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Gloucester Gas Project

Gloucester to Hexham

Final

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Gloucester Gas Project
Gloucester to Hexham

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Glossary of Terms

ASL	Above Sea Level
CPF	Central Processing Facilities
CRA	Comprehensive Regional Assessment
DEC	Department of Environment and Conservation
DECC	Department of Environment and Climate Change
DEWHA	Department of the Environment, Water, Heritage and the Arts
DPI	Department of Primary Industries
EEC	Endangered Ecological Community
EMP	Environmental Management Plan
EP&A Act	*Environmental Planning and Assessment Act* 1979
EPBC Act	*Environment Protection and Biodiversity Conservation Act* 1999
FM Act	*Fisheries Management Act* 1994
GFDA	Gas Field Development Area
GIS	Geographic Information System
GPS	Global Positioning System
HDD	Horizontal Directional Drilling
KP	Kilometre Point
LGA	Local Government Area
LHCC	Lower Hunter and Central Coast
LHCCREMS	Lower Hunter and Central Coast Regional Environmental Management Strategy
NPW Act	*National Parks and Wildlife Act* 1974
NPWS	New South Wales National Parks and Wildlife Service
NRP	National Recovery Plan
NSW REC	New South Wales Roadside Environment Committee
NV Act	*Native Vegetation Act* 2003
NW Act	*Noxious Weeds Act 1993*
PASS	Potential Acid Sulfate Soils
PO Act	*Petroleum (Onshore) Act* 1991
ROW	Right of Way
SPRAT	Species Profile and Threats Database, maintained by DEWHA
TSC Act	*Threatened Species Conservation Act* 1995
VCA	Voluntary Conservation Agreement

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Executive Summary

AGL Gloucester Pty Ltd (AGL) proposes to develop a coal seam gas (CSG) extraction and transport system from Gloucester to Hexham. The project consists of a Gas Field Development Area (GFDA) within Petroleum Exploration Lease 285, principally comprising approximately 110 wells and gathering lines, Central Processing Facilities (CPF) including gas and water treatment and compression at Stratford, and a Gas Transmission Pipeline (pipeline).

AECOM Australia Pty Ltd (AECOM) has been commissioned by AGL to undertake this ecological assessment to:

- identify key ecological constraints associated with the production licence area, GFDA and CPF sites, and the proposed pipeline route
- meet the Key Assessment Requirements identified by the Director-General in relation to ecological impacts
- pursuant to the referral decision made by the Environment Assessment Branch on 25 September 2008 that the proposed action is a controlled action under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act), address the potential impacts to matters of national environmental significance.

This report acts as a full technical Appendix to the main Environmental Assessment (EA) in Volume 1. This report was undertaken on the basis of relevant State and Commonwealth legislation and in accordance with the Environmental Assessment Requirements (EARs) provided by Department of Planning specifically for this project.

This assessment was undertaken using:

- Desktop reviews of available information (including reviews of previous studies, DECC and DPI database searches, Commonwealth Protected Matters database search) to identify protected areas, species, populations and communities potentially occurring within the proposed development and surrounding areas and allow field surveys to target specific areas of concern.
- Targeted field surveys to:
  - describe vegetation communities, wetlands and fauna habitats
  - assess potential habitat for listed threatened species (under the TSC Act and the EPBC Act) and listed Migratory and / or Marine Protected Species (under the EPBC Act)
  - search for listed threatened flora species in suitable habitat using the random meander technique
  - search for listed threatened fauna species in suitable habitat (including indirect signs such as scats, tracks, diggings, scratches, etc), to a limited extent.
- Analyses conducted of information collected in the desktop and field studies to:
  - assess the potential for direct and indirect impacts of the proposed development on the ecological values of the study area
  - develop appropriate measures to avoid, mitigate or offset identified potential impacts

- identify uncertainties in the current assessment that may require further investigation
- where appropriate, recommend locations for infrastructure such as gas wells, CPF and pipelines.

A series of recommendations were formulated on the basis of this assessment. Provided that the recommended mitigation measures outlined in **Section 5.0** are implemented effectively, impacts are anticipated to be limited to:

- Clearing of between 16.72 and 25 ha of native vegetation.
- Impacts on one population of Small-flower Grevillea, which would not lead to any net loss in the total number of populations or area of extent.
- Little or no disturbance of native vegetation within Wallaroo National Park.
- Little or no disturbance of native vegetation in the proposed nature refuge at Lot 68 DP753176
- Little or no impacts on any Endangered Ecological Communities.
- Little or no impacts on other threatened flora and fauna species listed at both State and Commonwealth levels.
- No indirect or downstream effects on threatened flora and fauna species or wetland areas.

1.0 Introduction

AGL Gloucester L E Pty Ltd (AGL) proposes to develop a coal seam gas (CSG) extraction and transport system from Gloucester to Hexham. The project consists of a Gas Field Development Area (GFDA) within Petroleum Exploration Licence 285 (PEL 285), principally comprising approximately 110 wells and gathering lines, Central Processing Facilities (CPF) including gas and water treatment and compression at Stratford, and a Gas Transmission Pipeline (Pipeline). The Minister for Planning has declared the project under Part 3A of the *Environmental Planning and Assessment Act* 1979 (EP&A Act) and some preliminary work has already been undertaken, including:

- approvals strategy
- permissibility assessment
- stakeholder management strategy
- preliminary environmental review / scoping report.

AECOM Australia Pty Ltd (AECOM) has been commissioned by AGL to undertake this ecological assessment to:

- identify key ecological constraints associated with the GFDA, CPF site and Pipeline.
- meet the Key Assessment Requirements identified by the Director-General in relation to ecological impacts.
- pursuant to the referral decision made by the Environment Assessment Branch on 25 September 2008 that the proposed action is a controlled action under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act), address the potential impacts to matters of national environmental significance.

This ecological assessment has been developed in accordance with the Department of Environment and Conservation (now Department of Environment and Climate Change - DECC) and Department of Primary Industries (DPI) 'Draft Guidelines for Threatened Species Assessment' (DEC / DPI 2005), which identifies matters of relevance for the assessment of Major Projects under Part 3A of the EP&A Act.

This assessment has specifically considered threatened species, populations and communities listed under both State and Commonwealth legislation that have been recorded on the site and surrounding areas. This assessment identifies potential impacts on threatened species and details measures to avoid or mitigate such impacts. Residual ecological risks associated with the construction and operation of the proposed infrastructure are identified and discussed.

1.1 Project description

The location of the proposed GFDA, CPF and pipeline are shown in **Figure 1.1 in Volume 4 of this EA**. The study area lies north of Newcastle from Gloucester to Hexham. The project area lies within six local government areas (LGAs) - Gloucester, Dungog, Great Lakes, Port Stephens, Maitland and Newcastle. Three main catchments (the Avon, Karuah and Williams / Hunter) are found in the study area and the proposed pipeline route crosses numerous waterways.

1.1.1 Field Development Area and Central Processing Facilities

The GFDA is located east of Gloucester and Stratford, covering an area of approximately 34.5 km^2. The area is used mainly for mining and agriculture, including grazing and cropping with a number of dispersed homesteads. The Avon River flows within the GFDA and contains a few remnant riparian forest patches. An open pit coal mine is located in the southern side of the GFDA. The CPF is proposed to be located within an existing rail loop near the south-east corner of the GFDA.

The infrastructure would consist of a network of approximately 110 wells and associated flowlines. The arrangement of the wells has been loosely identified within the GFDA but detailed locations are to be designed and finalised around the environmental and social constraints identified during the environmental approval process. In accordance with the requirements of the *Petroleum (Onshore) Act* 1991 (PO Act), all wells would be located at least 200 m from existing residences. The required disturbance footprint during well drilling is 65 m x 65 m. The area would be topped with hard stand material (e.g. gravel) to protect the land surface from heavy machinery and avoid bogging of equipment.

Once wells are in production, hard stand materials such as gravel would be removed and a reduced area (15 m x 15 m) would be fenced off. This area would contain the wellhead, as well as a wellhead pump for water lift and control equipment. The reminaing area within the fence would be suitably rehabilitated to reflect the original condition of the land.

Flowlines would transport the gas from the individual wellheads into a main spineline, which would be connected to the CPF. The gas would then be transported to Hexham via an underground pipeline.

1.1.2 Pipeline

The proposed gas transmission pipeline would be approximately 92 km long, running from the CPF near Gloucester to Hexham. It would pass primarily through cleared agricultural land, but would transect a number of remnant vegetation patches. It would cross the Karuah River, the Williams River, the Hunter River and various tributaries of these rivers.

The proposed pipeline would be constructed in accordance with the requirements of the *Pipelines Act* 1967 and would be underground. In already cleared areas without other constraints, the disturbance footprint would be contained within a 30 m right of way (ROW). In sensitive areas (e.g. remnant native vegetation, stream crossings, on steep slopes, etc.), the ROW would be reduced to minimise impacts.

1.2 Scope of Works

The following tasks were undertaken to address ecological components of the requirements made by the Director General and Environment Assessment Branch.

- Desktop reviews were undertaken of available information (including reviews of previous studies, DECC and DPI database searches, Commonwealth Protected Matters database search) to identify protected areas, species, populations and communities potentially occurring within the proposed development and surrounding areas and allow field surveys to target specific areas of concern.
- Targeted field surveys were undertaken to:
  - describe vegetation communities, wetlands and fauna habitats
  - assess potential habitat for listed threatened species (under the TSC Act and the EPBC Act) and listed Migratory and / or Marine Protected Species (under the EPBC Act)
  - search for listed threatened flora species in suitable habitat using the random meander technique

- search for listed threatened fauna species in suitable habitat (including indirect signs such as scats, tracks, diggings, scratches, etc), to a limited extent.

- Analyses were conducted of information collected in the desktop and field studies to:
  - assess the potential for direct and indirect impacts of the proposed development on the ecological values of the study area
  - develop appropriate measures to avoid, mitigate or offset identified potential impacts
  - identify uncertainties in the current assessment that may require further investigation
  - appropriate, recommend locations for infrastructure such as gas wells, CPF and pipelines.

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2.0 Assessment Methods

The methods used in this assessment are in accordance with the 'Draft Guidelines for Threatened Species Assessment' (DEC / DPI 2005) and consider the matters of relevance for the assessment of Major Projects under Part 3A of the EP&A Act.

Threatened species considered in this assessment are those species, populations and ecological communities identified within Schedules 1, 1A and 2 of the NSW *Threatened Species Conservation Act* 1995 (TSC Act), Schedules 4, 4A, 5 and 5A of the NSW *Fisheries Management Act* 1994 (FM Act) and / or under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act). A summary of legislation relevant to the assessment of ecological impacts of the proposed development is given in **Appendix D**.

2.1 Desktop Assessment

Desktop searches for significant flora and fauna species and ecological communities were conducted for three geographical blocks that incorporate the proposed GFDA, CPF, pipeline and adjacent areas. These three blocks comprise the broader study area for the purposes of this report. The coordinates for these three blocks are:

- -31.95°S, 152.01°E to -32.32°S, 151.85°E
- -32.32°S, 151.97°E to -32.71°S, 151.75°E
- -32.57°S, 151.75°E to -32.9°S, 151.6°E.

The EPBC Act identifies significant flora and fauna species and ecological communities and other matters of national significance. A Protected Matters Report was generated on 13 August 2008 that identified all EPBC Act listed species and ecological communities potentially occurring within the study area.

The Atlas of NSW Wildlife Database and BioNet Database contain recorded sightings of flora and fauna species within New South Wales and identify their current status under the TSC Act. A report from both the Atlas of NSW Wildlife and BioNet was generated on 14 August 2008 that identified all flora and fauna species known to occur within the study area.

Additionally, data were requested from the Atlas of NSW Wildlife Data Unit on 19 August 2008 to identify all threatened ecological communities under the TSC Act that potentially occur in the region (i.e. Dungog, Bulahdelah and Newcastle map sheets). These data include detailed geographic coordinates for individual records of threatened flora and fauna species.

The FM Act identifies all threatened aquatic species, populations and ecological communities within NSW. A search of the DPI website was undertaken to determine any species, populations or ecological communities that potentially occur in the study area.

Critical Habitats are areas which are considered to be critical to the survival of an endangered species, populations or ecological communities. Critical Habitats are protected under the TSC Act and FM Act. A search of the following websites was undertaken to identify the occurrence of any known Critical Habitats within the study area:

- http://www.environment.nsw.gov.au/criticalhabitat/CriticalHabitatProtectionByDoctype.htm
- http://www.dpi.nsw.gov.au/fisheries/species-protection/species-conservation/what/register-of-critical-habitat

As well as searching the above databases, vegetation and landscape patterns across the site were assessed using:

- Comprehensive Regional Assessment (CRA) forest ecosystem mapping for the upper and lower northeast region (NPWS, 1999) – **Figures 1 to 19**
- Lower Hunter and Central Coast (LHCC) Region vegetation mapping, which covers the southern section of the proposed pipeline from KP 66 to 97.5 (NPWS, 2000) – **Figures 21** to **25**
- NSW native vegetation mapping (Keith, 2002)
- recent aerial imagery.

2.1.1 Determination of Significance Level

Threatened flora species and threatened fauna species are defined as those taxa listed in the EPBC Act and / or the TSC Act as Critically Endangered, Endangered or Vulnerable. Regionally Significant fauna are defined as those taxa that have not been listed as threatened species under the EPBC Act or TSC Act, but have been listed in the relevant Action Plan for their respective taxonomic group as Vulnerable, Rare, Near Threatened, Insufficiently Known or Data Deficient. Migratory and / or Marine Protected Species listed under the EPBC Act are assessed separately from threatened species.

2.2 Field Survey

Initial field surveys were carried out during from 28 August to 5 September 2008. The field surveys were conducted by AECOM flora ecologists Dr Con Lokkers and Jodi Blandthorn and AECOM fauna ecologists Lysanne de Graaf and Dario Rivera. Additional surveys were conducted by Dr Con Lokkers (17 October 2008) and Rachel Manassa (19 November 2008).

The objective of the field surveys was to confirm the presence and / or potential presence of the threatened species and ecological communities identified in the desktop assessment or the presence of their preferred habitat(s). Detailed fauna survey techniques (e.g. trapping) were not undertaken. Incidental fauna observations were recorded and these were supplemented by limited spotlighting, ultrasonic bat detecting and call-playback activities.

Flora field surveys were conducted at 81 sites and fauna ground surveys were conducted at 82 sites, mostly within timbered areas selected through aerial photograph interpretation. Of these, detailed assessments were made at 22 flora sites and 21 fauna sites, while briefer observation records were made at 59 flora sites and 61 fauna sites. The locations of the flora and fauna survey sites are shown in **Figures 1** to **19.**

The detailed flora assessments recorded an inventory of dominant and common woody flora species and dominant ground storey species (including native and exotic flora species), structural characteristics (average height and approximate abundance), landform characteristics and information on condition and sensitivity. The detailed fauna assessments were based upon an analysis of habitat quality and recorded features such as the extent of habitat fragmentation and the presence of key habitat features like hollow bearing trees, fallen logs and water bodies. Detailed sites were established where the characteristics of the site indicated the greatest chance of detecting significant species and other values. Only dominant flora and fauna characteristics were recorded for the observational sites.

Survey sites and vehicular traverses were distributed so as to sample as much environmental variability within the study area as possible, within practical time and accessibility constraints. As well as recording dominant species, the surveys and traverses also focused on locating any potential threatened flora and fauna species.

Fauna surveys were supplemented by night spotlighting and ultrasonic bat detecting activities (using AnaBat equipment). Spotlighting and bat detecting were undertaken at dusk for one hour on 30 August (GFDA) and 1 September (Black Camp Road).

Call-playback surveys of approximately 20 minutes were undertaken for several species in appropriate habitats within the study area. Species surveyed at least once by this method were: *Phascolarctos cinereus, Tyto tennibricosa, Tyto novaehollandiae, Ninox strenua, Ninox connivens, Clayptorhynchus lathami, Lathamus discolour, Litoria booroolongensis, Litoria aurea, Mixophyes balbus* and *Mixophyes iteratus*. In the case of *Phascolarctos cinereus,* the surveys were typically up to 40 minutes in duration.

Scats, bones, feathers and other signs (e.g. scratchings, diggings, etc.) were specifically searched for during the detailed fauna assessments, and on an incidental basis elsewhere. Scats were forwarded to Barbara Triggs (renowned expert and author of *Scats, Tracks and other Traces: A Field Guide to Australian Mammals*) for laboratory identification.

GPS coordinates were taken using hand held GPS with an accuracy of +/- 10 m.

2.3 Analysis of Results

Threatened flora and fauna species, populations and ecological communities that may potentially be impacted by the project were identified from the desktop study, the site habitat assessments and an analysis of the ecology of the species. These assessments drew heavily on information on the threatened species pages of the DECC website, and also included a review of existing Recovery Plans, where these exist, for those threatened species, populations and ecological communities considered to be potentially present. Potential impacts were then identified and categorised. Risk assessments were undertaken for each species (or group of species) that might potentially be impacted by the proposed actions, using the TSC Act Section 5a assessment (also known as the Seven Part Test). Where possible, mitigation measures to avoid or minimise potential impacts were recommended.

2.4 Assumptions and limitations

The presence or otherwise of a particular flora or fauna species within the study area can only be confirmed by detailed targeted field surveys. Where field sampling effort was not adequate for detecting particular threatened flora or fauna species, the precautionary principle has been applied to their potential presence within the study area (i.e. they are assumed to be potentially present).

Whilst a significant proportion of the study area is cleared and is likely to be suitable for locating infrastructure which would be required for the construction and operation of the pipeline, the specific locations for wellhead pumps, gas pipelines, secondary access roads, and other support infrastructure had not been precisely identified at the time of the assessment.

A number of properties could not be accessed during the field survey due to a lack of consent by landholders. In some cases, observations could be made from adjacent roadsides and properties. Otherwise, aerial imagery and available mapping was used to derive likely vegetation and habitat information.

Heavy rainfall before and during the present survey made access to many locations difficult. Some areas were inundated, impairing detection and identification of ground storey flora. These conditions also hindered detection of fauna and signs of fauna such as diggings and scats.

3.0 Existing Environment

3.1 Description of Survey Areas

The GFDA is approximately 3,456 ha and lies in a flat to gently sloping plain. The majority is cleared for cattle pastures and the southern section is further disturbed by an active coal mining operation. Comprehensive Regional Assessment (CRA) mapping indicates only 203 ha of the GFDA (5.9%) contains remnant native vegetation (**Figures 1** to **19**). Aerial imagery and field ground truthing support the mapping data, with most remnant vegetation contained within several blocks in the central and southern portions of the GFDA. Narrow strips of remnant vegetation also occur along the Avon River and tributaries, although these are often heavily disturbed by weeds, such as willows (*Salix* species), Wandering Jew (*Tradescantia fluminensis*), privet (*Ligustrum* species) and Peach (*Prunus persica*).

The CPF is proposed to be located near the south-western corner of the GFDA, in a cleared area within an existing rail loop. However, this exact location was not available at the time of the field assessment.

The proposed gas transmission pipeline would run 91.6 km from the GFDA to Hexham and traverse a variety of landforms, including flat plains, gently to moderately sloping hills, streams of varying sizes, swamps and one small tidal channel. The major streams transected would include the Karuah River, the Williams River and the Hunter River. The majority of the proposed pipeline would pass through cleared pastures, but it would transect or lie adjacent to a number of significant blocks of remnant vegetation. Along the proposed route, the largest areas of remnant vegetation are the eucalypt forests associated with hilly terrain along Black Camp Road and in Wallaroo National Park.

The proposed GFDA and the majority of the proposed pipeline lie within the NSW North Coast biogeographic region. The southern 18 km of the proposed pipeline lies in the Sydney Basin biogeographic region.

3.2 Protected Areas

3.2.1 RAMSAR Wetlands

The southern end of the proposed pipeline lies about 1 km upstream of the Hunter Estuary Wetlands, which is listed as a Ramsar wetland because it contains:

- unique combination of high conservation near-natural wetlands (Melaleuca swamp forest, freshwater reed marsh and coastal estuarine mangrove-lined creek) and artificial wetlands (constructed freshwater lagoons, coastal estuarine Casuarina-lined channel, model farm dam)
- ecologically diverse flora and avifauna communities that represent a significant genetic pool for wetland species in the Sydney Basin biogeographic region
- populations of at least 45 species of migratory birds listed under the EPBC Act, Japan - Australia Migratory Bird Agreement (JAMBA) and China - Australia Migratory Bird Agreement (CAMBA)
- actual or potential habitat for numerous threatened species, including the Green and Golden Bell Frog (*Litoria aurea*), Australasian Bittern (*Botaurus poiciloptilus*), Black-necked Stork (*Ephippiorhynchus asiaticus*), Comb-crested Jacana (*Irediparra gallinacea*) and Magpie Goose (*Anseranas semipalmata*).

- habitat that supports a large number of migratory shorebird species at a critical seasonal stage of their breeding cycle, including 2 to 5% of the East Asian-Australasian Flyway population of Eastern Curlew (*Numenius madagascariensis*) and more than 1 % of the Australian populations of sixteen migratory wading bird species (Smith 1991; Watkins 1993).

3.2.2 State Protected Areas

The proposed pipeline transects Wallaroo National Park for approximately 3.3 km from KP 59.8 to 63.1. The route is on the western edge of the National Park, ranging from 50 to 350 m from the western boundary. The proposed pipeline follows an existing powerline easement that contains a clearing of approximately 25 m width (**Plate 1**).

The southern end of the proposed pipeline lies about 0.8 km east of the Hexham Swamp section of the Hunter Estuary National Park and 1 km southeast of the Kooragang section of the Hunter Estuary National Park.

Two landholders with properties on or adjacent to the proposed pipeline have a Voluntary Conservation Agreement (VCA) or are currently negotiating a VCA. A VCA is a contract between landholders and the Minister for the Environment that aims to conserve the natural, cultural and / or scientific values of a property or portion of a property and restricts land uses likely to compromise these values. These properties include:

- Lot 1 DP1004421 - a property immediately east of the proposed pipeline from KP 2.3 to KP 4 (1.7 km)
- Lot 68 DP753176 - a property transected by the proposed pipeline from KP 54.1 to KP 54.9 (0.8 km).
- No protected tenures were identified within the GFDA and CPF. The western boundary of the Glen Nature Reserve lies approximately 2.5 km east of the south-eastern corner of the GFDA.

3.2.3 Significant Roadside Environment Areas

The New South Wales Roadside Environment Committee (NSW REC) has identified significant roadside environment areas within the study site and adjacent areas. NSW REC has installed signs at the start and finish of these roadside areas. Significant roadside environment areas often represent some of the last remaining native vegetation within mostly cleared landscapes and may provide ecological values such as conservation of biodiversity and cultural / historical significance, corridors for wildlife movement, buffering of adjacent ecosystems, reducing weed spread, improving waterway health, reducing land degradation and improving visual amenity.

A number of roadside areas which contained remnant vegetation within a mostly cleared landscape were observed along or adjacent to the pipeline during the field survey. These areas, listed in **Table T1**, were identified as significant roadside environment areas for the purposes of the present assessment.

3.3 Critical Habitat

No areas or habitats within the project area have been declared as critical habitat for threatened species or ecological communities under either the EPBC or TSC Acts.

3.4 Flora

During the field survey, detailed flora assessments were conducted at 22 sites and briefer flora observations were made at 59 other sites (**Figures 1** to **19**). Completed field sheets for the 22 detailed survey sites are provided in **Appendix A**. Results of the detailed flora assessments are summarised in **Table T2**.

Where possible, vegetation was assigned to existing regional and state vegetation communities, including:

- Lower Hunter and Central Coast (LHCC) Region vegetation mapping, which covers the southern section of the proposed pipeline from KP 60 to KP 91.6 (NPWS, 2000)
- Comprehensive Regional Assessment (CRA) forest ecosystem mapping for the upper and lower northeast region (NPWS, 1999)
- NSW native vegetation mapping (Keith, 2002).

A breakdown of all remnant vegetation and cleared areas along the proposed pipeline with lengths and start / end KPs is given in **Table T3**. The majority of the proposed GFDA and proposed pipeline ROW was cleared, with a dense ground cover of exotic pasture grasses. Most cleared areas had very few trees, but regrowth of native tree species was observed in some areas. Based on field and desktop information, approximately 3,253 ha (94%) of the GFDA was cleared and 81 km (88%) of the proposed pipeline ROW was cleared.

Most remnant vegetation in plain and hillslope landforms was open forest dominated by eucalypts such as Spotted Gum (*Cor. maculata*), Ironbark (*Euc. siderophloia*), Grey Gums (*Euc. punctata* and *Euc. propinqua*), Broad-leaved White Mahogany (*Euc. umbra*) and Grey Box (*Euc. moluccana*). Most sites had a relatively sparse midstorey of shrubs and sapling eucalypts, while the groundstorey was often dense, with a variety of grasses, herbs and rushes.

Most streams within the study site supported a narrow band of riparian vegetation, with cleared pastures on either side. The canopy often contained one to several dominant species, such as Grey Myrtle (*Backhousia myrtifolia*), Lillypillies (*Waterhousia floribunda*, *Syzygium* species), Snow-in-summer (*Melaleuca lineariifolia*) and Willow Bottlebrush (*Callistemon salignus*). Riparian vegetation generally supported a higher diversity of canopy species than other communities, while the ground storey was generally sparse. Emergent eucalypts were often present. Some streams (especially the Avon River in the GFDA) were heavily degraded by weeds, including willows (*Salix* species), Wandering Jew (*Tradescantia fluminensis*), Privet (*Ligustrum* species) and Peach (*Prunus persica*).

3.4.1 Threatened Ecological Communities under the EPBC Act

The EPBC Act Protected Matters Report identified one critically endangered ecological community that may potentially occur within the study site and adjacent area:

- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland.

Targeted searches were made for this ecological community during the field survey but it was not observed in the areas inspected. Furthermore, the tree species that are recognised as dominant and characteristic of this ecological community were not recorded within the areas inspected.

3.4.2 Threatened Ecological Communities under the TSC Act

The Atlas of NSW Wildlife Data Unit identified that 35 ecological communities listed as threatened under the TSC Act may potentially occur within the study area (**TableT5**). Vegetation with floristic and structural characteristics resembling six of these ecological communities was recorded within or immediately adjacent to areas inspected within the study area. Of these six communities, it is considered that five Endangered Ecological Communities occur within or adjacent to the pipeline. Each observed ecological community is discussed below.

Freshwater Wetlands

Three Endangered wetland communities were recorded along the proposed pipeline corridor:

- Freshwater Wetlands on Coastal Floodplains of New South Wales North Coast, Sydney Basin and South East Corner Bioregions - correspond to Lower Hunter and Central Coast Regional Environmental Management Strategy (LHCCREMS) map unit 46 (freshwater wetland complex) and NSW map unit 56 (coastal freshwater lagoon)
- Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner - corresponds to LHCCREMS map unit 41 (Swamp Oak sedge forest), CRA map unit 143 (Swamp Oak) and NSW map unit 50 (coastal floodplain wetland)
- Swamp Sclerophyll Forest of Coastal Floodplains of the New South Wales North Coast, Sydney Basin and the South East Corner- corresponds to LHCCREMS map unit 37 (swamp mahogany paperbark swamp forest), CRA map unit 142 (swamp mahogany) and NSW map unit 50 (coastal floodplain wetland).

Freshwater Wetlands on Coastal Floodplains were recorded within the proposed pipeline corridor at the following locations:

- an ephemeral wetland, which is dominated by sedges such as *Carex apressa* and *Juncus pallidus*, near the Williams River for about 0.9 km at approximately KP 68, including:
  - transecting the wetland for about 0.15 km (**Plate 2**)
  - transecting an artificial drainage channel, which is fringed by sedges for about 5 to 10 m
  - passing through cleared pasture just east of the wetland for 0.7 km
- passing through cleared pasture that lies in a 100 m gap between the Williams River and a sedge-dominated wetland for 0.5 km at approximately KP 66.5 (detailed site assessment at flora site 20)
- passing through cleared pasture just north of the Williams River and just south-east of a narrow strip of wetland with sedges and occasional paperbarks (about 10 m wide at approximately KP 69.2)
- passing to the east of Woodberry Swamp (mapped as a SEPP14 wetland) for about 0.8 km at approximately KP 86
- passing to the east of Tarro Swamp (mapped as a SEPP14 wetland) for about 1.2 km at approximately KP 88.

- Swamp Oak Floodplain Forests were observed along the proposed pipeline corridor at the following locations:
- passing through a 50 m wide cleared strip through an open forest dominated by Swamp Oak (**Plate 3**) for about 300 m at KP 86 (to the east of Woodberry Swamp)
- passing through cleared pasture just south of the Williams River and just south-east of a narrow strip of wetland with an open canopy of Swamp Oaks and a dense ground story of sedges (about 50 m wide at KP 70).

Swamp Sclerophyll Forest of Coastal Floodplains was recorded adjacent to the proposed pipeline for 0.2 km and is transected for about 30 m, just north of the Williams River at approximately KP 69. A detailed assessment of this community was conducted at flora site 21 (**Figures 1** to **19**, **Table T2, Plate 4**). The transected area has been partially cleared for a powerline corridor (**Plate 5**). A 10 m wide strip directly underneath the powerline is totally cleared, while the areas 10 to 20 m on either side contain well-established regenerating paperbark trees characteristic of this community. The majority of this community lies to the south-east of the proposed pipeline, with a small area also extending about 50 to 100 m to the north-west. This wetland (including the section transected by the proposed pipeline) is mapped as a SEPP 14 wetland.

Hunter Lowland Redgum Forest

A small area of Hunter Lowland Redgum Forest was recorded along Little Black Camp Creek at approximately KP 45.5 (**Plate 6**). The proposed pipeline would transect a 100 m wide strip of open forest dominated by Forest Red Gum on alluvial soils. The community was dissected by a 20 m wide clearing associated with Black Camp Creek Road. To the west of the road, the community had been partially cleared with a canopy cover of about 10%, while the eastern side was much denser with a canopy cover up to 40%. The vegetation on the western edge of the road is considered to be regrowth, while the eastern side is remnant. This community most closely resembles LHCCREMS map unit 19 (Hunter lowlands redgum forest), CRA map unit 49 (redgum / apple forest) and NSW map unit 21 (northern hinterland semi-mesic forest).

Lower Hunter Spotted Gum – Ironbark Forest

Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion is a community occurring on Permian age sediments and dominated by Spotted Gum (*Cor. maculata*) and Broad-leaved Ironbark (*Euc. fibrosa*). It is very similar to a number of Spotted Gum communities in the region, including Seaham Spotted Gum - Ironbark Forest. LHCCREMS mapping indicates that Spotted Gum - Ironbark forests along the proposed pipeline are Seaham Spotted Gum - Ironbark Forest, rather than the Endangered Lower Hunter Spotted Gum – Ironbark Forest. The present assessment supports this mapping for the following reasons:

- Ironbarks observed in this community were predominantly *Euc. siderophloia*, not *Euc. fibrosa*.
- Under story species composition was more characteristic of Seaham Spotted Gum - Ironbark Forest (e.g. *Pratia purpurascens, Leucopogon juniperensis, Lomandra multiflora*).
- Seaham Spotted Gum - Ironbark Forest occurs primarily on Carboniferous sediments, while Lower Hunter Spotted Gum – Ironbark Forest occurs primarily on Permian sediments.

Lowland Rainforest on Floodplain of the NSW North Coast Bioregion and Lowland Rainforest in NSW North Coast and Sydney Basin Bioregion

Both of these EECs are subtropical rainforest communities that are characterised by closed canopies with high floristic diversity (although disturbed stands may have a broken canopy). Lowland Rainforest in NSW North Coast and Sydney Basin Bioregion occurs in a range of high nutrient lithic substrates on coastal plains, foothills and plateaux, while Lowland Rainforest on Floodplain of the NSW North Coast Bioregion is found on floodplain alluvium.

Narrow bands of riparian forest that contain some rainforest elements are transected by the proposed pipeline in numerous locations (approximately 0.66 km) and also occur in the GFDA. These are primarily associated with the Karuah River (**Plate 8**), the Avon River and tributaries of the Avon, Karuah, Williams and Hunter Rivers. These riparian bands correspond most closely to dry rainforest communities in existing mapping (Hunter Valley dry rainforest - LHCCREMS map unit 3, Rainforest - CRA map unit 168, dry rainforest - NSW map unit 4). As they are forests with some rainforest elements on recent alluvial soils, they also resemble the EEC, Lowland Rainforest on Floodplain of the NSW North Coast Bioregion. No rainforests in the development area resemble the EEC, Lowland Rainforest in NSW North Coast and Sydney Basin Bioregion, as no rainforests occurring on lithic substrates were recorded.

The crossing points of the Karuah River (KP 19.3, 23.5, 24.3; survey sites FL 08, FL 10) support riparian vegetation with a diverse canopy storey. Common canopy species include *Syzygium australe, Waterhousea floribunda, Tristaniopsis laurina, Backhousia myrtifolia, Eucalyptus tereticornis* and *Casuarina cunninghamiana*, The first three species are included in the core species assemblage of the EEC, Lowland Rainforest on Floodplains of the NSW North Coast Bioregion. The riparian communities on the Karuah River are therefore considered to fall within the definition of this EEC. The pipeline transects approximately 240 m of this community.

However, other riparian crossings are not considered to contain Lowland Rainforest on Floodplain of the NSW North Coast Bioregion, as their canopies are dominated by species that are not characteristic of the EEC. The canopy vegetation of creeks from KP 27 to KP 62 (KP 27, KP 36.9, KP 38.3, KP 40.2, KP 49.5, KP 62.1) are dominated by a variety of species, including Paperbark species (e.g. *Melaleuca styphelioides, M. linariifolia*), Eucalypt species (e.g. *E. umbra, C. maculata*) and Grey Myrtle (*Backhousia myrtifolia*). Riparian sites examined on the Avon River and tributaries (GFDA, KP 8.4) have a very broken canopy, with common species including Paperbark species (e.g. *Melaleuca styphelioides, M. linariifolia*), Bottlebrush (*Callistemon salignus*) and Grey Myrtle (*Backhousia myrtifolia*).

3.4.3 Ecological Communities Protected under the FM Act

No specific ecological communities listed in the FM Act are likely to occur in the study area. However, mangroves, seagrasses and other marine vegetation are protected under the FM Act. Under Section 205 of the FM Act, a permit is required from DPI to harm (e.g. cut, remove, damage, destroy, shade) marine vegetation.

The proposed pipeline crosses one small occurrence of marine vegetation associated with a small tidal channel beside Hunter River at KP 90 (**Plate 7**). This channel is about 10 m wide and supports scattered mangroves, including Grey Mangrove (*Avicennia marina*). At the time of survey, landholder permission to access this site had not been granted, so survey was limited to remote observation using binoculars.

3.4.4 Other Remnant Vegetation

Eucalypt forests are the most common community type along the proposed pipeline ROW, transecting approximately 14.5 km (**Table T3).** The largest areas of eucalypt forest occur along Black Camp Road (KP 31.5 to KP 38) and in Wallaroo National Park (KP 59.8 to KP 63). Several blocks of remnant eucalypt forest are also present in the central and southern portions of the GFDA. These forests are classified as Hunter Macleay dry sclerophyll forest (unit 69) and northern hinterland semi-mesic forest (unit 21) in NSW mapping. CRA forest ecosystems that most closely correspond to these forests are ironbark (unit 71), dry foothills Spotted Gum (unit 33) and south coast Shrubby Grey Gum (unit 134). Corresponding LHCCREMS vegetation units include Seaham Spotted Gum Ironbark forest (unit 16) and Hunter Valley moist forest (unit 12).

Narrow bands of riparian forest are transected by the proposed pipeline in numerous locations (approximately 0.42 km) and also occur in the GFDA. This vegetation corresponds most closely to dry rainforest communities in existing mapping (Hunter Valley dry rainforest - LHCCREMS map unit 3, Rainforest - CRA map unit 168, dry rainforest - NSW map unit 4). The riparian communities along the Karuah River (**Plate 8**) are considered to be endangered under the TSC Act (Lowland Rainforest on Floodplain of the NSW North Coast Bioregion) and are discussed in more detail in the previous section.

Wetland communities were observed along 0.2 km of the proposed pipeline. These communities are listed as endangered under the TSC Act and are discussed in more detail in the previous section.

3.4.5 Endangered Populations

The Atlas of NSW Wildlife Data Unit identified seven endangered populations of flora species listed under the TSC Act that may potentially occur within the study site and adjacent regions (**Table T4)**. Five of these have preferred habitat which was identified within the study area during the field survey. These species / populations were targeted during the field survey, but none were observed in the areas inspected. Seven-part tests (pursuant to Section 5a of the TSC Act) for these populations are provided in **Appendix E**. They are not considered likely to occur within the boundaries of the project area and are therefore not evaluated further in this report.

3.4.6 Threatened Flora Species

Nineteen flora species known to occur or potentially occur within the study area and surrounding region are identified as being critically endangered, endangered or vulnerable under the EPBC Act and / or the TSC Act (**Table T6**). Fourteen species are listed under the EPBC Act (six endangered and eight vulnerable) and 19 species are listed under the TSC Act (seven endangered and 12 vulnerable). Of the 19 threatened species identified as potentially occurring within the greater area, 14 have preferred habitat which was identified within the study area. These species were targeted during the field study, but only one species was detected. One population of *Grevillea parviflora* subsp*. parviflora* was recorded at KP 58.9 along the proposed pipeline route.

***Grevillea parviflora* subsp*. parviflora* (Small-flower Grevillea)**

Small-flower Grevillea is listed as vulnerable in Schedule 2 of the TSC Act and vulnerable under the EPBC Act (**Plate 9**). The Wildlife Atlas database contains 46 records of this species from five localities within 20 km of the proposed alignment, all in the southern section. The majority of these records are from a population about 20 km west of the alignment.

The current survey recorded a population of Small-flower Grevillea within a previously cleared 25 m wide powerline corridor at approximately KP 59. The site supported a range of low forbs, shrubs, grasses and sedges, including *Pultenaea villosa, Daviesia ulcifolia, Themeda triandra, Entolasia stricta* and *Lepidospermum laterale*. The population extended approximately 200 m along the corridor and was estimated to contain several hundred to a thousand plants. An accurate population count was not made during the initial survey as its identity was not confirmed until a specimen was sent to the Royal Botanic Gardens, Sydney. It was also difficult to determine the extent of individual plants as they were coppicing extensively under the current regular slashing regime. An individual plant was recorded in remnant open forest approximately 0.5 km north of the main population. It is therefore likely that other populations exist in surrounding remnant vegetation (including the nearby Wallaroo National Park).

The population is regularly slashed during maintenance works for the powerline and is transected by a maintenance track. Plants were relatively prostrate and multi-stemmed, but appeared to be otherwise healthy, with most of them flowering at the time of the survey. Several plants were observed growing between the wheel ruts of the maintenance track. No specific management plan is in place for this population, as it was not previously known to be present in the easement. However, the population appears to be coping effectively with the current management regime.

NPWS (2002) noted that competition and shading from tick bush can limit the spread of this species, so regular slashing may even assist the population by reducing competition. Comparison of population sizes within the easement and surrounding native vegetation might provide circumstantial support for this possibility.

The entire powerline easement in the vicinity of this population was traversed by foot or vehicle and no other populations or individuals of this species were observed. Given the high visibility of this species at the time of survey (most plants were flowering profusely), it is considered unlikely that other significant populations were present in the powerline easement in Wallaroo National Park and nearby areas. However, it is possible that scattered individuals may be present.

Other Threatened Species

Three of the flora species potentially present are relatively large and conspicuous. As none of these species were recorded during the field survey, it is considered highly unlikely that any of these species occurs within the sites investigated. Sixteen of the identified species are smaller and less conspicuous, so are more difficult to detect during a single rapid survey. For example, the Leafless Tongue Orchid (*Cryptostylis hunteriana*) is only visible when flowering from November to February and the Eastern Underground Orchid (*Rhizanthella slateri*) grows almost entirely underground, so is usually discovered only when the soil is disturbed. Although none of these species were observed within the sites investigated during the field survey, because of their inconspicuous nature it is not possible to discount the occurrence of these species within the investigated sites.

Seven part tests for these species are provided in **Appendix E**. As not all parts of the study area could be closely inspected due to time and access limitations, it is not possible to discount the possibility that any of the identified threatened flora species occur within the study area or surrounding regions. However, it is considered unlikely that any of these species occur within the study site, especially in the areas that are heavily impacted through grazing and / or cultivation. Even if they do occur, it is very likely that they would be in very small numbers.

One undescribed orchid, closely related to *Diuris alba*, has recently been discovered in forest near KP 54.5 (Kathleen Tuohy-Main, landholder, pers. comm.). No orchids of this genus were recorded in this area or within other sites inspected during the present field survey.

No threatened or protected flora species under the FM Act are known to occur or potentially occur within the study area or adjacent regions.

3.4.7 Declared Weeds

Eight weed species that are declared under the *Noxious Weeds Act 1993* (NW Act) were recorded within or immediately adjacent to the study area (**Table T7).** Under the NW Act, weed species are classified into 5 categories:

- Classes 1 and 2: The plant must be eradicated from the land and the land kept free of the plant.
- Class 3: The plant must be fully and continuously suppressed and destroyed.
- Class 4: The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local authority.
- Class 5: The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.

Of the eight declared weeds recorded, four species are listed as Class 4 (Mistflower, Water Hyacinth, Small Leaf Privet and Blackberry) and four as Class 5 (Lantana, Onion Grass, Oxalis and Willow).

A weedy *Sporobolus* species, identified as Parramatta Grass (*S. africanus*), was recorded at several locations within the study area **(Table T7**). This species is not declared, but a very similar species, Giant Parramatta Grass (*S. fertilis*) is listed as a Class 3 weed. These two species are very difficult to distinguish, so it is possible that the declared Giant Parramatta Grass was also present at the sites where Parramatta Grass was recorded. I

A weed warning for Alligator Weed (*Alternanthera philoxeroides*) was observed for a section of the proposed pipeline at approximately KP 86. This species is listed as a Class 2 weed. No Alligator Weed was observed during the present survey, but the area had been inundated by recent rains, so young plants would be submerged and therefore not visible.

Some weed species are also recognised by the Commonwealth Government as Weeds of National Significance (WONS) based on their:

- invasiveness and impact characteristics
- potential and current area of spread
- current primary industry, environment and socioeconomic impacts.

WONS that were recorded in the proposed pipeline area included Lantana and Blackberry, but the only WONS recorded in the GFDA was Willow.

3.5 Fauna

3.5.1 Fauna Habitats

Seven vegetation communities were identified from the flora assessments as occurring in the project area (**Table T3)**. Fauna habitats within the project area can be classified more simply on the basis of the preferred habitats types of fauna species found in the project area. In this way, four broad habitat classes can be recognised (**Table T8)**, although these are not necessarily mutually exclusive:

- grasslands and pastures
- riparian and / or closed forests
- sclerophyll woodlands and forests
- open freshwater wetlands.

The most widespread of these four habitats in the project area is grasslands and pastures. About 94% of the proposed GFDA is grazed pasture and about 88% of the proposed gas pipeline passes through cleared pastures, intentionally avoiding all other habitats wherever possible. No threatened species identified as potentially occurring in the project area prefer grassland or pasture habitats.

The proposed gas pipeline crosses streams of varying sizes. Narrow bands of riparian forest are intersected by the proposed pipeline in numerous locations and also occur in the GFDA. These are primarily associated with the Avon River and the Karuah River and tributaries of the Avon, Karuah, Williams and Hunter Rivers. Up to 11 threatened fauna species potentially occur in riparian habitats along the proposed pipeline route, especially at the Karuah River.

The proposed pipeline route passes through or lies adjacent to a number of significant blocks of remnant vegetation. The largest remnant areas are eucalypt forests associated with hilly terrain along Black Camp Road and in Wallaroo National Park. The forests along Black Camp Road are the tallest, most closed and most moist forests on the proposed route. Several semi-mesic and dry forest types dominated by eucalypts occur here. There is potential for several threatened fauna species reliant on mesic forests to occur in these forests (e.g. forest owls, Yellow-Bellied Glider), although being fairly dry the habitat is marginal for such species.

A large number of threatened fauna species identified as potentially occurring in the project area (over 30) prefer to inhabit drier woodlands and open forests. By strict definition, true woodlands were not recorded in the project area, although the distinction between these and open forests is gradual. Open forests in or adjacent to the project area occur along Black Camp Road and in Wallaroo National Park, as well as in small patches scattered along the proposed pipeline route. Single paddock trees (particularly large old-growth trees with numerous hollows) can potentially comprise important habitat for several threatened species (e.g. Barking Owl, micro-bats). A number of roadside areas which contained remnant vegetation within a mostly cleared landscape were observed along or adjacent to the proposed pipeline route during the field survey (**Table T1)**. These areas could potentially provide important habitat, particularly movement corridors for threatened woodland fauna species.

Open freshwater wetlands and timbered freshwater wetlands were recorded along the proposed pipeline route at several locations, generally between KP 66 and KP 89 (**Section 3.4.2**). Several threatened species (water birds and frogs) potentially occur in theses habitats. The Green and Golden Bell Frog, which is listed as endangered and is reliant on open freshwater wetlands, has previously been recorded at 140 locations within 5 km of the project site.

3.5.2 Endangered Populations

The Atlas of NSW Wildlife Data Unit identified two endangered populations of fauna species listed under the TSC Act that may potentially occur within the study site and adjacent regions (**Table T4)**. Seven-part tests (pursuant to Section 5a of the TSC Act) for these populations are provided in **Appendix E**. Neither of these fauna populations has preferred habitat which occurs in the study area and neither was observed during the field surveys. They are not considered likely to occur within the boundaries of the project area and are therefore not evaluated further in this report.

3.5.3 Threatened Fauna

The desktop search revealed 81 threatened fauna species previously recorded from the broader study area surrounding the proposed project footprint (i.e. the three search-area boxes described in **Section 2.1**). As a first stage screening process these species were separated into two groups based on the likelihood of their occurrence in the project area:

- Group 1: Species classed as potentially occurring in the project area because suitable potential habitat was recorded in or adjacent to the proposed project footprint or because previous records exist from within 5 km of the proposed footprint.
- Group 2: Species classed as unlikely to occur in the project area because suitable potential habitat was not recorded in or adjacent to the proposed project footprint and because no previous records were found from within 5 km of the proposed footprint.

Table T9 lists the 47 threatened fauna species from Group 1 (potentially occurring in the project area) along with their legislative status and a brief summary of their distribution, ecology and habitat requirements. A seven-part test pursuant to Section 5a of the TSC Act was undertaken for each of these species (**Appendix E**). All 47 species are listed as either vulnerable or endangered under the TSC Act and 10 species are also listed as either vulnerable or endangered under the EPBC Act (**Table T16)**. This group is comprised of 3 amphibians, 2 reptiles, 24 birds and 18 mammals. Of the birds, 18 are woodland or forest species and six are wetland species. Of the mammals, 9 are bats. Only one threatened species, the Grey-crowned Babbler (*Pomatostomus temporalis*) was recorded during the survey at KP 4, KP 36.9 and KP 39.5.

Table T10 lists the threatened fauna species from Group 2 (unlikely to occur in the project area) along with their legislative status, a brief summary of their distribution, ecology and habitat requirements, and a statement on why they were not assessed in further detail.

3.5.4 Migratory and Marine Protected Birds

A total of 21 bird species listed as Migratory and / or Marine under the EPBC Act were identified as potentially occurring within the project area. It is considered unlikely that the proposed development would have impacts of national significance on any of these species. **Table T11** summarises the distribution, ecology, habitat requirements and assesses the potential impacts for these 21 bird species.

3.5.5 Koalas in the Port Stephens LGA.

The *Port Stephens Council Comprehensive Koala Plan of Management* (Port Stephens Council 2002; CKPoM*)* was prepared under SEPP 44 to establish a management framework for Koalas and their habitat in the Port Stephens LGA. The CKPoM is described in **Appendix D**.

The pipeline transects two Koala Management Units defined in the CKPoM:

- The Balickera Management Unit from KP 59.7 to KP 66.8
- The Western Management Unit, from from KP 66.8 to KP 79.7.

The proposed pipeline avoids all *Preferred* and *Supplementary* Koala habitat mapped in the Balickera Management Unit.

The proposed pipeline skims the edge of narrow slivers of *Preferred* habitat between KP 61.0 and KP 62.5 where it follows the existing pipeline easement through Wallaroo National Park. The easement is mapped as cleared *Buffer* zone habitat.

The pieline will transect a small patch or habitat mapped as *Marginal* for about 50 m at KP 66.3. The pieline will also transect a small patch or habitat mapped as *Marginal* for 50 m at KP 66.7.

From KP 67.7 to KP 68.8 the proposed pipeline follows an existing easement on the north-east side of the Willimas River, traversing cleared habitat mapped as *Buffer*, and skirting habitat mapped as *Preferred*.

The proposed pipeline avoids all *Preferred* and *Supplementary* Koala habitat mapped in the Western Management Unit.

The proposed pipeline skirts riparian habitat mapped as *Preferred* from KP 68.8 to KP 69.5. It transects three very small patches of habitat mapped as *Marginal* between KP 70.1 and KP 71.1. The pipeline threads through a gap in habitat mapped as *Preferred* at KP 73.7. The pipeline route utilises an existing easement to avoid habitat mapped as *Marginal* from KP 73.8 to 76.9.

The CKPoM recognises the threat that bushfires pose to Koalas and Koala habitat and the importance of considering the welfare of Koalas. Both of these issues are considered in detail in **Section 4** and **Section 5** of this report.

3.5.6 Introduced Species

Four introduced mammal species were recorded during the field surveys. European Rabbit (*Oryctolagus cuniculus*) was observed at KP 4 and KP 50.5. Brown Hare (*Lepus capensis*) was observed in remnant eucalypt forest in the GFDA. Scats of Red Fox (*Vulpes vulpes*) were collected in the GFDA and along the proposed pipeline at KP 19 (Karuah River). Most Red Fox scats contained remains of House Mouse (*Mus musculus*).

A number of other introduced mammal and bird species are likely to occur in the project area. The proposed development activities are not likely to lead to any change in the status, abundance or distribution of introduced fauna species in the local area, region, state or country.

4.0 Potential Impacts

4.1 Introduction

The potential impacts discussed here are based on desktop studies of the project area and field investigations of the sections that were considered most at risk of negative impacts from construction and maintenance activities. Legislation and regulations relevant to the assessment of potential ecological impacts of the proposed development are summarised in **Appendix D**. A matrix table of potential impacts and the environmental values (pursuant to the EPBC and TSC Acts) that they potentially could impact on is provided in **Table T14**. Assessments of environmental values (i.e. threatened species and ecological communities) are provided in **Appendix E.**

Potential impacts arising from the proposed development can be classed as those that are reversible and those that are non-reversible. The most wide-spread impact likely to arise from the proposal is the loss of native vegetation (**Section 4.2**, **Table T14**). However, this is largely a reversible impact. Once the proposed pipeline has been constructed, there is potential to allow tree, shrub and ground storey vegetation to naturally re-establish over all but the area immediately over the pipeline and shallow-rooted vegetation directly over the pipeline itself. Keeping a 3 m strip on either side of the proposed pipeline free of trees and shrubs may be all that is necessary to protect the pipe from potential root damage and facilitate ongoing pipeline inspection and necessary maintenance. As such, subject to landholder property management practices, it is expected that over the medium term (typically around 20 years) significant portions of the proposed pipeline construction footprint would naturally regenerate.

The proposed pipeline is likely to be decommissioned within several decades. The impacts associated with clearing for construction and maintenance of the pipeline are considered to be reversible within all vegetation communities within the medium term and potentially within 10 years.

4.2 Removal of Native Vegetation

Native vegetation is made up of plant communities that comprise primarily indigenous species and have a structure resembling that of the undisturbed community. It includes canopy trees (where present), understorey, ground cover and below ground biomass (roots, bulbs and the seed bank). Removal of native vegetation not only affects the plant species removed but also reduces habitat (feeding, breeding, roosting and sheltering resources) for native fauna species. Numerous impacts can result from clearing native vegetation (DECC, 2005), including:

- Destruction of habitat causing a loss of biological diversity, which may result in total extinction of species or loss of local genotypes.
- Fragmentation of populations resulting in limited gene flow between small isolated populations, reduced potential to adapt to environmental change and loss or severe modification of the interactions between species.
- Riparian zone degradation, such as bank erosion leading to sedimentation that affects aquatic communities.
- Disturbed habitat which may permit the establishment and spread of exotic species that may displace native species.
- Loss of leaf litter, removing habitat for a wide variety of vertebrates and invertebrates.

- There are numerous threatened species, populations and ecological communities adversely affected by the clearing of native vegetation. "*Clearing of native vegetation*" is listed as a key threatening process in Schedule 3 of the TSC Act and "*Land Clearing*" is listed as a key threatening process under the EPBC Act.

Impacts potentially arising from removal of native vegetation have particular relevance in this proposal for a number of protected areas, threatened ecological communities, threatened flora species and threatened fauna species that have been recorded in the study area or wider locality (**Table T14**). More specific details for each environmental value potentially impacted are provided in **Appendix E**.

Approximately 203 ha of the GFDA (5.9%) contains remnant native vegetation. While the exact locations of wells have not been finalised, it is unlikely that any of this remnant vegetation would be cleared or disturbed for construction and operation of wells, with appropriate mitigation as described in **Section 5.0**. Installation of flowlines for transporting gas may require clearing of narrow strips within riparian areas. The area of riparian vegetation impacted by flowlines cannot be accurately determined until locations of wells and associated flowlines are resolved. However, measures recommended in **Section 5.0** will be generally applicable to avoiding, minimising and / or mitigating potential impacts of flowlines on riparian areas within the GFDA.

The following principles would be used to locate gas wells and flowlines:

- not within 200 m of existing residences or as required to meet project noise goals
- minimum of 40 m from a watercourse
- avoiding vegetation and riparian areas
- avoiding Indigenous and European heritage places or items
- located adjacent to existing fence lines and access tracks where possible
- located on relatively flat ground, where possible
- considering visual effects and opportunistic use of natural screening such as vegetation
- considering land use and landowner preferences.

Approximately 16.4 km of remnant native vegetation is transected by the proposed 92 km pipeline route. Clearing may also be required for other construction requirements (e.g. access tracks, batch plants, stockpile and storage areas etc.). While exact locations for these requirements were unknown at the time of reporting, it is anticipated that these would be located in existing cleared areas as far as possible to reduce the total area of vegetation loss.

Clearance figures for each scenario are summarised for each vegetation community in **Table T13**. To help consider the significance of this proposed clearing in a regional context, the table also shows the estimated area of each vegetation community that occurs within a 5 km buffer centred on the proposed pipeline route (i.e. an area extending 5 km either side of the route). Comparisons were made with CRA mapping (NPWS, 1999), which covers the entire route, and with LHCC mapping (NPWS, 2000), which provides higher resolution mapping but covers only the southern third of the route.

A worst case scenario is shown in **Table T13** to illustrate a comparison with the confirmed pipeline clearance requirements. This worst case scenario (Scenario 1 in **Table T13**) is based on a consistent 30 m ROW along the entire length of the pipeline route. However, this will not be the construction approach and has been included for comparison purposes only.

This assessment has identified defined points where a reduced ROW should be employed to reduce or avoid impacts. It also identified areas where an HDD construction technique should be employed to further reduce impacts.

Under scenario 1 (entire 30 m ROW is remnant vegetation and all native vegetation is cleared), a maximum of 49.3 ha of remnant vegetation would be cleared for the proposed pipeline. This represents only 0.13% of the estimated remaining vegetation within the 5 km buffer based on CRA mapping and 0.2% based on LHCC mapping.

However, the following measures have been included in this project:

- Areas of the full 30 m ROW can utilise existing power easements that have already been largely cleared with some regrowth native vegetation (known as free width).
- Reduction to a 20 m wide ROW where specific ecological features have been identified to minimise direct impacts.
- Employment of the HDD construction technique at the Karuah River to avoid any clearing of riparian rainforest communities that are identified as the EEC, Lowland Rainforest on Floodplain of the NSW North Coast Bioregion.
- Alignment of the pipeline through the existing cleared easement within the Wallaroo National Park, utilising a reduced ROW. No additional clearing will be undertaken through this section.

All of these measures have been included in the project where possible. In some areas, however, a reduced 20 m wide ROW may not be able to be achieved due to other physical constraints. In addition, where existing easements are utilised, some minor areas of vegetation regrowth may still need to be cleared. As such, the actual clearance of native vegetation is anticipated to be between 16.72 ha (which is the lowest possible amount of clearing based on achieving the 20 m ROW in all required locations and free width of existing cleared easements) to 25 ha.

The potential impacts on each protected area and vegetation community are considered further in the following sections.

4.2.1 Protected Areas

Wallaroo National Park

The proposed pipeline transects Wallaroo National Park for approximately 3.3 km, following an existing powerline easement that contains a clearing of approximately 25 m width. Construction would be restricted to the existing ROW and no additional clearing would be undertaken within Wallaroo National Park.

Nature Refuge

A proposed Nature Refuge in Lot 68 DP753176 is transected by the proposed pipeline for approximately 0.8 km. The pipeline follows an existing powerline easement of approximately 40 m width. Construction would be restricted to the existing ROW and no additional clearing would be undertaken within the Nature Refuge area.

SEPP 14 wetlands

The pipeline transects one section of Swamp Sclerophyll Forest for about 30 m, which is mapped as a SEPP 14 wetland. This wetland is also an EEC and discussed in more detail in the following Section. If the full 30 m ROW was cleared, a maximum of 0.09 ha of wetland would be removed.

Clearing could be reduced by use of an existing 10 m clearing within the powerline easement and / or by reducing the clearing width in this short section. Dependent on further investigations, it may be possible to avoid any clearing of this community by rerouting of the proposed pipeline about 100 m to the west or by use of HDD beneath this area.

4.2.2 Threatened Vegetation Communities

No communities listed as threatened under the EPBC Act or FM Act were recorded within the proposed GFDA or pipeline route. Five Endangered Ecological Communities listed in the TSC Act were observed in the proposed pipeline route: three wetland communities, one rainforest community and one eucalypt forest. None of these communities was observed in the GFDA.

Freshwater Wetlands on Coastal Floodplains

One small section of Freshwater Wetland on Coastal Floodplains of New South Wales North Coast, Sydney Basin and South East Corner Bioregions was transected by the proposed pipeline near the Williams River at approximately KP 68. If the full 30 m ROW is cleared, a maximum of 0.45 ha of wetland would be removed (**Table T13**). This represents about 2% of the entire wetland patch at this site, which is approximately 24 ha in extent. Based on LHCCREMS mapping (which only covers the southern third of the study area), 2970 ha of freshwater wetland complex remains within the 5 km buffer area). The maximum clearing proposed by this development therefore represents only 0.02% of the estimated total extent in the buffer area. Therefore, this impact would not be considered significant.

Several other areas of Freshwater Wetlands on Coastal Floodplains lie adjacent to the proposed pipeline, so they could be disturbed by indirect impacts such as altered hydrology, movement of sediments, nutrients and pollutants, disturbance of wildlife during construction and introduction and spread of wetland weeds.

Table T14 lists environmental values that could be affected by these potential impacts. These values include wetland areas listed under Ramsar and SEPP 14 and potential habitat for up to six threatened flora species. In addition, fringing and emergent vegetation in and surrounding wetland habitats provides potential habitat for up to six threatened water birds and the Green and Golden Bell Frog. The potential impacts to these environmental values are assessed in **Appendix E**, and they could be potentially significant if they were not mitigated. Therefore, **Recommendations 4, 6, 10, 12, 13, 14, 15, 17** and **18** in **Section 5** outline measures specifically designed to avoid potentially significant impacts.

Swamp Oak Floodplain Forests

Several areas of Swamp Oak Floodplain Forest lie adjacent to the proposed pipeline, including a 300 m section of Swamp Oak forest to the east of Woodberry Swamp at KP 86 and a 50 m section just south of the Williams River at KP 70. Although these areas would not be directly impacted, they could be disturbed by indirect impacts such as altered hydrology, movement of sediments, nutrients and pollutants, disturbance of wildlife during construction and introduction and spread of wetland weeds.

Table T14 lists environmental values that could be affected by these potential impacts. These values include wetland areas listed under Ramsar and SEPP 14 and potential habitat for up to six threatened flora species. In addition, fringing and emergent vegetation in and surrounding wetland habitats provides potential habitat for up to six threatened water birds and the Green and Golden Bell Frog. The potential impacts to these environmental values are assessed in **Appendix E**, and they could be potentially significant if they were not mitigated. Therefore, **Recommendations 4, 6, 7, 8, 10, 12, 13, 14, 15, 17** and **18** in **Section 5** outline measures specifically designed to avoid potentially significant impacts.

Swamp Sclerophyll Forest of Coastal Floodplains

Swamp Sclerophyll Forest of Coastal Floodplains was recorded adjacent to the proposed pipeline for 0.2 km and is transected for about 30 m, just north of the Williams River at approximately KP 69. This wetland is mapped as a SEPP 14 wetland. If the full 30 m ROW was cleared, a maximum of 0.09 ha of swamp sclerophyll forest would be removed. This represents about 1.7% of the community at this site and only 0.03% of the community within the 5 km buffer (based on LHCC mapping). Clearing could be reduced by use of an existing 10 m clearing within the powerline easement and / or by reducing the clearing width in this short section. Dependent on further investigations, it may be possible to avoid any clearing of this community by rerouting of the proposed pipeline about 100 m to the west or by use of HDD beneath this area.

The proposed pipeline also lies adjacent to this wetland for approximately 200 m, so could cause indirect impacts such as altered hydrology, movement of sediments, nutrients and pollutants, disturbance of wildlife during construction and introduction and spread of wetland weeds.

Table T14 lists environmental values that could be affected by these potential impacts. These values include wetland areas listed under SEPP 42 and potential habitat for up to six threatened flora species. In addition, fringing and emergent vegetation in and surrounding wetland habitats provides potential habitat for up to six threatened water birds and the Green and Golden Bell Frog. The potential impacts to these environmental values are assessed in **Appendix E** and they could be potentially significant if they were not mitigated. Therefore, **Recommendations 4, 6, 7, 8, 10, 12, 13, 14, 15, 17** and **18** in **Section 5** outline measures specifically designed to avoid potentially significant impacts.

Hunter Lowland Redgum Forest

A 100 m section of Hunter Lowland Redgum Forest was transected by the proposed pipeline route along Little Black Camp Creek at approximately KP 45.5.

The requirement for clearing could be reduced by utilising the existing 20 m wide clearing associated with Black Camp Creek Road and using a reduced ROW through this section of the alignment. This would reduce the clearing requirements to a maximum of 0.1 ha. Impacts could also be reduced by utilising the western edge of the road, which has been partially cleared with a canopy cover of only 10%.

Table T14 lists environmental values that could be affected by the proposed development, assuming no mitigation. **Appendix E** assesses potential impacts and identifies measures to avoid and mitigate impacts. **Recommendations 4, 6, 7, 8, 11, 12, 13, 14, 15, 17 and 18** in **Section 5** outline measures specifically designed to avoid potentially significant impacts.

Lowland Rainforest on Floodplain of the NSW North Coast Bioregion

The proposed alignment transects three narrow bands of Lowland Rainforest on Floodplain of the NSW North Coast Bioregion, totalling approximately 240 m, where it crosses the Karuah River (KP 19.3, 23.5 and 24.3). Conventional construction methods would require clearing of up to 0.72 ha of this community.

HDD techniques are proposed for all crossings of the Karuah River, which would avoid any clearing of this EEC. Therefore, potential impacts are likely to be limited to indirect impacts such as altered hydrology, movement of sediments, nutrients and pollutants, disturbance of wildlife during construction and introduction and spread of riparian weeds.

Table T14 lists environmental values that could be affected by the proposed development, assuming no mitigation. **Appendix E** assesses potential impacts and identifies measures to avoid and mitigate impacts. **Recommendations 4, 6, 11, 12, 13, 14, 15** and **17** in **Section 5** outline measures specifically designed to avoid potentially significant impacts.

4.2.3 Other Remnant Vegetation

In addition to ecological communities listed as threatened under the EBPC Act and / or the TSC Act, vegetation communities occur in the project area that are not listed themselves, but which provide potential or known habitat for listed threatened species of flora and / or fauna.

Marine Vegetation

The proposed pipeline crosses one small tidal channel beside Hunter River at KP 90. This channel is about 10 m wide and supports scattered mangroves. Approximatly 0.04 ha of mangroves potentially could be removed (depending on the construction method) for the proposed development (**Table T12** and **Table T13)**.

Riparian Rainforest

Excluding riparian communities along the Karuah River (which are discussed under the EEC Lowland Rainforest on Floodplain of the NSW North Coast Bioregion in Section 3.4.2), the proposed pipeline transects 10 streams that support riparian rainforest vegetation, totalling approximately 0.42 km. This would require removal of up to 1.26 ha of rainforest if the full 30 m ROW was cleared. This represents about 0.7% of this community within the 5 km buffer based on CRA mapping and 0.3% based on LHCC mapping. Using existing clearings and reducing clearing width at stream crossings would further reduce this figure. For example, using a 20 m ROW would require only 0.77 ha of clearing.

Pipeline construction may also impact indirectly on downstream riparian environments through altered hydrology, erosion, movement of sediments, nutrients and pollutants, disturbance of wildlife during construction and introduction and spread of riparian weeds.

Eucalypt forests

The proposed pipeline transects approximately 15.5 km of remnant eucalypt forests. If the full 30 m ROW was cleared, a maximum of 46.6 ha of eucalypt forest would be removed. This represents less than 0.2% of eucalypt communities within the 5 km buffer based on CRA mapping. Clearing would be reduced to 34.4 ha if existing unobstructed clearing within tracks and powerline easements could be utilised within the 30 m ROW. Existing clearings include the 5 m roadway along Black Camp Road and 5 to 10 m strips beside power transmission towers. This figure could be further reduced to 18.9 ha if clearing could be confined to a 20 m ROW. If clearing of vegetation could be avoided within Wallaroo National Park, total clearing of eucalypt forest would drop to 15.6 ha.

The clearing of vegetation and associated direct and indirect impacts could potentially affect a national park, a nature reserve, and areas of wetlands listed under SEPP 14, as well as up to 14 flora species and up to 47 fauna species listed as threatened under the EPBC Act and / or the TSC Act (**Table T14)**. The potential impacts to these environmental values are assessed in **Appendix E**, and they and they could be potentially significant if they were not mitigated. Therefore, **Recommendations 4, 5, 6, 7, 8, 12, 13, 14, 15, 17** and **18** in **Section 5** outline measures specifically designed to avoid potentially significant impacts.

4.3 Loss of Hollow-Bearing Trees

Tree hollows are cavities formed in the trunk or branches of a living or dead tree. Hollows are usually more characteristic of older, mature to over-mature trees. Hollows may develop in the trunk and branches of trees as a result of wind breakage, lighting strikes, fire and / or following the consumption and decay of internal heartwood by fungi and invertebrates, primarily termites. Hollow entrances are more common in larger trunks and branches because damage is less likely to be covered by growth of external sapwood (DECC, 2005).

Hollows occur primarily in old eucalypt trees, and are uncommon in many other native and introduced species such as wattle (*Acacia*), cypress pine (*Callitris*), she-oak (*Allocasuarina*) and pine (*Pinus*). The presence, abundance and size of hollows are positively correlated with tree trunk diameter, which is an index of age. Hollows with large internal dimensions are the rarest and occur predominantly in large old trees, which are rarely less than 220 years old. Larger, older trees also provide a greater density of hollows per tree. As such, large old hollow-bearing trees are relatively more valuable to hollow-using fauna than younger hollow-bearing trees. The latter are important as a future resource (DECC, 2005).

Mature and old hollow-bearing trees offer other valuable resources. Mature trees provide more flowers, nectar, fruit and seeds than younger trees, and a complex substrate that supplies diverse habitats for invertebrate populations. When hollow-bearing trees collapse or shed limbs, they also provide hollow logs that serve as important foraging substrates and shelter sites (DECC, 2005). Hollow-bearing trees can be considered a finite resource in the study area, given the long time periods involved with the ontogeny of hollow development (Wormington and Lamb, 1999) and that the repercussions of the removal of hollow-bearing trees from an area may persist for several hundred years (Gibbons and Lindenmayer, 2002).

Some hollow-bearing trees may be removed by the proposal. "*Loss of hollow bearing trees*" is listed as a key threatening process under Schedule 3 of the TSC Act.

Impacts potentially arising from a loss of hollow-bearing trees have particular relevance in this proposal for up to 20 threatened fauna species listed under the TSC and EPBC Acts that are dependent on hollows and definitely or potentially occur in the study area or locality (**Table T14**). An assessment of potential impacts that could occur is provided for each of these species in **Appendix E**. These potential impacts could be potentially significant if they were not mitigated. Therefore, **Recommendation 7** in **Section 5** outline measures specifically designed to avoid potentially significant impacts.

4.4 Removal of Dead and Fallen Timber

Dead wood and dead trees provide essential habitat for a wide variety of native animals and are important to the functioning of many ecosystems. The removal of dead wood can have a range of environmental consequences, including the loss of habitat (as they often contain hollows used for shelter by animals), disruption of ecosystem processes and soil erosion (DECC 2005).

Removal of dead old trees (either standing or on the ground) results in the loss of important habitat such as hollows and decaying wood (Gibbons and Lindenmayer, 2002) for a wide variety of vertebrates, invertebrates and microbial species and may adversely affect numerous threatened species. The proposal has the potential to remove dead and fallen timber wherever it occurs within the proposed pipeline footprint. "*Removal of dead wood and dead trees*" is listed as a Key Threatening Process under Schedule 3 of the TSC Act.

Impacts potentially arising from the removal of ground debris have particular relevance in this proposal for a number of threatened fauna species, in particular a large suite of woodland birds that are reliant on fallen timber and have been recorded or have the potential to occur in the study area.

This potentially could have direct and indirect impacts on a national park, a nature reserve, and areas of wetlands listed under SEPP 14, as well as up to five ecological communities and up to 22 fauna species listed as threatened under the EPBC Act and / or the TSC Act (**Table T14)**. The potential impacts to these environmental values are assessed in **Appendix E**. **Recommendation 8** in **Section 5** outlines measures designed to avoid, minimise and / or mitigate these potential impacts.

4.5 Removal of Rock

Rocks serve many purposes in the natural environment. They provide habitat for many plants and animals, some of which are threatened. Many animals use rocks and rocky environments for shelter, to hide from predators, find food, avoid extreme weather conditions and escape bushfires. Bushrock is also known to provide egg-laying sites for reptiles (DECC, 2005). A number of reptile species are highly dependent on rocks for both protection and the thermal characteristics of rock shelters, and may become locally extinct in areas from which loose rocks and rock outcrops have been removed or destroyed (Shine et al., 1998; Webb and Shine, 2000; Shah et al., 2004).

"*Bushrock removal*" is listed as a Key Threatening Process under Schedule 3 of the TSC Act.

Impacts potentially arising from removal of rock have little relevance in this proposal because little if any outcropping rock and no rocky escarpment occur in the GFDA or the proposed pipeline route and no threatened species reliant on rocky microhabitats are likely to occur in the project footprint. Spotted-tailed Quoll can be impacted on by removal of rock where it occurs in rocky areas (DECC, 2005) but the species also occurs in areas without rock (Edgar and Belcher, 1995). **Recommendation 9** in **Section 5** outlines measures designed to avoid, minimise and / or mitigate potential impacts that might arise in the unlikely event that areas of bush rock were encountered in the proposed construction footprint.

4.6 Creation of Edge Effects

Indirect impacts of the proposed development may potentially include the increase or extension of edge effects where the proposed pipeline would run adjacent to previously undisturbed vegetation. Edge effects are caused by changed environmental conditions and may include alterations to light, wind, temperature and runoff along the edges of vegetated areas. Increased light exposure may lead to a reduction in the amount of water available due to increased evaporation and / or evapo-transpiration. Other potential edge effects resulting from the proposed development include further establishment of weeds and modification of habitat to the disadvantage of forest fauna assemblages and advantage of edge-specialist assemblages. This may result in changes to species composition in these areas. Bali (2000) concluded that effects from a new edge would extend at least 50 m towards the interior of the habitat.

Impacts potentially arising from edge effects have particular relevance in this proposal wherever the proposed pipeline would run through or immediately adjacent to timbered habitats. These potentially could have direct and indirect impacts on a national park, a nature reserve, and areas of wetlands listed under SEPP 14, as well as up to four ecological communities and up to 13 fauna species listed as threatened under the EPBC Act and / or the TSC Act (**Table T14)**. The potential impacts to these environmental values are assessed in **Appendix E.** Since the majority of the proposed route has been cleared previously and the landscape is highly fragmented, the potential impacts are not considered to be significant. Nevertheless, recommendations relating to vegetation clearing and rehabilitation in **Section 5** outline measures designed to avoid, minimise and / or mitigate these potential impacts.

4.7 Spread of Environmental Weeds

Several noxious weeds (**Table T7**) and numerous environmental weeds are present in the study area. Environmental weeds have many severe impacts on Australian environments, including smothering of native vegetation, competition with native vegetation, prevention of seedling recruitment and alteration of fire regimes. There is potential to spread weeds and increase their areas of infestation during the construction phase of the proposed development, during ongoing maintenance activities, and through modified drainage patterns. Schedule 3 of the TSC Act lists four Key Threatening Processes related to weed invasion:

- "invasion and establishment of exotic vines and scramblers"
- "invasion of native plant communities by bitou bush and boneseed"
- "invasion of native plant communities by exotic perennial grasses"
- "invasion, establishment and spread of lantana".

This potentially could have direct and indirect impacts on a national park, a nature reserve, and areas of wetlands listed under Ramsar and SEPP 14, as well as up to five ecological communities, up to 14 flora species and up to 19 fauna species listed as threatened under the EPBC Act and / or the TSC Act (**Table T14)**. The potential impacts to these environmental values are assessed in **Appendix E**, and they could be potentially significant if they were not mitigated. Therefore, **Recommendation 15** in **Section 5** outlines measures specifically designed to avoid potentially significant impacts.

4.8 Maintenance of the Easement

The actions associated with easement maintenance are recognised as threats to some listed flora species in NSW. Activities which can cause negative impacts include slashing, clearing of regrowth, spraying of weeds, fire, and trampling by vehicles and machinery. Priority action statements to address these potential impacts generally require that where threatened species or their potential habitats occur, planning and maintenance staff are made aware of threatened species before road, trail, or easement maintenance activities commence and processes are in place to avoid impacting upon them.

Impacts potentially arising from maintenance of the easement have particular relevance in this proposal to the population of Small-flower Grevillea (*Grevillea parviflora* subsp. *parviflora*) recorded during the field surveys within a previously cleared 25 m wide powerline corridor at approximately KP 59. The NPWS Threatened Species Information Sheet for Small-flower Grevillea (NPWS, 2002) identifies that the species often occurs in slightly disturbed areas such as easements. Therefore, widening and maintenance of easements and vehicular use are recognised threats to populations. High frequency fire may impact on populations and it is important that the interval between successive fires is sufficient to allow adequate accumulation of seeds in the soil seedbank for subsequent seedling recruitment. Although Small-flower Grevillea is not dependant solely on regeneration from seed, this form of regeneration is important for maintaining genetic diversity within populations.

Activities associated with maintenance of the easement potentially could have direct and indirect impacts on a national park, a nature reserve, and areas of wetlands listed under SEPP 14, as well as up to three ecological communities, up to 14 flora species and up to four fauna species listed as threatened under the EPBC Act and / or the TSC Act (**Table T14)**. The potential impacts to these environmental values are assessed in **Appendix E**. **Recommendation 19** in **Section 5** outlines measures designed to avoid, minimise and / or mitigate these potential impacts.

4.9 Excavation Works

Many fauna species burrow or shelter in deep cracks in soil. There is potential for direct impact on some fauna species from being unearthed during construction of the proposed pipeline trench. While many larger and more mobile fauna such as birds, macropods and larger reptiles are likely to move away from the disturbance resulting from construction, smaller burrowing fauna (especially nocturnal species) are likely to remain under the surface and therefore risk being dug up and injured or killed. A broad range of burrowing and crack-dwelling fauna including frogs, lizards, snakes and small mammals are potentially present along the entire length of the proposed pipeline route.

To facilitate the laying of the pipeline, an open trench would be required. The trenching would be progressive and therefore the full length of the proposed pipeline would not be open at any given time. The open trench provides a temporary barrier to movement of ground-dwelling fauna. Ground-dwelling species, particularly smaller species such as reptiles and amphibian are also at risk of falling into open trenches, becoming trapped by the steep banks and being exposed to overheating, dehydration, predation and / or drowning. Fauna entrapment within proposed pipeline trenches has been recognised as a key environmental issue by the Australian Pipeline Industry Association Code of Environmental Practice (APIA, 2005). A broad range of ground-dwelling fauna species occurs in the project area.

Published information from other Australian pipeline projects has demonstrated that pipeline trenches can entrap high numbers of a wide diversity of terrestrial animals (including threatened species), particularly reptiles, frogs and small mammals, with the potential for very high levels of mortality (Ayers and Wallace, 1997; Woinarski et al., 2000; Doody et al. 2003, Wilson and Swan, 2004; Wilson, 2005).

Small-flower Grevillea relies on underground rhizomes for regeneration following fire. Excavation of the trench has the potential to inadvertently remove and destroy these rhizomes, where a population occurs within a previously cleared 25 m wide powerline corridor at approximately KP 59.

Excavation works may also impact indirectly on ecological values by exposing potential acid sulphate soils (PASS). These soils mostly occur below 5 m ASL, so are most likely to occur in the southern end of the proposed pipeline route, especially in low-lying wetlands and tidal areas where soils are often saturated. PASS contain iron sulfides, which form sulfuric acid when exposed to atmospheric oxygen. As well as impacting the local environment, acids can leach into surrounding ground and surface waters. If large quantities of PASS were disturbed in the southern section of the pipeline, acid leachate could impact on the lower Hunter estuary, including the Ramsar listed Hunter Estuary Wetlands.

This potentially could have direct and indirect impacts on a national park, a nature reserve, and areas of wetlands listed under SEPP 14, as well as up to five ecological communities, up to two flora species and up to 10 fauna species listed as threatened under the EPBC Act and / or the TSC Act (**Table T14)**. Excavation works could also indirectly impact on the Ramsar wetland. The potential impacts to these environmental values are assessed in **Appendix E**, and they could be potentially significant if they were not mitigated. Therefore, **Recommendations 3, 14** and **16** in **Section 5** outline measures specifically designed to avoid potentially significant impacts.

4.10 Soil Compaction

Small-flower Grevillea relies on underground rhizomes for regeneration following fire. Soil compaction from construction machinery and easement maintenance vehicles has the potential to inadvertently destroy these rhizomes, where a population occurs within a previously cleared 25 m wide powerline corridor at approximately KP 59. Soil compaction may also impair regeneration of vegetation following construction and result in increased erosion and sediment loss.

This potentially could have direct and indirect impacts on a national park, a nature reserve, and areas of wetlands listed under SEPP 14, as well as up to five ecological communities, up to one flora species and up to three fauna species listed as threatened under the EPBC Act and / or the TSC Act (**Table T14)**. The potential impacts to these environmental values are assessed in **Appendix E**. **Recommendations 14** and **16** in **Section 5** outline measures specifically designed to avoid potentially significant impacts.

4.11 Barrier Effects to Wildlife Movement

In some circumstances, linear infrastructure projects can create barriers to wildlife movements, in particular terrestrial and arboreal fauna species. At their most extreme, these barriers can reduce gene flow in populations. This is mostly seen in major arterial roads with dual carriageways and fauna-proof fencing. In buried pipelines such as the current proposal, only the most sedentary species would be affected and the impacts would be largely short-term, resulting from disturbance and temporary loss of vegetation cover. The impacts are largely reversible with restoration of vegetation cover.

Barrier effects are considered unlikely to present significant or long-term impacts (**Table T14)** because:

- the pipeline will mostly follow existing cleared corridors through native vegetation
- the pipeline will require a maximum clearing of 30 m
- the clearing width will be reduced wherever possible by use of existing cleared corridors
- a significant proportion of the cleared area will be revegetated.

Nevertheless, **Recommendation 14** in **Section 5** outlines measures designed to avoid, minimise and / or mitigate these potential impacts.

4.12 Alterations to Hydrology

Alteration to natural flow regimes refers to reducing or increasing flows, altering seasonality of flows, changing the frequency, duration, magnitude, timing, predictability and variability of flow events, altering surface and subsurface water levels and changing the rate of rise or fall of water levels. The three primary human processes that have altered flows in streams, rivers and their floodplains, and wetlands in NSW are:

- building of dams
- diversion of flows by structures or extraction
- alteration of flows on floodplains with levees and structures (DECC, 2005).

Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands is recognised as a major factor contributing to loss of biological diversity and ecological function in aquatic ecosystems, including floodplains. Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands has been identified as a threat to a number of threatened species and communities. "*Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands*" is listed on Schedule 3 of the TSC Act as a Key Threatening Process.

Alterations to ground water hydrology may also lead to activation of PASS, by exposing normally water-logged soils to atmospheric oxygen. These soils mostly occur below 5 m ASL, so are most likely to occur in the southern end of the proposed pipeline route, especially in low-lying wetlands and tidal areas where soils are often saturated.

Impacts potentially arising from alteration to the natural flow regimes potentially could have direct and indirect impacts on a national park, and areas of wetlands listed under Ramsar and SEPP 14, as well as up to four ecological communities, up to six flora species and up to nine fauna species listed as threatened under the EPBC Act and / or the TSC Act (**Table T14)**. The potential impacts to these environmental values are assessed in **Appendix E**, and they could be potentially significant if they were not mitigated. Therefore, **Recommendations 10 and 11** in **Section 5** outline measures specifically designed to avoid potentially significant impacts. Provided that the mitigation measures are implemented, it is considered unlikely that the development will impact significantly on hydrology.

4.13 Wild Fire

Construction activities could create unintended wild fires in the project area. Fires have the potential to spread rapidly and well beyond the intended project footprint. Wild fires could also be started by vegetation maintenance activities in the proposed pipeline easement throughout the operational phase of the proposed project. Conversely, the proposed pipeline easement may act as a fire break and retard wild fire in some areas.

Impacts potentially arising from changes to the local regime of wild fire potentially could have direct and indirect impacts on a national park, a nature reserve, and areas of wetlands listed under Ramsar and SEPP 14, as well as up to five ecological communities, up to 14 flora species and up to seven fauna species listed as threatened under the EPBC Act and / or the TSC Act (**Table T14)**. The potential impacts to these environmental values are assessed in **Appendix E**. **Recommendations 1, 4 and 19** in **Section 5** outline measures designed to avoid, minimise and / or mitigate these potential impacts.

4.14 Construction Waste

Construction activities can generate large amounts of waste (e.g. wrapping and packaging from construction materials, domestic waste from crew members, etc). Linear infrastructure projects provide the potential to strew this waste extensively across a landscape.

Impacts potentially arising from construction waste potentially could have direct and indirect impacts on a national park, a nature reserve, and areas of wetlands listed under SEPP 14, as well as up to five ecological communities and up to nine fauna species listed as threatened under the EPBC Act and / or the TSC Act (**Table T14)**. Construction waste could also indirectly impact on the Ramsar wetland. The potential impacts to these environmental values are assessed in **Appendix E**. **Recommendations 1** and **16** in **Section 5** outline measures designed to avoid, minimise and / or mitigate these potential impacts.

4.15 Erosion, Sedimentation and Dust Emissions

Earthworks, vegetation clearing, vehicle movements on unformed tracks and other machinery operations have the potential to cause erosion and dust emissions. Erosion is of particular concern in waterways and steep areas. Erosion and dust can cause sedimentation of waterways, including streams and freshwater wetlands. Potential impacts arising from dust emissions would likely be short-term and reversible, but could affect vegetation communities and flora species through smothering. Erosion and sedimentation could continue after construction is completed and the impacts of sedimentation could persist after erosion has ceased.

Erosion, sedimentation and dust emissions potentially could have direct and indirect impacts on a national park, a nature reserve, and areas of wetlands listed under SEPP 14, as well as up to five ecological communities, up to 14 flora species and up to nine fauna species listed as threatened under the EPBC Act and / or the TSC Act (**Table T14)**. These impacts could also indirectly affect the Ramsar wetland. The potential impacts to these environmental values are assessed in **Appendix E**. **Recommendations 1, 16 and 19** in **Section 5** outline measures specifically designed to avoid potentially significant impacts.

4.16 Spread of the plant pathogen *Phytophthora cinnamomi*

Pytophthora cinnamomi (root rot fungus) is a microscopic, soil-borne plant pathogen that infects and destroys the root systems of susceptible plant species. Root rot has been responsible for significant mortaility of native plants and threatens native ecosystems, forestry and agricultural industries (DECC, 2008).

Pytophthora cinnamomi occurs worldwide and infects a wide range of plant species. It has infected thousands of hectares of native forest in Western Australia, Victoria, Tasmania and South Australia. It has been identified in several natural areas in New South Wales and coastal Queensland, although the extent of the spread in these areas is unclear. *Phytophthora* induced die-back has been identified in forest, woodland and heatAECOMnd communities in the Hunter-Central catchment within the proposed development area. *Phytophthora* is usually restricted to moister habitats along drainage lines, in gullies and depressions and in areas of surface seepage along ridge tops (DECC, 2008).

The fungus lives within the soil on the roots and stems of living plants. It produces zoospores which are transported between areas in contaminated soil and on footwear, tools, equipment and vehicles. The spores are also transported large distances in surface and sub-surface water supplies. They are attracted to the root systems of plants and quickly infect susceptible plant species (DECC, 2008).

Thousands of Australian native plant species are potentially susceptible to *Phytophthora,* although some plant species are more susceptible than others. This disease has the potential to significantly influence biodiversity and species composition, particularly in dry open woodlands, woodlands and heatAECOMnds, where the disease has been most destructive. Fauna can also be indirectly affected by *Phytophthora* through changes in habitat structure and in the availability of food and shelter resources (DECC, 2008).

'Infection of native plants by *Phytophthora cinnamomi'* has been listed as a key threatening process in Schedule 3 of the TSC Act and 'Dieback caused by the root rot fungus (*Phytophthora cinnamomi*) is listed as a key threatening process under the EPBC Act. Several threatened plants that could potentially be found along the proposed pipeline route, including *Grevillea guthrieana* and *Tetratheca juncea*, are susceptible to the *Phytophthora* pathogen (DECC, 2008).

The effects of *Phytophthor*a could potentially could have direct impacts on a national park, a nature reserve, and areas of wetlands listed under SEPP 14, as well as up to four ecological communities and up to 3 flora species listed as threatened under the EPBC Act and / or the TSC Act **(Table T14).** The potential impacts to these environmental values are assessed in **Appendix E** , and they could be potentially significant if they were not mitigated. Therefore, **Recommendation 17** in **Section 5** outlines measures specifically designed to avoid potentially significant impacts.

4.17 Spread of the amphibian pathogen 'Chytrid fungus'

Chytrid fungus is a fungal pathogen that infects amphibians and causes the disease chytridiomycosis. The pathogen was introduced to south-east Queensland in the 1970s and has spread throughout coastal eastern Australia. The pathogen infects the skin of frogs and in most cases causes death within 18 to 48 days (DEH, 2006b).

'Infection of amphibians with chytrid fungus resulting in chytridiomycosis' is identifid as a Key Threatening Process under the EPBC Act. The fungus is a known pathogen in 49 species of Australian frogs and is known to infect 52% of threatened frog species including *Litoria aurea* and *Mixophyes iterates*, which could potentially occur along the proposed development route (DEH, 2006b).

Chytrid fungus is spread through movement of infected water, transport of infected frogs and tadpoles, on equipment used by researchers and through handling frogs. There is no evidence that Chytrid fungus can survive outside of waterbodies and it is considered unlikely that the disease can be transported in dry soil (DEH, 2006b).

Although spread of the chytrid fungus has the potential to cause the extinction of many species of Australian frogs, it is unlikely that the proposed development will increase the spread of disease for three reasons (DEH, 2006b):

- The disease can only survive in water and it is unlikely that water will be transported between watercourses during the development.
- The disease is spread through contact with frogs and it is unlikely that staff or contractors will come into contact with frogs.
- To AECOM's knowledge there have be no recorded infections in areas affected by the proposed development.

Therefore the risk of spreading Chytrid fungus during the proposed development is considered negligible and no additional mitigation measures, other than general recommendations for minimising disturbance to wetlands and permanent streams, are required.

5.0 Mitigation Measures

5.1 Pre- Construction Phase

Recommendation 1: Develop and Implement best-practice site management measures within an Environmental Management Plan (EMP) framework.

Incorporate impact mitigation and environmental management measures into EMPs for the proposed development and include provisions for the preconstruction, construction and operational stages of the development. In the EMPs detail specific management strategies to be implemented during the construction phase of the proposed development, including strategies and protocols relating to soil and water management, protection of vegetation to be retained, fauna protection, rehabilitation strategies, containment of waste, and an emergency response program for accidental spills and other emergencies. Include a number of detailed management strategies in the EMPs sufficient to facilitate the implementation and auditing of all the mitigation measures recommended in this Section.

Develop an induction program for the EMP and induct all site workers involved in construction activities (whether directly or indirectly) into the EMP program prior to their commencement of duties.

Recommendation 2: Develop and implement an appropriate multi-faceted management plan for the Small-flower Grevillea in the powerline easement at approximately KP 59.

Develop strategies to minimise potential impacts during the construction phase, including, but not necessarily limited to:

- Conduct a detailed survey for the Small-flower Grevillea population within the proposed ROW along the powerline easement and adjacent area to determine population characteristics (including precise distribution, extent and abundance).
- Investigate and use the absolute minimum construction width within the ROW wherever the Grevillea occurs.
- Select the alignment of access tracks for vehicle and construction machinery along the powerline easement to minimise compaction of soil around the underground rhizomes of the Grevillea.
- Manage the construction process to minimise impacts on Grevilleas within and adjacent to the construction footprint, including:
  - fencing of the population adjacent to the development to avoid accidental damage
  - development and implementation of appropriate sediment and erosion control systems
  - stockpiling of topsoil containing seeds of this species and respreading it following construction
  - revegetation with native species as soon as possible following construction
  - development and implementation of weed management protocols (including hygiene and control) during and for at least two years following construction.

Develop strategies to minimise easement maintenance impacts during the operation phase, including, but not necessarily limited to:

- Liaise with relevant stakeholders and authorities (e.g. DECC, DEHWA, the electrical authority that currently maintains the powerline easement) to develop an appropriate management plan (including construction and operational / maintenance phases).
- Document the current management regime of the easement because it appears to be favourable for the species.
- Develop and implement appropriate maintenance strategies to minimise ongoing impacts on the existing population.
- Minimise any change to the current management regime of the easement.
- Consider the appropriateness of minor changes to the current management regime that may be beneficial, such as raising the height of slashing.
- Avoid causing any significant changes to current fire regime.
- Fit spark-arrestors to all machinery and equipment operating in the powerline easement during dry periods in summer.

Develop a monitoring program (including pre-construction baseline data) for the abundance and geographical extent of this species in the easement, including as far as possible, but not necessarily limited to the following:

- Conduct a detailed survey for the Small-flower Grevillea population within the proposed ROW along the powerline easement and adjacent area to determine population characteristics (including precise distribution, extent and abundance), as recommended above.
- Document the pre-construction (baseline) management regime of the powerline easement.
- Monitor and record the annual management regime of the powerline easement in a way that can be compared to baseline to detect any relevant changes.
- Monitor the Grevillea population during and for at least two years following construction to assess the effectiveness of the current management regime and modify the management plan, if required.

Develop an offset strategy to compensate for residual impacts that cannot be avoided or mitigated, following principles outlined in ***Recommendation 18****. The offset strategy will include, but not necessarily be limited to:*

- Develop the offset strategy in consultation with DECC.
- Assess the extent and number of plants that would be impacted and calculate the biodiversity credits required to offset the impact.
- Identify and procure an appropriate offset area nearby where a population of this species can be established, preferably adjacent to an existing conservation area.
- Investigate and develop appropriate translocation, propagation and cultivation techniques. Olde and Marriott (1995) note that *G. parviflora* adapts readily to cultivation and can be grown from seeds and cuttings of half-hardened new growth in early Spring. No published information on translocation of *G. parviflora* could be located, but other species of *Grevillea* have beeen successfully translocated (e.g. Stack *et al*., 2003).

- Undertake seed collection, propagation and translocation would be in accordance with currently accepted Australian guidelines, including:
  - Guidelines for the Translocation of Threatened Plants in Australia. 2nd edition (Vallee et al., 2004)
  - Germplasm Conservation Guidelines for Australia (ANPC, 1997)
  - Floradata: A guide to the collection, storage and propagation of Australian native plant seed (Mortlock and Lloyd, 2001)
  - Growing Australian Native Plants from Seed - for revegetation, tree planting and direct seeding (Murray, 2003).
- Propagate sufficient plants to offset the number impacted by the proposed development.
- Plant and maintain propagated plants (and translocated plants, if translocation is considered feasible) in the offset area for at least 2 years.
- Monitor to evaluate the success of the offset program for at least 5 years and identify any problems that require remedial actions.
- Manage weeds for at least 2 years following planting.
- Arrange for appropriate legislative protection of the offset area.

Recommendation 3: Undertake acid sulfate soil investigations in sections of the proposed pipeline route below 5 m ASL.

Develop an acid sulfate soil management plan in consultation with relevant authorities, to mitigate potential impacts from the disturbance of PASS in the vicinity of Hexham. As a minimum this would include:

- a detailed account of the geology, hydrology, physical characteristics and environmental receptors within the locality
- management options considered for the project, including construction, operation and decommissioning. The four main strategic options for the management of acid in the environment are:
  - containment within the soil profile in natural depressions, ponds or drains
  - neutralisation typically either lime ($CaCO_3$) or the bicarbonate (HCO_3) in seawater
  - dilution by use of freshwater to raise the pH
  - transformation reduction into stable compounds
- treatment measures proposed – including bunding, testing, application of lime or bicarbonate, sampling and any other relevant measures
- leachate controls
- monitoring requirements and frequencies
- requirements and application for disposal of ass materials
- responsibilities of individual members – including reporting requirements, authorities, and training requirements.

For further details, see the Soil and Geology Chapter in the main report.

5.2 Construction Phase

Recommendation 4: Minimise clearing of native vegetation during construction works.

The following general measures are recommended to minimise impacts on native vegetation:

- Retain and protect hollow-bearing trees wherever possible.
- Locate site compounds and parking areas, site-offices, stockpiles and other ancillary works areas in existing cleared areas, away from waterways or other sensitive areas.
- Install highly visible barriers (e.g. barrier webbing) between the construction area and adjacent native vegetation.
- Restrict access from the construction area into adjacent areas of native vegetation and waterways.
- Provide clear instructions regarding the limits of vegetation clearing to all workers and contractors.
- Minimise the amount of native vegetation (timber) to be cleared by employing the minimum construction footprint in timbered habitats.
- Avoid removal of large paddock trees wherever feasible.
- Fit spark arresters on diesel engines used in construction.
- Ensure fire extinguishers and personnel trained in fire fighting are on-hand during welding operations to minimise damage caused by accidental fires.

Recommendation 5: Minimise clearing of native vegetation in the GFDA.

The following measures are recommended to minimise clearing of native vegetation required for construction purposes:

- Adopt the following locational principles to locate envelopes for gas wells, flowlines and CPF:
  - not within 200 m of existing residences or as required to meet project noise goals
  - minimum of 40 m from a watercourse
  - avoiding native vegetation (about 6% of GFDA) and riparian areas
  - avoiding Indigenous and European heritage places or items
  - located adjacent to existing fence lines and access tracks where possible
  - located on relatively flat ground where possible
  - considering visual effects and opportunistic use of natural screening such as vegetation
  - considering land use and landowner preferences.
- Follow measures proposed in **Recommendation 4** to minimise impacts on native vegetation.

Recommendation 6: Minimise clearing of native vegetation along the pipeline route.

Avoid clearing of riparian rainforest vegetation at Karuah River crossings by using HDD at KP 19.3, KP 23.5 and KP 24.3.

Consider the use of construction techniques and management regimes to avoid clearing native vegetation at the following locations:

- At crossings of permanent streams identified as being sensitive during the ecological field assessment to avoid impacts to hydrological flow regimes and impacts to existing riparian vegetation (KP 36.9, KP 40.3).
- At the crossing of the tidal creek at KP 89.8. If marine vegetation is impacted at this point, a permit may be required.
- At the freshwater wetland (at KP 67.9 to KP 68) to avoid impacts to this Endangered Ecological Community and potential habitat for numerous protected fauna species.
- At the paperbark swamp forest (at KP 68.9) to avoid impacts to this endangered ecological community and potential habitat for numerous protected fauna species.
- Consider minor re-routing of the proposed pipeline route to avoid clearing of native vegetation at the following locations:
- At KP 27.6 to KP 28.5, move the proposed pipeline outside road reserve (which contains significant roadside vegetation), either east into the powerline easement or west into cleared pasture.
- At KP 35.7 to KP 36.4, move the proposed pipeline west into cleared pasture and the powerline easement to avoid remnant eucalypt forest.
- At KP 45.6 to KP 45.7, move the proposed pipeline east into the road alignment and / or regrowth forest on the western side of the road to avoid remnant Redgum forest (which is an Endangered Ecological Community).

Avoid clearing of native vegetation in Wallaroo National Park by using the minimum width ROW through the powerline easement from KP 59.7 to KP 63.

Avoid clearing of native vegetation in the proposed Nature Refuge by using the minimum width ROW through the powerline easement from KP 54 to KP 54.8.

Minimise clearing of native vegetation in the large remnant vegetation block along Black Camp Road by utilising the existing cleared roadway and reducing the width of the ROW from KP 31.5 to KP 38.

Minimise clearing of native riparian vegetation at other watercourses by utilising existing clearings (where present) and reducing the width of the ROW.

When transecting native vegetation, utilise existing cleared areas and reduce the width of the ROW wherever feasible.

Conduct pre-clearing surveys just prior to construction to identify minor route refinements that reduce clearing of native vegetation.

*Follow measures proposed in **Recommendation 4** to minimise impacts on native vegetation.*

Recommendation 7: Minimise the impacts arising from removal of large hollow-bearing trees wherever they are encountered.

Avoid the removal of large-hollow-bearing trees wherever possible.

Undertake surveys to map the location of hollow bearing trees in timbered habitats and large paddock trees prior to clearing and construction. Have wildlife-clearance surveys conducted by qualified people to identify hollow-bearing trees likely to be important for the following threatened species that occur or potentially occur in the project area, including:

- Barking Owl, which nests in large hollows in large hollow-bearing trees in open woodlands
- Powerful Owl, which nests in large hollows in large hollow-bearing trees in tall forests
- Sooty Owl, which nests in large hollows in large hollow-bearing trees in tall closed forests
- Masked Owl, which nests in large hollows in large hollow-bearing trees in woodlands and forests
- Yellow-bellied Glider, which dens in large hollows in large hollow-bearing trees in tall forests.
- Wherever it is not possible to avoid the removal of hollow bearing trees, all large hollows should be salvaged and strapped to standing trees nearby, to restore the potential habitat.
- The salvage and restoration of small hollows and the provision of nest boxes is not recommended. This is because the prevailing habitats in the project area are rural landscapes inhabited by three species of introduced cavity-nesting birds (Common Starling; Common Myna and House Sparrow). Provision of small hollows or nest boxes is more likely to benefit these species than native species.
- Recommendation 8: Minimise the impact of removing dead trees and fallen timber wherever possible.

Avoid felling dead trees wherever possible.

Avoid disturbing, removing or breaking up fallen timber (especially larger logs) wherever possible.

Wherever it is unavoidable to disturb fallen timber, either relocate it to adjacent areas of native vegetation or stockpile it and return to the ROW following completion of earthworks or as otherwise agreed.

Where possible, recycle timber cleared from the ROW by placing logs on the ground in the ROW following construction.

Recommendation 9: Minimise the potential impact from the removal of surface rock.

Little if any surface rock occurs in the project area, but this recommendation is included in case some rocky areas are encountered.

If an area of outcropping rock is encountered, adjust the local alignment of the proposed pipeline to avoid it.

Wherever it is unavoidable to disturb surface rock, stockpile it and return to the ROW following completion of earthworks or as otherwise agreed.

Recommendation 10: Minimise disturbance to freshwater wetlands and their associated vegetation.

Implement an appropriate acid sulphate soil management plan if PASS are detected during pre-construction investigations.

Wherever feasible, avoid the construction footprint encroaching or impacting on wetlands identified in ***Section 3.4.2****.This should include indirect impacts such as down-stream sedimentation, eutrophication and pollution.*

Wherever the proposed pipeline cannot be routed around wetlands identified in ***Section 3.4.2****, consider using HDD techniques to avoid disturbance to hydrology and threatened species.*

Wherever feasible, avoid damage or modification to emergent vegetation (e.g. sedges, spike rushes. bulrushes and reeds) fringing the wetlands identified in ***Section 3.4.2.***

Minimise the use and passage of heavy machinery and vehicles within and adjacent to wetlands during construction.

Do not remove dead wood and dead trees from near the wetlands identified in ***Section 3.4.2***

Recommendation 11: Minimise potential impacts to permanent streams.

Wherever the proposed pipeline crosses permanent streams, use HDD techniques to avoid disturbance to hydrology, riparian vegetation and threatened species (for further details, see the Water Chapter in main report)*.*

Avoid the development footprint encroaching or impacting on streams, including indirect impacts such as erosion, down-stream sedimentation, pollution and eutrophication.

Recommendation 12: Develop a detailed landscaping and rehabilitation plan for incorporation into project Environmental Management Plans.

Detail landscaping and rehabilitation strategies in an EMP for the proposed development.

Include a maintenance program in the landscaping and rehabilitation strategies, involving in planting and weed control, for at least 2 years after completion of construction activities. It is recommended that landscaping and rehabilitation works involve:

- Obtain local provenance native seeds, either from commercial seed suppliers or collection by qualified bush regenerators prior to clearing, for use in the revegetation of disturbed areas.
- Stockpile topsoil that is excavated from areas of native vegetation for application to rehabilitation areas in the ROW, to retain the natural seed bank from the site and assist in the regeneration of local flora.
- Revegetate progressively as construction proceeds, to reduce exposure of unstabilised surfaces and minimise opportunities for weed establishment.
- Revegetate with site-specific species compositions to match the characteristics of the local endemic communities.
- Wherever further fragmentation of existing native vegetation cannot be avoided, revegetate (using local native species) as soon as possible, in order to minimise edge effects.

- The landscaping and rehabilitation plan should aim to reconnect any patches of native vegetation isolated or fragmented by the proposed development, to improve connectivity for wildlife and reduce edge effects.
- Include *Allocasuarina* species in revegetation works wherever they occur naturally, to compensate for the loss of potential foraging habitat for the Glossy Black-cockatoo in the project footprint.
- Monitor vegetation re-establishment during and post-construction. A recommended key flora indicator is the percentage groundcover of desirable species (e.g. 50% of the desirable species cover occurring on adjoining undisturbed areas within two years). Desirable species may include native groundcover species in native vegetation areas or pasture grasses in agricultural landscapes (as requested by landholders).

Recommendation 13: Undertake wildlife-clearance surveys immediately before the vegetation clearing and / or trench excavation fronts.

Have wildlife-clearance surveys undertaken by appropriately qualified people immediately ahead of vegetation clearing operations to avoid disturbance to the following threatened fauna species:

- Conduct surveys for nests of the Bush Stone-curlew, which nests on the ground amongst fallen timber and undergrowth in open woodland. If a nest is found in the clearing path then clearing operations should be locally suspended or rerouted.
- Conduct surveys for nests of the Square-tailed Kite, which constructs large stick-nests in large trees. If a nest is found in the clearing path then clearing operations should be locally suspended or rerouted.
- Conduct surveys for nests of the Black-necked Stork, which constructs large stick-nests in large trees. If a nest is found in the clearing path then clearing operations should be locally suspended or rerouted.
- Conduct surveys for nests of the Barking Owl, which nests in large hollows in large hollow-bearing trees in open woodlands. If a nest is found in the clearing path then clearing operations should be locally suspended or rerouted.
- Conduct surveys for nests of the Powerful Owl, which nests in large hollows in large hollow-bearing trees in tall forests. If a nest is found in the clearing path then clearing operations should be locally suspended or rerouted.
- Conduct surveys for nests of the Sooty Owl, which nests in large hollows in large hollow-bearing trees in tall closed forests. If a nest is found in the clearing path then clearing operations should be locally suspended or rerouted.
- Conduct surveys for nests of the Masked Owl, which nests in large hollows in large hollow-bearing trees in woodlands and forests. If a nest is found in the clearing path then clearing operations should be locally suspended or rerouted.
- Conduct surveys for dens of the Yellow-bellied Glider, which nests in large hollows in large hollow-bearing trees in tall forests. If a nest is found in the clearing path then clearing operations should be locally suspended or rerouted.
- Conduct surveys for the presence of Koalas, which rest in trees by day. If a Koala is found in the clearing path then clearing operations should be suspended locally until the koala moves out of the impact zone.

Wherever it is not possible to avoid the removal of large, old-growth, hollow-bearing trees then the following protocols should to be employed:

- Clear the vegetation surrounding large, old-growth, hollow-bearing trees but leave the tree standing in order to give fauna an opportunity to move.
- Large, old-growth, hollow-bearing trees should be felled no less than two days after the removal of the surrounding vegetation.
- Large, old-growth, hollow-bearing trees should be felled carefully and left intact on the ground overnight to give fauna the opportunity to escape.

Authorised wildlife rescuers should be on hand to rescue and relocate fauna disaffected, disoriented or displaced by vegetation clearing and excavation of the trench.

- The NSW Roads and Traffic Authority has an applicable policy that could be used as a model.
- Whenever possible, release nocturnally active animals that are captured for relocation at dusk.
- Recommendation 14: Manage earthworks to minimise impacts on threatened fauna species.

Use temporary fencing to exclude access to the trench by livestock and larger native wildlife (APIA, 2005) where appropriate.

Trench progressively to minimise the period of time the trench is open and the length of open trench. The length of open trench at any one time should be the minimum practicable.

Construct ramps and trench plugs with slopes of no greater than 50% (APIA, 2005) and located at least every 500 m to assist escape for larger fauna species. Where possible, locate trench plugs to coincide with stock and wildlife trails.

Place branches, ramped gangplanks or similar to create 'ladders' at regular intervals to assist small fauna to exit the trench (APIA, 2005).

Supply some form of cool insulated cover in the trench to allow smaller fauna species to shelter in shade and / or climb above accumulated water. Following the method employed during construction of the North Queensland Gas Pipeline (Wilson and Swan, 2004), sawdust-filled hessian sacks used to support pipes prior to laying-in should be soaked in water and placed in pairs at approximately 250 m intervals.

Employ qualified fauna spotters and handlers to survey the open trench and remove any trapped fauna species. Such surveillance should occur along the entire length of the trench and not merely those areas described as fauna habitats or sensitive areas. Fauna spotters and handlers should be qualified or appropriately trained to assess and handle any injuries to native fauna that may occur due to trenchfall.

Have qualified veterinarian staff available on call to assess and treat or euthanase (as necessary) any large native vertebrates that are seriously injured.

Recommendation 15: Develop and implement a detailed weed management strategy.

Develop and implement a detailed weed management strategy as part of the EMPs. Include measures to control the spread of weeds into adjacent native vegetation (i.e. weed hygiene). Weed control measures would be particularly important where the proposed development traverses large, intact stands of vegetation, in riparian areas, and around freshwater wetlands. Include in the plan, as a minimum, the following measures:

- Remove existing noxious weeds within the project footprint.
- Destroy weed material removed from construction sites.
- Develop weed quarantine zones along the proposed pipeline route based on weed distribution and sub-catchments, for application of weed hygiene activities.
- Wash down vehicles, machinery and equipment moving between weed quarantine zones, especially after clearing activities and earthworks in weed infested areas.
- Implement a certification process to ensure that all vehicles and plant are weed-free whenever entering or leaving the site and whenever moving between weed quarantine zones within the site.
- Minimise the potential for the transport of weeds in soil, by not transporting excavated soil further than the nearest stockpile locations.
- Use shredded native plant material (uncontaminated by weeds) removed from the site as a mulch and groundcover on disturbed soil surfaces to reduce the potential for weed establishment.
- Use sediment control fencing to prevent soil contaminated with weed seeds from washing into waterways and wetlands.
- Conduct weed management works and monitor for at least two years following construction.

Recommendation 16: Develop and implement a detailed soil, water and waste management strategy.

Develop and implement a detailed soil, water and waste management strategy to control sediment and pollutant discharge from the construction area into adjoining vegetation, streams and wetlands. The following measures are recommended, as a minimum:

- Develop strategies and facilities to contain contaminants such as gross pollutants, weed seeds, fuels and oils, chemicals, etc.
- Stabilise exposed soil surfaces (e.g. through sterile grass seeding, erosion control meshing, progressive stabilisation and re-vegetation of finished soil surfaces and / or mulching using vegetative material removed from the project area.
- Vegetation and soil stockpiles should be separated where possible to maximise use of vegetation for sediment erosion control.
- Use erosion and sediment control fencing to prevent sedimentation of waterways.
- Implement a best practice self-auditing program for site stabilisation and erosion control.
- Dispose of waste materials and / or contaminants appropriately and away from adjacent native vegetation and waterways.
- Develop strategies to minimise erosion and related impacts on steep slopes and in riparian areas.

- Develop a strategy and facilities for the suppression of dust (e.g. dust trigger levels, air quality monitoring and water trucks).
- During construction, use matting to minimise the compaction and / or erosion of soft or erodible soils in sensitive areas such as watercourses and wetlands.
- Rehabilitate access tracks not required after construction, to minimise the potential for erosion and inappropriate vehicular access.
- Assess the potential for acid sulfate soils to occur along the proposed pipeline and implement an appropriate management strategy if they are present.
- If contaminated land is encountered during the construction phase, conduct a risk assessment immediately.

Measures to prevent the spread of weed seeds should be included in the strategy and integrated with the weed management strategy outlined in ***Recommendation 15.***

Recommendation 17: Develop and implement a *Phytopthora cinnamomi* management strategy

Develop and implement a detailed plant pathogen hygiene strategy as part of the EMPs. Include measures that minimise the transport of soil and vegetation and reduce disturbance to native vegetation as disturbed vegetation is most at risk of infection. Hygiene measures will be particularly important where the proposed development crosses watercouses and riparian vegetation. The plan should include the following measures as a minimum:

- Assess all operations for the likelihood of introducing or spreading *P. cinnamomi*, modify operations and apply hygiene measures to reduce the risks.
- Schedule activity for periods when soil is dry, wherever possible.
- Educate staff and contractors on the threat of *P. cinnamomi*, management objectives and mitigation measures.
- Supervise staff to ensure compliance with the mitigation measures.
- Use existing roads and tracks wherever possible.
- Minimise the amount of water used on the site.
- Wash down vehicles, tools and equipment between quarantine zones. Recommended zones are the three major catchments - Hunter / Williams, Karuah and Manning / Avon.
- Implement a certification process to ensure vehicles and equipment are soil-free when entering or leaving the site and when moving between quarantine zones.
- Minimise the potential for the transport of infected soil by transporting excavated soil no further than the nearest stockpile locations.
- Use sediment control fencing to prevent soil infected with *P. cinnamomi* from washing into waterways and wetlands.
- Where possible, ensure vegetation cleared from the ROW is not removed from the development site.
- Avoid disturbing vegetation along streams and drainage lines as *P. cinnamomi* causes significant damage in disturbed habitats.
- Only revegetate with plants and seeds from a nursery that can guarantee potting medium and plants that are free of *P. cinnamomi*.

Recommendation 18: Develop and implement offset strategies for residual biodiversity impacts (e.g. loss of native vegetation, EECs, SEPP14 wetlands).

Develop and implement offset strategies to compensate for loss of biodiversity values that cannot be adequately avoided or mitigated by the proposed measures. Offset strategies may be required for:

- clearing and / or disturbance of small areas of three EECs (up to 0.45 ha of Freshwater Wetland on Coastal Floodplains of New South Wales North Coast, 0.09 ha of Swamp Sclerophyll Forest of Coastal Floodplains and 0.1 ha of Hunter Lowland Redgum Forest)
- clearing of up to 0.09 ha of SEPP14 wetland
- clearing of up to 3.3 ha of native vegetation in Wallaroo National Park
- clearing of up to 0.8 ha of native vegetation in a proposed nature reserve (Lot 68 DP753176)
- clearing of native vegetation totalling 16.7 to 25 ha for pipeline construction (and possibly a small area for GFDA development, to be assessed when locations of gas wells and gathering lines are determined)
- removal and / or disturbance of recorded *Grevillea parviflora* populations (discussed in **Recommendation 2**)

Offset plans will be developed according to the following principles:

- Impacts must first be avoided as far as possible by using prevention and mitigation measures.
- All regulatory requirements must be met.
- Offsets should complement other government programs.
- Offsets must be underpinned by sound ecological principles.
- Offsets should aim to result in a net improvement in biodiversity over time.
- Offsets must be enduring – they must offset the impact of the development for at least the period that the impact occurs.
- Offsets should be agreed prior to the impact occurring.
- Offsets must be quantifiable – the impacts and benefits must be reliably estimated.
- Offsets must be targeted – they must offset impacts on a like-for-like or better basis.
- Offsets must be located appropriately – they must offset the impact in the same region.
- Offsets must be supplementary – they must be beyond existing requirements and not already be funded under another scheme.
- Offsets and their actions must be enforceable – through development consent conditions, licence conditions, conservation agreements or a contract.

Offset plans will be developed in liaison with DECC before development commences to define types and levels of biodiversity loss (debits), calculate the amounts of offsets (credits) required and develop appropriate implementation, monitoring and protection strategies.

5.3 Operation Phase

Recommendation 19: Develop and implement detailed strategies to minimise the impacts of operations (including the operations and maintenance of the CPF, wells and pipelines).

Develop and implement best-practice site management measures within an Environmental Management Plan (EMP) framework. Specific EMPs should be developed for operation and maintenance of gas wells, flowlines, CPF and the transmission gas pipeline.

The EMPs should include strategies and protocols relating to soil and water management, protection of retained vegetation and rehabilitation areas, fauna protection, site closure and rehabilitation strategies, containment of waste, an emergency response program for accidental spills and other emergencies, and monitoring / auditing protocols. Integrate strategies with activities conducted by other users of the sites and surrounding land managers (e.g. electrical supplier, coal mine, graziers, NPWS).

Develop induction programs for the EMPs and induct all site workers involved in operation and maintenance activities (whether directly or indirectly) into the appropriate EMP(s) prior to their commencement of duties.

Specific strategies should include, but not necessarily be limited to:

- access protocols for operations and maintenance personnel
- fire management (e.g. ignition suppression devices such as spark arrestors on equipment, fire-fighting equipment, fuel load control around assets, planned burns)
- monitoring, maintenance and repair of installed sediment and erosion control devices
- track and firebreak maintenance and repair procedures and schedules
- vegetation control protocols within easements and around assets (e.g. slashing, herbicide application, tree lopping and trimming)
- weed management and hygiene
- maintenance of any rehabilitation and offset areas created during construction
- Monitoring areas of natural vegetation with high ecological values and / or sensitivity within or adjacent to the development (e.g. Endangered Ecological Communities, wetlands, riparian areas, population of Small-flower Grevillea, Wallaroo National Park, important habitats for protected wildlife)
- containment of contaminants such as gross pollutants, acid leachates, weed seeds, fuels and oils, chemicals, etc.
- monitoring of acid leachates from areas of PASS (e.g. low-lying areas below 5 m ASL, wetlands)
- contact details for qualified veterinarian staff to assess and treat or euthanase (as necessary) any large native vertebrates that are seriously injured.

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6.0 Conclusion

Based on desktop and field investigations, the proposed development has the potential to have a number of ecological impacts. These are summarised in **Table 1** below with an indication of the key measures employed to avoid significant impacts.

Table 1: Summary of Residual impacts

Potential Impact	Management Response/Residual Impacts
The loss of up to 49.3 ha of native vegetation for construction of the proposed pipeline, depending on construction methods.	Reduced ROW at key points which reduces loss to a small area between 16.72 and 25 ha of native vegetation. Flora and Fauna Management Plan to avoid indirect and downstream impacts. Development of an offset strategy to compensate for residual loss of vegetation. Minimal impacts identified post-mitigation.
Disturbance of very small areas of several Endangered Ecological Communities listed under the TSC Act along the proposed pipeline route, including:	
Freshwater Wetland on Coastal Floodplains around KP 68, which may require clearing of up to 0.45 ha.	HDD construction technique to be employed to avoid significant direct impacts. Flora and Fauna Management Plan to avoid indirect and downstream impacts. Development of an offset strategy to compensate for any residual loss of vegetation. No significant impacts identified post-mitigation.
Swamp Sclerophyll Forest of Coastal Floodplains at KP 68.9 just north of the Williams River, which may require clearing of up to 0.09 ha.	Clearing can be reduced by use of an existing 10 m clearing within the powerline easement and / or by reducing the clearing width in this short section. Flora and Fauna Management Plan to avoid indirect and downstream impacts. Development of an offset strategy to compensate for any residual loss of vegetation. No significant impacts identified post-mitigation.
Hunter Lowland Redgum Forest (an EEC) at KP 45.6 to KP 45.7, which may require clearing of up to 0.3 ha.	By moving the proposed pipeline east into the existing 20 m wide clearing associated with Black Camp Creek Road, clearing would be reduced to 0.1 ha. Impacts could also be reduced by utilising the western edge of the road, which has been partially cleared with a canopy cover of only 10%. Flora and Fauna Management Plan to address and avoid indirect and downstream impacts. Development of an offset strategy to compensate for any residual loss of vegetation. No significant impacts identified post-mitigation.

Potential Impact	Management Response/Residual Impacts
Lowland Rainforest on Floodplain of the NSW North Coast Bioregion at crossings of the Karuah River at KP 20.3, KP 24.5 and KP 25.3.	Avoid clearing of riparian rainforest vegetation at Karuah River crossings by using HDD construction techniques. Flora and Fauna Management Plan to avoid indirect and downstream impacts. No significant impacts identified post-mitigation.
Consider the use of construction techniques and management regimes to avoid clearing native vegetation at the following locations	
At all crossings of permanent streams to avoid impacts to hydrological flow regimes and impacts to existing riparian vegetation (KP 36.9, KP 40.3).	Black Camp Creek and Cedar Tree Creek are both 3rd Order watercourses (rather than higher order watercourses such as the Avon, the Karuah and Williams Rivers). As such, they are considered sensitive and worthy of more cautious construction and management. However, as 3rd order streams, their flow is variable depending on rainfall events and so open trench construction techniques would be suitable when waterflow is low. Open trench with flow diversions and environmental management measures will be employed at these two locations if waterflows are increased. Refer to Section 12.3 in the Surface Water Chapter of the main EA in Volume 1 for further detail regarding sensitivity of watercourses as linked to construction techniques.
At the crossing of the tidal creek at KP 90.5	Purgatory Creek will be open trenched with flow diversions. The Construction Environmental Management Plan will be prepared and implemented to control potential impacts arising from open trench construction techniques.
Consider minor re-routing of the proposed pipeline route to avoid clearing of native vegetation at the following locations	
At KP 27.6 to KP 28.5, move the proposed pipeline outside road reserve (which contains significant roadside vegetation), either east into the powerline easement or west into cleared pasture.	This recommendation will be incorporated into the detailed design. Current maps show the alignment used to assess potential ecological aspects on which basis these recommendations have been developed. With the incorporation of this recommendation, no significant impacts are anticipated to the significant roadside vegetation
At KP 35.7 to KP 36.4, move the proposed pipeline west into cleared pasture and the powerline easement to avoid remnant eucalypt forest.	This recommendation will be incorporated into the detailed design. Current maps show the alignment used to assess potential ecological aspects on which basis these recommendations have been developed. With the incorporation of this recommendation, no significant impacts are anticipated to the remnant eucalypt forest.

Potential Impact	Management Response/Residual Impacts
Avoid clearing of native vegetation in Wallaroo National Park by using the minimum width ROW through the powerline easement from KP 59.7 to KP 63.	Pipeline alignment through the National Park reduces amount of clearance required (alternate alignment outside the NP required further clearance of native vegetation). Construction activites through National Park to be restricted to existing cleared ROW. In principle agreement from NSW NPWS for this alignment. Minimum width ROW to be used. Flora and Fauna Management Plan to avoid indirect and downstream impacts. Development of an offset strategy to compensate for any residual loss of vegetation. No significant impacts identified post-mitigation.
Avoid clearing of native vegetation in the proposed Nature Refuge from KP 54.1 to KP 54.9	Minimum width ROW through the powerline easement from KP 54.1 to KP 54.9 to avoid significant impacts. Construction activites through Nature refuge to be restricted to existing cleared ROW. Development of an offset strategy to compensate for any residual loss of vegetation.
Minimise clearing of native vegetation in the large remnant vegetation block along Black Camp Road	Existing cleared roadway to be utilised and reduction in the width of the ROW from KP 31.5 to KP 38 to avoid significant impacts.
Disturbance of flora and fauna species protected under the EPBC Act and / or the TSC Act, including:	
transecting a known population of the Small-flower Grevillea (listed as Vulnerable under the EPBC Act and the TSC Act) by the proposed pipeline at KP 59.	Development and implementation of a detailed Flora and Fauna Management Plan. Development and implementation of a comprehensive management plan to mitigate and, if necessary, offset impacts on the population of the Small-flower Grevillea.
transecting potential habitat for a further 18 threatened flora and 47 threatened fauna species.	Development and implementation of a detailed Flora and Fauna Management Plan. Reduced ROW and HDD as noted above.
disturbing habitat features important for fauna, including hollow-bearing trees and dead and fallen timber.	Development and implementation of Flora and Fauna Management Plan including strategy for management and protection of these types of habitat
excavation works, which may kill ground-dwelling fauna.	Development and implementation of a detailed Flora and Fauna Management Plan.
entrapment of fauna by the pipeline trench.	Development and implementation of a detailed Flora and Fauna Management Plan.
increased fragmentation of fauna habitats.	Development and implementation of a detailed Flora and Fauna Management Plan.

Potential Impact	Management Response/Residual Impacts
Possible disturbance of potential acid sulfate soils in low-lying areas along the southern end of the proposed pipeline, either by excavation or alteration of hydrology, which could impact on downstream environments (such as the Ramsar-listed Hunter Estuary wetlands).	Development and implementation of an acid sulfate soil management plan to minimise the potential for impacts on downstream environments. No significant release of acid leachate, sediment or other contaminants from construction or operation activities associated with the development.
Introduction and spread of noxious and environmental weeds throughout the project area.	Development and implementation of a weed management plan.
Alteration to existing fire regimes.	Development and implementation of Flora and Fauna Management Plan
Erosion and dust emission, which can lead to increased sedimentation of wetlands and streams.	Development and implementation of an erosion and sediment control plan and soil and water management plans.
Spread of the plant pathogen *Phytophthora cinnamomi.*	Development and implementation of a *Phytophthora cinnamomi* management strategy.

Provided that the recommended mitigation measures outlined in **Section 5.0** are implemented effectively, impacts are anticipated to be limited to:

- Clearing of 16.72 to 25 ha of native vegetation.
- Impacts on one population of Small-flower Grevillea, which would not lead to any net loss in the total number of populations or area of extent.
- Little or no disturbance of native vegetation within Wallaroo National Park.
- Little or no disturbance of native vegetation in the proposed nature refuge at Lot 68 DP753176.
- Little or no impacts on any Endangered Ecological Communities.
- Little or no impacts on other threatened flora and fauna species listed at both State and Commonwealth levels.
- No indirect or downstream effects on threatened flora and fauna species or wetland areas.

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Tables

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Table T1: Significant Roadside Environment Areas Transected or Adjacent to the Proposed Pipeline

Description of Environment	Location Relative to Pipeline	Total Length (km)	KP Start	KP Finish
Open forest dominated by *Euc. siderophloia*	Follows Black Camp Road	0.8	27.6	28.4
Open forest dominated by *Cor. maculata* and *Euc. siderophloia*	30-40m to north of Black Camp Road	1.5	39.3	40.8
Open forest dominated by *Cor. maculata* and *Euc. siderophloia*	30-40m to east of Glen Martin Road	0.5	50.3	50.8
Open forest dominated by *Euc. siderophloia*	20-40m to south and north of Glen Martin Road	0.8	56.8	57.6
Open forest dominated by *Cor. maculata* and *Euc. siderophloia*	20-40m to east of East Seaham Road in Wallaroo National Park	1.4	61.1	62.5
Open forest dominated by *Cor. maculata* and *Euc. siderophloia*	Transects East Seaham Road	0.1	64.1	64.2

Table T2: Vegetation Recorded at Detailed Flora Assessment Sites

Flora site	Dominant species	Landform	LHCCREMS Vegetation	LHCCREMS Map Unit	CRA Forest Ecosystem	CRA FE code	NSW Vegetation Type	NSW code
FL 01	*Euc. propinqua, Euc. umbra*	Plain	-		South Coast Shrubby Grey Gum	134	Northern hinterland semi-mesic forest	21
FL 02	*Euc. moluccana*	Plain	-		?	?	Northern hinterland semi-mesic forest	21
FL 03	*Casuarina cunninghamiana, Angophora subvelutina*	Stream	-		Redgum / apple	47	Northern hinterland semi-mesic forest	21
FL 04	*Euc. siderophloia, Euc. umbra*	Plain	-		Ironbark	71	Hunter Macleay dry sclerophyll forest	69
FL 05	*Euc. umbra, Euc. siderophloia*	Dry stream / plain	-		Dry foothills spotted gum	33	Hunter Macleay dry sclerophyll forest	69

Flora site	Dominant species	Landform	LHCCREMS Vegetation	LHCCREMS Map Unit	CRA Forest Ecosystem	CRA FE code	NSW Vegetation Type	NSW code
FL 06	*Callistemon salignus, Backhousia myrtifolia,* numerous riparian species	Stream	-		Rainforest	168	Dry rainforest	4
FL 07	*Euc. punctata*	Hillslope	-		South coast shrubby grey gum	134	Northern hinterland semi-mesic forest	21
FL 08	*Waterhousia floribunda, Syzygium australe,* numerous riparian species	Stream	-		Rainforest	168	Dry rainforest	4
FL 09	*Euc. umbra, Euc. siderophloia*	Dry stream / foothill	-		Dry foothills spotted gum	33	Hunter Macleay dry sclerophyll forest	69
FL 10	*Waterhousia floribunda, Syzygium australe,* numerous riparian species	Stream	-		Rainforest	168	Dry rainforest	4
FL 11	*Euc. umbra, Euc. siderophloia*	Hillslope	-		Dry foothills spotted gum	33	Hunter Macleay dry sclerophyll forest	69
FL 12	*Euc. umbra, Cor. citrodora*	Hillslope	-		Dry foothills spotted gum	33	Hunter Macleay dry sclerophyll forest	69
FL 13	*Euc. propinqua, Euc. microcorys*		-		South coast shrubby grey gum	134	Northern hinterland semi-mesic forest	21
FL 14	*Euc. umbra, Cor. citrodora*		-		Dry foothills spotted gum	33	Hunter Macleay dry sclerophyll forest	69
FL 15	*Backhousia myrtifolia,* numerous riparian species	Stream	Hunter Valley dry rainforest	3	Rainforest	168	Dry rainforest	4

Flora site	Dominant species	Landform	LHCCREMS Vegetation	LHCCREMS Map Unit	CRA Forest Ecosystem	CRA FE code	NSW Vegetation Type	NSW code
FL 16	*Cor. citrodora, Euc. umbra, Melaleuca nodosa*	Plain	Seaham Spotted Gum Ironbark forest	16	Ironbark	71	Hunter Macleay dry sclerophyll forest	69
FL 17	*Euc. siderophloia, Cor. maculata*	Foothill	Seaham Spotted Gum Ironbark forest	16	Ironbark	71	Hunter Macleay dry sclerophyll forest	69
FL 18	*Euc. siderophloia, Cor. maculata*	Foothill	Seaham Spotted Gum Ironbark forest	16	Ironbark	71	Hunter Macleay dry sclerophyll forest	69
FL 19	*Cor. maculata, Euc umbra, Backhousia myrtifolia,* numerous species	Dry stream / foothill	Hunter valley dry rainforest	3	Rainforest	168	Dry rainforest	4
FL 20	*Carex appressa, Juncus pallidus.*	Swamp	Freshwater wetland complex	46	na	na	Coastal freshwater lagoon	56
FL 21	*Melaleuca quinquenervia*	Swamp	Swamp Mahogany paperbark swamp forest	37	Swamp Oak / Swamp Mahogany	143/142	Coastal floodplain wetland	50
FL 22	*Euc. siderophloia*	Plain	-		Regrowth	na	Regrowth	na

Table T3: Vegetation Transected by the Proposed Pipeline

Vegetation (CRA mapping)	Landform	Length (km)	KP start	KP end	Notes
Cleared	Plain	4	0	4	
Dry foothills spotted gum	Plain	0.06	4	4.06	
Cleared	Hillslope / Plain	4.3	4.06	8.36	
Rainforest	Stream	0.03	8.36	8.39	Bull Creek
Cleared	Hillslope / Plain	6.21	8.39	14.6	
South coast shrubby grey gum	Hillslope / Plain	0.65	14.6	15.25	
Cleared	Hillslope / Plain	3.97	15.25	19.23	
Rainforest	Stream	0.07	19.23	19.29	Karuah River
Cleared	Hillslope / Plain	1.68	19.29	20.97	
Rainforest	Gully	0.05	20.97	21.02	
Cleared	Hillslope / Plain	2.49	21.02	23.51	
Rainforest	Stream	0.06	23.51	23.57	Karuah River
Cleared	Plain	0.73	23.57	24.29	
Rainforest	Stream	0.11	24.29	24.4	Karuah River
Cleared	Hillslope / Plain / Stream	2.59	24.4	26.99	
Rainforest	Stream	0.09	26.99	27.08	Barnes Creek
Cleared	Plain	0.56	27.08	27.64	
Ironbark	Plain	0.82	27.64	28.45	Roadside Environment Area
Cleared	Plain	0.11	28.45	28.56	
Ironbark	Plain	0.13	28.56	28.69	
Cleared	Plain	0.91	28.69	29.6	

Vegetation (CRA mapping)	Landform	Length (km)	KP start	KP end	Notes
Ironbark	Plain	0.4	29.6	30	
Cleared	Plain	0.86	30	30.87	
Ironbark	Stream	0.04	30.87	30.91	Barnes Creek
Cleared	Hillslope / Plain	0.44	30.91	31.34	
Dry foothills spotted gum	Hillslope	5.11	31.34	36.45	
South coast shrubby grey gum	Hillslope	0.43	36.45	36.88	
Rainforest	Hillslope / Stream	0.07	36.88	36.95	Black Camp Creek
Dry foothills spotted gum	Hillslope	1.06	36.95	38.01	
Cleared	Plain	0.23	38.01	38.24	
Rainforest	Stream	0.03	38.24	38.27	
Cleared	Plain	1.94	38.27	40.21	
Rainforest	Stream	0.07	40.21	40.28	Cedar Tree Creek
Cleared	Plain	5.3	40.28	45.58	
Redgum / apple	Stream	0.1	45.58	45.67	Little Black Camp Creek
Cleared	Plain	0.1	45.67	45.77	
Ironbark	Plain	0.2	45.77	45.97	
Cleared	Hillslope / Plain	3.48	45.97	49.45	
Rainforest	Stream	0.04	49.45	49.5	Bridge Creek
Cleared	Hillslope / Plain	4.49	49.5	53.99	
Ironbark	Plain	0.82	53.99	54.81	Nature Reserve
Cleared	Plain	3.29	54.81	58.1	
Ironbark	Hillslope / Plain	1.37	58.1	59.47	

Vegetation (CRA mapping)	Landform	Length (km)	KP start	KP end	Notes
Cleared	Hillslope / Plain	0.23	59.47	59.7	
Ironbark	Hillslope / Plain	2.38	59.7	62.08	Wallaroo National Park
Rainforest	Stream	0.04	62.08	62.12	Wallaroo National Park
Ironbark	Hillslope / Plain	0.9	62.12	63.02	Wallaroo National Park
Cleared	Hillslope / Plain	1.05	63.02	64.07	
Ironbark	Plain	0.09	64.07	64.16	Roadside Environment Area
Cleared	Hillslope / Plain	3.72	64.16	67.88	
Freshwater wetland complex	Swamp	0.15	67.88	68.03	
Cleared	Hillslope / Plain	0.08	68.03	68.11	
Ironbark	Hillslope / Plain	0.49	68.11	68.6	
Cleared	Hillslope / Plain	0.27	68.6	68.88	
Swamp Oak / Swamp Mahogany	Swamp	0.06	68.88	68.91	
Cleared	Plain / Stream	1.63	68.91	70.54	Williams River
Ironbark	Hillslope / Plain	0.35	70.54	70.89	
Cleared	Hillslope / Plain	0.63	70.89	71.52	
Ironbark	Hillslope / Plain	0.14	71.52	71.66	
Cleared	Hillslope / Plain / Stream	18.09	71.66	89.75	Hunter River
Mangrove	Tidal channel	0.02	89.75	89.77	
Cleared	Plain	1.75	89.77	91.52	Hexham

Table T4: Endangered Populations under the TSC Act Potentially Occurring in the Wider Study Area.

Population		Preferred Habitat	Habitat Present in or Adjacent to Study Area		Recorded in Field Survey	Source**
Scientific Name	Common Name		GFDA	Pipeline		
Acacia pendula	Weeping Myall	*Acacia pendula* population in the Hunter Catchment. Occurs on heavy clay soils, sometimes on the margins of small floodplains, but also in more undulating locations.	No	Yes	No	DECC, PlantNet
Cymbidium canaliculatum	Tiger Orchid	*Cymbidium canaliculatum* population in the Hunter Catchment. Grows in the hollows of trees in dry sclerophyll forest or woodland	Yes	Yes	No	DECC, PlantNet
Eucalyptus camaldulensis	Red River Gum	*Eucalyptus camaldulensis* population in the Hunter Catchment. Occurs in major floodplains, especially in areas where water impoundment occurs after flood.	No	No	No	DECC, PlantNet
Eucalyptus parramattensis subsp. *parramattensis*	Parramatta Red Gum	*Eucalyptus parramattensis* population in Wyong and Lake Macquarie local government areas. Grows in low moist areas alongside drainage lines and adjacent to wetlands. It is often found in woodland on sandy soils.	No	Yes	No	DECC, PlantNet
Eucalyptus seeana	Narrow-leaved Red Gum	*Eucalyptus seeana* population in the Greater Taree local government area. Grows woodlands and open forests on low, often swampy, sandy soils.	No	Yes	No	DECC, PlantNet
Leionema lamprophyllum subsp. obovatum	Shiny Phebalium	*Leionema lamprophyllum subsp.obovatum* population in the Hunter Catchment. Occurs in dry eucalypt forest and heath on exposed rocky terrain.	No	No	No	DECC, PlantNet
Rhizanthella slateri	Eastern Australian Underground Orchid	*Rhizanthella slateri* in the Great Lakes local government area. Various habitats. Mostly sclerophyll forests where the soils has been disturbed.	Yes	Yes	No	DECC, PlantNet

Population		Preferred Habitat	Habitat Present in or Adjacent to Study Area		Recorded in Field Survey	Source**
Scientific Name	Common Name		GFDA	Pipeline		
Dromaius novaehollandiae	Emu	Emu population in the NSW North Coast Bioregion and Port Stephens local government area. On the NSW north coast, largely restricted to coastal and near coastal areas between Evans Head and Red Rock; some records from the Port Stephens area.	No	No	No	DECC
Mastacomys fuscus	Broad-toothed Rat	Broad-toothed Rat at Barrington Tops in the local government areas of Gloucester, Scone and Dungog. The population is restricted to sub-alpine swamp complexes and associated grassland and streamside heath environments above 1400 metres elevation at Barrington Tops	No	No	No	DECC

**Source: DECC = NSW Threatened Species, Populations and Ecological Communities; PlantNet = NSW Flora Online

TableT5: Threatened Ecological Communities under the TSC Act as Potentially Occurring in the Wider Study Area

Threatened Ecological Community	Conservation Significance	Recorded in Field Survey	
		GFDA	Pipeline
Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions	EEC	No	No
Blue Gum High Forest in the Sydney Basin Bioregion	Critically EEC	No	No
Blue Mountains Shale Cap Forest in the Sydney Basin Bioregion	EEC	No	No
Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC	No	No
Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	EEC	No	No
Duffys Forest Ecological Community in the Sydney Basin Bioregion	EEC	No	No
Eastern Suburbs Banksia Scrub in the Sydney Basin Bioregion	EEC	No	No
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC	No	Yes
Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions	EEC	No	Yes
Hunter Valley Weeping Myall Woodland of the Sydney Basin Bioregion	EEC	No	No
Illawarra Subtropical Rainforest in the Sydney Basin Bioregion	EEC	No	No
Kurri Sand Swamp Woodland in the Sydney Basin Bioregion	EEC	No	No
Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC	No	No
Lower Hunter Spotted Gum - Ironbark Forest in the Sydney basin Bioregion	EEC	No	Yes
Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	EEC	No	No
Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion	EEC	No	Yes
Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion	EEC	No	No
Milton Ulladulla Subtropical Rainforest in the Sydney Basin Bioregion	EEC	No	No
Moist Shale Woodland in the Sydney Basin Bioregion	EEC	No	No

Threatened Ecological Community	Conservation Significance	Recorded in Field Survey	
		GFDA	Pipeline
Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern HigAECOMnds and Australian Alps bioregions	EEC	No	No
Mount Gibraltar Forest in the Sydney Basin Bioregion	EEC	No	No
Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion	EEC	No	No
Quorrobolong Scribbly Gum Woodland in the Sydney Basin Bioregion	EEC	No	No
River-Flat Eucalypt Forest on Coastal Floodplains	EEC	No	No
Robertson Basalt Tall Open-forest in the Sydney Basin Bioregion	EEC	No	No
Robertson Rainforest in the Sydney Basin Bioregion	EEC	No	No
Shale gravel Transition Forest in the Sydney Basin Bioregion	EEC	No	No
Southern HigAECOMnds Shale Woodlands in the Sydney Basin Bioregion	EEC	No	No
Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion	EEC	No	No
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC	No	Yes
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC	No	Yes
Sydney Freshwater Wetlands in the Sydney Basin Bioregion	EEC	No	No
Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions	EEC	No	No
Warkworth Sands Woodland of the Sydney Basin Bioregion	EEC	No	No
White Box Yellow Box Blakely's Red Gum Woodland	EEC	No	No

EEC = Endangered Ecological Community (Under TSC Act)

Table T6: Flora Species Listed under Commonwealth and / or State Legislation and Identified from database Searches as Previously Recorded from the Wider Study Area, or with Geographical Ranges that Overlap the Wider Study Area with Preferred Habitat.

Scientific Name	Common Name	Status*		Preferred Habitat	Habitat Present Within or Adjacent to Study Area		Recorded in Field Survey	Source**
		EPBC	TSC		GFDA	Pipeline		
Allocasuarina defungens	Dwarf Heath Casuarina	E	E	Mainly in tall heath on sand, but can also occur on clay soils and sandstone. Also extends onto exposed nearby-coastal hills or headlands adjacent to sandplains.	No	No	No	A
Angophora inopina	Charmhaven Apple	V	V	Open woodland with a dense shrub understorey on deep white sandy soils over sandstone.	No	No	No	E, B, A
Asperula asthenes	Trailing Woodruff	V	V	Grows in damp soils often along river banks.	Yes	Yes	No	B, A
Callistemon linearifolius	Netted Bottle Brush		V	Dry sclerophyll forest on the coast and adjacent ranges.	No	Yes	No	B, A
Cryptostylis hunteriana	Leafless Tongue Orchid	V	V	Various, including swamp-heath and woodland, mostly in coastal areas.	No	Yes	No	E, A
Cynanchum elegans	White-flowered Wax Plant	E	E	Edge of rainforest vegetation, especially in gullies in scrub and on scree slopes.	No	Yes	No	E, A
Diuris pedunculata	Small Snake Orchid	E	E	Grassy slopes or flats, often on peaty soils in moist areas. Also on shale and trap soils, on fine granite, and among boulders.	No	No	No	B, A
Eucalyptus glaucina	Slaty Red Gum	V	V	Grassy woodland on deep, moderately fertile and well-watered soil.	Yes	Yes	No	E, B, A
Eucalyptus parramattensis subsp. *decadens*		V	V	Dry sclerophyll woodland with dry heath understory, on sandy soils in low, often wet sites.	Yes	Yes	No	E, A

Scientific Name	Common Name	Status*		Preferred Habitat	Habitat Present Within or Adjacent to Study Area		Recorded in Field Survey	Source**
		EPBC	TSC		GFDA	Pipeline		
Grevillea guthrieana	Guthrie's Grevillea	E	E	Grows along creeks and cliff lines in eucalypt forest, on granitic or sedimentary soil.	Yes	Yes	No	B, A
Grevillea parviflora subsp. *parviflora*	Small-flower Grevillea	V	V	Grows in heath or shrubby woodland, in sandy or light clay soils usually over shale substrates.	Yes	Yes	Yes	E, B, A
Maundia triglochinoides			V	Grows in swamps, creeks or shallow freshwater 30 - 60 cm deep on heavy clay, low nutrients.	Yes	Yes	No	B, A
Melaleuca groveana	Grove's Paperbark		V	Ridges, high mountain slopes and the summit of mountains in heath and eucalypt woodlands and forests with heathy understorey.	No	No	No	B, A
Persicaria elatior	Tall Knotweed	V	V	Growns in damp sites, especially beside streams and lakes and occasionally in swamp forest.	Yes	Yes	No	A
Pomaderris queenslandica	Scant Pomaderris		E	Moist eucalypt forest or sheltered woodlands with shrubby understorey; occasionally along creeks.	Yes	Yes	No	B, A
Rhizanthella slateri	Eastern Underground Orchid	E	V	Various. Mostly sclerophyll forests where the soils has been disturbed.	Yes	Yes	No	E
Rulingia prostrata	Dwarf Kerrawang	E	E	Occurs on sandy, sometimes peaty soils in a wide variety of habitats, mainly in gullies along the escarpment.	No	No	No	E, B, A
Tetratheca juncea	Black-eyed Susan	V	V	Sandy, occasionally swampy heath and in dry sclerophyll forest; mostly in coastal districts.	Yes	Yes	No	E, B, A
Zannichellia palustris			E	Submerged in fresh or slightly saline stationary or slowly flowing water.	Yes	Yes	No	B, A

*Status: E = Endangered; V = Vulnerable

**Source of record: A = Atlas of NSW Wildlife; B = BioNet; E= EPBC Protected Matters

Table T7: Declared Weeds Recorded During Field Surveys

Scientific Name	Common Name	Status		Recorded During Field Study		Specific Sites Where Recorded During Field Surveys	
		Class*	WONS**	FD	Pipeline	Detailed Sites	Observational Sites
Ageratina riparia	Mistflower	4		No	Yes	FL 09, FL 10, FL 08	OB 18
Eichhornia crassipes	Water Hyacinth	4		No	Yes	FL 20	
Lantana camara	Lantana	5	Yes	No	Yes	FL 09, FL 10, FL 07, FL 13, FL 15, FL 18, FL 19	OB 03, OB 13, OB 17, OB 45
Ligustrum sinense	Small Leaf Privet	4		Yes	Yes	FL 10, FL 08, FL 03	OB 02
Oxalis spp.	Oxalis	5		No	Yes	FL 07	
Romulea rosea	Onion Grass	5		No	Yes	FL 07	
Rubus fruitcosus	Blackberry	4	Yes	No	Yes	FL 15	OB 03
Salix spp.	Weeping Willow	5	Yes	Yes	No		OB 01
Not recorded or not declared							
Alternanthera philoxeroides	Alligator Weed	2	Yes	No	No		
Sporobolus africanus	Parramatta Grass	-		No	Yes		OB 58, OB 59, OB 08

*Class: Under the NSW *Noxious Weeds Act 1993*, weed species are classified into 5 categories:

Classes 1 and 2: *This plant must be eradicated from the land and the land kept free of the plant.*

Class 3: *The plant must be fully and continuously suppressed and destroyed.*

Class 4: *The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local authority.*

Class 5: *The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with*.

**WONS: Commonwealth Weeds of National Significance

Table T8: Fauna Habitats Recorded along Proposed Pipeline

Fauna Habitat	Corresponding vegetation communities	Total area impacted (ha)*
Woodland and open forests	Ironbark, dry foothills Spotted Gum, South Coast Shrubby Grey Gum, Redgum / apple	46.7
Riparian / closed forest	Rainforest, mangrove	2.1
Open freshwater wetlands	Freshwater wetland complex, Swamp Mahogany	0.42
Grasslands and pastures	-	243.1

* Assuming entire 30 m ROW requires clearing.

Table T9: Threatened Fauna Species Previously Recorded from the Wider Study Area, with Potential Habitat in the Project Site.

Scientific Name	Common Name	Status *	Preferred Habitat	Potential Habitat in site	Source **
Amphibians					
Litoria aurea	Green and Golden Bell Frog	V[1] / E[2,3]	Marshes, dams and streams particularly containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.), generally free of fish and unshaded but often disturbed.	Yes	A, B, E
Mixophyes balbus	Stuttering Frog	V[1,3] / E[2]	Typically associated with permanent streams through temperate and sub-tropical rainforest and wet sclerophyll forest, rarely in dry open tableland riparian vegetation (Mahony et al. 1997), and also in moist gullies in dry forest (Gillespie and Hines, 1999).	Yes	E
Mixophyes iteratus	Giant Barred Frog	E[1,2,3]	Wet sclerophyll forest and rainforest and riparian vegetation beside permanent streams; often in leaf litter near permanent fast-flowing streams.	Yes	B, E
Reptiles					
Hoplocephalus bitorquatus	Pale-headed Snake	V[2]	Dry eucalypt forests and woodlands, cypress woodland and occasionally rainforest or moist eucalypt forest. Prefers streamside areas, particularly in drier habitats. During the day, shelters between loose bark and tree trunks, or in hollow trunks and limbs of dead trees.	Yes	A, B
Hoplocephalus stephensii	Stephens' Banded Snake	V[2] / R / IK[3]	Rainforest and wet eucalypt forest along the coast and ranges from mid-NSW to SE Qld. Semi-arboreal, sheltering beneath loose bark, in tree hollows and rarely in rafters.	Yes	A, B
Birds					
Anseranas semipalmata	Magpie Goose	V[2]	Shallow wetlands (usually < 1 m deep) with dense growth of rushes and sedges. Wetlands associated with floodplains of rivers and large shallow wetlands formed by run off.	Yes	A, B
Botaurus poiciloptilus	Australasian Bittern	V[2,3]	Permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.).	Yes	A, B
Burhinus grallarius	Bush stone-Curlew	E[2] / NT[3]	Open woodlands, lightly timbered country, mallee and mulga - prefer groundcover of small sparse shrubs, grass or litter of twigs.	Yes	A, B

Scientific Name	Common Name	Status *	Preferred Habitat	Potential Habitat in site	Source **
Callocephalon fimbriatum	Gang-gang Cockatoo	V[2]	In summer, generally in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. Also in sub-alpine Snow Gum *Eucalyptus pauciflora* woodland and occasionally in temperate rainforests. Favours old growth attributes for nesting and roosting. Moves to lower altitudes in winter, favouring drier more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or dry forest in coastal areas and often found in urban areas.	Yes	A, B
Calyptorhynchus lathami	Glossy black-Cockatoo	V[2] / NT[3]	Coastal forest and open inland woodland. Feeds primarily on *Allocasuarina littoralis* or *Allocasuarina torulosa*.	Yes	A, B, E
Climacteris picumnus	Brown Treecreeper	V[2] / NT[3]	Eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (*Euc. camaldulensis*) Forest bordering wetlands usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging. Less commonly, in similar woodland habitats on the coastal ranges and plains.	Yes	A, B
Coracina lineata	Barred Cuckoo-shrike	V[2]	Rainforest, eucalypt forests and woodlands, clearings in secondary growth, swamp woodlands and timber along watercourses.	Yes	A, B
Ephippiorhynchus asiaticus	Black-necked Stork	E[2] / LC[3]	Lakes, swamps, freshwater pools and mangroves. Nests in trees or large bushes, often over swamps.	Yes	A, B
Irediparra gallinacea	Comb-crested Jacana	V[2]	Permanent wetlands with a good surface cover of floating vegetation, especially water lillies.	Yes	A, B
Ixobrychus flavicollis	Black Bittern	V[2]	Freshwater and estuarine wetlands in areas of permanent water and dense vegetation. Where water is permanent, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves.	Yes	A, B
Lathamus discolor	Swift Parrot	E[1,2,3] / Ma[1]	Breeds in Tasmania and over-winters in forests and woodlands on the Australian mainland, congregating where eucalypts are flowering profusely, including Red Ironbark, Redgum and Yellow Box forests.	Yes	A, B, E

Scientific Name	Common Name	Status *	Preferred Habitat	Potential Habitat in site	Source **
Lophoictinia isura	Square-tailed Kite	V[2] / LC[3]	Sparsely distributed in open eucalypt forests, woodlands and sand plains.	Yes	A, B
Melanodryas cucullata	Hooded Robin	V[2] / NT[3]	Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. Often perches on low dead stumps and fallen timber or on low-hanging branches, using a perch-and-pounce method of hunting insect prey.	Yes	A, B, E
Melithreptus gularis	Black-chinned Honeyeater	V[2] / NT[3]	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Euc. sideroxylon*), White Box (*Euc. albens*), Grey Box (*Euc. microcarpa*), Yellow Box (*Euc. melliodora*) and Forest Red Gum (*Euc. tereticornis*). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks and tea-trees.	Yes	A, B
Neophema pulchella	Turquoise Parrot	V[2] / NT[3]	Inhabits steep, rocky ridges and gullies, rolling hills, valleys and river-flats and the nearby plains of the Great Dividing Range (Higgins, 1999); eucalypt woodlands and open forests, with a ground cover of grasses and low understorey of shrubs (Jarman, 1973; Morris, 1980), usually with Cypress Pine *Callitris* and a variety of *Eucalyptus* species, Morris1980; Quinn and Baker-Gabb, 1993; Quinn and Reid, 1996). Occasionally in savannah and riparian woodlands and farmland, preferring edges of forest and pasture or other grassland	Yes	A, B
Ninox connivens	Barking Owl	V[2] / NT[3]	Eucalypt woodland, open forest, swamp woodlands and, especially in inland areas, timber along watercourses.	Yes	A, B
Ninox strenua	Powerful Owl	V[2] / LC[3]	Eucalypt forests along Great Dividing Range, preferring tall wet sclerophyll forests, where territories of 800-1000 ha centre on densely vegetated gullies.	Yes	A, B
Pomatostomus temporalis	Grey-crowned Babbler	V[2] / NT[3]	Inhabits open box gum woodlands on the slopes, and Cypress Pine and open box gum woodlands on alluvial plains.	Yes	A, B

Scientific Name	Common Name	Status *	Preferred Habitat	Potential Habitat in site	Source **
Pyrrholaemus saggitatus	Speckled Warbler	V[2]	Lives in a wide range of *Eucalyptus* dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat includes scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Mostly requires large, relatively undisturbed remnants.	Yes	A, B
Rostratula (benghalensis) australis	Australian Painted Snipe	V[1,3] / E[2]	Shallow muddy freshwater swamps and marshes.	Yes	A, B, E
Stagonopleura guttata	Diamond Firetail	V[2] / NT[3]	Grassy eucalypt woodlands, including box-gum woodlands and Snow Gum *Eucalyptus pauciflora* woodlands. Also occurs in open forest, mallee, natural temperate grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland.	Yes	A, B
Tyto novaehollandiae	Masked Owl	V[2] / NT[3]	Dry eucalypt forests and woodlands from sea level to 1,100 m.	Yes	A, B, E
Tyto tenebricosa	Sooty Owl	V[2]	Dense subtropical and temperate rainforest and fern gullies; tall wet sclerophyll forest.	Yes	A, B
Xanthomyza phrygia	Regent Honeyeater	E[1, 2,3]	Eucalypt woodland and open forest on the slopes of the Great Dividing Range and occasionally on the coast. Particularly favours box-ironbark woodland, and riparian forests of River She-oak.	Yes	A, B, E
Mammals					
Cercartetus nanus	Eastern Pygmy-Possum	V[2] / LC[3]	Found in a broad range of habitats from rainforest through sclerophyll (including box-ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest.	Yes	A, B
Chalinolobus dwyeri	Large-eared Pied bat	V[1,2,3]	Dry forests and woodlands, moist eucalypt forests, caves and mines.	Yes	A, B, E

Scientific Name	Common Name	Status *	Preferred Habitat	Potential Habitat in site	Source **
Dasyurus maculatus	Spotted-tailed Quoll	E[1] / V[2,3]	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individuals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites. They make latrines.	Yes	A, B, E
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V[2] / LC[3]	Moist forest habitats with trees taller than 20 m. Roosts in eucalypt hollows; also found under loose bark on tress or in buildings.	Yes	A, B
Macropus parma	Parma Wallaby	V[2] / NT[3]	Moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest.	Yes	A, B
Miniopterus australis	Little Bent-wing Bat	V[2] / LC[3]	Moist eucalypt forest, rainforest or dense coastal banksia scrub. Roosts in caves, tunnels and sometimes tree hollows Forages for small insects beneath the canopy of densely vegetated habitats.	Yes	A, B
Miniopterus schreibersii	Common Bent-wing Bat	V[2] / LC[3]	Occurs in dry sclerophyll forest and woodland east of the Great Dividing Range typically in well-timbered gullies. Roosts in caves, derelict mines, storm-water tunnels, buildings and other man-made structures. Hunts in forested areas, catching moths and other flying insects above the tree tops.	Yes	A,B
Mormopterus norfolkensis	Eastern Free-tail Bat	V[2] / DD[3]	Occurs in dry sclerophyll forest and woodland east of the Great Dividing Range. Roosts mainly in tree hollows but will also roost under bark or in man-made structures.	Yes	A, B
Myotis adversus	Large-footed Myotis	V[2]	Roosts in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forages over streams and pools.	Yes	A, B
Petaurus australis	Yellow-bellied Glider	V[,2,3]	Tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Prefers mixed coastal forests to dry escarpment forests in the north.	Yes	A, B, E
Petaurus norfolcensis	Squirrel Glider	V[2] / NT[3]	Mature or old growth box, box-ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or acacia midstorey.	Yes	A, B

Scientific Name	Common Name	Status *	Preferred Habitat	Potential Habitat in site	Source **
Phascogale tapoatafa	Brush-tailed Phascogale	V[2] / NT[3]	Dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also heath, swamps, rainforest and wet sclerophyll forest.	Yes	A, B
Phascolarctos cinereus	Koala	V[2] / NT[3]	Inhabits eucalypt woodlands and forests. Feeds on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	Yes	A, B
Planigale maculata	Common Planigale	V[2] / LC[3]	Inhabits rainforest, eucalypt forest, heatAECOMnd, marsAECOMnd, grassland and rocky areas where there is surface cover, and usually close to water. They are active at night and during the day shelter in saucer-shaped nests built in crevices, hollow logs, beneath bark or under rocks.	Yes	A, B
Potorous tridactylus	Long-nosed Potoroo	V[1,2,3]	Coastal wet heath, dry and wet forests with thick ground cover.	Yes	A, B, E
Pteropus poliocephalus	Grey-headed Flying-fox	V[1,2,3]	Roosting sites usually in dense forest adjacent to waterbodies. Forages within 15 km of camp in flowering trees or rainforests, eucalypts, paperbarks and banksias.	Yes	A, B, E
Saccolaimus flaviventris	Yellow-bellied Sheath-tail Bat	V[2] / LC[3]	Roosts in tree hollows and buildings; and in mammal burrows in treeless areas. Forages in most habitats across its very wide range, with and without trees.	Yes	A, B
Scoteanax rueppellii	Greater Broad-nosed Bat	V[2] / NT[3]	Woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Usually roosts in tree hollows, sometimes in buildings.	Yes	A, B

*** Status:** [1]:= Commonwealth (EPBC) status ; [2]: = State (TSC Act) status [3]:= Action Plan; **E** = Endangered; **V** = Vulnerable; **NT** = Near Threatened; **LC** = Least Concern; **R** = Rare; **DD** = Data Deficient; **IK** = Insufficiently Known; **Mi/Ma** = Migratory and/or Marine

**** Source:** A = Atlas NSW; B = BioNet; E = EPBC Protected Matters.

Table T10: Threatened Fauna Species and Previously Recorded from the Wider Study Area, but without Potential Habitat in the Project Site.

Scientific Name	Common Name	Status *	Preferred Habitat	Reason for no Further Assessment	Source **
Amphibians					
Litoria booroolongensis	Booroolong Frog	$E^{1,2}$ / IK^{3}	Mostly found along the western-flowing streams of the Great Divide, mostly the south-west slopes of NSW. Adults occur in permanent streams with fringing vegetation such as ferns or sedges. Shelters under rocks or in vegetation near the ground on the stream edge.	Recorded in region only from pristine forests in ranges to north of subject area	E
Litoria littlejohni	Littlejohn's Tree Frog	$V^{1,2}$	Inhabits forest, coastal woodland and heath from 100 to 950 m ASL (White and Ehmann, 1997), but not tied to specific vegetation types.	Occcurs from the Watagan Mts south, well south of the subject site.	E
Reptiles					
Hoplocephalus bungaroides	Broad-headed Snake	$V^{1,}$/ E^{2}	Restricted to sandstone escarpments. Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges. In summer moves to shelters in hollows in large trees within 200 m of escarpments.	No sandstone escarpments in the study site	E
Birds					
Calidris tenuirostris	Great Knot	V^{2}	Sheltered coastal habitats with large, intertidal mudflats or sandflats, including inlets, bays, harbours, estuaries, lagoons, sandy spits, islets and sometimes on exposed reefs or rock platforms.	Exclusively coastal in NSW	A, B
Charadrius leschenaultii	Greater Sand-Plover	V^{2}	Occurs mainly on sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks. Roosts during high tide on sandy beaches and rocky shores, often with other waders.	Almost exclusively coastal in NSW	A, B
Charadrius mongolus	Lesser Sand Plover	V^{2}	Occurs mainly on sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks. Roosts during high tide on sandy beaches and rocky shores, often with other waders.	Exclusively coastal in NSW	A, B, E
Diomedea (exulans) antipodensis	Antipodean Albatross	$V^{1,2,3}$	Marine and oceanic, coastal seas. Follows ships and fishing boats.	Exclusively marine in NSW	E

Scientific Name	Common Name	Status *	Preferred Habitat	Reason for no Further Assessment	Source **
Diomedea (exulans) gibsoni	Gibson's Albatross	V[1,2,3]	Marine and oceanic, coastal seas. Follows ships and fishing boats.	Exclusively marine in NSW	E
Falco hypoleucos	Grey Falcon	V[2] /NT[3]	Mainly in semi-arid and arid regions; lightly timbered country, especially stony plains and lightly timbered acacia scrublands.	Essentially inland species, only vagrants reach coast	A, B
Hamirostra melanosternon	Black-breasted Buzzard	V[2]	Mainly in semi-arid and arid regions; nests in large trees along inland watercourses and hunts out over surrounding scrub or grassland plain.	Essentially inland species, only vagrants reach coast	A, B
Limicola falcinellus	Broad-billed Sandpiper	V[2]	Sheltered coastal estuaries, lagoons with soft inter-tidal mudflats; muddy coastal creeks, swamps, occasionally reefs.	Exclusively coastal in NSW	A, B, E
Limosa limosa	Black-tailed Godwit	V[2]	Sheltered bays, estuaries and lagoons with large intertidal mudflats and / or sandflats. In inland areas, found on mudflats and in water less than 10 cm deep, around muddy lakes and swamps. Has also been recorded in wet fields and sewerage treatment works.	Mostly marine, occasionally on shores of large fresh water wetlands; neither found in project area	A, B, E
Macronectes giganteus	Southern Giant-Petrel	E[1,2] / V[3]	Breeds in subantarctic. Marine, over open seas and inshore waters; favours edge of continental shelf and edge of pack-ice.	Exclusively marine in NSW	E
Macronectes halli	Northern Giant-Petrel	V[1,2] / NT[3]	Breeding in Australian territory is limited to Macquarie Island. Adults usually remain near the breeding colonies throughout the year while immature birds disperse, many reaching seas off NSW.	Exclusively marine in NSW	E
Oxyura australis	Blue-Billed Duck	V[2]	Deep water in large permanent wetlands and swamps with dense aquatic vegetation. Completely aquatic, swimming low in the water along the edge of dense cover.	No deep water wetlands within the study site	A, B
Pandion haliaetus	Osprey	V[2]	Favours coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water. Breed from July to September in NSW. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea. Sometimes follows rivers inland	Project would avoid large rivers, estuaries etc.	A, B
Pterodroma leucoptera	Gould's Petrel	E[1, 2] / V[3]	Marine and pelagic. Breeds at Cabbage Tree Island off Port Stephens	Exclusively marine	A, B, E

Scientific Name	Common Name	Status *	Preferred Habitat	Reason for no Further Assessment	Source **
Pterodroma neglecta	Kermadec Petrel	V[1,2] / CR / NT[3]	Marine and pelagic.	Exclusively marine in NSW	E
Pterodroma solandri	Providence Petrel	V[2,3]	Marine and pelagic.	Exclusively marine in NSW	A, B
Ptilinopus magnificus	Wompoo Fruit-Dove	V[2]	In or near rainforest, low elevation moist eucalypt forest and brush box forests.	No rainforest or wet sclerophyll forest with high plentiful fruit in proposed footprint	A, B
Ptilinopus regina	Rose-crowned Fruit-Dove	V[2]	Sub-tropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest where fruit is plentiful.	No rainforest or wet sclerophyll forest with high plentiful fruit in proposed footprint	A, B
Puffinus carniepes	Flesh-Footed Shearwater	V[2,3]	Marine and pelagic.	Exclusively marine	A, B
Sterna albifrons	Little Tern	E[2] / LC[3]	Almost exclusively coastal, preferring sheltered environments; may occur several kilometres from the sea in harbours, inlets and rivers Nests in small, scattered colonies in low dunes or on sandy beaches just above high tide mark near estuaries, coastal lakes and islands.	Almost exclusively coastal	A, B, E
Stictonetta naevosa	Freckled Duck	V[2] / LC[3]	Large, open freshwater swamps and fresh to salty open lakes.	No large, open wetlands in proposed footprint	A, B
Thalassarche bulleri	Buller's Albatross	V[1,3]	Marine and oceanic, coastal seas. Follows ships and fishing boats.	Exclusively marine in NSW	E
Thalassarche cauta	Shy Albatross	V[1,2,3]	Marine and oceanic, coastal seas. Follows ships and fishing boats.	Exclusively marine in NSW	E
Thalassarche (melanophris) impavida	Campbell Albatross	V[1,3]	Marine and oceanic, coastal seas. Follows ships and fishing boats.	Exclusively marine in NSW	E

Scientific Name	Common Name	Status *	Preferred Habitat	Reason for no Further Assessment	Source **
Thalassarche (cauta) salvini	Salvin's Albatross	V[1,3]	Marine and oceanic, coastal seas. Follows ships and fishing boats.	Exclusively marine in NSW	E
Thalassarche (cauta) steadi	White-capped Albatross	V[1,3]	Marine and oceanic, coastal seas. Follows ships and fishing boats.	Exclusively marine in NSW	E
Tyto capensis	Grass Owl	V[2]	Tall grass, including grass tussocks in swampy areas, grassy plains, swampy heath, and cane grass or sedges on flood plains.	Only occurs as a vagrant south of Harrington NSW (Hobcroft and James, 1997)	A, B
Xenus cinereus	Terek Sandpiper	V[2]	Coastal mudflats, lagoons, creeks and estuaries. Favours mudbanks and sandbanks near mangroves, but also rocky pools and reefs. Roosts communally, often with related wader species.	Exclusively coastal in NSW	A, B, E
Mammals					
Petrogale penicillata	Brush-Tailed Rock-Wallaby	V[1,3] / E[2]	Rock escarpments, rock piles and cliffs with ledges, caves and crevices in wet and dry sclerophyll forests.	No escarpments or outcrops in the study site	A, B, E
Kerivoula papuensis	Golden-Tipped Bat	V[2] / NT[3]	Found in rainforest and adjacent sclerophyll forest. Roosts in abandoned hanging nests of scrubwrens and gerygones, over first- and second-order streams. Forages up to 2 km from roosts in rainforest and sclerophyll forest on upper-slopes. Specialist feeder on small web-building spiders.	No rainforest or wet sclerophyll forest with rainforest elements in proposed footprint.	A, B
Pseudomys oralis	Hastings River Mouse	E[1,2,3]	Dry open forest types with dense, low ground cover and diverse mixture of ferns, grass, sedges and herbs.	Within the region, only occurs in the Barrington sub-region above 400 m	A,B,E

Status: [1]:= Commonwealth (EPBC) status ; [2]: = State (TSC Act) status [3]:= Action Plan; **E** = Endangered; **V** = Vulnerable; **NT** = Near Threatened; **LC** = Least Concern; **R** = Rare; **DD** = Data Deficient; **IK** = Insufficiently Known;

**** Source:** A = Atlas NSW; B = BioNet; E = EPBC Protected Matters.

Table T11: Assessment of migratory species listed under the EPBC Act

This table summarises the impact assessment for Migratory and / or Marine species listed under the EPBC Act that were considered to potentially occur in the study area, or for which there is potential habitat within the study area. The impact assessment follows the 'significant impact criteria' as outlined in the EPBC Act Policy Statement 1.1, Significant Impact Guidelines (DEH 2006).

Species	Distribution, ecology and habitat	Substantially modify, destroy or isolate an area of important habitat?	Result in an invasive species becoming established in an area of important habitat?	Seriously disrupt the lifecycle of an ecologically significant proportion of the population?	Conclusion
Haliaeetus leucogaster White-bellied Sea-Eagle	Usually coastal, over islands, reefs, headlands, beaches, bays, estuaries, mangroves, seasonally flooded inland swamps, lagoons and floodplains; often far inland on large pools of major rivers.	Only small, widely dispersed numbers in locality, not a significant proportion of the national population. Habitat not important for a significant proportion of the national population. Widely distributed species, not near the limits of its range. Not listed as threatened so not considered to be in decline.	The proposed works would not result in the establishment of any invasive species in the project area. No 'important habitat' for the listed migratory species under consideration exists in the project area.	The study area does not support important breeding or feeding habitat. The proposal is not likely to disrupt migration or resting behaviour of migratory species, nor the lifecycle of an ecologically significant proportion of a population.	No significant impact is expected from the proposed development
Ardea alba Great Egret *Ardea ibis* Cattle Egret *Gallinago hardwickii* Latham's Snipe	Wetlands, flooded pastures, dams, estuarine mudflats, mangroves and reefs; moist pastures with tall grass; low vegetation around wetlands in shallows, sedges, reeds, heaths, saltmarsh, irrigated crops; rank and inundated grasslands	Only small, widely dispersed numbers potentially in the locality, so not a significant proportion of the national population. Habitat not important for a significant proportion of the national population. Widely distributed species, not near limits of their ranges. Not listed as threatened so not considered to be in decline.	The proposed works would not result in the establishment of any invasive species in the project area. No 'important habitat' for the listed migratory species under consideration exists in the project area.	The study area does not support important breeding or feeding habitat. The proposal is not likely to disrupt the migration or resting behaviour of any migratory species. Therefore, the proposal would not disrupt the lifecycle of an ecologically significant proportion of a population.	No significant impact is expected from the proposed development

Species	Distribution, ecology and habitat	Substantially modify, destroy or isolate an area of important habitat?	Result in an invasive species becoming established in an area of important habitat?	Seriously disrupt the lifecycle of an ecologically significant proportion of the population?	Conclusion
Arenaria interpres Ruddy Turnstone *Calidris acuminate* Sharp-tailed Sandpiper *Calidris ferruginea* Curlew Sandpiper *Pluvialis fulva* Pacific Golden Plover *Tringa nebularia* Common Greenshank *Limosa lapponica* Bar-tailed Godwit *Numenius madagascariensis* Eastern Curlew *Numenius phaeopus* Whimbrel	Breed outside Australia. Mainly coastal: inter-tidal mudflats of estuaries, lagoons, mangrove channels; around lakes, dams, floodwaters, flooded saltbush surrounds of inland lakes.	These species breed outside Australia. They all primarily inhabit coastal wetlands. Occasionally they occur in freshwater wetlands but rarely if ever at nationally significant levels (Watkins 1993). No freshwater wetlands habitats large enough to support significant numbers of these species occur in the project area. Widely distributed species, not near the limits of ranges. Not listed as threatened so not considered to be in decline.	The proposed works would not result in the establishment of any invasive species in the project area. No 'important habitat' for the listed migratory species under consideration exists in the project area.	The study area does not support important breeding or feeding habitat. The proposal is not likely to disrupt migration or resting behaviour of migratory species, nor the lifecycle of an ecologically significant proportion of a population.	No significant impact is expected from the proposed development

Species	Distribution, ecology and habitat	Substantially modify, destroy or isolate an area of important habitat?	Result in an invasive species becoming established in an area of important habitat?	Seriously disrupt the lifecycle of an ecologically significant proportion of the population?	Conclusion
Apus pacificus Fork-tailed Swift *Hirundapus caudacutus* White-throated Needletail	Breed outside Australia Low to very high, open airspace over almost any habitat, including oceans, forests and deserts. At times gather over ranges, headlands, often in humid, unsettled weather preceding thunderstorms.	No breeding habitat and no substantial areas of feeding habitat in project area; therefore no significant populations occur in or are reliant on habitat within the proposed development footprint. Widely distributed species, not near the limits of ranges. Not listed as threatened so not considered to be in decline	The proposed works will not result in the establishment of any invasive species in the project area. No 'important habitat' for the listed migratory species under consideration exists in the project area	The study area does not support important breeding or feeding habitat. The proposal is not likely to disrupt migration or resting behaviour of migratory species, nor the lifecycle of an ecologically significant proportion of a population.	No significant impact is expected from the proposed development
Merops ornatus Rainbow Bee-eater	Open country of woodlands, open forest, semi-arid scrub, grasslands, clearings in heavier forests, farmlands; avoids heavy forest. In breeding season, requires open clearing or paddock with loamy soil soft enough for nest tunnelling, yet firm enough to support the tunnel.	Species does not congregate in large flocks to feed or breed, so populations are dispersed. During migration flocks occur in virtually any habitat and not reliant on specific habitats or sites. Widely distributed species, not near the limits of range. Not listed as threatened so not considered to be in decline.	The proposed works would not result in the establishment of any invasive species in the project area. No 'important habitat' for the listed migratory species under consideration exists in the project area.	The study area does not support important breeding or feeding habitat. The proposal is not likely to disrupt migration or resting behaviour of migratory species, nor the lifecycle of an ecologically significant proportion of a population.	No significant impact is expected from the proposed development

Species	Distribution, ecology and habitat	Substantially modify, destroy or isolate an area of important habitat?	Result in an invasive species becoming established in an area of important habitat?	Seriously disrupt the lifecycle of an ecologically significant proportion of the population?	Conclusion
Lathamus discolor Swift Parrot *Xanthomyza phrygia* Regent Honeyeater	Breed outside project area. Migrate to woodlands of eastern Australia during winter, where attracted to winter flowering eucalypts, especially box-ironbark woodlands and riparian forests of River She-oak.	No breeding habitat and no substantial areas of feeding habitat in project area; therefore no significant populations occur in or are reliant on habitat within the proposed development footprint.	The proposed works would not result in the establishment of any invasive species in the project area. No 'important habitat' for the listed migratory species under consideration exists in the project area.	The study area does not support important breeding or feeding habitat. The proposal is not likely to disrupt migration or resting behaviour of migratory species, nor the lifecycle of an ecologically significant proportion of a population.	No significant impact is expected from the proposed development
Monarcha melanopsis Black-faced Monarch *Monarcha trivirgatus* Spectacled Monarch *Myiagra cyanoleuca* Satin Flycatcher *Rhipidura rufifrons* Rufous Fantail	Usually rainforests, eucalypt forests and mangroves; often in moist gullies of dense wet eucalypt forests.	Very little potential habitat for these species occurs in the project area. These species may occur in the forests at the southern end of Black Camp Road. However, area is too small to support ecologically significant numbers of the species. Widely distributed species, not near the limits of range. Not listed as threatened so not considered to be in decline.	The proposed works would not result in the establishment of any invasive species in the project area. No 'important habitat' for the listed migratory species under consideration exists in the project area.	The study area does not support important breeding or feeding habitat. The proposal is not likely to disrupt migration or resting behaviour of migratory species, nor the lifecycle of an ecologically significant proportion of a population.	No significant impact is expected from the proposed development

Table T12: Lengths of Remnant Vegetation Transected and Potential Areas to be Cleared along Proposed Pipeline

Vegetation	Land form	Length (km)	KP start	KP end	Existing cleared width (m) ^	Free width (m) *	30m ROW	Clearing Area (ha) # Required				Location Notes
								30 m ROW - free width	20 m ROW - free width	20 m ROW - free width, HDD of Karuah	20 m ROW - free width, HDD of Karuah, NP uncleared	
Dry foothills Spotted Gum	Plain	0.06	4	4.06	5	5	0.18	0.15	0.09	0.09	0.09	
Rainforest	Stream	0.03	8.36	8.39	0	0	0.09	0.09	0.06	0.06	0.06	Bull Creek
South Coast Shrubby Grey Gum	Hillslope / Plain	0.65	14.6	15.25	40	15	1.95	0.975	0.325	0.325	0.325	
Rainforest	Stream	0.07	19.23	19.29	0	0	0.21	0.21	0.14	0	0	Karuah River
Rainforest	Gully	0.05	20.97	21.02	0	0	0.15	0.15	0.1	0.1	0.1	
Rainforest	Stream	0.06	23.51	23.57	0	0	0.18	0.18	0.12	0	0	Karuah River
Rainforest	Stream	0.11	24.29	24.4	0	0	0.33	0.33	0.22	0	0	Karuah River
Rainforest	Stream	0.09	26.99	27.08	0	0	0.27	0.27	0.18	0.18	0.18	Barnes Creek
Ironbark	Plain	0.82	27.64	28.45	6	6	2.46	1.968	1.148	1.148	1.148	Roadside Environment Area
Ironbark	Plain	0.13	28.56	28.69	6	6	0.39	0.312	0.182	0.182	0.182	
Ironbark	Plain	0.4	29.6	30	6	6	1.2	0.96	0.56	0.56	0.56	
Ironbark	Stream	0.04	30.87	30.91	5	5	0.12	0.1	0.06	0.06	0.06	Barnes Creek
Dry foothills Spotted Gum	Hillslope	5.11	31.34	36.45	5	5	15.33	12.775	7.665	7.665	7.665	
South Coast Shrubby Grey Gum	Hillslope	0.43	36.45	36.88	5	5	1.29	1.075	0.645	0.645	0.645	

Vegetation	Land form	Length (km)	KP start	KP end	Existing cleared width (m) ^	Free width (m) *	30m ROW	Clearing	Area	Required	(ha) #	Location Notes
								30 m ROW - free width	20 m ROW - free width	20 m ROW - free width, HDD of Karuah	20 m ROW - free width, HDD of Karuah, NP uncleared	
Rainforest	Hillslope / Stream	0.07	36.88	36.95	5	5	0.21	0.175	0.105	0.105	0.105	Black Camp Creek
Dry foothills Spotted Gum	Hillslope	1.06	36.95	38.01	5	5	3.18	2.65	1.59	1.59	1.59	
Rainforest	Stream	0.03	38.24	38.27	0	0	0.09	0.09	0.06	0.06	0.06	
Rainforest	Stream	0.07	40.21	40.28	0	0	0.21	0.21	0.14	0.14	0.14	Cedar Tree Creek
Redgum / apple	Stream	0.1	45.58	45.67	20	20	0.3	0.1	0	0	0	Little Black Camp Creek
Ironbark	Plain	0.2	45.77	45.97	20	20	0.6	0.2	0	0	0	
Rainforest	Stream	0.04	49.45	49.5	0	0	0.12	0.12	0.08	0.08	0.08	
Ironbark	Plain	0.82	53.99	54.81	40	15	2.46	1.23	0.41	0.41	0.41	Nature Reserve
Ironbark	Hillslope / Plain	1.37	58.1	59.47	25	10	4.11	2.74	1.37	1.37	1.37	
Ironbark	Hillslope / Plain	2.38	59.7	62.08	25	10	7.14	4.76	2.38	2.38	0	Wallaroo National Park
Rainforest	Stream	0.04	62.08	62.12	25	10	0.12	0.08	0.04	0.04	0	Wallaroo National Park
Ironbark	Hillslope / Plain	0.9	62.12	63.02	25	10	2.7	1.8	0.9	0.9	0	Wallaroo National Park

Vegetation	Land form	Length (km)	KP start	KP end	Existing cleared width (m) ^	Free width (m) *	30m ROW	Clearing (ha) #		Area Required (ha) #		Location Notes
								30 m ROW - free width	20 m ROW - free width	20 m ROW - free width, HDD of Karuah	20 m ROW - free width, HDD of Karuah, NP uncleared	
Ironbark	Plain	0.09	64.07	64.16	10	10	0.27	0.18	0.09	0.09	0.09	Roadside Environment Area
Freshwater wetland complex	Swamp	0.15	67.88	68.03	0	0	0.45	0.45	0.3	0.3	0.3	
Ironbark	Hillslope / Plain	0.49	68.11	68.6	25	10	1.47	0.98	0.49	0.49	0.49	
Swamp Mahogany	Swamp	0.03	68.88	68.9	10	5	0.09	0.075	0.045	0.045	0.045	
Ironbark	Hillslope / Plain	0.35	70.53	70.88	0	0	1.05	1.05	0.7	0.7	0.7	
Ironbark	Hillslope / Plain	0.14	71.51	71.65	0	0	0.42	0.42	0.28	0.28	0.28	
Mangrove	Tidal channel	0.02	89.74	89.76	0	0	0.06	0.06	0.04	0.04	0.04	
TOTAL CLEARED		16.4					49.2	36.92	20.52	20.04	16.72	

^ Existing cleared width = width of existing clearing within the Right of Way (ROW).

* Free width = width of existing clearing within the ROW that is unobstructed by electrical transmission towers.

Maximum area of remnant vegetation that would be cleared under various scenarios:

30 m ROW = entire 30 m ROW containing remnant vegetation cleared

30 m ROW - free width = unobstructed cleared width included in 30 m ROW, remainder assumed to be entirely remnant vegetation

20 m ROW - free width = same as previous, but assumes only 20 m ROW is required for construction

HDD of Karuah = assumes HDD of Karuah River crossings (no clearing of riparian rainforest communities)

NP uncleared = assumes ROW contained entirely within existing cleared powerline easement (no clearing of remnant vegetation) in Wallaroo National Park.

Table T13: Summary of Potential Areas of Remnant Vegetation to be Cleared along Proposed Pipeline

Vegetation	30m ROW	Clearing Area (ha) #		Required Buffer Area (ha) ^			% of Buffer Cleared *	
		30 m ROW - free width	20 m ROW - free width	20 m ROW - free width, HDD of Karuah	20 m ROW - free width, HDD of Karuah, NP uncleared	Area in 5 km buffer (CRA mapping)	Area in 5 km buffer (LHCC mapping)	% of total in buffer (CRA mapping)	% of total in buffer (LHCC mapping)
Dry foothills spotted gum	18.69	15.575	9.345	9.345	9.345	1828.45	5248.11	1.02	0.36
South Coast Shrubby Grey Gum	3.24	2.05	0.97	0.97	0.97	17576.30	1851.14	0.02	0.18
Ironbark	24.39	16.7	8.57	8.57	5.29	7560.16	5248.11	0.32	0.46
Redgum / apple	0.3	0.1	0	0	0	1242.78	161.34	0.02	0.19
Eucalypt forests	46.62	34.425	18.885	18.885	15.605				
Freshwater wetland complex	0.45	0.45	0.3	0.3	0.3	-	2967.95	-	0.015
Swamp Mahogany	0.09	0.075	0.045	0.045	0.045	172.43	327.79	0.05	0.027
Wetlands	0.54	0.525	0.345	0.345	0.345				
Rainforest	1.98	1.905	1.245	0.765	0.725	178.00	402.84	1.11	0.49
Mangrove	0.06	0.06	0.04	0.04	0.04	3.26	6457.62	1.84	0.001
Total Area	49.2	36.92	20.52	20.04	16.72	38076.28	24652.25	0.13	0.20

Table legend on following page.

Table T13 Legend

Maximum area of remnant vegetation that would be cleared under various scenarios:
30 m ROW = entire 30m Right of Way (ROW) containing remnant vegetation cleared
30m ROW - free width = unobstructed cleared width included in 30m ROW, remainder assumed to be entirely remnant vegetation
(free width = width of existing clearing within the ROW that is unobstructed by electrical transmission towers)
20 m ROW - free width = same as previous, but assumes only 20 m ROW is required for construction
HDD of Karuah = assumes HDD of Karuah River crossings (no clearing of riparian rainforest communities)
NP uncleared = assumes ROW contained entirely within existing cleared powerline easement (no clearing of remnant vegetation) in Wallaroo National Park.

^ Area of each remnant vegetation community estimated within 5 km buffer area surrounding pipeline route:
CRA = Forest ecosystem mapping for Comprehensive Regional Assessment of North East Region - covers entire pipeline route (NPWS, 1999)
LHCC = Mapping for Lower Hunter and Central Coast - covers only southern third of pipeline route (NPWS, 2000)

* Percentage of total area of each remnant vegetation community within 5 km buffer area that would be cleared, assuming entire 30m ROW is cleared for pipeline construction.

Table T14: Protected Environmental Values and Likelihood of Identified Potential Impacts Without Mitigation

Environmental Value	Sources of Potential Impacts														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Protected Areas															
Wallaroo National Park	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	
Nature Reserve at KP 54 (Lot 68 DP753176)	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes	-	-	Yes	Yes	Yes	
SEPP 14 wetlands	Yes	Yes	Yes	-	-	Yes	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	
Ramsar Hunter Estuary Wetland	-	-	-	-	-	Yes		Yes	-	Yes	Yes	Yes	Yes	Yes	
Threatened Ecological Communities															
Freshwater wetlands on coastal floodplains of the Sydney Basin Bioregion	Yes	Yes	Yes	-	-	Yes	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes
Hunter lowland Redgum forest in the Sydney Basin Bioregion	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes	-	-	Yes	Yes	Yes	Yes
Lower Hunter Spotted Gum - Ironbark forest in the Sydney Basin Bioregion	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Yes
Swamp Oak floodplain forest of the Sydney Basin Bioregion	-	-	Yes	-	Yes	Yes	-	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes
Swamp sclerophyll forest on coastal floodplains of the Sydney Basin Bioregion	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes
Lowland Rainforest on floodplain of the NSW North Coast Bioregion	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes

Environmental Value	Sources of Potential Impacts														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Endangered Populations															
Weeping Myall (*Acacia pendula*) population in the Hunter catchment	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cymbidium cancaliculatum population in the Hunter Catchment	Yes	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eucalyptus parramattensis subsp. *parramattensis* in the Wyong and Lake Macquarie LGA's	Yes	-	-	-		-	-	-	-	-	Yes	-	-	-	-
Narrow-leaved Red Gum (*Eucalyptus seena*) population in the Greater Tarree LGA	Yes	-	-	-	-	Yes	-	-	-	-	-	-	-	-	-
Rhizanthella slateri population in the Great Lakes LGA	Yes	-	-	-	-	-	-	Yes	-	-	-	-	-	-	-
Threatened Flora															
Asperula asthenes Trailing Woodruff	Yes	-	-	-	-	Yes	Yes	-	-	-	-	Yes	-	Yes	
Callistemon linearifolius Netted Bottle Brush	Yes	-	-	-	-	Yes	Yes	-	-	-	-	Yes	-	Yes	
Cryptostylis hunteriana Leafless Tongue Orchid	Yes	-	-	-	-	Yes	Yes	-	-	-	Yes	Yes	-	Yes	
Cynanchum elegans White-flowered Wax Plant	Yes	-	-	-	-	Yes	Yes	-	-	-	-	Yes	-	Yes	

Environmental Value	Sources of Potential Impacts														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Eucalyptus glaucina Slaty Red Gum	Yes	-	-	-	-	Yes	Yes	-	-	-	-	Yes	-	Yes	
Eucalyptus parramattensis subsp. *decadens*	Yes	-	-	-	-	Yes	Yes	-	-	-	Yes	Yes	-	Yes	
Grevillea guthrieana Guthrie's Grevillea	Yes	-	-	-	-	Yes	Yes	-	-	-	-	Yes	-	Yes	Yes
Grevillea parviflora subsp. *parviflora* small-flower Grevillea	Yes	-	-	-	-	Yes	Yes	Yes	Yes	-	-	Yes	-	Yes	Yes
Maundia triglochinoides	Yes	-	-	-	-	Yes	Yes	-	-	-	Yes	Yes	-	Yes	
Persicaria elatior Tall Knotweed	Yes	-	-	-	-	Yes	Yes	-	-	-	Yes	Yes	-	Yes	
Pomaderris queenslandica Scant Pomaderris	Yes	-	-	-	-	Yes	Yes	-	-	-	-	Yes	-	Yes	
Rhizanthella slateri Eastern Underground Orchid	Yes	-	-	-	-	Yes	Yes	Yes	Yes	-	-	Yes	-	Yes	
Tetratheca juncea Black-eyed Susan	Yes	-	-	-	-	Yes	Yes	-	-	-	Yes	Yes	-	Yes	Yes
Zannichellia palustris	Yes	-	-	-	-	Yes	Yes	-	-	-	Yes	Yes	-	Yes	
Threatened Fauna															
Litoria aurea Green and Golden Bell Frog	Yes	-	Yes	-	-	Yes	Yes	Yes	Yes	-	Yes	?	Yes	Yes	
Mixophyes balbus Stuttering Frog	Yes	-	Yes	-	-	Yes	Yes	Yes	Yes	-	Yes	?	Yes	Yes	

Environmental Value	Sources of Potential Impacts														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mixophyes iteratus Giant Barred Frog	Yes	-	Yes	-	-	Yes	Yes	Yes	Yes	-	Yes	?	Yes	Yes	
Hoplocephalus bitorquatus Pale-headed Snake	Yes	Yes	Yes	-	-	Yes	-	Yes	-	-	-	Yes	-	-	
Hoplocephalus stephensii Stephens' Banded Snake	Yes	Yes	Yes	-	-	Yes	-	Yes	-	-	-	Yes	-	-	
Anseranas semipalmata Magpie Goose	Yes	-	-	-	-	Yes	-	-	-	-	Yes	-	Yes	Yes	
Botaurus poiciloptilus Australasian Bittern	Yes	-	-	-	-	Yes	-	-	-	-	Yes	-	Yes	Yes	
Burhinus grallarius Bush Stone-curlew	Yes	-	Yes	-	-	Yes	-	-	-	-	-	?	-	-	
Callocephalon fimbriatum Gang-gang Cockatoo	Yes	Yes	-	-	-	-	-	-	-	-	-	?	-	-	
Calyptorhynchus lathami Glossy Black-Cockatoo	Yes	Yes	-	-	Yes	-	-	-	-	-	-	Yes	-	-	
Climacteris picumnus Brown Treecreeper	Yes	-	Yes	-	-	Yes	-	-	-	-	-	?	-	-	
Coracina lineate Barred Cuckoo-shrike	Yes	-	-	-	Yes	-	-	-	-	-	-	?	-	-	
Ephippiorhynchus asiaticus Black-necked Stork	Yes	-	-	-	-	-	-	-	-	-	Yes	-	Yes	Yes	
Irediparra gallinacean Comb-crested Jacana	Yes	-	-	-	-	Yes	-	-	-	-	Yes	-	Yes	Yes	

Environmental Value	Sources of Potential Impacts														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ixobrychus flavicollis Black Bittern	Yes	-	-	-	-	-	-	-	-	-	Yes	-	Yes	Yes	
Lathamus discolor Swift Parrot	Yes	-	-	-	-	-	-	-	-	-	-	?	-	-	
Lophoictinia isura Square-tailed Kite	Yes	-	Yes	-	-	-	-	-	-	-	-	?	-	-	
Melanodryas cucullata Hooded Robin	Yes	-	Yes	-	-	Yes	-	-	-	-	-	?	-	-	
Melithreptus gularis Black-chinned Honeyeater	Yes	-	-	-	-	-	-	-	-	-	-	?	-	-	
Neophema pulchella Turquoise Parrot	Yes	Yes	Yes	-	-	Yes	-	-	-	-	-	?	-	-	
Ninox connivens Barking Owl	Yes	Yes	Yes	-	-	-	-	-	-	-	-	?	-	-	
Ninox strenua Powerful Owl	Yes	Yes	-	-	Yes	-	-	-	-	-	-	Yes	-	-	
Pomatostomus temporalis Grey-crowned Babbler	Yes	-	Yes	-	-	Yes	-	-	-	-	-	?	-	-	
Pyrrholaemus saggitatus Speckled Warbler	Yes	-	Yes	-	Yes	Yes	-	-	-	-	-	Yes	-	-	
Rostratula benghalensis Painted Snipe	Yes	-	Yes	-	-	Yes	-	-	-	-	Yes	-	Yes	Yes	
Stagonopleura guttata Diamond Firetail	Yes	-	Yes	-	-	Yes	-	-	-	-	-	Yes	-	-	

Environmental Value	Sources of Potential Impacts														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Tyto novaehollandiae Masked Owl	Yes	Yes	Yes	-	-	-	-	-	-	-	-	?	-	-	
Tyto tenebricosa Sooty Owl	Yes	Yes	Yes	-	Yes	-	-	-	-	-	-	Yes	-	-	
Xanthomyza phrygia Regent Honeyeater	Yes	-	-	-	-	-	-	-	-	-	-	?	-	-	
Cercartetus nanus Eastern Pygmy-Possum	Yes	Yes	-	-	Yes	-	-	-	-	-	-	?	-	-	
Chalinolobus dwyeri Large-eared Pied Bat	Yes	-	-	-	-	-	-	-	-	-	-	-	-	-	
Dasyurus maculatus Spotted-tailed Quoll	Yes	Yes	Yes	?	Yes	Yes	-	Yes	-	-	-	?	-	-	
Falsistrellus tasmaniensis Eastern False Pipistrelle	Yes	Yes	-	-	-	-	-	-	-	-	-	-	-	-	
Macropus parma Parma Wallaby	Yes	-	Yes	-	Yes	?	-	Yes	-	-	-	-	-	-	
Miniopterus australis Little Bent-wing Bat	Yes	Yes	-	-	-	-	-	-	-	-	-	-	-	-	
Miniopterus schreibersii Common Bent-wing Bat	Yes	Yes	-	-	-	-	-	-	-	-	-	-	-	-	
Mormopterus norfolkensis Eastern Free-tail Bat	Yes	Yes	-	-	?	-	-	-	-	-	-	-	-	-	
Myotis adversus Large-footed Myotis	Yes	Yes	-	-	-	-	-	-	-	-	-	-	-	-	

Environmental Value	Sources of Potential Impacts														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Petaurus australis Yellow-bellied Glider	Yes	Yes	-	-	Yes	-	-	-	-	-	-	Yes	-	-	
Petaurus norfolcensis Squirrel Glider	Yes	Yes	-	-	Yes	-	-	-	-	-	-	Yes	-	-	
Phascogale tapoatafa Brush-tailed Phascogale	Yes	-	Yes	-	Yes	-	-	Yes	-	-	-	Yes	-	-	
Phascolarctos cinereus Koala	Yes	-	-	-	Yes	-	-	-	-	-	-	Yes	-	-	
Planigale maculata Common Planigale	Yes	-	Yes	-	-	Yes	-	Yes	-	-	-	?	-	-	
Potorous tridactylus Long-nosed Potoroo	Yes	-	Yes	-	Yes	Yes	-	Yes	-	-	-	Yes	-	-	
Pteropus poliocephalus Grey-headed Flying-fox	Yes	-	-	-	-	-	-	-	-	-	-	-	-	-	
Saccolaimus flaviventris Yellow-bellied Sheath-tail Bat	Yes	Yes	-	-	-	-	-	-	-	-	-	-	-	-	
Scoteanax rueppellii Greater Broad-nosed Bat	Yes	Yes	-	-	-	-	-	-	-	-	-	-	-	-	

Sources of potential impacts:. 1 loss of vegetation; 2 Loss of hollow-bearing trees; 3 removal of dead and fallen timber; 4 removal of rock; 5 edge effects; 6 spread of environmental weeds; 7 easement maintenance; 8 soil excavation; 9 soil compaction; 10 barrier effects to wildlife movement; 11 alterations to hydrology; 12 wild fire; 13 construction waste; 14 sediment, erosion and dust, 15 Phytopthora

Table T15: Assessment of flora species listed under the EPBC Act

This table summarises the impact assessment for flora species listed under the EPBC Act that were considered to potentially occur in the study area, or for which there is potential habitat within the study area. The impact assessment follows the 'significant impact criteria' as outlined in the EPBC Act Policy Statement 1.1, Significant Impact Guidelines (DEH 2006).

Species	Distribution, ecology and habitat	EPBC Assessment Criteria *Is there a real chance or possibility that the action will:*									Conclusion
		1. decrease population long-term	**2. reduce species' area of occupancy**	**3. fragment existing population**	**4. adversely affect critical habitat**	**5. disrupt population breeding cycle**	**6. alter the availability or quality of habitat**	**7. encourage harmful invasive species**	**8. introduce harmful disease**	**9. interfere with species' recovery**	
Endangered											
Cynanchum elegans White-flowered Wax Plant	Refer **Table T6** and **Appendix E** (Seven-part Tests). White-flowered Wax Plant was not recorded during the field survey.	With the recommended mitigation measures (**Section 5.0**), long-term White-flowered Wax Plant population size decrease is unlikely.	With the recommended mitigation measures (**Section 5.0**), significant reduction of the White-flowered Wax Plant's area of occupancy is unlikely.	With the recommended mitigation measures (**Section 5.0**), White-flowered Wax Plant population fragmentation is unlikely.	No critical habitat has been declared for the White-flowered Wax Plant (Web1).	With the recommended mitigation measures (**Section 5.0**), the White-flowered Wax Plant's breeding cycle would is unlikely to be disrupted.	With the recommended mitigation measures (**Section 5.0**), the species habitat would not be adversely impacted to the extent that the species is likely to decline.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful invasive species is unlikely.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful disease is unlikely.	There is no NRP for this species. (Web2). With the recommended mitigation measures (**Section 5.0**), the proposal is unlikely to have an adverse affect on the species recovery.	No significant impact is expected from the proposed development.
Rhizanthella slateri Eastern Underground Orchid	Refer **Table T6** and **Appendix E** (Seven-part Tests). Eastern Underground Orchid was not recorded during the field survey.	With the recommended mitigation measures (**Section 5.0**), long-term Eastern Underground Orchid's population size decrease is unlikely.	With the recommended mitigation measures (**Section 5.0**), significant reduction of the Eastern Underground Orchid area of occupancy is unlikely.	With the recommended mitigation measures (**Section 5.0**), Eastern Underground Orchid population fragmentation is unlikely.	No critical habitat has been declared for the Eastern Underground Orchid (Web1).	With the recommended mitigation measures (**Section 5.0**), the Eastern Underground Orchid's breeding cycle would is unlikely to be disrupted.	With the recommended mitigation measures (**Section 5.0**), the species habitat would not be adversely impacted to the extent that the species is likely to decline.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful invasive species is unlikely.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful disease is unlikely.	There is no NRP for this species. With the recommended mitigation measures (**Section 5.0**) the proposal is unlikely to interfere with any of the 3 recovery actions listed in the *Conservation Advice for Rhizanthella slateri* 2007.	No significant impact is expected from the proposed development.

Species	Distribution, ecology and habitat	EPBC Assessment Criteria *Is there a real chance or possibility that the action will:*									Conclusion
		1. decrease population long-term	**2. reduce species' area of occupancy**	**3. fragment existing population**	**4. adversely affect critical habitat**	**5. disrupt population breeding cycle**	**6. alter the availability or quality of habitat**	**7. encourage harmful invasive species**	**8. introduce harmful disease**	**9. interfere with species' recovery**	
Vulnerable											
Asperula asthenes Trailing Woodruff	Refer **Table T6** and **Appendix E** (Seven-part Tests). Trailing Woodruff was not recorded during the field survey.	With the recommended mitigation measures (**Section 5.0**), long-term Trailing Woodruff population size decrease is unlikely.	With the recommended mitigation measures (**Section 5.0**), significant reduction of the Trailing Woodruff's area of occupancy is unlikely.	With the recommended mitigation measures (**Section 5.0**), Trailing Woodruff population fragmentation is unlikely.	No critical habitat has been declared for the Trailing Woodruff (Web1).	With the recommended mitigation measures (**Section 5.0**), the Trailing Woodruff's breeding cycle would is unlikely to be disrupted.	With the recommended mitigation measures (**Section 5.0**), the species habitat would not be adversely impacted to the extent that the species is likely to decline.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful invasive species is unlikely.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful disease is unlikely.	There is no NRP for this species (Web2). With the recommended mitigation measures (**Section 5.0**) the proposal is unlikely to interfere with any of the 8 recovery actions listed in the *Conservation Advice for Asperula asthenes* 2008.	No significant impact is expected from the proposed development.
Cryptostylis hunteriana *Maundia triglochinoides*	Refer **Table T6** and **Appendix E** (Seven-part Tests). Leafless Tongue Orchid was not recorded during the field survey.	With the recommended mitigation measures (**Section 5.0**), long-term Leafless Tongue Orchid population size decrease is unlikely.	With the recommended mitigation measures (**Section 5.0**), significant reduction of the Leafless Tongue Orchid's area of occupancy is unlikely.	With the recommended mitigation measures (**Section 5.0**), Leafless Tongue Orchid population fragmentation is unlikely.	No critical habitat has been declared for this species (Web1).	With the recommended mitigation measures (**Section 5.0**), the Leafless Tongue Orchid's breeding cycle would is unlikely to be disrupted.	With the recommended mitigation measures (**Section 5.0**), the species habitat would not be adversely impacted to the extent that the species is likely to decline.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful invasive species is unlikely.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful disease is unlikely.	There is no NRP for this species (Web2). With the recommended mitigation measures (**Section 5.0**) the proposal is unlikely to interfere with any of the 15 recovery actions listed in the *Conservation Advice for Cryptostylis hunteriana* 2008.	No significant impact is expected from the proposed development.

Species	Distribution, ecology and habitat	EPBC Assessment Criteria *Is there a real chance or possibility that the action will:*									Conclusion
		1. decrease population long-term	**2. reduce species' area of occupancy**	**3. fragment existing population**	**4. adversely affect critical habitat**	**5. disrupt population breeding cycle**	**6. alter the availability or quality of habitat**	**7. encourage harmful invasive species**	**8. introduce harmful disease**	**9. interfere with species' recovery**	
Eucalyptus glaucina Slaty Red Gum	Refer **Table T6** and **Appendix E** (Seven-part Tests). Slaty Red Gum was not recorded during the field survey.	With the recommended mitigation measures (**Section 5.0**), long-term Slaty Red Gum population size decrease is unlikely.	With the recommended mitigation measures (**Section 5.0**), significant reduction of the Slaty Red Gum's area of occupancy is unlikely.	With the recommended mitigation measures (**Section 5.0**), Slaty Red Gum population fragmentation is unlikely.	No critical habitat has been declared for this species (Web1).	With the recommended mitigation measures (**Section 5.0**), the Slaty Red Gum's breeding cycle would is unlikely to be disrupted.	With the recommended mitigation measures (**Section 5.0**), the species habitat would not be adversely impacted to the extent that the species is likely to decline.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful invasive species is unlikely.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful disease is unlikely.	There is no NRP for this species (Web2). With the recommended mitigation measures (**Section 5.0**) the proposal is unlikely to interfere with any of the 15 recovery actions listed in the *Conservation Advice for Eucalyptus glaucina* 2008.	No significant impact is expected from the proposed development.
Eucalyptus parramattensis subsp. decadens	Refer **Table T6** and **Appendix E** (Seven-part Tests). *Eucalyptus parramattensis* subsp*. decadens* was not recorded during the field survey.	With the recommended mitigation measures (**Section 5.0**), long-term *Eucalyptus parramattensis* subsp*. decadens* population size decrease is unlikely.	With the recommended mitigation measures (**Section 5.0**), significant reduction of the *Eucalyptus parramattensis* subsp*. decadens* area of occupancy is unlikely.	With the recommended mitigation measures (**Section 5.0**), *Eucalyptus parramattensis* subsp*. decadens* population fragmentation is unlikely.	No critical habitat has been declared for this species (Web1)	With the recommended mitigation measures (**Section 5.0**), the *Eucalyptus parramattensis* subsp*. decadens* breeding cycle would is unlikely to be disrupted.	With the recommended mitigation measures (**Section 5.0**), the species habitat would not be adversely impacted to the extent that the species is likely to decline.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful invasive species is unlikely.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful disease is unlikely.	There is no NRP for this species. (Web2). With the recommended mitigation measures (**Section 5.0**), the proposal is unlikely to have an adverse affect on the species recovery.	No significant impact is expected from the proposed development.
Grevillea guthrieana Guthrie's Grevillea	Refer Table T6 and Appendix E (Seven-part Tests). Guthrie's Grevillea was not recorded during the field survey.	With the recommended mitigation measures (**Section 5.0**), long-term *Eucalyptus parramattensis* subsp*. decadens* population size decrease is unlikely.	With the recommended mitigation measures (**Section 5.0**), significant reduction of the Guthrie's Grevillea's area of occupancy is unlikely.	With the recommended mitigation measures (**Section 5.0**), Guthrie's Grevillea population fragmentation is unlikely.	No critical habitat has been declared for this species (Web1)	With the recommended mitigation measures (**Section 5.0**), the Guthrie's Grevillea breeding cycle would is unlikely to be disrupted.	With the recommended mitigation measures (**Section 5.0**), the species habitat would not be adversely impacted to the extent that the species is likely to decline.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful invasive species is unlikely.	With the recommended mitigation measures (**Section 5.0**), the risk of spreading of *Phytopthora cinnamomi* is unlikely.	There is no NRP for this species. (Web2). With the recommended mitigation measures (**Section 5.0**), the proposal is unlikely to have an adverse affect on the species recovery.	No significant impact is expected from the proposed development.

Species	Distribution, ecology and habitat	EPBC Assessment Criteria *Is there a real chance or possibility that the action will:*									Conclusion
		1. decrease population long-term	**2. reduce species' area of occupancy**	**3. fragment existing population**	**4. adversely affect critical habitat**	**5. disrupt population breeding cycle**	**6. alter the availability or quality of habitat**	**7. encourage harmful invasive species**	**8. introduce harmful disease**	**9. interfere with species' recovery**	
Grevillea parviflora subsp. parviflora Small-flower Grevillea	Refer **Table T6** and **Appendix E** (Seven-part Tests). Small-flower Grevillea was recorded during the field survey in a previously cleared powerline corridor.	With the recommended mitigation measures and , if necessary, offset measures (**Section 5.0**), long-term Small-flower Grevillea population size decrease is unlikely.	With the recommended mitigation measures and , if necessary, offset measures (**Section 5.0**), significant reduction of the Small-flower Grevillea's area of occupancy is unlikely.	With the recommended mitigation measures and , if necessary, offset measures (**Section 5.0**), Small-flower Grevillea population fragmentation is unlikely.	No critical habitat has been declared for this species (Web1).	With the recommended mitigation measures and , if necessary, offset measures (**Section 5.0**), the Small-flower Grevillea's breeding cycle would is unlikely to be disrupted.	With the recommended mitigation measures and , if necessary, offset measures (**Section 5.0**), the species habitat would not be adversely impacted to the extent that the species is likely to decline.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful invasive species is unlikely.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful disease is unlikely.	There is no NRP for this species (Web2). With the recommended mitigation measures (**Section 5.0**) the proposal is unlikely to interfere with any of the 11 recovery actions listed in the *Conservation Advice for Grevillea parviflora subsp. parviflora* 2008.	No significant impact is expected from the proposed development.
Persicaria elatior Tall Knotweed	Refer **Table T6** and **Appendix E** (Seven-part Tests). Tall Knotweed was not recorded during the field survey.	With the recommended mitigation measures (**Section 5.0**), long-term Tall Knotweed population size decrease is unlikely.	With the recommended mitigation measures (**Section 5.0**), significant reduction of the Tall Knotweed's area of occupancy is unlikely.	With the recommended mitigation measures (**Section 5.0**), Tall Knotweed population fragmentation is unlikely.	No critical habitat has been declared for this species (Web1).	With the recommended mitigation measures (**Section 5.0**), the Tall Knotweed's breeding cycle would is unlikely to be disrupted.	With the recommended mitigation measures (**Section 5.0**), the species habitat would not be adversely impacted to the extent that the species is likely to decline.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful invasive species is unlikely.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful disease is unlikely.	There is no NRP for this species (Web2). With the recommended mitigation measures (**Section 5.0**) the proposal is unlikely to interfere with any of the 13 recovery actions listed in the *Conservation Advice for Persicaria elatior* 2008.	No significant impact is expected from the proposed development.

Species	Distribution, ecology and habitat	EPBC Assessment Criteria *Is there a real chance or possibility that the action will:* 1. decrease population long-term	2. reduce species' area of occupancy	3. fragment existing population	4. adversely affect critical habitat	5. disrupt population breeding cycle	6. alter the availability or quality of habitat	7. encourage harmful invasive species	8. introduce harmful disease	9. interfere with species' recovery	Conclusion
Tetratheca juncea Black-eyed Susan	Refer **Table T6** and **Appendix E** (Seven-part Tests). Black-eyed Susan was not recorded during the field survey.	With the recommended mitigation measures (**Section 5.0**), long-term Black-eyed Susan population size decrease is unlikely.	With the recommended mitigation measures (**Section 5.0**), significant reduction of the Black-eyed Susan's area of occupancy is unlikely.	With the recommended mitigation measures (**Section 5.0**), Black-eyed Susan population fragmentation is unlikely.	No critical habitat has been declared for this species (Web1).	With the recommended mitigation measures (**Section 5.0**), the Black-eyed Susan's breeding cycle would is unlikely to be disrupted.	With the recommended mitigation measures (**Section 5.0**), the species habitat would not be adversely impacted to the extent that the species is likely to decline.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful invasive species is unlikely.	With the recommended mitigation measures (**Section 5.0**), the risk of spreading of *Phytopthora cinnamomi* is unlikely.	There is no NRP for this species (Web2). With the recommended mitigation measures (**Section 5.0**) the proposal is unlikely to interfere with any of the 14 recovery actions listed in the *Conservation Advice for Tetratheca juncea* 2008.	No significant impact is expected from the proposed development.

NRP- National Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

Web1 - 2009. Register of critical habitat. Department of Environment, Water, Heritage and the Arts, Commonwealth of Australia, viewed 8 April 2009. URL: http://www.environment.gov.au/cgi-bin/sprat/public/publicregisterofcriticalhabitat.pl

Web2 - 2009. Recovery Plans for Australian Species. Department of Environment, Water, Heritage and the Arts, Commonwealth of Australia, viewed 8 April 2009. URL: http://www.environment.gov.au/biodiversity/threatened/recovery-list-scientific.html

Web3 - 2009. Species profiles and threats database. Department of Environment, Water, Heritage and the Arts, Commonwealth of Australia, viewed 8 April 2009. URL: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

Table T16: Assessment of fauna species listed under the EPBC Act

This table summarises the impact assessment for fauna species listed under the EPBC Act that were considered to potentially occur in the study area, or for which there is potential habitat within the study area. The impact assessment follows the 'significant impact criteria' as outlined in the EPBC Act Policy Statement 1.1, Significant Impact Guidelines (DEH 2006). The information was sourced from the SPRAT database (Web3) unless otherwise stated.

Species	Distribution, ecology and habitat	EPBC Assessment Criteria *Is there a real chance or possibility that the action will:*									Conclusion
		1. decrease population long-term	**2. reduce species' area of occupancy**	**3. fragment existing population**	**4. adversely affect critical habitat**	**5. disrupt population breeding cycle**	**6. alter the availability or quality of habitat**	**7. encourage harmful invasive species**	**8. introduce harmful disease**	**9. interfere with species' recovery**	
Endangered											
Mixophyes iterates Giant Barred Frog	Refer **Table T9** and **Appendix E** (Seven-part Tests). The Giant Barred Frog was not recorded during the field survey.	With the recommended mitigation measures (**Section 5.0**), long-term Giant Barred Frog population size decrease is unlikely.	With the recommended mitigation measures (**Section 5.0**), significant reduction of the Giant Barred Frog's area of occupancy is unlikely.	With the recommended mitigation measures (**Section 5.0**), Giant Barred Frog population fragmentation is unlikely.	No critical habitat has been declared for the Giant Barred Frog (Web1).	With the recommended mitigation measures (**Section 5.0**), the Giant Barred Frog's breeding cycle is unlikely to be disrupted.	With the recommended mitigation measures (**Section 5.0**), habitat alteration would be minimal and therefore pose little threat to the survival of the Giant Barred Frog.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful invasive species (*Gambusia holbrooki*) is unlikely.	With the recommended mitigation measures (**Section 5.0**), the risk of spreading harmful disease (Chytrid fungus) is significantly reduced.	There is no NRP for this species (Web2). With the recommended mitigation measures (**Section 5.0**) the proposal is unlikely to interfere with any of the 4 recovery objectives listed in the *Action Plan for Australian Frogs* 1997.	No significant impact is expected from the proposed development.
Lathamus discolor Swift Parrot	Refer **Table T9** and **Appendix E** (Seven-part Tests). The Swift Parrot was not recorded during the field survey.	Long-term population size decrease is unlikely as the Swift Parrot Is not expected to be reliant on habitat within the study area.	With the recommended mitigation measures (**Section 5.0**), significant reduction of the Swift Parrot's area of occupancy is unlikely.	With the recommended mitigation measures (**Section 5.0**), Swift Parrot population fragmentation is unlikely.	The NRP lists priority winter foraging habitats that occur in the proposed pipeline route. 15 to 35 ha of this would be cleared in narrow strips. This is minimal compared to large areas of undisturbed habitat in surrounding	Breeding cycle disruption is unlikely as the Swift Parrot's breeding range is confined to Tasmania.	With the recommended mitigation measures (**Section 5.0**), the species habitat would not be adversely impacted to the extent that the species is likely to decline.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful invasive species is unlikely.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful disease is unlikely.	With the recommended mitigation measures (**Section 5.0**) the proposal is unlikely to interfere with any of the 6 recovery objectives listed in the *Swift Parrot NRP for (2001-2005)* (Web2).	No significant impact is expected from the proposed development.

Species	Distribution, ecology and habitat	EPBC Assessment Criteria *Is there a real chance or possibility that the action will:*									Conclusion
		1. decrease population long-term	**2. reduce species' area of occupancy**	**3. fragment existing population**	**4. adversely affect critical habitat**	**5. disrupt population breeding cycle**	**6. alter the availability or quality of habitat**	**7. encourage harmful invasive species**	**8. introduce harmful disease**	**9. interfere with species' recovery**	
Xanthomyza phrygia Regent Honeyeater	Refer **Table T9** and **Appendix E** (Seven-part Tests). The Regent Honeyeater was not recorded during the field survey.	Long-term population size decrease is unlikely as the Regent Honeyeater is not expected to be reliant on habitat within the study area.	With the recommended mitigation measures (**Section 5.0**), reduction of the Regent Honeyeater's area of occupancy is unlikely.	With the recommended mitigation measures (**Section 5.0**), Regent Honeyeater population fragmentation is unlikely.	No critical habitat has been declared for the Regent Honeyeater (Web1).	Breeding cycle disruption is unlikely as the known Regent Honeyeater breeding regions in NSW (2) are not within the study area.	With the recommended mitigation measures (**Section 5.0**), habitat alteration would be minimal and therefore pose little threat to the survival of the Regent Honeyeater.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful invasive species is unlikely.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful disease is unlikely.	With the recommended mitigation measures (**Section 5.0**) the proposal is unlikely to interfere with any of the 6 recovery objectives listed in the *Regent Honeyeater NRP for (1999-2003)* (Web2).	No significant impact is expected from the proposed development.
Dasyurus maculatus Spotted-tailed Quoll	Refer **Table T9** and **Appendix E** (Seven-part Tests). The Spotted-tailed Quoll was not recorded during the field survey.	With the recommended mitigation measures (**Section 5.0**), long-term Spotted-tailed Quoll population size decrease is unlikely.	With the recommended mitigation measures (**Section 5.0**), significant reduction of the Spotted-tailed Quoll's area of occupancy is unlikely.	With the recommended mitigation measures (**Section 5.0**), Spotted-tailed Quoll population fragmentation is unlikely.	No critical habitat has been declared for the Spotted-tailed Quoll (Web1)	With the recommended mitigation measures (**Section 5.0**), the spotted-tailed quoll's breeding cycle would is unlikely to be disrupted.	With the recommended mitigation measures (**Section 5.0**), the species habitat would not be adversely impacted to the extent that the species is likely to decline.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful invasive species is unlikely.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful disease is unlikely.	There is no NRP for this species. (Web2). With the recommended mitigation measures (**Section 5.0**), the proposal is unlikely to have an adverse affect on the species recovery.	No significant impact is expected from the proposed development.
Vulnerable											
Litoria aurea Green And Golden Bell Frog	Refer **Table T9** and **Appendix E** (Seven-part Tests). The Green And Golden Bell Frog was not recorded during the field survey.	With the recommended mitigation measures (**Section 5.0**), long-term Green And Golden Bell Frog population size decrease is unlikely.	With the recommended mitigation measures (**Section 5.0**), reduction of the Green And Golden Bell Frog's area of occupancy is unlikely.	With the recommended mitigation measures (**Section 5.0**), Green And Golden Bell Frog population fragmentation is unlikely.	No critical habitat has been declared for the Green And Golden Bell Frog (Web1).	With the recommended mitigation measures (**Section 5.0**), the Green And Golden Bell Frog's breeding cycle is unlikely to be disrupted.	With the recommended mitigation measures (**Section 5.0**), habitat alteration would be minimal and therefore pose little threat to the survival of the Green And Golden Bell Frog.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful invasive species (*Gambusia holbrooki*) is unlikely.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful disease (Chytrid fungus) is unlikely.	There is no NRP for this species (Web2). With the recommended mitigation measures (**Section 5.0**) the proposal is unlikely to interfere with any of the 2 recovery objectives listed in the *Action Plan for Australian Frogs* 1997.	No significant impact is expected from the proposed development.

Species	Distribution, ecology and habitat	EPBC Assessment Criteria *Is there a real chance or possibility that the action will:*									Conclusion
		1. decrease population long-term	**2. reduce species' area of occupancy**	**3. fragment existing population**	**4. adversely affect critical habitat**	**5. disrupt population breeding cycle**	**6. alter the availability or quality of habitat**	**7. encourage harmful invasive species**	**8. introduce harmful disease**	**9. interfere with species' recovery**	
Mixophyes balbus Stuttering Frog	Refer **Table T9** and **Appendix E** (Seven-part Tests). The Stuttering Frog was not recorded during the field survey.	With the recommended mitigation measures (**Section 5.0**), long-term Stuttering Frog population size decrease is unlikely.	With the recommended mitigation measures (**Section 5.0**), significant reduction of the Stuttering Frog's area of occupancy is unlikely.	With the recommended mitigation measures (**Section 5.0**), Stuttering Frog population fragmentation is unlikely.	No critical habitat has been declared for the Stuttering Frog (Web1).	With the recommended mitigation measures (**Section 5.0**), the Stuttering Frog's breeding cycle is unlikely to be disrupted.	With the recommended mitigation measures (**Section 5.0**), habitat alteration would be minimal and therefore pose little threat to the survival of the Stuttering Frog.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful invasive species (*Gambusia holbrooki*) is unlikely.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful disease (Chytrid fungus) is unlikely.	There is no NRP for this species (Web2). With the recommended mitigation measures (**Section 5.0**) the proposal is unlikely to interfere with any of the 4 recovery objectives listed in the *Action Plan for Australian Frogs* 1997.	No significant impact is expected from the proposed development.
Rostratula (benghalensis) australis Painted Snipe	Refer **Table T9** and **Appendix E** (Seven-part Tests). The Painted Snipe was not recorded during the field survey.	With the recommended mitigation measures (**Section 5.0**), long-term Painted Snipe population size decrease is unlikely.	With the recommended mitigation measures (**Section 5.0**), significant reduction of the Painted Snipe's area of occupancy is unlikely.	With the recommended mitigation measures (**Section 5.0**), Painted Snipe population fragmentation is unlikely.	No critical habitat has been declared for the Painted Snipe (Web1).	With the recommended mitigation measures (**Section 5.0**), the Painted Snipe's breeding cycle is unlikely to be disrupted.	With the recommended mitigation measures (**Section 5.0**), habitat alteration would be minimal and therefore pose little threat to the survival of the Painted Snipe.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful invasive species is unlikely.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful disease is unlikely.	There is no NRP for this species (Web2). With the recommended mitigation measures (**Section 5.0**), the proposal is unlikely to have an adverse affect on the species recovery.	No significant impact is expected from the proposed development.
Chalinolobus dwyeri Large-eared Pied Bat	Refer **Table T9** and **Appendix E** (Seven-part Tests). The Large-eared Pied Bat was not recorded during the field survey.	Long-term population size decrease is unlikely as the Large-eared Pied Bat is not expected to be reliant on habitat within the study area.	With the recommended mitigation measures (**Section 5.0**), reduction of the Large-eared Pied Bat's area of occupancy is unlikely.	With the recommended mitigation measures (**Section 5.0**), Large-eared Pied Bat population fragmentation is unlikely.	No critical habitat has been declared for the Large-eared Pied Bat (Web1).	With the recommended mitigation measures (**Section 5.0**), the Large-eared Pied Bat's breeding cycle is unlikely to be disrupted.	With the recommended mitigation measures (**Section 5.0**), habitat alteration would be minimal and therefore pose little threat to the survival of the Large-eared Pied Bat.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful invasive species is unlikely.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful disease is unlikely.	There is no NRP for this species (Web2). With the recommended mitigation measures (**Section 5.0**) the proposal is unlikely to interfere with any of the 3 recovery objectives listed in the *Action Plan for Australian Bats* 1999.	No significant impact is expected from the proposed development.

Species	Distribution, ecology and habitat	EPBC Assessment Criteria *Is there a real chance or possibility that the action will:*									Conclusion
		1. decrease population long-term	**2. reduce species' area of occupancy**	**3. fragment existing population**	**4. adversely affect critical habitat**	**5. disrupt population breeding cycle**	**6. alter the availability or quality of habitat**	**7. encourage harmful invasive species**	**8. introduce harmful disease**	**9. interfere with species' recovery**	
Potorous tridactylus Long-nosed Potoroo	Refer **Table T9** and **Appendix E** (Seven-part Tests). The Long-nosed Potoroo was not recorded during the field survey.	With the recommended mitigation measures (**Section 5.0**), long-term Long-nosed Potoroo population size decrease is unlikely.	With the recommended mitigation measures (**Section 5.0**), significant reduction of the Long-nosed Potoroo's area of occupancy is unlikely.	With the recommended mitigation measures (**Section 5.0**), Long-nosed Potoroo population fragmentation is unlikely.	No critical habitat has been declared for the Long-nosed Potoroo (Web1)	With the recommended mitigation measures (**Section 5.0**), the Long-nosed Potoroo's breeding cycle is unlikely to be disrupted.	With the recommended mitigation measures (**Section 5.0**), habitat alteration would be minimal and therefore pose little threat to the survival of the Long-nosed Potoroo.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful invasive species is unlikely.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful disease is unlikely.	There is no NRP for this species (Web2). With the recommended mitigation measures (**Section 5.0**), the proposal is unlikely to have an adverse affect on the species recovery.	No significant impact is expected from the proposed development.
Pteropus poliocephalus Grey-headed Flying-fox	Refer **Table T9** and **Appendix E** (Seven-part Tests). The Grey-headed Flying-fox was not recorded during the field survey.	With the recommended mitigation measures (**Section 5.0**), long-term Grey-headed Flying-fox population size decrease is unlikely.	With the recommended mitigation measures (**Section 5.0**), significant reduction of the Grey-headed Flying-fox's area of occupancy is unlikely.	With the recommended mitigation measures (**Section 5.0**), Grey-headed Flying-fox population fragmentation is unlikely.	No critical habitat has been declared for the Grey-headed Flying-fox (Web1).	With the recommended mitigation measures (**Section 5.0**), the Grey-headed Flying-fox's breeding cycle is unlikely to be disrupted.	With the recommended mitigation measures (**Section 5.0**), habitat alteration would be minimal and therefore pose little threat to the survival of the Grey-headed Flying-fox.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful invasive species is unlikely.	With the recommended mitigation measures (**Section 5.0**), introduction of harmful disease is unlikely.	There is no NRP for this species (Web2). With the recommended mitigation measures (**Section 5.0**) the proposal is unlikely to interfere with any of the 4 recovery objectives listed in the *Action Plan for Australian Bats* 1999.	No significant impact is expected from the proposed development.

NRP- National Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

Web1 - 2009. Register of critical habitat. Department of Environment, Water, Heritage and the Arts, Commonwealth of Australia, viewed 8 April 2009. URL: http://www.environment.gov.au/cgi-bin/sprat/public/publicregisterofcriticalhabitat.pl

Web2 - 2009. Recovery Plans for Australian Species. Department of Environment, Water, Heritage and the Arts, Commonwealth of Australia, viewed 8 April 2009. URL: http://www.environment.gov.au/biodiversity/threatened/recovery-list-scientific.html

Web3 - 2009. Species profiles and threats database. Department of Environment, Water, Heritage and the Arts, Commonwealth of Australia, viewed 8 April 2009. URL: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

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Plates

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Plate P1: Cleared Powerline Easement through Wallaroo National Park at KP 61.9

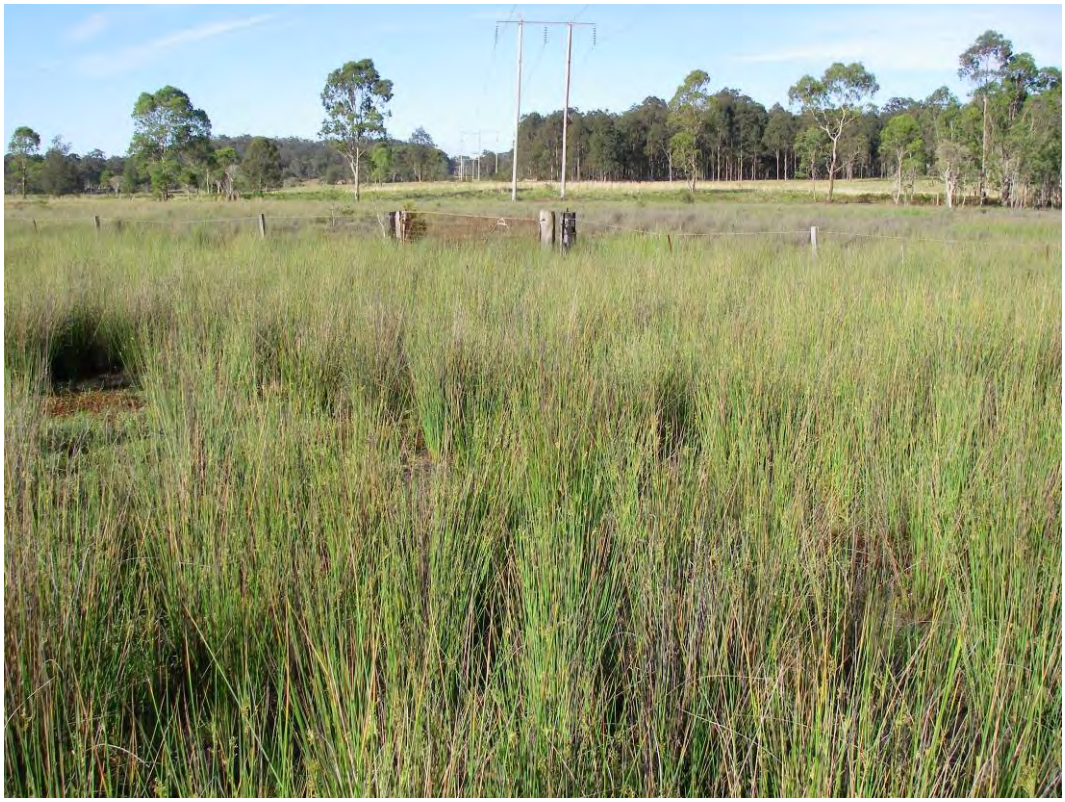

Plate P2: Freshwater Wetland Transected by the Proposed Pipeline at KP 67.9

Plate P3: Swamp Oak Forest Adjacent to the Proposed Pipeline at KP 86

Plate P4: Swamp Sclerophyll Forest Adjacent to the Proposed Pipeline at KP 68.8

Plate P5: Swamp Scerophyll Forest Transected by the Proposed Pipeline at KP 68.9

Plate P6: Redgum Forest Transected by the Proposed Pipeline at KP 45.6

Plate P7: Tidal Channel with Mangroves the Proposed Pipeline at KP 89.8

Plate P8: Riparian Rainforest Transected by the Pipeline on the Karuah River at KP 19.2

Plate P9: Flowers and Leaves of *Grevillea parviflora* subsp*. parviflora* at KP 58.9

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