the study period are detailed in Table 2 below.

**Table 2: Fauna survey conditions**

| DATE | SURVEY TYPE | TEMP | WIND | CLOUD | MOON | RAIN |
|---|---|---|---|---|---|---|
| 8 October 2010 | Diurnal | $17^{o}$ - $20^{o}$C | 0-1 | 4/8-8/8 | N/A | 0 |
| 5 November 2010 | Diurnal | $19^{o}$ - $21^{o}$C | 1 | 8/8 | N/A | 0 |

| DATE | SURVEY TYPE | TEMP | WIND | CLOUD | MOON | RAIN |
|---|---|---|---|---|---|---|
| 26 November 2010 | Diurnal & nocturnal | 21°C – 26°C | 0-1 | 4/8 | N/A | 0 |
| 3 December 2010 | Diurnal & nocturnal | 22°C | 0 | N/A | 2/4 | 0-1 |

### Survey Effort

The fauna survey effort employed a total of 13.5 person hours, as documented in Table 3.

**Table 3: Fauna survey effort employed over the study area**

| DATE | METHOD | EFFORT | TARGET SPECIES |
|---|---|---|---|
| 8 October 2010 | Habitat survey | 2 person hours | All species including Green and Golden Bell Frog |
| | Bird survey – active search | 1 person hour | All birds |
| 5 November 2010 | Habitat survey | 1.5 person hours | All species including Green and Golden Bell Frog |
| | Bird survey – active search | 1 person hour | All birds |
| 26 November 2010 | Habitat survey | 1 person hour | All species |
| | Bird survey – active search | 1 person hour | All birds |
| | Frog survey | 1 person hour | Green and Golden Bell Frog |
| 3 December 2010 | Bird survey – active search | 1 person hour | All bird species |
| | Frog survey (call playback and spotlighting) | 4 person hours | Green and Golden Bell Frog |

## 3.4 SURVEY LIMITATIONS

The floristic audit undertaken recorded as many species as possible and provides a comprehensive but not definitive species list. More species would probably be recorded during a longer survey over various seasons.

Similarly the results of fauna surveys can be optimised by conducting investigations over a long period to compensate for the effect of unfavourable weather, seasonal changes and climatic variation. In general, the longer the survey the more species will be detected. Results can also be improved by using a wide range of techniques, since some species are more likely to be detected by a particular method.

However, surveys are subject to constraints that determine the amount of time allocated, the methods used and the timing of the work. Thus, the results should be viewed in the light of these limitations. The fauna detected in current survey work are a guide to the native fauna present, but are by no means a definitive list of the species occurring in the study area.

These factors are taken into consideration in relation to likelihood of occurrence, assessment of potential impacts and discussion regarding threatened species within the study area. Where limitations are considered likely to effect assessment of impacts, adjustment such as additional survey effort may be recommended.

Nevertheless, the techniques used in this investigation are considered adequate to gather the data necessary to assess the impacts of the proposal on the flora and fauna species and vegetation communities found in the study area.

# 4 Results

## 4.1 DATA AUDIT

The results of data base searches for threatened flora and fauna and migratory species and ecological communities that have been recorded within a 10 km radius of the study area are presented in the likelihood of occurrence table in Appendix D.

## 4.2 LITERATURE REVIEW

Review of relevant literature and previous surveys indicate that one endangered ecological community, *Illawarra Lowlands Grassy Woodlands,* has been mapped within and adjacent to the study area. Previous fauna surveys (ELA 2009, 2010) have recorded the threatened Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis)* and East Coast Freetail Bat (*Mormopterus norfolkensis)* and the migratory Cattle Egret *(Ardea ibis)* on land adjacent to the study area. Threatened species habitat modelling by NPWS (2002b) also shows the artificial wetlands in the south east of the study area as moderate quality habitat for the Green and Golden Bell Frog (*Litoria aurea*) and high quality habitat for the Australasian Bittern (B*otaurus poiciloptilus*).

## 4.3 FIELD SURVEYS

### 4.3.1 Flora Surveys

***Vegetation Community Validation***

The flora survey results found that the vegetation communities within the study area are generally consistent with previous vegetation community composition and mapping, apart from the forested riparian areas in the south east. These riparian areas contain almost pure stands of Swamp Oak *Casuarina glauca*, which is not part of the *Illawarra Lowlands Grassy Woodland* and is consistent with the *Swamp Oak Floodplain Forest* endangered ecological community. Six vegetation communities or associations were identified within the study area, as shown in Figure 4, and a complete list of flora species recorded is presented in Appendix B.

**Coastal Grassy Red Gum Forest**

This community generally occurs in the study area as small remnant patches on the northern fringes. All examples of this community have been disturbed by clearing, grazing and weed invasion. The residential section of the Bong Bong Road easement previously constituted this community (ELA (2004), however has been subject to severe disturbance from clearing, roadside landscaping (planting), and weed invasion such that it only resembles the community from scattered remnant and regrowth trees and some understorey species that are characteristic of the original community.

Canopy: Dominated by *Eucalyptus tereticornis* (Forest Red Gum), but also includes individuals of *Eucalyptus bosistoana* (Coastal Grey Gum), *Eucalyptus eugenioides* (Narrow-leaved Stringybark) and *Angophora floribunda* (Rough-barked Apple).

# Figure 4: Vegetation and habitats

Study area
Hollow-bearing trees
Drainage line
Coastal Grassy Red Gum Forest (EEC)
Coastal Grassy Red Gum Forest (heavily modified)
Lowland Woollybutt Melaleuca Forest (EEC)
Swamp Oak Forest (EEC)
Artificial wetland (farm dams)
Weeds
Planted native and exotic trees
Pasure and roadside

0 0.1 0.2 0.4
Kilometres

Datum/Projection:
GDA 1994 MGA Zone 56

Data Sources:
Google Earth

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Sub canopy Trees & Shrubs: Disturbed and variable, species include *Pittosporum undulatum* (Sweet Pittosporum), *Acacia mearnsii* (Black Wattle), *A. binervata* (Two-veined Hickory), *Melaleuca linearifolia* (Flax-leaf Paperbark), *Syzygium* sp. (Lilly Pilly), *Kunzea ambigua* (White Kunzea), *Hakea dactyloides* (Finger Hakea), *Callistemon salignus* (Willow Bottlebrush), *Rubus parvifolius* (Native Raspberry), *R. fruticosus* (Blackberry) and *Lantana camara* (Lantana).

Ground Covers: Disturbed and variable, species include *Dichondra repens* (Kidney Weed), *Microlaena stipoides*, *Commelina cyanea*, *Poa labillardieri* (Tussock Grass), *Themeda australis* (Kangaroo Grass), *Eragrostis leptostachya* (Paddock Lovegrass), *Chloris gayana* (Rhodes Grass), *Carex longebrachiata*.

Conservation Status: This community is consistent with the final determination of *Illawarra Lowlands Grassy Woodland,* which is listed an endangered ecological community under the TSC Act.

**Lowland Woollybutt-Melaleuca Forest**

This vegetation community occurs in the southeast portion of the study area, excluding the main riparian sections. Most of the community shows evidence of recent grazing and weed invasion, with a very open shrub layer. The canopy was relatively young with no old growth components present, suggesting widespread previous clearing. The northwest occurrence of this community in the study area starts to resemble the Coastal Grassy Red Gum Forest, which replaces the Lowland Woollybutt-Melaleuca Forest community at slightly higher elevations.

Canopy: Height is up to 15m tall. Mean Projected Canopy Cover is 70%. In the study area typical species include *Melaleuca decora*, *Melaleuca linearifolia, Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus eugenioides* (Narrow-leaved Stringybark) and *Eucalyptus amplifolia* (Cabbage Gum).

Sub canopy Trees & Shrubs: The sub-canopy and shrub layer was generally very sparse, but included *Callistemon salignus* (Willow Bottlebrush), *Pittosporum revolutum* (Rough-fruit Pittosporum), *Leucopogon juniperinus* (Prickly beard Heath), *Lantana camara* (Lantana) and in more open areas regenerating eucalypts and melaleucas.

Ground Covers: Species include *Entolasia*, *Pratia purpurascens*, *Cheilanthes sieberi*, *Dichondra repens* (Kidney Weed), *Plectranthus parviflorus* (Cockspur Flower), *Urtica incisa* (Stinging Nettle) *Pennisetum clandestinum* (Kikuyu).

Vines & Climbers: *Parsonsia straminea* (Monkey Rope), *Glycine tabacina* and *Geitonoplesium cymosum* (Scrambling Lily).

Conservation Status: This association is consistent with the final determination of *Illawarra Lowlands Grassy Woodland,* which is listed an endangered ecological community under the TSC Act.

**Swamp Oak Forest**

This vegetation community is restricted to the forested riparian areas in the southeast portion of the study area, and is characterised by stands of *Casuarina glauca* (Swamp Oak). Previous disturbance is evident, as is weed invasion in the understorey. Previous vegetation mapping of the study area appears to have included this community with the Lowland Woollybutt-Melaleuca Forest community and associated *Illawarra Lowlands Grassy Woodland* EEC*,* however *C. glauca* is not characteristic of the above EEC.

Canopy: Height is up to 16m tall. Mean Projected Canopy Cover is 75%. This community is dominated and characterised by a single species, *Casuarina glauca* (Swamp Oak).

Sub canopy Trees & Shrubs: Shrubs were generally absent, but included occasional *Melaleuca ericifolia* (Swamp Paperbark) and weeds such as *Lantana camara*.

Ground Covers: Sparse in more intact and established parts of the community, but edges and areas of regrowth have a dense groundcover of native and introduced grasses and other weeds.

Vines & Climbers: *Parsonsia straminea* (Monkey Rope).

Conservation Status: This association is consistent with the final determination of *Swamp Oak Floodplain Forest,* which is listed an endangered ecological community under the TSC Act.

**Artificial Wetlands**

Artificial wetland communities have been formed by the creation of farm dams in the southeast of the study area. Native aquatic vegetation is dominated by *Triglochin procerum* (Water Ribbons), *Typha orientalis* (Cumbungi), *Baumea sp*. (Twigrush) *Ludwigia peploides ssp. montevidensis* (Water Primrose), *Azolla pinnata* (Ferny Azolla) and *Juncus sp*. (Rush). Aquatic weeds are dominated by *Nasturtium microphyllum* (Brown Watercress) and the wetlands are largely surrounded by exotic pasture grasses.

Conservation Status: As this wetland community is artificial, it is not considered to constitute the *Freshwater Wetlands on Coastal Floodplains* endangered ecological community listed under the TSC Act.

**Pasture and Roadside**

This community occurs throughout the majority of the study area. Historically it has been cleared for grazing. It comprises dense groundcover of exotic and native grasses and herbs with a few trees scattered across the area. Most of the roadside vegetation in the study area is similar to nearby pasture, but at least recently has been subject to less grazing disturbances and contains a greater proportion of introduced species.

Very occasional paddock trees are present, including *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus eugenioides* (Narrow-leaved Stringybark), *Angophora floribunda* (Rough-barked Apple) and *Casuarina glauca* (Swamp Oak).

Typical groundcovers include *Axonopus fissifolius* (Narrow-leafed Carpet Grass), *Juncus continuous, Poa labillardieri var. labillardieri* (Tussock Grass), *Chloris gayana* (Rhodes Grass), *Dichondra repens* (Kidney Weed), *Briza minor* (Shivery Grass), *Pratia purpurascens* (Whiteroot), *Senecio madagascariensis* (Fireweed) and *Pennisetum clandestinum* (Kikuyu Grass).

**Planted native and exotic species**

One part of the study area that doesn't fit into any of the above associations is the northern portion of the Illawarra Gun Club land, which is cleared with a primarily exotic groundcover of grasses and a diverse range of planted native and exotic trees and shrubs. These include *Lophostemon confertus* (Brush Box), *Grevillea robusta* (Silky Oak), *Jacaranda mimosifolia* (Jacaranda), *Erythrina X sykesii* (Coral Tree), *Agapanthus praecox* (Common Agapanthus), *Hakea dactyloides* (Finger Hakea),

*Pittosporum undulatum* (Sweet Pittosporum) and a number of *Casuarina*, *Eucalyptus, Callistemon*, *Melaleuca, Pinus* and *Ficus* species.

**Threatened Flora**

No naturally occurring threatened plants were identified in the study area. The lack of detection during targeted surveys and the disturbed condition of habitats present suggest that threatened flora species are not likely to occur naturally in the study area.

An unidentified *Syzygium* species was recorded as part of landscape plantings along the Bong Bong Road easement in the north east of the study area. This is likely to be *Syzygium paniculatum* (Magenta Lilly Pilly), which is commonly propagated and used for landscaping, but is also listed as a threatened species under both the TSC Act and EPBC Act. However, the species occurs naturally only in coastal rainforest communities; there are no records in the locality, and the study area does not provide potential habitat for the species. So while potentially a threatened species, this commonly planted species does not occur naturally in the study area and will not be assessed further in this report.

### 4.3.2 Fauna Habitat

Four hollow-bearing trees were recorded in the northern parts of the study area, although only one of these trees may need to be removed for the proposal (Figure 4). No hollow-bearing trees were recorded in the southern parts of the study area. Other notable fauna habitats included the farm dams in the south east, which have created artificial wetland habitats, and associated ephemeral drainage lines.

### 4.3.3 Fauna Surveys

All fauna recorded during the survey period are listed in Appendix C.

***Bird Surveys***

A total of 49 bird species were recorded within or close to the study area. No threatened species were recorded. All bird species recorded are considered common woodland and farmland species within the Illawarra region. The Cattle Egret, which is listed as migratory under the EPBC Act, was recorded in the south of the study area. A complete list of birds recorded is presented in Appendix C.

***Frog Surveys***

No threatened species were recorded during frog surveys for the Green and Golden Bell Frog. Six frog species were recorded (Appendix C), all of which are considered relatively common in the Illawarra region.

***Opportunistic Observations and Secondary Evidence***

No evidence of threatened or otherwise significant fauna species was detected opportunistically. Other fauna recorded opportunistically included four native lizard species (all of which are common in the region) and six introduced mammals (Appendix C).

## 4.4 CONSTRAINTS

Known and potential ecological constraints to the proposal are listed below and are shown in Figure 5.

The ecological constraints were used to determine the optimum pipeline routes to minimise impacts on the environment. Threatened and migratory biota with the potential to occur in the locality have been assessed in Appendix A for their likelihood to occur in the study area and to be affected by the proposal. This rationale considers the type and quality of habitats in the study area, the expected changes to these habitats caused by the short and long-term direct and indirect impacts of the proposal. The outcomes of this assessment are detailed in Section 5 of this report.

### *Endangered Ecological Communities*

The vegetation communities Coastal Grassy Red Gum Forest and Lowland Woollybutt-Melaleuca Forest both constitute the *Illawarra Lowlands Grassy Woodland* endangered ecological community listed under the TSC Act. The Swap Oak Forest community constitutes the *Swamp Oak Floodplain Forest* endangered ecological community listed under the TSC Act.

### *Threatened Flora*

No naturally occurring threatened flora species were recorded in the study and none are expected to occur in the habitats to be affected by the proposal. The threatened Syzygium *paniculatum* (Magenta Lilly Pilly) potentially recorded as a landscaping species along the residential section of Bong Bong Road does not occur naturally in the locality and does not represent a constraint to this project.

### *Threatened Fauna and Fauna Habitats*

No threatened fauna species were recorded during the study and the proposal is not expected to remove or degrade any important habitats for threatened species. Forested habitats in and around the study area may be used for foraging occasionally by wide ranging threatened fauna such as bats and birds.

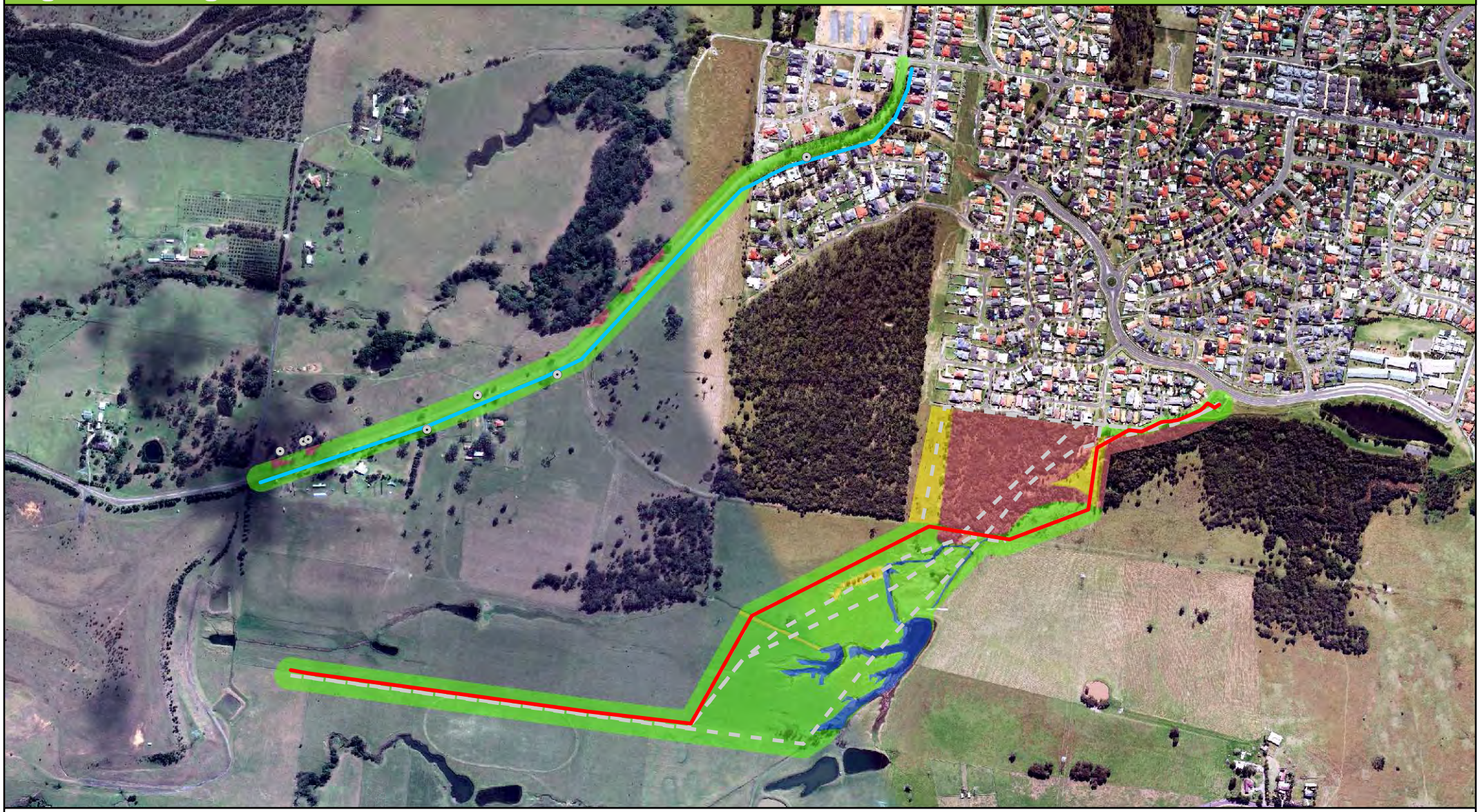
Hollow-bearing trees have the potential to be used for shelter and/or breeding sites by some bird and microbat species. Only one hollow-bearing tree is likely to be removed by the proposal. This tree is located in a disturbed residential setting, is not of high quality and is unlikely to provide important habitat for any threatened species. Other hollow-bearing trees in and adjacent to the study area are unlikely to be affected by the proposal.

Artificial wetland habitats may be used occasionally by threatened waterbirds and insectivorous bats, particularly the Southern Myotis (*Myotis macropus),* but will not be directly affected by the proposal. The wetlands, drainage lines and adjacent grassy areas also provide suitable habitat for the threatened Green and Golden Bell Frog, although the species is not known or expected to occur in the area.

### *Migratory Species*

One migratory species, the Cattle Egret, was recorded in grazing land in the south of the study area. The proposal will not substantially affect this species or suitable habitat. Other migratory listed waterbirds may occasionally utilise the artificial wetland habitats, but are not expected to be adversely affected by the proposal. Other migratory listed forest bird species may occur in the general area on occasions, but no suitable habitat will be affected by the proposal and these species do not pose constraints to the project.

# Figure 5: Ecological constraints



- High constraint (EEC)
- Moderate-high constraint (aquatic habitat)
- Moderate constraint (other habitat or habitat link)
- Moderate constraint (hollow-bearing trees)
- Low constraint (pasture/urban)
- Water pipeline route

Wastewater pipeline:

- Recommended route for wastewater pipeline
- Other route options investigated

0 0.1 0.2 0.4

Kilometres

Datum/Projection:
GDA 1994 MGA Zone 56

Data Sources:
Google Earth

N

eco logical AUSTRALIA

www.ecoaus.com.au

Client: Sydney Water

Project Number: 10NEWECO-0025

Prepared by: SE

Approved by: DC

Status: Final

Date: 24/01/11

# 5 Impact Assessment

The proposal to provide two underground pipelines through approximately 3.5 km of heavily disturbed land will have relatively minor impacts on the existing environment. The following direct impacts on flora and fauna are anticipated from the proposal:

a) Clearing of or modification of approximately 0.1 ha of highly disturbed native vegetation comprising Coastal Grassy Red Gum Forest adjacent to Bong Bong Road, and small areas on the periphery of the Lowland Woollybutt-Melaleuca Forest and Swamp Oak Forest adjacent to Bridgewater Drive;

b) Modification of approximately 3.4 ha of cleared roadside, electricity easement or pasture;

c) The likely removal of one lower quality hollow bearing tree, situated in a residential context;

d) Soil excavation for trenching of pipes and soil compaction by construction vehicles;

e) Temporary disturbance to soil and possibly water flow at three sections of ephemeral drainage line located within cleared areas.

Indirect impacts on flora and fauna that are anticipated from the proposal include increased potential for weed invasion, erosion and sedimentation of minor creeklines, however all of these processes are already present to some extent due to the range of disturbances throughout the site.

No intact areas of native vegetation or important habitats will be removed or permanently degraded by the proposal. While one threatened plant species *Syzygium paniculatum* (Magenta Lilly Pilly) may be removed from a roadside area, the few individuals affected have been planted for landscaping purposes and are not occurring in natural habitat. No other threatened species were recorded or are likely to regularly occur in the subject site. Adjacent endangered ecological communities will not be further degraded by the proposal.

Table 4 provides a list of entities that are known or considered likely to utilise the site and have potential to be affected by the proposal (as per Appendix A). The potential impact of the proposal on these species has been assessed under relevant legislation in Appendix D.

**Table 4: Species and communities requiring an assessment of significance**

| Scientific Name | Common Name | TSC Act | EPBC Act | Occurrence |
|---|---|---|---|---|
| *Callocephalon fimbriatum* | Gang-gang Cockatoo | V | — | Potential |
| *Chalinolobus dwyeri* | Large-eared Pied Bat | V | V | Potential |
| *Falsistrellus tasmaniensis* | Eastern False Pipistrelle | V | — | Potential |
| *Miniopterus schreibersii oceanensis* | Eastern Bent-wing Bat | V | — | Potential |
| *Mormopterus norfolkensis* | East Coast Freetail Bat | V | — | Potential |

| Scientific Name | Common Name | TSC Act | EPBC Act | Occurrence |
|---|---|---|---|---|
| *Scoteanax rueppellii* | Greater Broad-nosed Bat | V | — | Potential |
| *Myotis macropus* | Southern Myotis | V | — | Potential |
| *Saccolaimus flaviventris* | Yellow-bellied Sheathtail Bat | V | — | Potential |
| *Litoria aurea* | Green and Golden Bell Frog | E | V | Potential |
| Illawarra Lowlands Grassy Woodland | | EEC | — | Known |
| Swamp Oak Floodplain Forest | | EEC | — | Known |

## 5.1 CONCLUSION OF SEVEN-PART TEST

An assessment of significance under Section 5A of the EPA Act was undertaken on those species and EEC's observed on the site or considered likely to occur on the site (Appendix D). The outcome of this assessment was that it is unlikely that the development would significantly impact on those threatened species and EEC's assessed.

The extent of habitat to be affected is considered a negligible impact in the context of the available resources in the remaining vegetation in the locality. The removal of the vegetation in the study area will not affect habitat connectivity nor increase fragmentation as the areas affected have already been cleared.

Based on the assessment provided above, it is considered unlikely that the proposal will result in significant impacts to any threatened species or EEC's.

Further recommendations have been provided in Section 6 to ameliorate the potential impacts on site.

## 5.2 CONCLUSION OF EPBC ACT ASSESSMENT

An assessment of significance under the EPBC Act was undertaken on those species observed on the site or considered likely to occur on the site (Appendix D). The outcome of this assessment was that it is unlikely that the development would significantly impact on those threatened or migratory species assessed. The areas affected provide only marginal habitat for the assessed species and the level of habitat disturbance is minor. Referral to the Commonwealth under the EPBC Act would not be recommended.

Further recommendations have been provided in Section 6 to ameliorate the potential impacts on site.

## 5.3 SEPP 44 – KOALA HABITAT PROTECTION

The identification of an area of land as SEPP44 Potential Koala Habitat is determined by the presence of Schedule 2 Koala feed tree species, as listed under Schedule 2 of SEPP44: Koala Habitat Protection.

Potential Koala Habitat is defined as areas where the tree species listed under Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component. An area of land to which the policy applies must be at least one hectare in area (and may include adjoining land in the same ownership).

*Eucalyptus tereticornis* comprised at least 15% of the total number of trees in the upper or lower strata of the tree component in the Coastal Grassy Red Gum Forest and probably the Lowland Woollybutt-Melaleuca Forest communities; therefore the site qualifies as Potential Koala Habitat.

There has been a total of five recorded koala sightings within 10km of the site since 2000, the closest being over 8km away. Surveys of adjacent and similar habitats undertaken by ELA (2009) included scat searches for Koala, call play back and spotlighting. The Koala was not detected via any of these methods, suggesting that the site does not support a resident Koala population and does not qualify as Core Koala Habitat. Furthermore, the proposal will only remove a small number of mostly young trees within a residential context and will not adversely affect Koala habitat. A Plan of Management for Koala Habitat is not required.

# 6 Recommendations

Several recommendations have been developed in order to further mitigate the impacts and potential impacts of the proposal. These have been designed to manage statutory requirements, maximise retention of areas of greater biodiversity value and to develop measures to manage the subject site to improve current ecological condition within retained vegetation. Recommendations include:

- Selection of the recommended wastewater pipeline route to avoid areas of higher ecological sensitivity.
- The pipeline routes and construction methods should minimise disturbance to native vegetation and other habitats as much as possible, particularly when close to endangered ecological communities and drainage lines.
- Retain hollow bearing trees and other large trees in situ where possible. In the event that a hollow-bearing tree needs to be removed, a qualified ecologist should be present to check for native fauna. Hollows found to be occupied by fauna should not be removed until fauna have vacated the hollow. A hollow-bearing tree removal procedure may be required, and may involve measures that ensure fauna have vacated, sectional removal of the tree hollows and soft-drop techniques to avoid direct impacts on fauna.
- Hygiene protocols should be employed on all vehicles and equipment used during the construction of the wastewater pipeline. This involves ensuring that all such machinery is cleaned of soil, potential environmental weed seeds and Chytrid fungus prior to entering the site. This measure will reduce the potential spread of environmental weeds, particularly exotic grasses, and aquatic fungi detrimental to frog species.
- Appropriate erosion and sediment controls are to be used during and following the construction period, and are to remain in place until disturbed soil has been stabilised.

# 7 Conclusion

This report has assessed the proposal to construct a water and wastewater pipeline to service the proposed residential expansion at West Horsley, with regard to relevant Commonwealth, state and local government legislation, policies and plans.

Six vegetation communities or associations were found within the study area. These include Coastal Grassy Red Gum Forest, Lowland Woollybutt-Melaleuca Forest, Swamp Oak Forest, Pasture, Planted Native and Exotic Trees and Artificial Floodplain Wetlands. Two EECs occur within the study area: Illawarra Lowlands Grassy Woodlands and Swamp Oak Floodplain Forest. One threatened flora species, *Syzygium paniculatum*, was tentatively recorded as a landscape planting in a residential part of the study area, and one migratory bird species was recorded. A number of threatened or migratory fauna species may occasionally occur within the study area and surrounds, although the limited impacts of the proposal will not adversely affect any important habitats for these species.

The proposal will occur only on land that has been previously cleared and disturbed and has been designed to avoid substantial ecological constraints. Approximately 0.1 ha of heavily disturbed native vegetation will be removed from a residential and rural context, probably including one lower quality hollow-bearing tree. A further 3.4 ha of pasture and similar roadside grasses will be temporarily disturbed by the proposal, which includes three ephemeral drainage lines.

In relation to the 'maintain or improve' principles, the project has identified ecological constraints early in the process and the proposal has been modified to avoid impacts to high level constraints as much as possible by restricting the pipelines to areas of high disturbance. The direct and indirect impacts to native vegetation are further mitigated by the use of best practice methods to avoid erosion, sedimentation and weed spread. Given the minimal impacts of the proposal, the provision of offsets to compensate for the removal of native vegetation is not considered necessary.

Based on the assessment provided in Appendix D, it is considered unlikely that the proposal will result in significant impacts to any threatened or migratory species, populations or communities listed under the TSC Act or EPBC Act. Therefore a Species Impact Statement (SIS) and/or referral to the Commonwealth under the EPBC Act are not considered necessary.

Portions of the study area are considered to qualify as Potential Koala Habitat, due to the presence of *Eucalyptus tereticornis* (Forest Red Gum) at greater than 15% of the upper and lower canopy component. However, the paucity of local records and lack of evidence of Koala during recent studies on adjacent land suggests that the site does not contain Core Koala Habitat.

The recommendations in Section 6 provide measures to further reduce the overall impacts of the proposal.

# 8 References

DEC (2004) *Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft),* New South Wales Department of Environment and Conservation, Hurstville, NSW.

DEC and DPI (2005) Draft Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities. DEC, Hurstville.

DIPNR (2004) *Riparian Corridor Management Study*. Report prepared for Wollongong City Council.

Eco Logical Australia (2009) *West Dapto Ecological Study.* Report to Stocklands.

Eco Logical Australia (2010) *West Dapto Flora and Fauna Impact Assessment. Proposed Subdivision: Southern Bong Bong Road, West Dapto.* Report to Stocklands.

Eco Logical Australia (2004) *West Dapto Release Area Ecological Assessment*. Report to Wollongong City Council.

MWH+PB (2010) West Dapto Detailed Planning Water and Wastewater Options Study: Ecological Constraints. Report for Sydney Water Corporation.

NPWS (2002a) *Bioregional Assessment Study Part I - Native Vegetation of the Illawarra Escarpment and Coastal Plain*, NSW National Parks and Wildlife Service, Hurstville.

NPWS (2002b) *Bioregional Assessment Study Part II - Fauna of the Illawarra Escarpment and Coastal Plain,* NSW National Parks and Wildlife Service, Hurstville.

# Appendix A: Likelihood of Occurrence Table

**Summary of initial assessment to determine the likelihood of occurrence of threatened species, populations and ecological communities in the proposal site.**

An assessment of likelihood of occurrence was made for threatened and migratory species identified from the database search. Five terms for the likelihood of occurrence of species are used in this report. This assessment was based on database or other records, presence or absence of suitable habitat, features of the proposal site, results of the field survey and professional judgement. The terms for likelihood of occurrence are defined below:

- "yes" = the species was or has been observed on the site
- "likely" = a medium to high probability that a species uses the site
- "potential" = suitable habitat for a species occurs on the site, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur
- "unlikely" = a very low to low probability that a species uses the site
- "no" = habitat on site and in the vicinity is unsuitable for the species.

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Caladenia tessellata* | *Thick Lip Spider Orchid* | E | V | Occurs in grassy sclerophyll woodland, often growing in well-structured clay loams or sandy soils south from Swansea (DECC 2007). Usually in sheltered moist places, in areas of increased sunlight. It flowers from September to November (DECC 2007) | Unlikely<br>Heavily disturbed habitat, not recorded during surveys |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Chorizema parviflorum* | Eastern Flame Pea | E2 | | Erect or ascending shrub to 50 cm high, with a stout rootstock. Leaves are alternate, narrow, 1 to 4 cm long, 1 to 4 mm wide, with a conspicuous midrib. Pea-flowers are yellow with a red centre, borne in loose clusters at the ends of branches (DECC 2005). This endangered population has been recorded from between Austinmer and Albion Park in the LGA's of Wollongong and Shellharbour (DECC 2005). All known sites (excluding the site at Austinmer) occupy woodland or forest dominated by Forest Red Gum (Eucalyptus tereticornis) and/or Woollybutt (E. longifolia). Flowering period is August to January, with seeds maturing from November (DECC 2005). The species is difficult to locate when not in flower, as it is often tangled amongst (and partially concealed by) a grassy understorey (DECC 2005). | Unlikely<br>Not recorded in study area during flowering period. |
| *Cryptostylis hunteriana* | *Leafless Tongue Orchid* | V | V | It is known from a range of vegetation communities including swamp-heath and woodland (DECC 2007). The larger populations typically occur in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black Sheoak (*Allocasuarina littoralis*); where it appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (*C. subulata*) and the Tartan Tongue Orchid (*C. erecta*) (DECC 2007). Flowers between November and February, although may not flower regularly (DECC 2007). | No |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Cynanchum elegans* | White-flowered Wax Plant | E | E | Climber or twiner with a variable form (DECC 2007). It occurs in dry rainforest gullies, scrub and scree slopes (NPWS 1997). It prefers the ecotone between dry subtropical rainforest and sclerophyll woodland/forest. However has been found in littoral rainforest; *Leptospermum laevigatum – Banksia integrifolia* subsp *integrifolia* coastal scrub; *Eucalyptus tereticornis* aligned open forest/ woodland; *E. maculata* aligned open forest/woodland; and *Melaleuca armillaris* scrub to open scrub (DECC 2007). Flowers between August and May, peaking in November (DECC 2007). Seeds are unlikely to persist in the seedbank (DECC 2007). | Unlikely<br>Not recorded during surveys, no likely habitat affected |
| *Daphnandra sp. C Illawarra* | Illawarra Socketwood | E | E | Rainforest tree to 20 metres tall. Restricted to the Illawarra region where it has been recorded from the local government areas of Shoalhaven, Kiama, Shellharbour and Wollongong (DECC 2005). Occupies the rocky hillsides and gullies of the Illawarra lowlands, occasionally extending onto the upper escarpment slopes (DECC 2005). Associated vegetation includes rainforest and moist eucalypt forest. Associated soils are loams and clay loams derived from volcanic and fertile sedimentary rocks (DECC 2005). Flowers briefly in September and early October with fruits taking 10 to 12 months to mature (DECC 2005). | No |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Daphnandra johnsonii* | | | E | A medium sized rainforest tree that grows to 20 metres and is capable of prolific suckering. The longevity of the species is not known although, given its clonal nature and the large size of some individuals, it is believed to be a long-lived species (DECC 2005) flowers briefly in September and early October although not all populations or individuals appear to flower each year (DECC 2005). | No |
| *Grevillea parviflora* subsp*. parviflora* | Small Flower Grevillea | V | V | Occurs on sandy clay loam soils, often with lateritic ironstone gravels (DECC 2007). Soils are mostly derived from Tertiary sands or alluvium and from the Mittagong Formation with alternating bands of shale and fine-grained sandstones. Soil landscapes include Lucas Heights and Berkshire Park (DECC 2007). Often occurs in open, slightly disturbed sites such as along tracks. Flowering has been recorded between July to December as well as April-May (DECC 2007). | Unlikely<br>Heavily disturbed habitat, not recorded during surveys |
| *Haloragis exalata* subsp*. exalata* | | V | - | Square Raspwort occurs in 4 widely scattered localities in eastern NSW. It is disjunctly distributed in the central coast, south coast and north-western slopes botanical subdivisions of NSW. Damp places near watercourses (Harden 1994). | Unlikely<br>Not recorded during surveys |
| *Irenepharsus trypherus* | Illawarra Irene | E | - | Gullies on the coastal escarpment between Wollongong and the Shoalhaven (Harden 1994). Generally occurs on the fringes of rainforest on the upper slopes of the Illawarra escarpment (NPWS 2004). | Unlikely |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Lespedeza juncea subsp. sericea* | | E2 | | An erect or spreading perennial subshrub. Pink-purple pea flowers borne singularly, or in clusters of up to seven. Fruit a small pod to 3 mm long (DECC 2005). This endangered population occurs south of Dapto in the Wollongong LGA. Known from just one roadside population of approximately 200 plants (DECC 2005). Located in a small strip of open forest dominated by Eucalyptus tereticornis (Forest Red Gum), E. longifolia (Woollybutt), and Melaleuca decora (White Feather Honeymyrtle), on Budgong Sandstone. Prefers full sun to light shade. Flowers between February and March (DECC 2005) | Unlikely<br>Not recorded during surveys. |
| *Leucopogon exolasius* | | V | V | Associated with Sydney Sandstone Gully Forest on rocky hillsides and creek banks in the upper Georges River area and Heathcote National Park (NPWS 1997). | No |
| *Melaleuca biconvexa* | Biconvex Paperbark | V | V | Associated with damp habitats, such as Coastal Narrabeen Moist Forest, Riparian Melaleuca Swamp Woodland (LMCC 2001). This species may occur in dense stands forming a narrow strip adjacent to watercourses, in association with other *Melaleuca* species or as an understorey species in wet forest (NSW Scientific Committee 1998). Flowering occurs over just 3-4 weeks in September and October (DECC 2007). | Unlikely<br>Not known from locality, not recorded during surveys |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Pimelea spicata* | | E | E | In western Sydney, it occurs on an undulating topography of well structured clay soils, derived from Wianamatta shale (DEC 2004). It is associated with Cumberland Plains Woodland (CPW), in open woodland and grassland often in moist depressions or near creek lines (*Ibid.*). Has been located in disturbed areas that would have previously supported CPW (*Ibid.*). In the Illawarra, populations are associated with coastal grasslands and woodlands, including those dominated by *E. tereticornis*. *E. eugenioides*, *Themeda australis* and *Lomandra longifolia* (DEC 2006). No extant populations are known from the Wollongong LGA. | Unlikely<br>Not recorded during surveys |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Pterostylis gibbosa* | Illawarra Greenhood | E | E | Associated with seasonally hard setting clay soils with approximately 1000mm of rainfall (NPWS 1997). All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage. In the Illawarra region, the species grows in woodland dominated by Forest Red Gum *Eucalyptus tereticornis*, Wollybutt *E. longifolia* and White Feather Honey-myrtle *Melaleuca decora*. Near Nowra, the species grows in an open forest of Spotted Gum *Corymbia maculata*, Forest Red Gum and Grey Ironbark *E. paniculata*. In the Hunter region, the species grows in open woodland dominated by Narrow-leaved Ironbark *E. crebra*, Forest Red Gum and Black Cypress Pine *Callitris endlicheri.* The Illawarra Greenhood is a deciduous orchid that is only visible above the ground between late summer and spring, and only when soil moisture levels can sustain its growth. The leaf rosette grows from an underground tuber in late summer, followed by the flower stem in winter and flowers in spring. | Unlikely<br>Heavily disturbed habitat, not recorded during flowering period |
| *Pterostylis saxicola* | | E | E | Terrestrial orchid predominantly found in Hawkesbury Sandstone Gully Forest growing in small pockets of soil that have formed in depressions in sandstone rock shelves (NPWS 1997). Known from Georges River National Park, Ingleburn, Holsworthy, Peter Meadows Creek, St Marys Tower (NSW Scientific Committee 1999). | No |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Pultenaea aristata* | | V | V | Associated with scrub and heath on sandstone ridge tops and upper slopes of large upland swamps on shallow sandy loams (Keith 1994). | No |
| *Syzygium paniculatum* | Magenta Lilly Pilly | E | V | Restricted to riparian, gallery or littoral rainforest habitats in NSW, although is widely cultivated and commonly used for landscaping in gardens, parks and roadsides. Very restricted natural occurrence in the locality. | Likely - planted near Bong Bong Rd. No natural habitat in or near study area. |
| *Thelymitra* sp. Kangaloon | Kangaloon Sun-orchid | - | CE | The Kangaloon Sun-orchid occurs in NSW and is known from three locations near Robertson in the Southern Highlands. This species occurs within the Southern Rivers Natural Resource Management Region. The species has an estimated extent of occurrence of 300 km². The Kangaloon Sun-orchid has an estimated area of occupancy of 10 km². The three localities are Butler's Swamp (0.125 km²), Stockyard Swamp (once known as Molly Morgan Swamp) (7 km²) and Wildes Meadow Swamp (3 km²), and are all located above what is known as the Kangaloon Aquifer | No |
| *Thesium australe* | Austral Toadflax | V | V | Occurs in grassland or grassy woodland. Often found in damp sites in association with Kangaroo Grass (Themeda australis) (DECC 2007). Flowers in spring–summer. Widespread but rare. NSW subdivisions: NC, CC, SC, NT, ST, NWS, CWS. Other Australian states: Qld, Tas. | Unlikely |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Zieria granulata* | Illawarra Zieria | E1 | E | A tall bushy shrub that grows to 6 m. The entire plant is densely covered with glandular tubercles (DECC 2005). Restricted to the Illawarra region where it is recorded from a number of sites. The species primarily occupies the coastal lowlands between Oak Flats and Toolijooa, in the local government areas of Shellharbour and Kiama. This is a range of approximately 22 kilometres (DECC 2005). The typical habitat is dry ridge tops and rocky outcrops on shallow volcanic soils, usually on Bumbo Latite. Less frequently found on the moist slopes of the Illawarra escarpment and in low-lying areas on Quaternary sediments (DECC 2005). Associated vegetation includes Bracelet Honey-myrtle Melaleuca armillaris scrub, Forest Red Gum Eucalyptus tereticornis woodland and rainforest margins, although the species has been recorded from a number of other vegetation types (DECC 2005). | Unlikely<br>Heavily disturbed habitat, not recorded during surveys |

Disclaimer: Data extracted from the Atlas of NSW Wildlife and EPBC Act Protected Matters Report are only indicative and cannot be considered a comprehensive inventory.

**Summary of initial assessment to determine the likelihood of occurrence of threatened species, populations and ecological communities in the proposal site.**

An assessment of likelihood of occurrence was made for threatened and migratory species identified from the database search. Five terms for the likelihood of occurrence of species are used in this report. This assessment was based on database or other records, presence or absence of suitable habitat, features of the proposal site, results of the field survey and professional judgement. The terms for likelihood of occurrence are defined below:

- "yes" = the species was or has been observed on the site
- "likely" = a medium to high probability that a species uses the site
- "potential" = suitable habitat for a species occurs on the site, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur
- "unlikely" = a very low to low probability that a species uses the site
- "no" = habitat on site and in the vicinity is unsuitable for the species.

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| **FISH** | | | | | |
| *Macquarie australasica* | Macquarie Perch | - | E | Habitat for the Macquarie perch is bottom or mid-water in slow-flowing rivers with deep holes, typically in the upper reaches of forested catchments with intact riparian vegetation. Macquarie perch also do well in some upper catchment lakes. In some parts of its range, the species is reduced to taking refuge in small pools which persist in midland–upland areas through the drier summer periods. | No |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Prototroctes maraena* | Australian Grayling | - | V | Historically, this species occurred in coastal streams from the Grose River southwards through NSW, VIC and TAS. On mainland Australia, this species has been recorded from rivers flowing east and south of the main dividing ranges. This species spends only part of its lifecycle in freshwater, mainly inhabiting clear, gravel-bottomed streams with alternating pools and riffles, and granite outcrops but has also been found in muddy-bottomed, heavily silted habitat. Grayling migrate between freshwater streams and the ocean and as such it is generally accepted to be a diadromous (migratory between fresh and salt waters) species. | No |
| **FROGS** | | | | | |
| *Heleioporus australiacus* | Giant Burrowing Frog | V | V | Forages in woodlands, wet heath, dry and wet sclerophyll forest (Ehmann 1997). Associated with semi-permanent to ephemeral sand or rock based streams (Ehmann 1997), where the soil is soft and sandy so that burrows can be constructed (Environment Australia 2000). | Unlikely |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Litoria aurea* | Green and Golden Bell Frog | E | V | This species has been observed utilising a variety of natural and man-made waterbodies (Pyke & White 1996) such as coastal swamps, marshes, dune swales, lagoons, lakes, other estuary wetlands, riverine floodplain wetlands and billabongs, stormwater detention basins, farm dams, bunded areas, drains, ditches and any other structure capable of storing water (DECC 2007). Fast flowing streams are not utilised for breeding purposes by this species (Mahony 1999). Preferable habitat for this species includes attributes such as shallow, still or slow flowing, permanent and/or widely fluctuating water bodies that are unpolluted and without heavy shading (DECC 2007). Large permanent swamps and ponds exhibiting well-established fringing vegetation (especially bulrushes–Typha sp. and spikerushes–Eleocharis sp.) adjacent to open grassland areas for foraging are preferable (Ehmann 1997; Robinson 1993). Ponds that are typically inhabited tend to be free from predatory fish such as Mosquito Fish (Gambusia holbrooki) (DECC 2007). | Potential |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Litoria littlejohni* | Littlejohn's Tree Frog, Heath Frog | V | V | Littlejohn's Tree Frog has a distribution that includes the plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest (90 km north of Sydney) south to Buchan in Victoria (DECC 2007). It occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops. It appears to be restricted to sandstone woodland and heath communities at mid to high altitude (NSW Scientific Committee 2000). It forages both in the tree canopy and on the ground, and it has been observed sheltering under rocks on high exposed ridges during summer (NSW Scientific Committee 2000).<br>It hunts either in shrubs or on the ground. Breeding is triggered by heavy rain and can occur from late winter to autumn, but is most likely to occur in spring when conditions are favourable.<br>Males call from low vegetation close to slow flowing pools. Eggs and tadpoles are mostly found in slow flowing pools that receive extended exposure to sunlight, but will also use temporary isolated pools (DECC 2007). | No |
| *Mixophyes balbus* | Stuttering Frog | E | V | A variety of forest habitats from rainforest through wet and moist sclerophyll forest to riparian habitat in dry sclerophyll forest (DECC 2007) that are generally characterised by deep leaf litter or thick cover from understorey vegetation (Ehmann 1997). Breeding habitats are streams and occasionally springs. Not known from streams disturbed by humans (Ehmann 1997) or still water environments (NSW Scientific Committee 2002). | No |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Pseudophryne australis* | Red-crowned Toadlet | V | - | Red-crowned Toadlets are found in steep escarpment areas and plateaus, as well as low undulating ranges with benched outcroppings on Triassic sandstones of the Sydney Basin (DECC 2007). Within these geological formations, this species mainly occupies the upper parts of ridges, usually being restricted to within about 100 metres of the ridgetop. However they may also occur on plateaus or more level rock platforms along the ridgetop (DECC 2007). Associated with open forest to coastal heath (Ehmann 1997). Utilises small ephemeral drainage lines which feed water from the top of the ridge to the perennial creeks below for breeding, and are not usually found in the vicinity of permanent water (Ehmann 1997). Breeding sites are often characterised by clay-derived soils and generally found below the first sandstone escarpment in the talus slope (NPWS 1997). | No |
| **REPTILES** | | | | | |
| *Hoplocephalus bungaroides* | Broad-headed Snake | E | V | Typical sites consist of exposed sandstone outcrops and benching where the vegetation is predominantly woodland, open woodland and/or heath on Triassic sandstone of the Sydney Basin (DECC 2007). They utilise rock crevices and exfoliating sheets of weathered sandstone during the cooler months and tree hollows during summer (Webb & Shine 1998b). Some of the canopy tree species found to regularly co-occur at known sites include *Corymbia eximia, C. gummifera, Eucalyptus sieberi, E. punctata* and *E. piperita* (DECC 2007). | No |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Varanus rosenbergi* | Heath Monitor | V | - | Associated with Sydney sandstone woodland and heath land. Rocks, hollow logs and burrows are utilised for shelter (Environment Australia 2000). Terrestrial termitaria are required for reproduction (King and Green 1999). | No |
| **DIURNAL BIRDS** | | | | | |
| *Anthochaera Phrygia* *(aka Xanthomyza phrygia)* | Regent Honeyeater | E | E & M | Associated with temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts, and riparian forests of River Oak (*Casuarina cunninghamiana*) (Garnett 1993). Areas containing Swamp Mahogany (*Eucalyptus robusta*) in coastal areas have been observed to be utilised (NPWS 1997). The Regent Honeyeater primarily feeds on nectar from box and ironbark eucalypts and occasionally from banksias and mistletoes (NPWS 1995). As such it is reliant on locally abundant nectar sources with different flowering times to provide reliable supply of nectar (Environment Australia 2000). | Unlikely |
| *Botaurus poiciloptilus* | Australasian Bittern | V | - | Terrestrial wetlands with tall dense vegetation, occasionally estuarine habitats (Marchant & Higgins 1993). Reedbeds, swamps, streams, estuaries (Simpson & Day 1999). | Potential for occasional occurrence in artificial wetlands, unlikely to be affected by proposal. |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Calidris alba* | Sanderling | V | - | Occur in coastal areas on low beaches, near reefs and inlets along tidal mudflats and bare open coastal lagoons (DECC 2007). Rarely seen in near-coastal wetlands such as lagoons, hypersaline lakes, saltponds and samphire flats (DECC 2007) | No |
| *Callocephalon fimbriatum* | Gang-gang Cockatoo | V | - | During summer in dense, tall, wet forests of mountains and gullies, alpine woodlands (Morcombe 2004). In winter they occur at lower altitudes in drier more open forests and woodlands, particularly box-ironbark assemblages (Shields & Chrome 1992). They sometimes inhabit woodland, farms and suburbs in autumn/winter (Simpson & Day 2004). | Potential |
| *Calyptorhynchus lathami* | Glossy Black-Cockatoo | V | - | Associated with a variety of forest types containing Allocasuarina species, usually reflecting the poor nutrient status of underlying soils (Environment Australia 2000; NPWS 1997; DECC 2007). Intact drier forest types with less rugged landscapes are preferred (DECC 2007). Nests in large trees with large hollows (Environment Australia 2000). | Unlikely |
| *Daphoenositta chrysoptera* | Varied Sittella | V | - | The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands, with a nearly continuous distribution in NSW from the coast to the far west (Higgins and Peter 2002; Barrett *et al.* 2003). It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland. (DECC 2010) | Unlikely<br>Not recorded during surveys, poor habitat in study area |
| *Charadrius leschenaultii* | Greater Sand Plover | V | - | Entirely coastal in NSW, foraging on intertidal sand and mudflats in estuaries, roosting during high tide on sandy beaches or rocky shores (DECC 2007). | No |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Charadrius mongolus* | Lesser Sand Plover | V | M | Favours coastal areas including beaches, mudflats and mangroves where they forage (DECC 2007). They may be seen roosting during high tide on sandy beaches or rocky shores (DECC 2007). | No |
| *Coracina lineata* | Barred Cuckoo-shrike | V | - | It is associated with subtropical, dry and littorial rainforests and is restricted to below 500m elevation (DECC 2007). | No |
| *Dasyornis brachypterus* | Eastern Bristlebird | E | E | Habitat is characterised by dense, low vegetation including heath and open woodland with a heathy understorey; in northern NSW occurs in open forest with tussocky grass understorey; all of these vegetation types are fire prone. | No |
| *Ephippiorhynchus asiaticus* | Black-necked Stork | E | - | Associated with tropical and warm temperate terrestrial wetlands, estuarine and littoral habitats, and occasionally woodlands and grasslands floodplains (Marchant & Higgins 1993). Forages in fresh or saline waters up to 0.5m deep, mainly in open fresh waters, extensive sheets of shallow water over grasslands or sedgeland, mangroves, mudflats, shallow swamps with short emergent vegetation and permanent billabongs and pools on floodplains (Marchant & Higgins 1993; DECC 2007). | Rare non-breeding visitor. Potential for occasional occurrence in artificial wetlands, unlikely to be affected by proposal. |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Epthianura albifrons* | White-fronted Chat | V | - | The distribution of the White-fronted Chat extends across the southern half of Australia, from the southernmost areas of Queensland to southern Tasmania and across to Western Australia as far north as Carnarvon (Barrett *et al.* 2003). Found mostly in temperate to arid climates and very rarely seen in sub-tropical areas, the White-fronted Chat occupies foothills and lowlands below 1000 m above sea level (North 1904; Higgins *et al.* 2001; Barrett *et al.* 2003). In New South Wales the White-fronted Chat occurs mostly in the southern half of the state, occurring in damp open habitats along the coast, and near waterways in the western part of the state (Higgins *et al.* 2001). (DECC 2009) | Unlikely |
| *Hieraaetus morphnoides* | Little Eagle | V | - | The Little Eagle is distributed throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment (Marchant and Higgins 1993). It occurs as a single population throughout NSW. The Little Eagle occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used (Marchant and Higgins 1993; Aumann 2001a) (DECC 2009). | Unlikely |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Glossopsitta pusilla* | Little Lorikeet | V | - | In New South Wales Little Lorikeets are distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Little Lorikeets mostly occur in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes. They feed primarily on nectar and pollen in the tree canopy, particularly on profusely-flowering eucalypts, but also on a variety of other species including melaleucas and mistletoes. On the western slopes and tablelands White Box Eucalyptus albens and Yellow Box E. melliodora are particularly important food sources for pollen and nectar respectively. | Possible occasional occurrence, no likely habitat affected by proposal |
| *Grantiella picta* | Painted Honeyeater | V | - | A nomadic species that typically inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests with abundant mistletoe (DECC 2007). It is a specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias, preferring Amyema sp mistletoe (DECC 2007). | Unlikely |
| *Haematopus fuliginosus* | Sooty Oystercatcher | V | - | A coastal species that inhabits rock coastlines, coral cays, reefs and occasionally sandy beaches and Marchant & Higgins 1993; Simpson & Day 1999). | No |
| *Haematopus longirostris* | Pied Oystercatcher | V | - | Roosts and forages on sandy beaches, sand banks, mudflats and estuaries (Marchant & Higgins 1993, Simpson & Day 1999). | No |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Ixobrychus flavicollis* | Black Bittern | V | - | Occurs in both terrestrial and estuarine wetlands generally in areas of permanent water and dense vegetation (DECC 2007). In areas with permanent water it may occur in flooded grassland, forest, woodland, rainforest and mangroves (DECC 2007). Typical habitat does not occur in the study area. | Potential for occasional occurrence in artificial wetlands, unlikely to be affected by proposal. |
| *Lathamus discolor* | Swift Parrot | E | E | Breeds in Tasmania between September and January. Migrates to mainland in autumn, where it forages on profuse flowering Eucalypts (Blakers et al. 1984; Schodde and Tidemann 1986; Forshaw and Cooper 1981). Hence, in this region, autumn and winter flowering eucalypts are important for this species. Favoured feed trees include winter flowering species such as Swamp Mahogany (*Eucalyptus robusta*), Spotted Gum (*Corymbia maculata*), Red Bloodwood (*C. gummifera*), Mugga Ironbark (*E. sideroxylon*), and White Box (*E. albens*) (DECC 2007). | Potential for occasional occurrence in forest habitats, no specific habitat affected |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Limicola falcinellus* | Broad-billed Sandpiper | V | M | The eastern form of the Broad-billed Sandpiper breeds in northern Siberia before migrating southwards in winter to Australia (DECC 2007). In Australia, Broad-billed Sandpipers over-winter on the northern coast, particularly in the north-west, with birds located occasionally on the southern coast (DECC 2007). In NSW, the main site for the species is the Hunter River estuary, with birds occasionally reaching the Shoalhaven estuary (DECC 2007). There are few records for inland NSW (DECC 2007). Broad-billed Sandpipers favour sheltered parts of the coast such as estuarine sandflats and mudflats, harbours, embayments, lagoons, saltmarshes and reefs as feeding and roosting habitat (DECC 2007). Occasionally, individuals may be recorded in sewage farms or within shallow freshwater lagoons (DECC 2007). Broad-billed Sandpipers roost on banks on sheltered sand, shell or shingle beaches. | Unlikely |
| *Limosa limosa* | Black-tailed Godwit | V | - | Primarily found along the coast on sandspits, lagoons and mudflats (DECC 2007). The species has also been found to occur inland on mudflats or shallow receding waters of portions of large muddy swamps or lakes (Pizzey and Knight 1997; Higgins & Davies 1996). | Unlikely |
| *Lophoictinia isura* | Square-tailed Kite | V | - | In coastal areas associated tropical and temperate forests and woodlands on fertile soils with an abundance of passerine birds (Marchant & Higgins 1993, DECC 2007). May be recorded inland along timbered watercourses (DECC 2007). In NSW it is commonly associated with ridge or gully forests dominated by Woollybutt (*Eucalyptus longiflora*), Spotted Gum (*E. maculata*), or Peppermint Gum (*E. elata, E. smithii*) (DECC 2007). | Potential for occasional occurrence in forest habitats, unlikely to be affected by proposal |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Neophema chrysogaster* | Orange-bellied Parrot | E4A | CE | Breeds only in coastal south-west Tasmania and spends the winter in coastal Victoria and South Australia. It nests in hollows in eucalypt trees which grow adjacent to its feeding plains. In early October the birds arrive in the south west and depart after the breeding season usually in March and April.<br>It feeds on the seeds of several sedges and heath plants, including buttongrass. Its main food preferences are found in sedgelands which have not been burned for between 3-15 years. Also included in the diet are seeds of three Boronia species and the everlasting daisy *Helichrysum pumilum*. After breeding, migrating birds move gradually northwards up the west coast, through the Hunter Group and King Island in Bass Strait and on to the mainland. On the journey the birds usually feed on beach-front vegetation including salt tolerant species such as sea rocket *Cakile maritima*. They also eat various coastal native and introduced grasses. | Unlikely |
| *Neophema pulchella* | Turquoise Parrot | V | - | Steep rocky ridges and gullies, rolling hills, valleys and river flats and the plains of the Great Dividing Range comprise the topography inhabited by this species (Marchant & Higgins 1993). Spends much of the time on the ground foraging on seed and grasses (DECC 2007). It is associated with coastal scrubland, open forest and timbered grassland, especially low shrub ecotones between dry hardwood forests and grasslands with high proportion of native grasses and forbs (Environment Australia 2000). | Unlikely<br>Few records in the locality, not likely to be a regular or breeding species in the Wollongong coastal plain. |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Pachycephala olivacea* | Olive Whistler | V | - | Elevated (>500 MASL), cool temperate rainforest and moist eucalypt forest in the northern part of their range. This species appears to favour large tracts of undisturbed and densely vegetated forest (SFNSW 1995). | Unlikely |
| *Pandion haliaetus* | Osprey | V | - | Associated with waterbodies including coastal waters, inlets, lakes, estuaries, beaches, offshore islands and sometimes along inland rivers (Schodde and Tidemann 1986; Clancy 1991; Olsen 1995). Osprey may nest on the ground, on sea cliffs or in trees (Olsen 1995). Osprey generally prefer emergent trees, often dead or partly dead with a broken off crown (Olsen 1995). | Unlikely |
| *Petroica boodang* | Scarlet Robin | V | - | The Scarlet Robin is found in south-eastern Australia (extreme south-east Queensland to Tasmania, western Victoria and south-east South Australia) and south-west Western Australia. In NSW it occupies open forests and woodlands from the coast to the inland slopes (Higgins and Peter 2002). Some dispersing birds may appear in autumn or winter on the eastern fringe of the inland plains. The Scarlet Robin breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within an open understorey of shrubs and grasses and sometimes in open areas. Abundant logs and coarse woody debris are important structural components of its habitat. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. (DECC 2010) | Potential for occasional occurrence, no habitat affected by proposal. |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Petroica phoenicea* | Flame Robin | V | - | The Flame Robin is found in south-eastern Australia (Queensland border to Tasmania, western Victoria and south-east South Australia). In NSW it breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. It migrates in winter to more open lowland habitats such as grassland with scattered trees and open woodland on the inland slopes and plains (Higgins and Peter 2002). (DECC 2009) | Potential for occasional occurrence, no habitat affected by proposal. |
| *Petroica rodinogaster* | Pink Robin | V | - | The Pink Robin is found in Tasmania and the uplands of eastern Victoria and far south-eastern NSW, almost as far north as Bombala. On the mainland, the species disperses north and west and into more open habitats in winter, regularly as far north as the ACT area, and sometimes being found as far north as the central coast of NSW.<br>Inhabits rainforest and tall, open eucalypt forest, particularly in densely vegetated gullies. Breeds between October and January and can produce two clutches in a season. | Unlikely |
| *Ptilinopus regina* | Rose-crowned Fruit-Dove | V | - | Tall tropical and subtropical, evergreen or semi-deciduous rainforests, especially with a dense growth of vines trees (Marchant and Higgins 1999). Also located in closed wet sclerophyll forest, gallery forests or sclerophyll woodlands with abundant fruiting trees, near or next to rainforest (DECC 2007). Is thought to prefer large areas of vegetation, but has been located in patches and occasionally in parks and gardens with fruiting trees (Marchant and Higgins 1999). | Unlikely |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Ptilinopus superbus* | Superb Fruit-Dove | V | - | Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms (DECC 2007). It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees (ibid.). Part of the population is migratory or nomadic (ibid.). At least some of the population, particularly young birds, moves south through Sydney, especially in autumn (ibid.). Breeding takes place from September to January (ibid.). Will feed in adjacent mangroves or eucalypt forests (Blakers et al. 1984). | Unlikely |
| *Rostratula australis (a.k.a. R. benghalensis)* | Painted Snipe (Australian subspecies) | E | E | Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber (DECC 2007). Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds (ibid.). Breeding is often in response to local conditions; generally occurs from September to December (DECC 2007). Roosts during the day in dense vegetation (NSW Scientific Committee 2004). Forages nocturnally on mud-flats and in shallow water (DECC 2007). Feeds on worms, molluscs, insects and some plant-matter (ibid.). | Unlikely<br>Potential habitat around artificial wetland but not regular occurrence in locality. |
| *Sterna albifrons* | Little Tern | E | - | Almost exclusively coastal, preferring sheltered areas (DECC 2007), however may occur several kilometres inland in harbours, inlets and rivers (Smith 1990). Australian birds breed on sandy beaches and sand spits (Simpson & Day 1999). | No |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Stictonetta naevosa* | Freckled Duck | V | - | Associated with a variety of plankton-rich wetlands, such as heavily vegetated, large open lakes and their shores, creeks, farm dams, sewerage ponds and floodwaters (DECC 2007). | Potential for occasional occurrence in artificial wetlands, unlikely to be affected by proposal. |
| *Thinornis rubricollis* | Hooded Plover | E | - | In south-eastern Australia this species uses long stretches of sandy shore, backed by tussock and creeper-covered dunes with nearby inland lakes (DECC 2007). Preferred habitat is beaches with a wide wash zone with seaweed mounds for feeding (Murlis 1989). | No |
| *Xenus cinereus* | Terek Sandpiper | V | M | A rare migrant to the eastern and southern Australian coasts, being most common in northern Australia, and extending its distribution south to the NSW coast in the east (DECC 2007). The two main sites for the species in NSW are the Richmond River estuary and the Hunter River estuary (DECC 2007). In Australia, has been recorded on coastal mudflats, lagoons, creeks and estuaries (DECC 2007). Favours mudbanks and sandbanks located near mangroves, but may also be observed on rocky pools and reefs, and occasionally up to 10 km inland around brackish pools (DECC 2007). Generally roosts communally amongst mangroves on dead trees, often with related wader species (DECC 2007). | Unlikely |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| **NOCTURNAL BIRDS** | | | | | |
| *Ninox connivens* | Barking Owl | V | - | Associated with a variety of habitats such as savanna woodland, open eucalypt forests, wetland and riverine forest. The habitat is typically dominated by Eucalypts (often Redgum species), however often dominated by Melaleuca species in the tropics (DECC 2007). It usually roosts in dense foliage in large trees such as River She-oak (*Allocasuarina cunninghamiana*), other Casuarina and Allocasuarina, eucalypts, Angophora, Acacia and rainforest species from streamside gallery forests (NPWS 2003). It usually nests near watercourses or wetlands (NPWS 2003) in large tree hollows with entrances averaging 2-29 metres above ground, depending on the forest or woodland structure and the canopy height (Debus 1997). | Unlikely |
| *Ninox strenua* | Powerful Owl | V | - | Powerful Owls are associated with a wide range of wet and dry forest types with a high density of prey, such as arboreal mammals, large birds and flying foxes (Environment Australia 2000, Debus & Chafer 1994). Large trees with hollows at least 0.5m deep are required for shelter and breeding (Environment Australia 2000). | Unlikely |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Tyto novaehollandiae* | Masked Owl | V | - | Associated with forest with sparse, open, understorey, typically dry sclerophyll forest and woodland (DECC 2007) and especially the ecotone between wet and dry forest, and non forest habitat (Environment Australia 2000). Known to utilise forest margins and isolated stands of trees within agricultural land (Hyem 1979) and heavily disturbed forest where its prey of small and medium sized mammals can be readily obtained (Kavanagh & Peake 1993). | Unlikely |
| *Tyto tenebricosa* | Sooty Owl | V | - | Sooty Owls are associated with tall wet old growth forest on fertile soil with a dense understorey and emergent tall Eucalyptus species (Environment Australia 2000, Debus 1994). Pairs roost in the daytime amongst dense vegetation, in tree hollows and sometimes in caves. The Sooty Owl is typically associated with an abundant and diverse supply of prey items and a selection of large tree hollows (Debus 1994, Garnett 1993, Hyem 1979). | Unlikely |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| **MAMMALS (EXCLUDING BATS)** | | | | | |
| *Cercartetus nanus* | Eastern Pygmy-possum | V | - | Found in wet and dry eucalypt forest, subalpine woodland, coastal banksia woodland and wet heath (Menkhorst & Knight 2004). Pygmy-Possums feed mostly on the pollen and nectar from banksias, eucalypts and understorey plants and will also eat insects, seeds and fruit (Turner & Ward 1995). The presence of Banksia sp. and Leptospermum sp. are an important habitat feature (DECC 2007). Small tree hollows are favoured as day nesting sites, but nests have also been found under bark, in old birds nests and in the branch forks of tea-trees (Turner & Ward 1995). | Unlikely |
| *Dasyurus maculatus*<br>*Dasyurus maculatus maculatus* | Spotted-tailed Quoll<br>Spotted-tailed Quoll (SE Mainland Population) | V<br>- | -<br>E | The Spotted-tailed Quoll inhabits a range of forest communities including wet and dry sclerophyll forests, coastal heathlands and rainforests (Mansergh 1984; DECC 2007j), more frequently recorded near the ecotones of closed and open forest. This species requires habitat features such as maternal den sites, an abundance of food (birds and small mammals) and large areas of relatively intact vegetation to forage in (DECC 2007). Maternal den sites are logs with cryptic entrances; rock outcrops; windrows; burrows (Environment Australia 2000). | Unlikely |
| *Isoodon obesulus* | Southern Brown Bandicoot | E | E | This species is associated with heath, coastal scrub, heathy forests (Menkhorst & Knight 2004), shrubland and woodland on well drained soils. This species is thought to display a preference for newly regenerating heathland and other areas prone to fire (Menkhorst & Seebeck 1990). | No |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Petaurus norfolcensis* | Squirrel Glider | V | - | Associated with dry hardwood forest and woodlands (Menkhorst et al. 1988; Quin 1995). Habitats typically include gum barked and high nectar producing species, including winter flower species (Menkhorst et al. 1988). The presence of hollow bearing eucalypts is a critical habitat value (Quin 1995). | Unlikely |
| *Petrogale penicillata* | Brush-tailed Rock-wallaby | E | V | Rocky areas in a variety of habitats, typically north facing sites with numerous ledges, caves and crevices (Strahan 1995). | No |
| *Phascolarctos cinereus* | Koala | V | - | Associated with both wet and dry Eucalypt forest and woodland that contains a canopy cover of approximately 10 to 70% (Reed et al. 1990), with acceptable Eucalypt food trees. Some preferred Eucalyptus species are: Eucalyptus tereticornis, E. punctata, E. cypellocarpa, E. viminalis. | Unlikely<br>Not known from immediate area, no impact to potential habitat |
| *Potorous tridactylus*<br>*Potorous tridactylus tridactylus* | Long-nosed Potoroo<br>Long-nosed Potoroo (SE Mainland Population) | V<br>- | -<br>V | Associated with dry coastal heath and dry and wet sclerophyll forests (Strahan 1998) with dense cover for shelter and adjacent more open areas for foraging (Menkhorst & Knight 2004). | No |
| *Pseudomys fumeus* | Smoky Mouse | E | E | The Smoky Mouse is currently limited to a small number of sites in western, southern and eastern Victoria, south-east NSW and the ACT. The Smoky Mouse appears to prefer heath habitat on ridge tops and slopes in sclerophyll forest, heathland and open-forest from the coast (in Victoria) to sub-alpine regions of up to 1800 metres, but sometimes occurs in ferny gullies. (DEC 2005) | No |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Pseudomys novaehollandiae* | New Holland Mouse | - | V | The New Holland Mouse has a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Across the species' range the New Holland Mouse is known to inhabit open heathlands, open woodlands with a heathland understorey and vegetated sand dunes (Keith and Calaby, 1968; Posamentier and Recher, 1974; Fox and Fox, 1978; Hocking, 1980; Fox and Mckay, 1981; Norton, 1987; Pye, 1991; Wilson, 1991; Lazenby et al., 2008). | No |
| **MAMMALS (BATS)** | | | | | |
| *Chalinolobus dwyeri* | Large-eared Pied Bat | V | V | The Large-eared Pied Bat has been recorded in a variety of habitats, including dry sclerophyll forests, woodland, sub-alpine woodland, edges of rainforests and wet sclerophyll forests (Churchill 1998; DECC 2007). This species roosts in caves, rock overhangs and disused mine shafts and as such is usually associated with rock outcrops and cliff faces (Churchill 1998; DECC 2007). | Potential |
| *Falsistrellus tasmaniensis* | Eastern False Pipistrelle | V | - | Prefers moist habitats with trees taller than 20m (DECC 2007). Roosts in tree hollows but has also been found roosting in buildings or under loose bark (DECC 2007). | Potential |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Miniopterus schreibersii oceanensis* | Eastern Bent-wing Bat | V | - | Associated with a range of habitats such as rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland (Churchill 1998). It forages above and below the tree canopy on small insects (AMBS 1995, Dwyer 1995, Dwyer 1981). Will utilise caves, old mines, and stormwater channels, under bridges and occasionally buildings for shelter (Environment Australia 2000, Dwyer 1995). | Potential |
| *Mormopterus norfolkensis* | East Coast Freetail Bat | V | - | Most records of this species are from dry eucalypt forest and woodland east of the Great Dividing Range (Churchill 1998). Individuals have, however, been recorded flying low over a rocky river in rainforest and wet sclerophyll forest and foraging in clearings at forest edges (Environment Australia 2000; Allison & Hoye 1998). Primarily roosts in hollows or behind loose bark in mature eucalypts, but have been observed roosting in the roof of a hut (Environment Australia 2000; Allison & Hoye 1998). | Potential |
| *Myotis adversus* | Southern Myotis | V | - | The Large-footed Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers. Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface. (DECC 2009) | Potential |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Pteropus poliocephalus* | Grey-headed Flying-Fox | V | V | Inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas (Churchill 1998, Eby 1998). Camps are often located in gullies, typically close to water, in vegetation with a dense canopy (Churchill 1998). | Potential to occur but no specific habitat affected |
| *Saccolaimus flaviventris* | Yellow-bellied Sheathtail-bat | V | - | Found in almost all habitats, from wet and dry sclerophyll forest, open woodland (Churchill 1998), open country, mallee, rainforests, heathland and waterbodies (SFNSW 1995). Roosts in tree hollows; may also use caves; has also been recorded in a tree hollow in a paddock (Environment Australia 2000) and in abandoned sugar glider nests (Churchill 1998). The Yellow-bellied Sheathtail-bat is dependent on suitable hollow-bearing trees to provide roost sites, which may be a limiting factor on populations in cleared or fragmented habitats (Environment Australia 2000). | Potential |
| *Scoteanax rueppellii* | Greater Broad-nosed Bat | V | - | Associated with moist gullies in mature coastal forest, or rainforest, east of the Great Dividing Range (Churchill, 1998), tending to be more frequently located in more productive forests (Hoye & Richards 1998). Within denser vegetation types use is made of natural and man made openings such as roads, creeks and small rivers, where it hawks backwards and forwards for prey (Hoye & Richards 1998). | Potential |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| **MIGRATORY TERRESTRIAL SPECIES LISTED UNDER EPBC ACT** | | | | | |
| *Haliaeetus leucogaster* | White-bellied Sea-Eagle | - | M | Forages over large open fresh or saline waterbodies, coastal seas and open terrestrial areas (Marchant & Higgins 1993, Simpson & Day 1999). Breeding habitat consists of tall trees, mangroves, cliffs, rocky outcrops, silts, caves and crevices and is located along the coast or major rivers. Breeding habitat is usually in or close to water, but may occur up to a kilometre away (Marchant & Higgins 1993). | Unlikely, no habitat affected by proposal |
| *Hirundapus caudacutus* | White-throated Needletail | - | M | Forages aerially over a variety of habitats usually over coastal and mountain areas, most likely with a preference for wooded areas (Marchant & Higgins 1993; Simpson & Day 1999). Has been observed roosting in dense foliage of canopy trees, and may seek refuge in tree hollows in inclement weather (Marchant & Higgins 1993). | Potential to overfly area, no habitat affected by proposal |
| *Merops ornatus* | Rainbow Bee-eater | - | M | Resident in coastal and subcoastal northern Australia; regular breeding migrant in southern Australia, arriving September to October, departing February to March, some occasionally present April to May (Pizzey and Doyle 1988). Occurs in open country, chiefly at suitable breeding places in areas of sandy or loamy soil: sand-ridges, riverbanks, road-cuttings, sand-pits, occasionally coastal cliffs (ibid). Nest is a chamber a the end of a burrow, up to 1.6 m long, tunnelled in flat or sloping ground, sandy back or cutting (*ibid*). | No |
| *Monarcha melanopsis* | Black-faced Monarch | - | M | Rainforest and eucalypt forests, feeding in tangled understorey (Blakers et al. 1984). | Unlikely, no habitat affected by proposal |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Myiagra cyanoleuca* | Satin Flycatcher | - | M | Wetter, denser forest, often at high elevations (Simpson & Day 2004). | Unlikely, no habitat affected by proposal |
| *Rhipidura rufifrons* | Rufous Fantail | - | M | The Rufous Fantail is a summer breeding migrant to southeastern Australia (Morcombe, 2004). The Rufous Fantail is found in rainforest, dense wet eucalypt and monsoon forests, paperbark and mangrove swamps and riverside vegetation (Morcombe, 2004). Open country may be used by the Rufous Fantail during migration (Morcombe, 2004). | Unlikely, no habitat affected by proposal |
| **MIGRATORY WETLAND SPECIES LISTED UNDER EPBC ACT** | | | | | |
| *Ardea alba* | Great Egret | - | M | The Great Egret is common and widespread in Australia (McKilligan, 2005). It forages in a wide range of wet and dry habitats including permanent and ephemeral freshwaters, wet pasture and estuarine mangroves and mudflats (McKilligan, 2005). | Potential |
| *Ardea ibis* | Cattle Egret | - | M | Cattle Egrets forage on pasture, marsh, grassy road verges, rain puddles and croplands, but not usually in the open water of streams or lakes and they avoid marine environments (McKilligan, 2005). Some individuals stay close to the natal heronry from one nesting season to the next, but the majority leave the district in autumn and return the next spring. Cattle Egrets are likely to spend the winter dispersed along the coastal plain and only a small number have been recovered west of the Great Dividing Range (McKilligan, 2005). | Yes |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Arenaria interpres* | Ruddy Turnstone | - | M | Frequents beaches along the coast of NSW (DNR 2000). Flies from Siberia or Alaska to Australia in August - September each year (*ibid*). | No |
| *Calidris acuminata* | Sharp-tailed Sandpiper | - | M | It prefers the grassy edges of shallow inland freshwater wetlands. It is also found around sewerage treatment ponds, flooded grasslands, mudflats, mangroves, rocky shores and beaches. | Unlikely |
| *Calidris ferruginea* | Curlew Sandpiper | - | M | Intertidal mudflats of estuaries, lagoons, mangrove channels; around lakes, dams, floodwaters, flooded saltbush surrounds of inland lakes (Morcombe, 2004). | Potential |
| *Calidris ruficollis* | Red-necked Stint | - | M | Spends the southern summer months in Australia. It is found widely in Australia, except in the arid inland. Red-necked Stints are found on the coast, in sheltered inlets, bays, lagoons, estuaries, intertidal mudflats and protected sandy or coralline shores. They may also be seen in saltworks, sewage farms, saltmarsh, shallow wetlands including lakes, swamps, riverbanks, waterholes, bore drains, dams, soaks and pools in saltflats, flooded paddocks or damp grasslands. (Birds Australia 2010) | Potential |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Calidris canutus* | Red Knot | - | M | The Red Knot is common in all the main suitable habitats around the coast of Australia (Barrett et al. 2002b; Minton, C.D.T. 2002, pers. comm.; Watkins 1993), but is less numerous in south-west Australia than elsewhere (Lane 1987). In Australasia the Red Knot mainly inhabit intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs. They are occasionally seen on terrestrial saline wetlands near the coast, such as lakes, lagoons, pools and pans, and recorded on sewage ponds and saltworks, but rarely use freshwater swamps. They rarely use inland lakes or swamps (Higgins & Davies 1996). (DSEWPC 2010) | Unlikely |
| *Calidris tenuirostris* | Great Knot | V | M | In NSW, the species has been recorded at scattered sites along the coast to about Narooma. It has also been observed inland at Tullakool, Armidale, Gilgandra and Griffith. Occurs within sheltered, coastal habitats containing large, intertidal mudflats or sandflats, including inlets, bays, harbours, estuaries and lagoons. Often recorded on sandy beaches with mudflats nearby, sandy spits and islets and sometimes on exposed reefs or rock platforms (DEC 2005) | Unlikely |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Charadrius bicinctus* | Double-banded Plover | - | M | The Double-banded Plover is found on littoral, estuarine and fresh or saline terrestrial wetlands and also saltmarsh, grasslands and pasture. It occurs on muddy, sandy, shingled or sometimes rocky beaches, bays and inlets, harbours and margins of fresh or saline terrestrial wetlands such as lakes, lagoons and swamps, shallow estuaries and rivers. The species is sometimes associated with coastal lagoons, inland saltlakes and saltworks. It is also found on seagrass beds, especially *Zostera*, which, when exposed at low tide, remain heavily saturated or have numerous water-filled depressions. The Double-banded Plover is also found on open grassy areas including short pasture, ploughed or newly cropped paddocks, swards, airstrips, and sports grounds such as golf courses or race-tracks near the coast and further inland (Marchant & Higgins 1993). The species is also sometimes found on exposed reefs and rock platforms with shallow rock pools and also on coastal sand dunes (Marchant & Higgins 1993) (DSEWPC 2010). | Potential |
| *Gallinago hardwickii* | Latham's Snipe | - | M | A variety of permanent and ephemeral wetlands, preferring open fresh water wetlands with nearby cover (Marchant and Higgins 1999). Occupies a variety of vegetation around wetlands (Marchant and Higgins 1999) including wetland grasses and open wooded swamps (Simpson and Day 1999). | Potential |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Heteroscelus brevipes* | Grey-tailed Tattler | - | M | In NSW the Grey-tailed Tattler is distributed along most of the coast from the Queensland border, south to Tilba Lake. It is more heavily distributed along coastal regions north of Sydney. The Grey-tailed Tattler is often found on sheltered coasts with reefs and rock platforms or with intertidal mudflats. It can also be found at intertidal rocky, coral or stony reefs as well as platforms and islets that are exposed at low tide. It has been found around shores of rock, shingle, gravel or shells and also on intertidal mudflats in embayments, estuaries and coastal lagoons, especially fringed with mangroves. It is less often on open flat sandy beaches or sandbanks, especially around accumulated seaweed or isolated clumps of dead coral. It is occasionally found around near-coastal wetlands, such as lagoons and lakes and ponds in sewage farms and saltworks. Inland records for the species are rare with sightings on river banks and the edges of rock pools (Higgins & Davies 1996). (DSEWPC 2010) | Unlikely |
| *Limosa lapponica* | Bar-tailed Godwit | - | M | Mainly coastal, usually sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats. Breeds in Northern Russia, Scandinavia, NW Alaska (DEH 2005a). | Unlikely |
| *Limosa limosa* | Black-tailed Godwit | - | M | Mainly coastal, usually sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats (DEH 2005a). Often found inland in small numbers (ibid). Breeds in Iceland, Nth Atlantic, Europe, Russian and China (*ibid*). | Unlikely |

| Scientific Name | Common Name | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Numenius madagascariensis* | Eastern Curlew | - | M | Intertidal coastal mudflats, coastal lagoons, sandy spits (DEH 2005a). Breeds in Russia, NE China (*ibid*). | Unlikely |
| *Numenius minutus* | Little Curlew, Little Whimbrel | - | M | The Little Curlew is known to breed in Siberia, with migrants arriving after early April. Southern migration begins in September following the Chinese coast and, after a staging in Mongolia, continues to Northern Australia and New Guinea (Barter 2002). Outside of the breeding season, the species inhabits grasslands, open plains, parklands and mud-flats of Northern Australia (Simpson and Day 1999). | Potential |
| *Numenius phaeopus* | Whimbrel | - | M | Intertidal coastal mudflats, river deltas and mangroves, occasionally sandy beaches (DEH 2005a). Breeds Siberia and Alaska (*ibid*.). | Unlikely |
| *Pluvialis fulva* | Pacific Golden Plover | - | M | Breeds North Siberia, Alaska (DEH 2005a). Mainly coastal, beaches, mudflats and sandflats and other open areas such as recreational playing fields in Australia (*ibid*.). | Potential |
| *Tringa stagnatilis* | Marsh Sandpiper | - | M | Coastal - Permanent or ephemeral wetlands of varying degrees of salinity, commonly inland (DEH 2005a). Breeds Eastern Europe to Eastern Siberia (*ibid*). | Potential |

Disclaimer: Data extracted from the Atlas of NSW Wildlife and DEW Protected Matters Report are only indicative and cannot be considered a comprehensive inventory. 'Migratory marine species' and 'listed marine species' listed on the EPBC Act (and listed on the DEW protected matters report) have not been included in this table, since they are considered unlikely to occur within the study area due to the absence of marine habitat.

*E = Endangered; V = Vulnerable; M = Migratory.*

# Appendix B: Flora List

| Species Name | Common Name | Northern Study Area | Southern Study Area |
|---|---|---|---|
| *Acacia binervata* | Two-veined Hickory | ✓ | |
| *Acacia mearnsii* | Black Wattle | ✓ | |
| *Agapanthus praecox** | Common Agapanthus | ✓ | |
| *Ageratina adenophora** | Crofton Weed | ✓ | |
| *Ageratina riparia** | Mistflower | ✓ | ✓ |
| *Alisma plantago-aquatica* | Water Plantain | | ✓ |
| *Andropogon virginicus** | Whisky Grass | ✓ | |
| *Angophora floribunda* | Rough-barked Apple | ✓ | ✓ |
| *Araujia sericifera** | Moth Vine | | ✓ |
| *Axonopus fissifolius** | Narrow-leafed Carpet Grass | ✓ | ✓ |
| *Azolla pinnata* | Ferny Azolla | | ✓ |
| *Baumea sp.* | Twigrush | | ✓ |
| *Bidens pilosa** | Cobbler's Pegs | ✓ | ✓ |
| *Brachychiton acerifolius** | Illawarra Flame Tree | ✓ | |
| *Briza minor** | Shivery Grass | ✓ | ✓ |
| *Bulbine bulbosa* | Native Leek | | ✓ |
| *Callistemon salignus* | Willow Bottlebrush | ✓ | ✓ |
| *Callistemon sp** | Bottlebrush | ✓ | |
| *Carex longebrachiata* | Bergalia Tussock | ✓ | |
| *Casuarina glauca* | Swamp Oak | | ✓ |
| *Centella asiatica** | Pennywort | | ✓ |
| *Cheilanthes sieberi* | Fern | | ✓ |
| *Chloris gayana** | Rhodes Grass | ✓ | |
| *Cinnamomum camphora* | Camphor laurel | | ✓ |
| *Cirsium vulgare** | Spear Thistle | | ✓ |
| *Commelina cyanea* | Native Wandering Jew | ✓ | |
| *Conyza sumatrensis** | Tall Fleabane | ✓ | ✓ |
| *Cotoneaster glaucophyllus** | | ✓ | |
| *Crepis sp.** | Hawksbeard | ✓ | |
| *Cynodon dactylon** | Common Couch | ✓ | ✓ |
| *Dichondra repens* | Kidney Weed | | ✓ |
| *Eleocharis acuta* | Common Spike-rush | | ✓ |
| *Entolasia sp.* | | | ✓ |
| *Eragrostis leptostachya* | Paddock Lovegrass | ✓ | |
| *Erythrina X sykesii** | Coral Tree | ✓ | |
| *Eucalyptus amplifolia* | Cabbage Gum | ✓ | ✓ |
| *Eucalyptus bosistoana* | Coast Grey Gum | ✓ | |
| *Eucalyptus eugenioides* | Thin-leaved Stringybark | ✓ | ✓ |
| *Eucalyptus longifolia* | Woollybutt | | ✓ |
| *Eucalyptus tereticornis* | Forest Red Gum | ✓ | ✓ |
| *Eustrephus latifolius* | Wombat Berry | | ✓ |

| Species Name | Common Name | Northern Study Area | Southern Study Area |
|---|---|---|---|
| *Exocarpos cupressiformis* | Native Cherry | ✓ | |
| *Ficus sp.* | Fig | ✓ | |
| *Geitonoplesium cymosum* | Scrambling Lily | | ✓ |
| *Geranium solanderi* | Native Geranium | | ✓ |
| *Glycine tabacina* | | | ✓ |
| *Gomphocarpus fruticosus* | Narrow-leaved Cotton Bush | | ✓ |
| *Grevillea robusta** | Silky Oak | ✓ | |
| *Grevillea sp.** | | ✓ | |
| *Hakea dactyloides* | Finger Hakea | ✓ | |
| *Hypochaeris radicata** | Catsear | ✓ | ✓ |
| *Imperata cylindrica* | Blady Grass | ✓ | |
| *Isolepis sp.* | Club-rush | | ✓ |
| *Jacaranda mimosifolia** | Jacaranda | ✓ | |
| *Juncus continuus* | | | ✓ |
| *Juncus sp.* | Rush | | ✓ |
| *Kunzea ambigua* | White Kunzea | ✓ | |
| *Lantana camara** | Lantana | ✓ | ✓ |
| *Leucopogon juniperinus* | Prickly beard Heath | | ✓ |
| *Ligustrum sinense** | Small-leaved Privet | | ✓ |
| *Lonicera japonica** | Japanese Honeysuckle | | ✓ |
| *Lophostemon confertus** | Brush Box | ✓ | |
| *Ludwigia peploides ssp. montevidensis* | Water Primrose | | ✓ |
| *Melaleuca decora* | | | ✓ |
| *Melaleuca ericifolia* | Swamp Paperbark | | ✓ |
| *Melaleuca linearifolia* | Flax-leaf Paperbark | ✓ | ✓ |
| *Melaleuca styphelioides* | Prickly-leaved Tea Tree | | ✓ |
| *Microlaena stipoides* | | ✓ | |
| *Nasturtium microphyllum** | Brown Watercress | | ✓ |
| *Notelaea longifolia* | Large Mock-olive | | ✓ |
| *Onopordum acanthium subsp. acanthium** | Scotch Thistle | ✓ | ✓ |
| *Oxalis sp.* | | ✓ | ✓ |
| *Parsonsia straminea* | Monkey Rope | | ✓ |
| *Paspalum dilatatum** | Caterpillar Grass | ✓ | |
| *Pennisetum clandestinum** | Kikuyu Grass | ✓ | ✓ |
| *Persicaria sp.* | | | ✓ |
| *Pinus sp.** | Pine | ✓ | |
| *Pittosporum undulatum* | Sweet Pittosporum | ✓ | ✓ |
| *Pittosporum revolutum* | Rough-fruit Pittosporum | | ✓ |
| *Plantago debilis** | | ✓ | ✓ |
| *Plectranthus parviflorus* | Cockspur Flower | | ✓ |
| *Poa labillardieri* | Tussock | ✓ | ✓ |
| *Pratia purpurascens* | Whiteroot | | ✓ |
| *Protasparagus aethiopicus** | Asparagus Fern | ✓ | ✓ |
| *Ranunculus sp.** | Buttercup | | ✓ |
| *Rubus parvifolius* | Native Raspberry | ✓ | ✓ |
| *Rubus fruiticosus** | Blackberry | ✓ | ✓ |
| *Rumex brownii** | Swamp Dock | ✓ | |

| Species Name | Common Name | Northern Study Area | Southern Study Area |
|---|---|---|---|
| *Rumex crispus** | Curled Dock | | ✓ |
| *Salix x pendulina** | Weeping Willow | | ✓ |
| *Senecio madagascariensis** | Fireweed | ✓ | ✓ |
| *Sida rhombifolia** | Paddy's Lucerne* | ✓ | ✓ |
| *Solanum mauritianum** | Wild Tobacco Bush | ✓ | |
| *Solanum nigrum** | Black-berry Nightshade | | ✓ |
| *Solanum pseudocapsicum** | Winter Cherry | ✓ | |
| *Sonchus oleraceus** | Common Sowthistle | ✓ | |
| *Sporobolus africanus** | Parramatta Grass | ✓ | ✓ |
| *Stellaria media** | Common Chickweed | ✓ | |
| *Stenotaphrum secundatum** | Buffalo Grass | | ✓ |
| *Syzygium sp*.* | Lilly Pilly | ✓ | |
| *Themeda australis* | Kangaroo Grass | ✓ | |
| *Trifolium repens** | White Clover | ✓ | ✓ |
| *Triglochin procerum* | Water Ribbons | | ✓ |
| *Typha orientalis* | Broad-leaved Cumbungi | | ✓ |
| *Urtica incisa* | Stinging Nettle | | ✓ |
| *Verbena bonariensis** | Purpletop | ✓ | ✓ |
| *Verbena rigida** | Veined Verbena | ✓ | ✓ |
| *Veronica anagallis-aquatica** | Blue Water Speedwell | | ✓ |
| *Wahlenbergia gracilis* | Australian Bluebell | | ✓ |

# Appendix C: Fauna List

| SCIENTIFIC NAME | COMMON NAME | Observation type |
|---|---|---|
| BIRDS | | |
| *Acanthiza nana* | Yellow Thornbill | obs |
| *Acridotheres tristis** | Common Myna | obs |
| *Acrocephalus australis* | Australian Reed-Warbler | call |
| *Chenonetta jubata* | Australian Wood Duck | obs |
| *Anas superciliosa* | Pacific Black Duck | obs |
| *Anthochaera carunculata* | Red Wattlebird | obs |
| *Ardea ibis* | Cattle Egret | obs |
| *Cacatua galerita* | Sulphur-crested Cockatoo | obs |
| *Cacatua tenuirostris* | Long-billed Corella | obs |
| *Cisticola exilis* | Golden-headed Cisticola | call |
| *Colluricincla harmonica* | Grey Shrike-thrush | call |
| *Coracina novaehollandiae* | Black-faced Cuckoo-shrike | obs |
| *Corvus coronoides* | Australian Raven | obs |
| *Cracticus torquatus* | Grey Butcherbird | obs |
| *Cygnus atratus* | Black Swan | obs |
| *Dacelo novaeguineae* | Laughing Kookaburra | obs |
| *Egretta novaehollandiae* | White-faced Heron | obs |
| *Eolophus roseicapillus* | Galah | obs |
| *Eopsaltria australis* | Eastern Yellow Robin | call |
| *Eurystomus orientalis* | Dollarbird | call |
| *Falco cenchroides* | Nankeen Kestrel | obs |
| *Gerygone olivacea* | White-throated Gerygone | call |
| *Grallina cyanoleuca* | Magpie-lark | obs |
| *Gymnorhina tibicen* | Australian Magpie | obs |
| *Hirundo neoxena* | Welcome Swallow | obs |
| *Lichenostomus chrysops* | Yellow-faced Honeyeater | obs |
| *Malurus cyaneus* | Superb Fairy-wren | obs |
| *Manorina melanocephala* | Noisy Miner | call |
| *Pachycephala rufiventris* | Rufous Whistler | call |
| *Pardalotus punctatus* | Spotted Pardalote | call |
| *Pardalotus striatus* | Striated Pardalote | call |
| *Passer domesticus** | House Sparrow | obs |
| *Pelecanus conspicillatus* | Pelican | obs |
| *Petrochelidon ariel* | Fairy Martin | obs |
| *Phalacrocorax carbo* | Great Cormorant | obs |
| *Phaps chalcoptera* | Common Bronzewing | obs |
| *Philemon corniculatus* | Noisy Friarbird | call |
| *Platycercus adscitus eximius* | Eastern Rosella | obs |
| *Platycercus elegans* | Crimson Rosella | obs |
| *Porphyrio porphyrio* | Purple Swamphen | obs |
| *Rhipidura albiscapa* | Grey Fantail | obs |
| *Rhipidura leucophrys* | Willie Wagtail | obs |
| *Scythrops novaehollandiae* | Channel-billed Cuckoo | call |
| *Smicrornis brevirostris* | Weebill | call |
| *Strepera graculina* | Pied Currawong | obs |

| SCIENTIFIC NAME | COMMON NAME | Observation type |
|---|---|---|
| *Threskiornis aethiopica* | Sacred Ibis | obs |
| *Todiramphus sanctus* | Sacred Kingfisher | obs |
| *Trichoglossus haematodus* | Rainbow Lorikeet | obs |
| *Vanellus miles* | Masked Lapwing | obs |
| MAMMALS | | |
| *Bos taurus** | Cow | obs |
| *Canis familiaris** | Dog | obs |
| *Equus caballus** | Horse | obs |
| *Felis catus** | Cat | obs |
| *Oryctolagus cuniculus** | European Rabbit | scat |
| *Vulpes vulpes** | Red Fox | obs |
| FROGS | | |
| *Crinia signifera* | Common Eastern Froglet | call |
| *Limnodynastes peronii* | Striped Marsh Frog | call |
| *Litoria peronii* | Peron's Tree Frog | call |
| *Litoria dentata* | Bleating Tree Frog | call |
| *Litoria fallax* | Eastern Dwarf Tree Frog | call |
| *Litoria nudidigitus* | Leaf Green Tree Frog | call |
| REPTILES | | |
| *Amphibolurus muricatus* | Jacky Lizard | obs |
| *Eulamprus quoyii* | Water Skink | obs |
| *Lampropholis delicata* | Dark-flecked Garden Sunskink | obs |
| *Tiliqua scincoides* | Blue-tongued Lizard | obs |

# Appendix D: Assessment of Significance

## EP&A ACT ASSESSMENT OF SIGNIFICANCE (7-PART TEST)

The Assessment of Significance (7-part test) is applied to species, populations and ecological communities listed on Schedules 1, 1A and 2 of the TSC Act and Schedules 4, 4A and 5 of the Fisheries Management Act. The assessment sets out 7 factors, which when considered, allow proponents to undertake a qualitative analysis of the likely impacts of an action and to determine whether further assessment is required via a Species Impact Statement (SIS). All factors must be considered and an overall conclusion made based on all factors in combination. An SIS is required if, through application of the 7-part test, an action is considered likely to have a significant impact on a threatened species, population or ecological community.

Threatened species, populations and ecological communities which may be directly or indirectly affected by the current proposal include:

- Illawarra Lowlands Grassy Woodland
- Swamp Oak Floodplain Forest
- Green and Golden Bell Frog
- Gang-gang Cockatoo
- Large-eared Pied Bat
- Eastern False Pipistrelle
- Eastern Bent-wing Bat
- East Coast Freetail Bat
- Greater Broad-nosed Bat
- Southern Myotis
- Yellow-bellied Sheathtail Bat

**Endangered Ecological Communities:**

**Illawarra Lowlands Grassy Woodland**

This community comprises a complex of vegetation types that occupy the Illawarra coastal plain and escarpment foothills. Characteristic tree species include Forest Red Gum *Eucalyptus tereticornis*, Thin-leaved Stringybark *Eucalyptus eugenioides*, Woollybutt *Eucalyptus longifolia*, Coast Grey Box *Eucalyptus bosistoana* and White Feather Honey-myrtle *Melaleuca decora*. The understorey is not necessarily grass dominated, as moist forest vegetation types are also included within this broad community. Common shrub species include *Acacia mearnsii* and *Dodonaea viscosa* subsp. *angustifolia*.

Floodplain vegetation dominated by *Casuarina* species or rainforests on latite soils are not part of this community (DECC 2005).

**Swamp Oak Floodplain Forest**

This community occurs on coastal floodplains of NSW in waterlogged or periodically flooded areas, often in close proximity to creeks, rivers, lakes and estuaries with a saline influence. The most characteristic tree species is *Casuarina glauca* (Swamp Oak) and *Melaleuca ericifolia* (Swamp Paperbark) may also be dominant in some areas (DECC 2007). Characteristic vines include *Parsonsia straminea, Geitonoplesium cymosum* and *Stephania japonica* var. *discolor.* The shrub layer is sparse and the generally continuous groundcover is variable and dependant on the extent of saline influence in the groundwater and disturbance (DECC 2005).

**a)** ***in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,***

*Not relevant to endangered ecological communities*

**b)** ***in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.***

*Not relevant to endangered ecological communities*

**c)** ***In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:***

***i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or***

The removal of approximately 0.1 ha of previously cleared and heavily disturbed *Illawarra Lowlands Grassy Woodland* vegetation from an isolated roadside verge and a maintained power line easement will not place the local occurrence of this community at risk of extinction. Similarly, impacts to the *Swamp Oak Floodplain Forest* endangered ecological community will be limited to the possible removal of several regrowth Swamp Oaks growing in heavily disturbed areas on the fringes of this community, and will not place the local occurrence at risk of extinction.

***ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.***

The areas of endangered ecological community affected have already been cleared and are subject to weed invasion. No intact areas of endangered ecological community will be affected and the proposal will not modify the composition of any endangered ecological community such that its local occurrence is placed at risk.

**d)** ***In relation to the habitat of a threatened species, population or ecological community.***

***i) The extent to which habitat is likely to be removed or modified as a result of the action proposed;***

The proposal will result in the removal of approximately 0.1ha of heavily disturbed *Illawarra Lowlands Grassy Woodland* and *Swamp Oak Floodplain Forest,* involving the removal of a low number of regrowth trees and shrubs within a previously cleared and heavily modified understorey.

***ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and***

The areas of habitat to be affected are already fragmented and have been previously cleared. The proposal will not add to fragmentation or isolation of habitat.

***iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.***

The vegetation to be affected is heavily modified and degraded and subject to a range of ongoing disturbances from occurrence in residential areas and infrastructure corridors. The affected areas are of low quality and not important to the survival of either endangered ecological community in the locality.

**e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).***

No areas identified under the TSC Act as 'critical habitat' will be affected by the proposed activity.

**f) *Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.***

No recovery plan has been prepared for the *Illawarra Lowlands Grassy Woodland* or *Swamp Oak Floodplain Forest.* The proposal has been designed to minimise the impact to these communities, will affect only heavily degraded sections of these communities and is consistent with recovery strategies and actions defined for these communities. The minor impacts of the proposal are not inconsistent with any threat abatement plan or strategy.

***g) Whether the action proposed constitutes or is part of a Key Threatening Process (KTP) or is likely to result in the operation of, or increase the impact of, a KTP.***

The proposal will result in the removal of up to 0.1 ha of degraded *Illawarra Lowlands Grassy Woodland* and *Swamp Oak Floodplain Forest* which is considered to represent a marginal cumulative contribution to the Key Threatening Process: 'clearing of native vegetation'.

The proposal may involve the removal of one hollow-bearing tree from a residential setting, previously part of the *Illawarra Lowlands Grassy Woodland,* which would marginally contribute to the Key Threatening Processes: 'loss of hollow-bearing trees'.

The proposal's contribution to the above processes in minimal given the small area and low quality of vegetation and habitats affected. Recommendations have been made in Section 6 to further reduce the impact of these key threatening processes.

**Conclusion**

The proposal will not result in a significant impact to the *Illawarra Lowlands Grassy Woodland* or *Swamp Oak Floodplain Forest.*

**Green and Golden Bell Frog**

The Green and Golden Bell Frog is distributed in eastern and south-eastern NSW, usually at low altitudes from east of Grafton, to the Narooma region. The species inhabits vegetated coastal wetlands and floodplains in the Shoalhaven, and is known from wetlands which merge into Swamp Mahogany *Eucalyptus robusta* woodland (Daly, 1996). It is often found under debris on low, oft-flooded river flats and is associated with ephemeral wetlands and coastal swampy heath. The species inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available. The species seems to prefer still water or very slow flowing sites. The water quality may be turbid and the species appears to have some tolerance to salinity. In the Wollongong LGA, the species is currently known only from the Port Kembla area.

**a)** ***in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,***

The Green and Golden Bell Frog was not recorded during the survey period or previous studies (ELA 2009) and is not known to occur in the vicinity. The closest known extant location for the species is around Port Kembla, approximately 10km away. While surveys for the species were not exhaustive, the species is not considered likely to occur in the study area.

In the study area, suitable habitat occurs in the farm dams (artificial wetlands) and adjoining creeks and pasture. The proposal is located at least 100m from the main artificial wetland areas, but will temporarily disturb nearby pasture and ephemeral drainage lines (possible foraging and dispersal habitat). The vast majority of potential habitat in and around the study area will not be affected by the proposal.

Given that the species is considered unlikely to occur in the study area and that the proposal only involves temporary and relatively minor disturbance to secondary habitats, the proposal is unlikely to adversely effect the life cycle of the species such that a viable local population would be placed at risk of extinction.

**b)** ***in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.***

No endangered populations occur in the study area.

**c)** ***In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:***

***i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or***

***ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.***

Not relevant to the Green and Golden Bell Frog.

**d)** ***In relation to the habitat of a threatened species, population or ecological community.***

***i) The extent to which habitat is likely to be removed or modified as a result of the action proposed;***

The proposal will temporarily disturb habitats along a 2km linear section of cleared land, including crossing of three small ephemeral drainage lines, which provide potential foraging or dispersal habitat for the Green and Golden Bell Frog.

***ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and***

The habitat affected is already cleared and the proposal will not fragment or isolate any areas of habitat for the Green and Golden Bell Frog.

***iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.***

The habitat to be affected is secondary (non-breeding) habitat for the Green and Golden Bell Frog, and the proposed disturbance is minor and temporary. Given also the lack of evidence of the species at the site, the affected habitat is not considered important for the long term survival of the species in the locality.

**e)** ***Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).***

No areas identified under the TSC Act as 'critical habitat' will be affected by the proposed activity.

**f)** ***Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.***

A Draft Recovery Plan has been prepared for the Green and Golden Bell Frog (DEC 2005). The objectives and actions of these plans have been reviewed and the proposal is consistent with this plan. The proposal does not conflict with any threat abatement plan.

***g) Whether the action proposed constitutes or is part of a Key Threatening Process (KTP) or is likely to result in the operation of, or increase the impact of, a KTP.***

In relation to the Green and Golden Bell Frog, the proposal is not likely to increase the impact of any Key Threatening Processes.

The use of appropriate hygiene protocols during implementation of the pipelines should avoid the transporting chytrid fungus into the area, and so not contributing to the key threatening process: *Infection of frogs by amphibian chytrid causing the disease chytridiomycosis.*

The pipeline crosses three ephemeral drainage lines, which will require trenching to lay the pipeline under the channel. If flowing, water may need to be temporarily diverted for a short distance. The construction process will follow best practice methods to minimise impacts on drainage lines and to avoid erosion and sedimentation.

Given the small and temporary scale of the impact and considering the natural flow regimes of waterways in the study area have already been altered by farming practices and dam construction, the

proposal is not considered likely to contribute to the key threatening process: *Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands.*

**Conclusion**
The proposal is unlikely to result in a significant impact to the Green and Golden Bell Frog.

**Gang-gang Cockatoo**

The Gang-gang Cockatoo is distributed from southern Victoria through south- and central-eastern New South Wales. In New South Wales, the Gang-gang Cockatoo is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. It occurs regularly in the Australian Capital Territory. It is rare at the extremities of its range, with isolated records known from as far north as Coffs Harbour and as far west as Mudgee.

In summer, the Gang-gang often occupies tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, individuals may move to lower altitudes in drier more open eucalypt forests and woodlands, and can also often be found in urban areas. However, the species is known to occur in coastal environments throughout the year, breeding in spring and summer. The species favours old growth attributes for nesting and is dependent on tree hollows in relative large trees. The seeds of Eucalypts and Acacias comprise much of the Gang-gang cockatoo's diet, which also includes introduced seed-bearing shrubs and trees.

**a)** ***in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,***

The study area provides some potential foraging habitat for this species in the form of eucalypt, acacia and other seed sources. Potential nesting habitat is provided by larger hollow-bearing trees. The proposal will remove a low number of mostly marginal foraging resources and probably one hollow-bearing tree. The hollow-bearing tree is considered a marginal nesting resource for this species, given the quality of visible hollows and the tree's context within a residential context and less than 2m from Bong Bong Road.

The species was not recorded during the survey period or nearby by ELA (2009; 1010). The Gang-gang Cockatoo does not appear to use the study area regularly and is unlikely to nest in the one tree that may need to be removed. Foraging resources for the species are widespread and those to be removed for the proposal are inconsequential.

The proposal is unlikely to adversely affect the life cycle of the Gang-gang Cockatoo such that a viable local population is placed at risk of extinction.

**b)** ***in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.***

No endangered populations occur in the study area.

**c)** ***In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:***

***i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or***

***ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.***

Not relevant to the Gang-gang Cockatoo.

**d)** ***In relation to the habitat of a threatened species, population or ecological community.***

***i) The extent to which habitat is likely to be removed or modified as a result of the action proposed;***

The proposal will removal up to 0.1 ha of heavily disturbed and previously cleared forest, containing a low number of marginal feeding resources and one hollow-bearing tree.

***ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and***

No habitat will become fragmented or isolated as a result of the proposal.

***iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.***

The foraging resources to be affected may potentially be used by the species on occasions, but are of relatively poor quality for the Gang-gang Cockatoo. The hollow-bearing tree to be removed for the proposal is unlikely to be used by the species for nesting given its marginal quality. The species ability to forage and breed elsewhere in the study area would not be affected by the proposal.

**e)** ***Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).***

No areas identified under the TSC Act as 'critical habitat' will be affected by the proposed activity.

**f)** ***Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.***

No recovery plan has been prepared for the Gang-gang Cockatoo, although a number of recovery strategies have been listed by DECCW. The proposal is considered to be consistent with these strategies.

***g) Whether the action proposed constitutes or is part of a Key Threatening Process (KTP) or is likely to result in the operation of, or increase the impact of, a KTP.***

The proposal will result in the removal of approximately 0.1 ha of heavily disturbed forest, including one hollow-bearing tree, which provides potential habitat for the Gang-gang Cockatoo and constitutes the key threatening processes: *Clearing of native vegetation* and *Loss of hollow-bearing trees.* The marginal quality of these resources for the Gang-gang Cockatoo relative to surrounding areas suggests that the proposal's contribution to these processes is negligible.

**Conclusion**

The proposal is unlikely to result in a significant impact to the Gang-gang Cockatoo.

**Microchiropterns (micro-bats)**

**Large-eared Pied Bat**

The Large-eared Pied Bat has been recorded in a variety of habitats, including dry sclerophyll forests, woodland, sub-alpine woodland, edges of rainforests and wet sclerophyll forests (Churchill 1998; DECC 2007). This species roosts in caves, rock overhangs and disused mine shafts and as such is usually associated with rock outcrops and cliff faces (Churchill 1998; DECC 2007).

**Eastern False Pipistrelle**

Occurs over the southeast coast and ranges, from southern Queensland to Tasmania. Prefers moist habitats with trees taller than 20m (DECC 2007). Roosts in tree hollows but has also been found roosting in buildings or under loose bark (DECC 2007).

**Eastern Bent-wing Bat**

Associated with a range of habitats such as rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland (Churchill 1998). It forages above and below the tree canopy on small insects (Dwyer 1995, Dwyer 1981). Will utilise caves, old mines, and stormwater channels, under bridges and occasionally buildings for shelter (Environment Australia 2000, Dwyer 1995).

**East Coast Freetail Bat**

Most records of this species are from dry eucalypt forest and woodland east of the Great Dividing Range (Churchill 1998). Individuals have, however, been recorded flying low over a rocky river in rainforest and wet sclerophyll forest and foraging in clearings at forest edges (Environment Australia 2000; Allison & Hoye 1998). Primarily roosts in hollows or behind loose bark in mature eucalypts, but have been observed roosting in the roof of a hut (Environment Australia 2000).

**Greater Broad-nosed Bat**

Associated with moist gullies in mature coastal forest, or rainforest, east of the Great Dividing Range (Churchill, 1998), tending to be more frequently located in more productive forests (Hoye & Richards 1998). Within denser vegetation types use is made of natural and manmade openings such as roads, creeks and small rivers, where it hawks backwards and forwards for prey (Hoye & Richards 1998).

**Southern Myotis**

The Large-footed Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers. Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface. (DECC 2009).

**Yellow-bellied Sheathtail-bat**

Found in almost all habitats, from wet and dry sclerophyll forest, open woodland (Churchill 1998), open country, mallee, rainforests, heathland and waterbodies (SFNSW 1995). Roosts in tree hollows; may also use caves; has also been recorded in a tree hollow in a paddock (Environment Australia 2000) and in abandoned sugar glider nests (Churchill 1998). The Yellow-bellied Sheathtail-bat is dependent on

suitable hollow-bearing trees to provide roost sites, which may be a limiting factor on populations in cleared or fragmented habitats (Environment Australia 2000).

**a)** ***in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,***

The study area contains potential foraging habitat for most of the above species in and around vegetated areas and in association with farm dams and drainage lines, particularly for the Southern Myotis. The Eastern False Pipistrelle, East Coast Freetail Bat, Greater Broadnosed Bat, Southern Myotis and Yellow-bellied Sheathtail-Bat may potentially also utilise tree hollows for roosting in the study area.

The removal of vegetation that supports invertebrate prey species is a negligible impact for these generally wide ranging species. Disturbance to small sections of ephemeral drainage lines for the proposal is also considered to be a negligible impact on potential foraging habitat for the Southern Myotis.

The one hollow-bearing tree likely to be removed along Bong Bong Road is not likely to provide important roosting resources for any of the above microchiropterans that utilise hollows. The tree is located within 2m of Bong Bong Road and has been extensively disturbed within a residential area. Numerous hollow-bearing trees have been identified nearby (e.g. ELA 2009) and this resource is expected to be plentiful within the extensive areas of vegetated land to the west. The one hollow-bearing tree to be removed for the proposal appears unlikely to be selected as an important roosting site for bats. The proposal is unlikely to have an adverse effect on the life cycle of these species such that a viable local population would be placed at risk of extinction.

**b)** ***in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.***

No endangered populations occur in the study area.

**c)** ***In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:***

***i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or***

***ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.***

Not relevant to microchiropteran species.

**d)** ***In relation to the habitat of a threatened species, population or ecological community.***

***i) The extent to which habitat is likely to be removed or modified as a result of the action proposed;***

The proposal will result in the removal of approximately 0.1ha of disturbed vegetation providing marginal foraging resources, temporary disturbance to small sections of ephemeral drainage line that may provide marginal foraging habitat for the Southern Myotis, and the likely removal of one hollow-bearing tree from a residential context.

***ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and***

The proposal will not isolate or fragment any habitat for microchiropteran species.

***iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.***

The habitat to be affected by the proposal is considered marginal in terms of both quality and quantity and is not important to the survival of microchiropteran species in the locality.

**e)** ***Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).***

No areas identified under the TSC Act as 'critical habitat' will be affected by the proposed activity.

**f)** ***Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.***

No recovery plans have been prepared for the microchiropteran species assessed, however a number of recovery strategies have been developed by DECCW. These recovery strategies and priority actions cover a range of issues but most relevant to the proposal are actions relating to protection of foraging habitat and roosting habitat including hollow-bearing trees. The proposal has been designed to minimise the impact to intact vegetation (foraging habitat) and hollow-bearing trees. Only a single hollow-bearing tree of relatively low quality located within a residential area is likely to be removed for the proposal. The proposal is therefore considered consistent with recovery strategies and actions for threatened microchiropterans.

***g) Whether the action proposed constitutes or is part of a Key Threatening Process (KTP) or is likely to result in the operation of, or increase the impact of, a KTP.***

The proposal will remove up to 0.1 ha of heavily disturbed foraging habitat and a single hollow-bearing tree. This is considered to represent a marginal contribution to the Key Threatening Process: 'clearing of native vegetation' and 'loss of hollow-bearing trees', which have the potential to adversely affect microchiropteran species. The proposal has been designed to minimise the impact of these threatening processes and further recommendations are made in Section 6.

**Conclusion**

The proposal is unlikely to result in result in significant impacts to any of these species.

## EPBC ACT SIGNIFICANT IMPACT CRITERIA

The EPBC Act Administrative Guidelines on Significance set out **'Significant Impact Criteria'** that are to be used to assist in determining whether a proposed action is likely to have a significant impact on matters of national environmental significance. Matters listed under the EPBC Act as being of national environmental significance include:

- Listed threatened species and ecological communities
- Listed migratory species
- Wetlands of International Importance
- The Commonwealth marine environment
- World Heritage properties
- National Heritage places
- Nuclear actions

Specific **'Significant Impact Criteria'** are provided for each matter of national environmental significance except for threatened species and ecological communities in which case separate criteria are provided for species listed as endangered and vulnerable under the EPBC Act.

Threatened and migratory species listed under the EPBC Act that are considered likely or potentially to occur within the study area are given in Appendix A of the Report. The relevant Significant Impact Criteria have been applied to these threatened and migratory species to determine the significance of impact of the project.

| MATTERS TO BE ADDRESSED | IMPACT (COMMONWEALTH LEGISLATION) |
|---|---|
| a. any environmental impact on a World Heritage Property; | No |
| b. any environmental impact on Wetlands of International Importance; | The proposal will not affect any part of RAMSAR wetland. |
| c. any impact on Commonwealth Listed Critically Endangered or Endangered Species; | One Commonwealth listed endangered species has potential to occur in the study area:<br>• Green and Golden Bell Frog (*Litoria aurea)*<br><br>The significant impact criteria in terms of the endangered species are discussed below.<br><br>*a. lead to a long-term decrease in the size of a population*<br>The species is not considered likely to occur in the study area, was not recorded during the survey and is not known from nearby. Potential habitat occurs mainly in and around the artificial wetlands (farm dams), which will not be affected by the proposal. Potential |

| MATTERS TO BE ADDRESSED | IMPACT (COMMONWEALTH LEGISLATION) |
|---|---|
| | foraging and dispersal habitat within surrounding pasture and ephemeral creeks will be temporarily disturbed by the proposal. No important habitat for the species will be directly affected by the proposal, which is not expected to affect any individuals or lead to any decrease in population size.<br><br>*b. reduce the area of occupancy of the species*<br>The proposal will have no effect on the area of occupancy of the species.<br><br>*c. fragment an existing population into two or more populations*<br>The proposed clearing will not fragment any populations.<br><br>*d. adversely affect habitat critical to the survival of a species*<br>No habitat to be affected is considered to be critical to the survival of this species.<br><br>*e. disrupt the breeding cycle of a population*<br>Potential breeding habitat is unlikely to be affected by the proposal.<br><br>*f. modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*<br>Only a small amount of potential habitat will be temporarily modified by the proposal, and will not cause the species to decline.<br><br>*g. result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*<br>The proposal will not increase the risk from invasive species.<br><br>*h. introduce disease that may cause the species to decline; or*<br>The proposal is unlikely to lead to the introduction of a disease that may cause the species to decline. Hygiene protocols for construction machinery, materials and personnel have been recommended to prevent the introduction of Chytrid fungus into waterways.<br><br>*i. interfere with the recovery of the species.*<br>The proposal will not interfere with the recovery of the species and will not affect frog dispersal from other areas to the artificial wetland habitats in the study area. |
| d. any impact on Commonwealth Listed Vulnerable Species; | Two Commonwealth listed vulnerable species could potentially occur in the study area:<br>• Grey-headed Flying-fox (*Pteropus poliocephalus*)<br>• Large-eared Pied Bat *(Chalinolobus dwyeri)*<br>However, only a tiny amount of potential foraging habitat (<0.1ha) would be removed and both species are highly mobile and wide ranging.<br><br>The significant impact criteria in terms of the vulnerable species are discussed below:<br><br>*a. lead to a long-term decrease in the size of an important population of a species,*<br>The negligible amount of possible foraging habitat removed will not affect the size of any populations of these species.<br><br>*b. reduce the area of occupancy of an important population*<br>The proposal will have no effect on the area of occupancy of these species.<br><br>*c. fragment an existing important population into two or more populations*<br>The proposed clearing will not further increase the fragmentation of any populations.<br><br>*d. adversely affect habitat critical to the survival of a species* |

| MATTERS TO BE ADDRESSED | IMPACT (COMMONWEALTH LEGISLATION) |
|---|---|
| | No habitat on site is considered to be critical to the survival of either species.<br><br>*e. disrupt the breeding cycle of an important population*<br>The site does not contain breeding habitat for the Grey-headed Flying-fox or Large-eared Pied Bat and will not cause any disruption to the breeding cycle of an important population.<br><br>*f. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*<br>The negligible amount of habitat affected will not cause these species to decline.<br><br>*g. result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*<br>The proposal will not increase the risk from invasive species.<br><br>*h. introduce disease that may cause the species to decline*<br>The proposal will not lead to the introduction of a disease that may cause these species to decline.<br><br>*i. interferes substantially with the recovery of the species.*<br>The proposal will not affect the recovery of these species in any way. |
| e. any environmental impact on Commonwealth Listed Migratory Species; | One Commonwealth listed migratory wetland species, the Cattle Egret *(Ardea ibis),* was recorded in the study area, and several other listed migratory wetland birds (see Appendix A) have the potential to occur occasionally in the study area in association with the artificial wetland habitats. The proposal is located at least 100m away from the farm dams providing the artificial wetland habitats.<br>The significant impact criteria in terms of the migratory species are discussed below:<br><br>*a. substantially modify (including fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species*<br>The proposal will not substantially modify, destroy or isolate any areas of important habitat for any migratory wetland species, as the proposal involves only a temporary and minor disturbance to occasional foraging habitat.<br><br>*b. result in invasive species that is harmful to the migratory species becoming established in an area of important habitat of the migratory species*<br>The proposal will not introduce or facilitate any invasive species that is harmful to the species and will not affect important habitat.<br><br>*c. seriously disrupt the lifecycle (breeding, feeding, migration or nesting behaviour) of an ecologically significant proportion of the population of the species.*<br>The proposal will not disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species. The proposal involves minor and temporary disturbance to occasional and widespread foraging habitat and will not disrupt breeding areas, migration or primary foraging areas. |
| f. does any part of the Proposal involve a Nuclear Action; | No. The project does not include a Nuclear Action. |
| g. any environmental impact on a | No. There are no Commonwealth Marine Areas within the study area. |

| MATTERS TO BE ADDRESSED | IMPACT (COMMONWEALTH LEGISLATION) |
|---|---|
| Commonwealth Marine Area; | |
| h. In addition, any direct or indirect impact on Commonwealth lands | No. The project does not directly or indirectly affect Commonwealth land. |

## CONCLUSION OF EPBC ACT ASSESSMENT

It is unlikely that the proposal will significantly impact on these threatened or migratory species. The proposal will only temporarily disturb relatively small areas of cleared land or heavily disturbed habitats that are unlikely to be important to these species. Impacts are considered to be negligible. Referral to the Commonwealth under the EPBC Act would not be recommended.

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