



Terrestrial Flora and Fauna Impact Assessment

Manning Colliery Extension of Mining
Manning Colliery, NSW

Prepared by:

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Executive Summary

RPS Australia East Pty Limited (RPS) was engaged by Centennial Mannering Pty Ltd (Centennial Mannering) to prepare a Terrestrial Flora and Fauna Impact Assessment for the Mannering Colliery Extension of Mining Project (proposed Project) located near Lake Macquarie, approximately 90 kilometres north east of Sydney. This study by RPS was undertaken as part of an application for a modification to Project Approval (PA06_0311) subject to Section 75W of the *Environmental Planning & Assessment Act 1979 (EP&A Act)*.

The proposed Project involves the extension of existing underground coal mining operations under terrestrial areas of Lake Macquarie and minimal parts of Lake Macquarie itself. This report investigated the potential impact of the proposed mining operations on terrestrial areas and creeks within the proposed mining extension areas.

Negligible surface disturbance will occur as existing surface infrastructure will be utilised to service the proposed Project and subsidence will be limited to a maximum of 20 millimetres. No water inflow from the surface into the workings is expected to change and therefore no changes to sub-surface hydrology are anticipated. Due to the prediction of negligible surface impacts this report was limited to a relevant desktop assessment with field surveys considered unnecessary.

The Project Application Area (PAA) to which the application and this assessment apply is shown on **Figure 1-2**. While the PAA includes areas of Lake Macquarie, this RPS assessment is limited to terrestrial flora and fauna species. Aquatic species such as fish and turtles are assessed in the Aquatic Impact Assessment (Cardno Ecology Lab, 2011).

The desktop assessment identified 17 threatened flora species, one endangered flora population and 5 Threatened Ecological Communities (TECs) as possibly occurring (EPBC Protected Matters Report (Appendix 3) and NSW Atlas of Wildlife search) within 10 kilometres of the PAA. Of the 17 threatened flora species, one has been recorded within the PAA, one is considered to potentially occur, 8 are considered likely to occur and 7 are considered unlikely to occur within the PAA. The single endangered population is considered likely to occur within the PAA. The five TECs have been mapped (House 2003, Bell 2002, Bell 2010) within the PAA.

The desktop assessment also identified 63 threatened fauna and one threatened invertebrate species listed as potentially occurring (EPBC Protected Matters Report (Appendix 3) and NSW Atlas of Wildlife search) within 10 kilometres of the PAA. Of the 63 threatened fauna species, 11 have been recorded within the PAA, one is considered to potentially occur, 25 are considered likely to occur and 26 are considered unlikely (one threatened invertebrate is also considered unlikely) to occur within the PAA.

Due to the expected negligible surface impacts, the proposed Project is unlikely to significantly impact on any species, population or ecological community listed under the *TSC Act*, *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* or SEPP 44.

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I Introduction

RPS Australia East (Pty Limited (RPS) was engaged by Centennial Mannering Pty Ltd (Centennial Mannering) to prepare a Terrestrial Flora and Fauna Impact Assessment to support an application to modify its existing Project Approval (PA_06_0311) subject to section 75W of the *Environmental Planning and Assessment Act 1979 (EP&A Act)*.

This proposal is for the extension of underground mining (the proposed Project) at Mannering Colliery located near Lake Macquarie, approximately 40 kilometres south of Newcastle (**Figure 1-1**). Mannering Colliery is wholly owned and operated by Centennial Mannering Pty Ltd, a fully owned subsidiary of Centennial Coal Company (Centennial), a fully owned subsidiary of Banpu Minerals (Singapore) Pte Limited (Banpu).

WARNING
No part of this plan should be used
for critical design dimensions.
Confirmation of critical positions
should be obtained from RPS Newcastle.

Legend



Project Area



2m Contours



Creeks & Watercourses

N



Wyee Point

Manning Park

Rutleys Road

0 0.5 1km

SCALE 1:22,000 AT A4 SIZE

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TITLE: FIGURE 1-1:
PROJECT AREA LOCATION

LOCATION: MANNERING PARK

DATUM: N/A
PROJECTION: MGA ZONE 56 (GDA 94)

DATE: 15/09/2011
PURPOSE: ECOLOGY

LAYOUT REF: J:\J085\Centennial\All Jobs\107888 Manning S75W\10- Drafting\Mapinfo Work... Maps for Reports
VERSION (PLAN BY): A A4 (AB-NW)

CLIENT: CENTENNIAL COAL
JOB REF: 107888

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RPS

1.1 Site Particulars

Locality - Mannering Colliery's Surface Facilities Area is located near Vales Point Power Station, 3 kilometres south of Mannering Park on the western side of Lake Macquarie. The underground workings comprise two coal seams at various depths and locations. The proposed underground workings generally extend throughout the land with only small segments occurring under the water of Lake Macquarie.

PAA - The PAA encompasses areas of lake and land totalling 422 hectares.

Current Land Use - A small part of the PAA is located below the water body of southern Lake Macquarie. The remainder includes Mannering Creek Ash Dam and areas of urban development, Open Space, infrastructure such as electricity water, Crown lands and other areas of reserved bushland.

Topography - The PAA is located on land and partial sections of water in Lake Macquarie. In addition, the site encompasses low rolling rises and crests of the peninsulas associated with the land and foreshores surrounding the lake. The land within the PAA ranges from 0 metres to 50 metres AHD. The land contains numerous watercourses, including Wyee Creek, and is generally accessible by established roads and farm / fire / access trails.

Geology and Soils - The geological formation of the PAA comprises a combination of the Gosford formation and quaternary alluvium. The Gosford formation is within the Clifton subgroup, which is part of the Narrabeen Group. It was formed in the Triassic period (approximately 250 – 200 million years ago) and is chiefly made up of claystone, sandstone and shale. The quaternary alluvium is of a more recent deposition (2.5 million years ago to present), and comprises alluvium, gravel, sand, silt and clay.

There are a number soil landscapes in the vicinity of the PAA, with the Doyalson landscape being the dominant landscape, followed by the Wyong landscape. There are also smaller concentrations of Tacoma swamp, Awaba and Gorokan landscapes, and disturbed terrain.

1.2 Project Description

1.2.1 Overview

Centennial Mannering are seeking a modification to PA 06_0311 subject to Section 75W of the Environmental Planning and Assessment Act 1979 (EP&A Act) to:

- Extend its underground mining operations within the Fassifern Seam beyond the existing approved 2008 Project Approval boundary using bord and pillar mining methods;
- Extend its underground mining operations into the Great Northern Seam using bord and pillar mining methods; and

- Provide full time employment for a total of 170 personnel.

The proposed Project will result in the extraction of approximately 3,200,000 tonnes of Run of Mine (ROM) coal from the Fassifern seam and approximately 1,400,000 tonnes of ROM coal from the Great Northern seam. All mining activities are proposed to be undertaken using bord and pillar mining methods with mining designed to achieve long term stable pillars resulting in less than 20 millimetres of subsidence on the surface.

The proposed combined extraction of coal from the Great Northern and Fassifern coal seams will not exceed the 1.1 Million tonnes per annum (Mtpa) of coal extraction previously assessed and approved. No changes to existing surface infrastructure, coal handling or water management systems are required for the proposed Project and the Project will not extend the life of Mannering Colliery beyond the existing approved 2018 life of mine. Operations will continue to be undertaken 24 hours a day seven days a week

1.2.2 Mining Area

The PAA encompasses the coal measures and two seams previously mined at Mannering Colliery and as such include some existing workings and areas requiring new workings to be developed. Access to new areas will be from the existing workings.

1.2.3 Surface Subsidence

Negligible surface disturbance will occur as existing surface infrastructure will be utilised to service the proposed Project. Negligible surface impacts are expected to occur. Surface subsidence will be limited to a maximum of 20 millimetres for the combined Fassifern and Great Northern Seams. No water inflow from the surface into the workings is expected to change and therefore no changes to sub-surface hydrology are anticipated. Due to the prediction of negligible surface impacts this report was limited to a relevant desktop assessment with field surveys considered unnecessary.

1.2.4 Mine Access and Surface Facilities

Existing mining areas (including existing underground workings for ventilation) will continue to be utilised for the proposed Project including (but not limited to) mine access, emergency management and underground services and infrastructure. As such, no changes are proposed to the current mine access, infrastructure or facilities.

1.3 Scope of the Study

The scope of this flora and fauna impact assessment report was composed of a desktop assessment of the following tasks:

- identify terrestrial plant and fauna species found within the PAA;
- identify and map existing vegetation communities within the PAA;
- assess the status of identified plant species, fauna species and vegetation communities under relevant legislation;
- assess the habitat potential for threatened species, populations, or ecological communities known from the PAA;

- identify threatened flora and fauna, and potential for threatened flora and fauna that may occur within the PAA; and
- assess the potential of the proposed Project to have a significant impact on any threatened species, populations or ecological communities identified or as having potential habitat on the PAA.

It is considered that a desktop assessment is adequate for the proposed Project due to continuation of existing mining that will require no additional surface facilities to be constructed, no change in existing operations (apart from increased coal production), no clearing of native vegetation, and negligible (less than 20 millimetres) subsidence in terrestrial areas.

It should be noted that this report does not assess the impacts on aquatic ecosystems of Lake Macquarie itself, as potential impacts on the aquatic ecology of Lake Macquarie have been considered separately by Cardno Ecology (2011). In addition it is expected that the discharge into riparian areas is to remain within the current licensed levels.

2 Qualifications and Licensing

2.1 Qualifications

This report was written by Toby Lambert (B.Env.Sc) and Arne Bishop (B.Env.Sc, BLA) of RPS Australia East Pty Ltd. The academic qualifications and professional experience of RPS consultants involved with the preparation of this report are documented in **Appendix 2**.

2.2 Licensing

Research was conducted under the following licences:

- NSW National Parks and Wildlife Service Scientific Investigation Licence S10300 (Valid 30 November 2011);
- Animal Research Authority (Trim File No: 01/1142) issued by NSW Agriculture (Valid 12 March 2012);
- Animal Care and Ethics Committee Certificate of Approval (Trim File No: 01/1142) issued by NSW Agriculture (Valid 12 March 2013); and
- Certificate of Accreditation of a Corporation as an Animal Research Establishment (Trim File No: 01/1522 & Ref No: AW2001/014) issued by NSW Agriculture (Valid 22 May 2012).

2.3 Certification

As the principal author, I, Toby Lambert make the following certification:

- The results presented in the report are, in the opinion of the principal author and certifier, a true and accurate account of the species recorded, or considered likely to occur within the PAA; and
- All research workers have complied with relevant laws and codes relating to the conduct of flora and fauna research, including the *Animal Research Act 1995*, *National Parks and Wildlife Act 1974* and the Australian Code of Practice for the Care and Use of Animals for Scientific Purposes.

Toby Lambert
Senior Project Manager - Senior Ecologist
RPS Australia East Pty Ltd
November 2011

3 Methodology

Due to the predicted minimal level of subsidence (less than 20 millimetres) within the PAA, negligible terrestrial ecological impacts are expected to occur. As negligible surface impacts are expected to occur as a result of the proposed Project, it was considered that a field survey of the PAA was not warranted. Numerous studies have been previously completed in the local area and these were considered to provide sufficient ecological information to determine if any significant impacts are likely to result from the proposed Project.

3.1 Literature Review

A literature review was undertaken to identify potential threatened species, endangered populations and TECs that may occur within the PAA. The following information sources were reviewed:

- Review of fauna and flora records contained in the Office of Environment and Heritage (OEH) Atlas of NSW Wildlife (Obtained data June 2011) within a 10 kilometre radius of the PAA;
- Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) *EPBC Act* Protected Matters Search (accessed 27 June 2011(Appendix 3)) within a 10 kilometre radius;
- OEH Threatened Species, Populations and Ecological Communities website (<http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/>);
- A review of Geographic Information System (GIS) data including (but not limited to) aerial photography, topographic maps, State Environmental Planning Policy (SEPP) 14 Wetland Mapping, Soil Landscapes and Acid Sulphate Soil Potential;
- Flora and fauna reports and relevant management plans for Mannering Colliery;
- Regional vegetation mapping covering the PAA;
- Collective knowledge gained from previous work in the local area.

Where relevant, assessment of threatened species listed on the *TSC Act* considered:

- Threatened Biodiversity Survey and Assessment: Guidelines for Activities and Developments (DEC 2004);
- Threatened Species Assessment Guidelines – The Assessment of Significance (DECC 2007).

A number of other guidelines and documents are not relevant due to the desktop assessment nature of this assessment and the negligible land surface subsidence and surface and groundwater impacts.

4 Results

4.1 Literature Review

A review of the literature listed in **Section 3.1** identified the following threatened flora species (**Table 4-1**), threatened fauna species (**Table 4-2**), endangered populations (**Table 4-3**) and TECs (**Table 4-4**) as occurring or likely to occur within the PAA.

4.1.1 Database Searches

Atlas of NSW Wildlife

A total of 17 threatened flora species and one endangered population have been recorded within 10 kilometres of the PAA (Atlas of NSW Wildlife database). Five of the species are listed as Endangered and 12 as Vulnerable on the *TSC Act*.

Table 4-1: Flora Species Identified Within 10km of the PAA by a Search of the NSW Atlas of Wildlife data

Scientific Name	Common Name	Status <i>TSC Act</i>	Status <i>EPBC Act</i>	10km Radius
<i>Acacia bynoeana</i>	Bynoe's Wattle	E1	V	63
<i>Angophora inopina</i>	Charmhaven Apple	V	V	186
<i>Caladenia tessellate</i>	Thick Lip Spider Orchid	E1	V	4
<i>Callistemon linearifolius</i>	Netted Bottle Brush	V		12
<i>Chamaesyce psammogeton</i>	Sand Spurge	E1		1
<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid	V	V	25
<i>Diuris praecox</i>	Newcastle Doubletail	V	V	19
<i>Eucalyptus camfieldii</i>	Camfield's Stringybark	V	V	6
<i>Eucalyptus parramattensis</i> subsp. <i>Decadens</i>		V	V	3
<i>Eucalyptus parramattensis</i> subsp. <i>Parramattensis</i>		E2		21
<i>Genoplesium insignis</i>	Variable Midge Orchid	E1		2
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Small-flower Grevillea	V	V	25
<i>Maundia triglochoides</i>		V		5
<i>Melaleuca biconvexa</i>	Biconvex Paperbark	V	V	215
<i>Pultenaea maritima</i>	Coast Headland Pea	V		6
<i>Rutidosia heterogama</i>	Heath Wrinklewort	V		177
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	E1	V	13
<i>Tetradlea juncea</i>	Black-eyed Susan	V	V	799

Status (TSC Act):

E1 Schedule 1: Endangered Species
E2 Schedule 1: Endangered Population
V Schedule 2: Vulnerable Species

Status (EPBC):

V Vulnerable Species

A total of 54 threatened fauna and one threatened invertebrate species on the Atlas of NSW Wildlife database have been recorded within 10 kilometres of the PAA (Atlas of NSW Wildlife database). Of these 55 threatened species one is listed as Critically Endangered, 7 as Endangered and 47 as Vulnerable under the *TSC Act*. It should be

noted that entirely marine species were not included in **Table 4-2**. Marine species are assessed in the aquatic report (Cardno Ecology 2011).

Table 4-2: Fauna Species Identified Within 10km of the PAA by a Search of the NSW Atlas of Wildlife data

Scientific Name	Common Name	Status TSC Act	Status EPBC Act	10km Radius
AMPHIBIANS				
<i>Crinia tinnula</i>	Wallum Froglet	V		82
<i>Mixophyes iteratus</i>	Giant Barred Frog	E	E	1
<i>Litoria aurea</i>	Green and Golden Bell Frog	E	V	2
<i>Litoria brevipalmata</i>	Green-thighed Frog	V		4
REPTILES				
<i>Hoplocephalus stephensii</i>	Stephens' Banded Snake	V		1
BIRDS				
<i>Oxyura australis</i>	Blue-billed Duck	V		1
<i>Ptilinopus regina</i>	Rose-crowned Fruit-Dove	V		3
<i>Ptilinopus superbus</i>	Superb Fruit-Dove	V		4
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	E		27
<i>Ixobrychus flavicollis</i>	Black Bittern	V		5
<i>Hieraaetus morphnoides</i>	Little Eagle	V		5
<i>Lophoictinia isura</i>	Square-tailed Kite	V		2
<i>Pandion cristatus</i>	Eastern Osprey	V	M	20
<i>Burhinus grallarius</i>	Bush Stone-curlew	V		1
<i>Haematopus fuliginosus</i>	Sooty Oystercatcher	V	M	20
<i>Haematopus longirostris</i>	Pied Oystercatcher	E	M	8
<i>Charadrius mongolus</i>	Lesser Sand-plover	V		3
<i>Calidris tenuirostris</i>	Great Knot	V		2
<i>Limicola falcinellus</i>	Broad-billed Sandpiper	V	M	2
<i>Limosa limosa</i>	Black-tailed Godwit	V	M	1
<i>Sterna albifrons</i>	Little Tern	E		10
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V		9
<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo	V		42
<i>Glossopsitta pusilla</i>	Little Lorikeet	V		37
<i>Lathamus discolor</i>	Swift Parrot	E	E	92
<i>Neophema pulchella</i>	Turquoise Parrot	V		3
<i>Ninox connivens</i>	Barking Owl	V		1
<i>Ninox strenua</i>	Powerful Owl	V		38
<i>Tyto novaehollandiae</i>	Masked Owl	V		17
<i>Tyto tenebricosa</i>	Sooty Owl	V		2
<i>Climacteris picumnus</i>	Brown Treecreeper (eastern subspecies)	V		3
<i>Pyrrholaemus saggitatus</i>	Speckled Warbler	V		2
<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	E	30
<i>Epthianura albifrons</i>	White-fronted Chat	V		3
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler (eastern subspecies)	V		3
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V		26
<i>Petroica boodang</i>	Scarlet Robin	V		3
<i>Stagonopleura guttata</i>	Diamond Firetail	V		3
MAMMALS				
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	E	8
<i>Phascolarctos cinereus</i>	Koala	V		22

Scientific Name	Common Name	Status TSC Act	Status EPBC Act	10km Radius
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	V		1
<i>Petaurus australis</i>	Yellow-bellied Glider	V		37
<i>Petaurus norfolcensis</i>	Squirrel Glider	V		170
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	59
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V		4
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V		54
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	1
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V		10
<i>Kerivoula papuensis</i>	Golden-tipped Bat	V		1
<i>Miniopterus australis</i>	Little Bentwing-bat	V		62
<i>Miniopterus schreibersii</i>		V		
<i>oceanensis</i>	Eastern Bentwing-bat			48
<i>Myotis macropus</i>	Southern Myotis	V		35
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V		41
<i>Vespadelus troungtoni</i>	Eastern Cave Bat	V		1
	INVERTEBRATES			
<i>Petalura gigantea</i>	Giant Dragonfly	E		1

Notes:

E Endangered Species

V Vulnerable Species

M Migratory Species

EPBC Protected Matters Report

An EPBC Protected Matters Report (Appendix 3) was generated on 27 June 2011 via the EPBC Protected Matters Search Tool. The EPBC Protected Matters Report identified 47 threatened species and 57 migratory species. However, habitat assessment and the results of surveys conducted within the region have been used to assess the likelihood of occurrence of threatened species, populations and ecological communities to occur within the PAA. For this reason have some species have not been considered in this report. Similarly, entirely marine species were also not included in **Table 4-3** and are assessed in the aquatic report (Cardno Ecology 2010).

The threatened and migratory species which are considered to have potential to occur within the PAA identified from the EPBC Protected Matters Report are 10 threatened flora, 15 threatened fauna species and 38 migratory species (**Table 4-3**).

Table 4-3: TECs, Threatened Species and Migratory Species Identified within the PAA by an EPBC Protected Matters Report

Threatened Species			
	Scientific Name	Common Name	Status
Flora	Species or Species Habitat Known to Occur		
	<i>Melaleuca biconvexa</i>	Biconvex Paperbark	V
	Species or Species Habitat Likely to Occur		
	<i>Acacia bynoeana</i>	Bynoe's Wattle	V
	<i>Angophora inopina</i>		V
	<i>Caladenia tessellata</i>	Thick-lipped Spider-orchid	V
	<i>Diuris praecox</i>	Newcastle Doubletail	V
	<i>Eucalyptus camfieldii</i>	Camfield's Stringybark	V
	<i>Grevillea parviflora subsp. parviflora</i>	Small-flower Grevillea	V

Threatened Species			
Fauna	<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	V
	<i>Tetratheca juncea</i>	Black-eyed Susan	V
	Species or Species Habitat May Occur		
	<i>Cryptostylis hunteriana</i>	Leafless Tongue-orchid	V
	Species or Species Habitat Known to Occur		
	<i>Psuedomys novaehollandiae</i>	New Holland Mouse	V
	Foraging, Feeding or Related Behaviour Known to Occur		
	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V
	Species or Species Habitat Likely to Occur		
	<i>Anthochaera phrygia</i>	Regent Honeyeater	E
	<i>Lathamus discolor</i>	Swift Parrot	E
	<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V
	<i>Mixophyes balbus</i>	Stuttering Frog	V
	<i>Mixophyes iteratus</i>	Giant Barred Frog	E
	<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	V
	Species or Species Habitat May Occur		
	<i>Rostratula australis</i>	Australian Snipe	Painted V
	<i>Litoria aurea</i>	Green and Golden Bell Frog	V
	<i>Litoria littlejohni</i>	Littlejohn's Tree Frog	V
	<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V
	<i>Dasyurus maculatus maculatus</i> (SE mainland population)	Spotted-tailed Quoll	E
	<i>Petrogale penicillata</i>	Brush-tailed wallaby	Rock- V
	<i>Potorous tridactylus tridactylus</i>	Long-nosed Potoroo	V
Migratory Species			
Fauna	Breeding Likely to Occur Within Area		
	<i>Myiagra cyanoleuca</i>	Satin Flycatcher	M
	Breeding May Occur Within Area		
	<i>Monarcha melanopsis</i>	Black-faced Monarch	M
	<i>Rhipidura rufifrons</i>	Rufous Fantail	M
	Roosting Known to Occur Within Area		
	<i>Actitis hypoleucos</i>	Common Sandpiper	M
	<i>Arenaria interpres</i>	Ruddy Turnstone	M
	<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	M
	<i>Calidris alba</i>	Sanderling	M
	<i>Calidris canutus</i>	Red Knot	M
	<i>Calidris ferruginea</i>	Curlew Sandpiper	M
	<i>Calidris melanotos</i>	Pectoral Sandpiper	M
	<i>Calidris ruficollis</i>	Red-necked Stint	M
	<i>Calidris tenuirostris</i>	Great Knot	M
	<i>Charadrius bicinctus</i>	Double-banded Plover	M
	<i>Charadrius mongolus</i>	Lesser Sand Plover	M
	<i>Charadrius ruficapillus</i>	Red-capped Plover	M
	<i>Gallinago hardwickii</i>	Latham's Snipe	M
	<i>Heteroscelus brevipes</i>	Grey-tailed Tattler	M
	<i>Himantopus himantopus</i>	Black-winged Stilt	M
	<i>Limosa lapponica</i>	Bar-tailed Godwit	M
	<i>Limosa limosa</i>	Black-tailed Godwit	M
	<i>Numenius madagascariensis</i>	Eastern Curlew	M
	<i>Numenius phaeopus</i>	Whimbrel	M
	<i>Pluvialis fulva</i>	Pacific Golden Plover	M
	<i>Pluvialis squatarola</i>	Grey Plover	M
	<i>Tringa stagnatilis</i>	Marsh Sandpiper	M
	<i>Xenus cinereus</i>	Terek Sandpiper	M

Threatened Species			
Roosting Likely to Occur Within Area			
<i>Gallinago megala</i>	Swinhoe's Snipe		M
<i>Gallinago stenura</i>	Pin-tailed Snipe		M
<i>Numenius minutus</i>	Little Curlew		M
Species or Species Habitat Likely to Occur			
<i>Anthochaera phrygia</i>	Regent Honeyeater		M
<i>Haliaeetus leucogaster</i>	White-bellied eagle	Sea-	M
Species or Species Habitat May Occur			
<i>Apus pacificus</i>	Fork-tailed Swift		M
<i>Hirundapus caudacutus</i>	White-throated Needletail		M
<i>Ardea alba</i>	Great Egret		M
<i>Ardea ibis</i>	Cattle Egret		M
<i>Merops ornatus</i>	Rainbow Bee-eater		M
<i>Rostratula benghalensis s. lat</i>	Painted Snipe		M
<i>Sterna albifrons</i>	Little Tern		M

Notes:

- E Endangered Species
- V Vulnerable Species
- M Migratory Species

4.1.2 Vegetation Mapping

Vegetation mapping from three different sources has been considered. These include:

- Lower Hunter Central Coast Regional Biodiversity Conservation Strategy (LHCCREMS) mapping (House 2003);
- Natural Vegetation of the Wyong Local Government Area (Bell 2002); and
- Draft Vegetation Mapping of Lake Macquarie LGA: Stages 1 & 2 (Bell 2010).

LHCCREMS mapping has been outlined for regional context purposes, however the Wyong and Lake Macquarie mapping is considered to be more accurate due to focus on local government areas rather than the entire lower hunter and central coast regions. As such these regional maps prepared by Stephen Bell have been used in their respective local government areas when assessing likely impacts to vegetation communities and threatened species.

LHCCREMS

LHCCREMS mapping delineated nine vegetation communities identified as occurring on the site, five of which are commensurate with four EECs listed under TSC Act 1995. Refer to **Figure 4-1** for the LHCCREMS vegetation community locations. Vegetation communities mapped in accordance with LHCCREMS (NPWS 2003) Vegetation Map Units (MU) include:

- MU 11 - Coastal Sheltered Apple - Peppermint Forest;
- MU 30 - Coastal Plains Smooth-barked Apple Woodland;

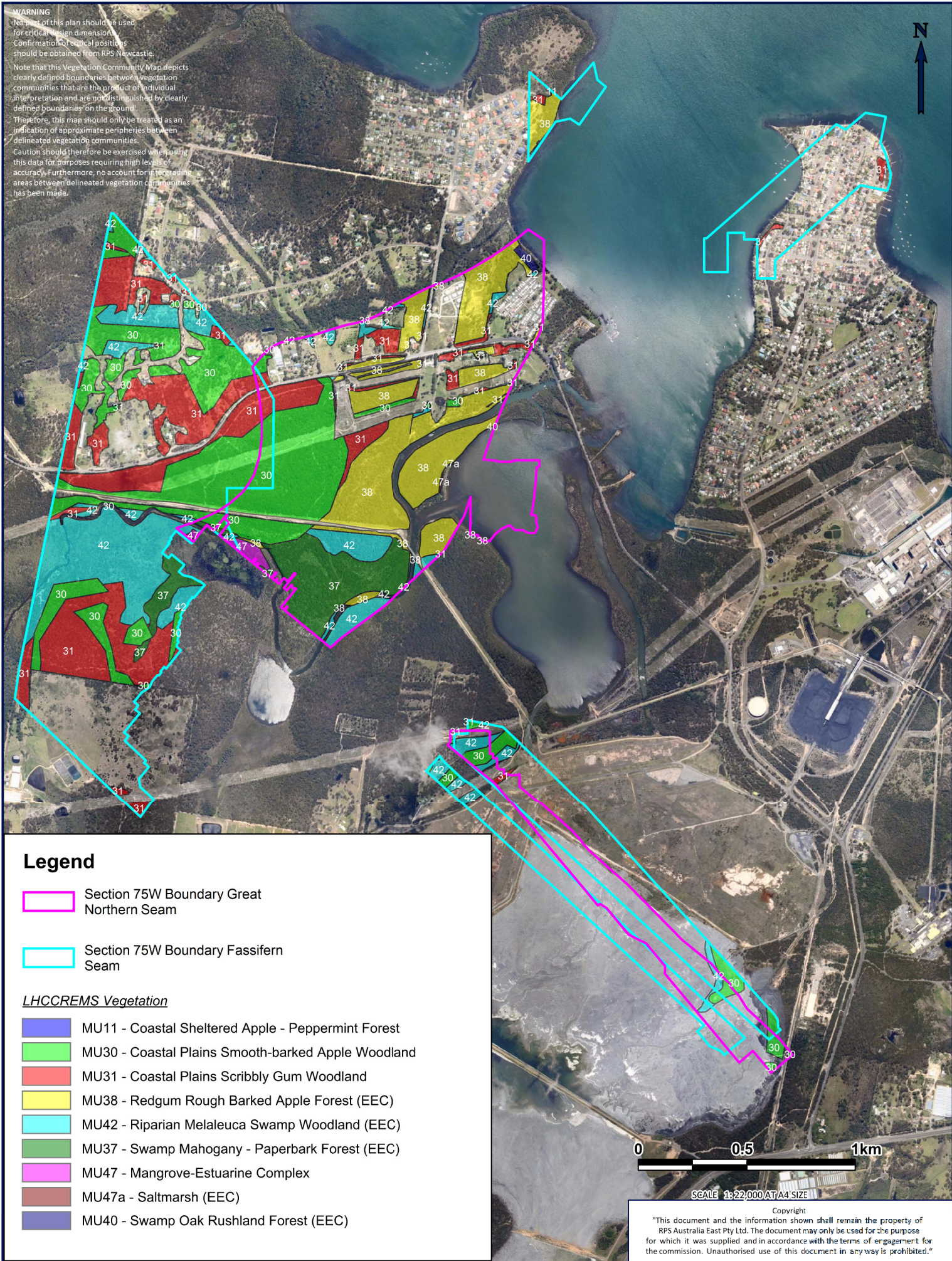
- MU 31 - Coastal Plains Scribbly Gum Woodland;
- MU 37 - Swamp Mahogany - Paperbark Forest (also MU 42-Swamp Mahogany/Paperbark Forest). Commensurate with EEC known as *Swamp Sclerophyll Forest of the Floodplains of the North Coast, Sydney Basin and Southeast Corner Bioregions*;
- MU 38 - Redgum - Rough-barked Apple Forest. Commensurate with EEC known as River Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and Southeast Corner Bioregions;
- MU 40 - Swamp Oak - Rushland Forest. Commensurate with EEC known as Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and Southeast Corner Bioregions;
- MU 42 - Swamp Mahogany/Paperbark Forest. Commensurate with EEC known as Swamp Sclerophyll Forest of the Floodplains of the North Coast, Sydney Basin and Southeast Corner Bioregions;
- MU 47 - Mangrove-Estuarine Complex; and
- MU 47a - Saltmarsh. Commensurate with EEC known as Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and Southeast Corner Bioregions.

The areas of each community mapped are included in **Table 4-4** below. The remainder of the PAA is occupied by cleared areas, Lake Macquarie, the ash dam or development.

Table 4-4: Vegetation Communities Mapped Within the PAA (LHCCREMS, House 2003)

Map Unit	Community Name	Area (ha)
11	Coastal Sheltered Apple – Peppermint Forest	0.0004
30	Coastal Plains Smooth-barked Apple Woodland	72.8
31	Coastal Plains Scribbly Gum Woodland	55.5
37	Swamp Mahogany – Paperbark Forest (EEC)	19.8
38	Redgum Rough Barked Apple Forest (EEC)	44.8
40	Swamp Oak Rushland Forest (EEC)	0.5
42	Riparian Melaleuca Swamp Woodland (EEC)	43.2
47a	Saltmarsh (EEC)	0.09
47	Mangrove-Estuarine Complex	1.4
Total area of mapped vegetation communities		238.09

WARNING
 No part of this plan should be used for critical design dimensions. Confirmation of critical positions should be obtained from RPS Newcastle.
 Note that this Vegetation Community Map depicts clearly defined boundaries between vegetation communities that are the product of individual interpretation and are not distinguished by clearly defined boundaries on the ground.
 Therefore, this map should only be treated as an indication of approximate peripheries between delineated vegetation communities.
 Caution should therefore be exercised when using this data for purposes requiring high levels of accuracy. Furthermore, no account for intergrading areas between delineated vegetation communities has been made.



Legend

- Section 75W Boundary Great Northern Seam
- Section 75W Boundary Fassifern Seam

LHCCREMS Vegetation

- MU11 - Coastal Sheltered Apple - Peppermint Forest
- MU30 - Coastal Plains Smooth-barked Apple Woodland
- MU31 - Coastal Plains Scribbly Gum Woodland
- MU38 - Redgum Rough Barked Apple Forest (EEC)
- MU42 - Riparian Melaleuca Swamp Woodland (EEC)
- MU37 - Swamp Mahogany - Paperbark Forest (EEC)
- MU47 - Mangrove-Estuarine Complex
- MU47a - Saltmarsh (EEC)
- MU40 - Swamp Oak Rushland Forest (EEC)

0 0.5 1km

SCALE 1:22,000 AT A4 SIZE

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TITLE: FIGURE 4-1: LHCCREMS VEGETATION MAPPING	LOCATION: MANNERING PARK	DATUM: N/A PROJECTION: MGA ZONE 56 (GDA 94)	DATE: 1/8/2011 PURPOSE: REPORT FIGURE	LAYOUT REF: H:\OBS\Cent_N\Hobol\387363 Mannering\5759\1 VERSION (PLAN BY): A A4 (AB-NW)
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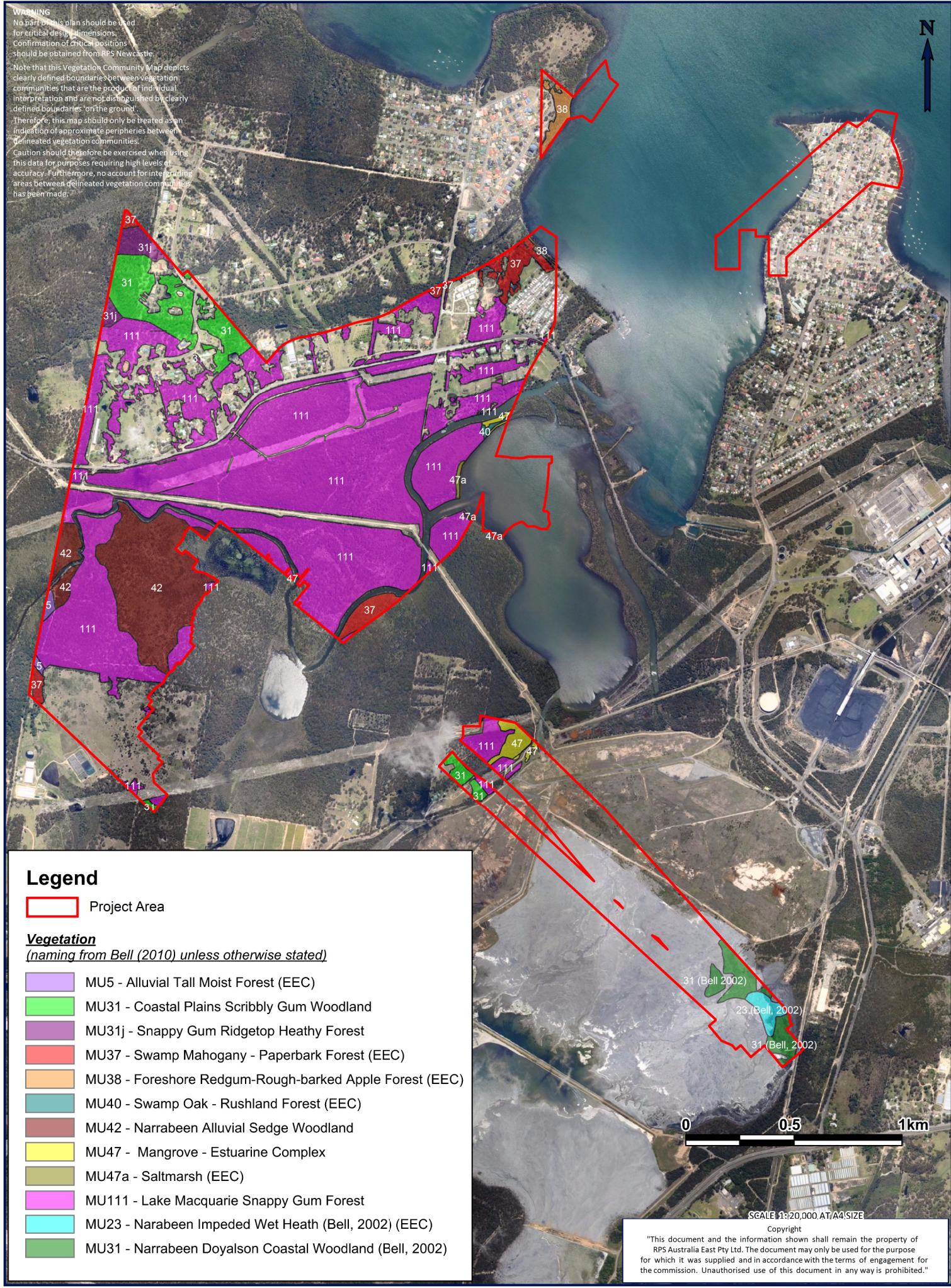
Bell mapping of Wyong and Lake Macquarie

Bell (2002) and Bell (2010) mapping delineated twelve vegetation communities identified as occurring in the PAA, seven of which are commensurate with five EECs listed under TSC Act 1995. Vegetation communities were mapped in accordance with Natural Vegetation of the Wyong Local Government Area (Bell 2002) and the Draft Mapping of Lake Macquarie LGA (Bell 2010). Refer to **Figure 4-2** for the Bell vegetation community locations. Vegetation Map Units (MU) include:

- MU 5 - Alluvial Tall Moist Forest (Bell 2010). Commensurate with EEC known as River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions;
- MU 31 - Coastal Plains Scribbly Gum Woodland (Bell 2010);
- MU 31j - Snappy Gum Ridgetop Heathy Forest (Bell 2010);
- MU 37 - Swamp Mahogany - Paperbark Forest (Bell 2010). Commensurate with EEC known as Swamp Sclerophyll Forest of the Floodplains of the North Coast, Sydney Basin and Southeast Corner Bioregions;
- MU 38 Foreshore Redgum - Rough-barked Apple Forest (Bell 2010). Commensurate with EEC known as River Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and Southeast Corner Bioregions;
- MU 40 - Swamp Oak - Rushland Forest (Bell 2010). Commensurate with EEC known as Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and Southeast Corner Bioregions;
- MU 42 - Narrabeen Alluvial Sedge Woodland (Bell 2010). Commensurate with EEC known as Swamp Sclerophyll Forest of the Floodplains of the North Coast, Sydney Basin and Southeast Corner Bioregions;
- MU 47 - Mangrove Estuarine Complex (Bell 2010);
- MU 47a – Saltmarsh (Bell 2010). Commensurate with EEC known as Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and Southeast Corner Bioregion;
- MU 111 - Lake Macquarie Snappy Gum Forest (Bell 2010);
- MU 23 - Narrabeen Impeded Wet Heath (Bell 2002). Commensurate with EEC known as Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bio-regions; and
- MU 31 - Narrabeen Doyalson Coastal Woodland (Bell 2002).

WARNING
 No part of this plan should be used for critical design dimensions. Confirmation of critical positions should be obtained from RPS Newcastle.

Note that this Vegetation Community Map depicts clearly defined boundaries between vegetation communities that are the product of individual interpretation and are not distinguished by clearly defined boundaries 'on the ground'. Therefore, this map should only be treated as an indication of approximate peripheries between delineated vegetation communities. Caution should therefore be exercised when using this data for purposes requiring high levels of accuracy. Furthermore, no account for intergrading areas between delineated vegetation communities has been made.



Legend

Project Area

Vegetation

(naming from Bell (2010) unless otherwise stated)

- MU5 - Alluvial Tall Moist Forest (EEC)
- MU31 - Coastal Plains Scribbly Gum Woodland
- MU31j - Snappy Gum Ridgetop Heathy Forest
- MU37 - Swamp Mahogany - Paperbark Forest (EEC)
- MU38 - Foreshore Redgum-Rough-barked Apple Forest (EEC)
- MU40 - Swamp Oak - Rushland Forest (EEC)
- MU42 - Narrabeen Alluvial Sedge Woodland
- MU47 - Mangrove - Estuarine Complex
- MU47a - Saltmarsh (EEC)
- MU111 - Lake Macquarie Snappy Gum Forest
- MU23 - Narabeen Impeded Wet Heath (Bell, 2002) (EEC)
- MU31 - Narrabeen Doyalson Coastal Woodland (Bell, 2002)

0 0.5 1km

SCALE 1:20,000 AT A4 SIZE

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TITLE: FIGURE 4-2:
BELL VEGETATION MAP

LOCATION: MANNERING PARK

DATUM: N/A
PROJECTION: MGA ZONE 56 (GDA 94)

DATE: 1/8/2011
PURPOSE: REPORT FIGURE

LAYOUT REF: 10-Draft-MapInfo Work-Maps for reports
VERSION (PLAN BY): B A4 (AB-NW-PH)

CLIENT: CENTENNIAL COAL
JOB REF: 107888

RPS AUSTRALIA EAST PTY LTD (ABN 44 140 292 762)
241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
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RPS

The areas of each community mapped are included in **Table 4-5** below. The remainder of the PAA is occupied by cleared areas, Lake Macquarie, the ash dam or existing development.

Table 4-5: Vegetation Communities Mapped Within the PAA (Bell 2002 and Bell 2010)

Map Unit	Community Name	Area (ha)
Natural Vegetation of the Wyong Local Government Area (Bell 2002) and the Draft Mapping for Lake Macquarie (Bell 2010).		
5	Alluvial Tall Moist Forest (Bell 2010 (EEC))	0.72
31	Coastal Plains Scribbly Gum Woodland (Bell 2010)	14.22
31j	Snappy Gum Ridgetop Heathy Forest (Bell 2010)	3.01
37	Swamp Mahogany – Paperbark Forest (Bell 2010 (EEC))	7.35
38	Foreshore Redgum - Rough-barked Apple Forest (Bell 2010 (EEC))	2.11
40	Swamp Oak Rushland Forest (Bell 2010 (EEC))	0.30
42	Narrabeen Alluvial Sedge Woodland (Bell 2010 (EEC))	22.85
47	Mangrove Estuarine Complex (Bell 2010)	2.46
47a	Saltmarsh (Bell 2010 (EEC))	0.37
111	Lake Macquarie Snappy Gum Forest (Bell 2010)	161.60
23	Narrabeen Impeded Wet Heath (Bell 2002 (EEC))	1.78
31	Narrabeen Doyalson Coastal Woodland (Bell 2002)	5.42
Total area of mapped vegetation communities		220.08

Of the twelve vegetation communities mapped across the PAA seven are commensurate with five EECs as listed within Schedule 1, Part 3 of the *TSC Act*.

None of the vegetation communities mapped within the PAA correspond to any TECs as listed within the EPBC Act.

4.2 Likelihood of Occurrence Assessment

Section 4.1 identified 17 threatened flora species, 63 threatened fauna species, one threatened invertebrate and 5 EEC's listed on the *TSC Act* and/or *EPBC Act* that are known or predicted to occur within the PAA. **Appendix 1** contains an assessment of the likelihood of occurrence of each species/population/community within the PAA based on a comparison of the habitat requirements of each species/population/community and the habitat types present within the PAA.

4.3 Key Threatening Processes

Key Threatening Processes (KTPs) are listed under Schedule 3 of the *TSC Act*. Of the currently listed 34 KTPs the following are relevant to the proposed Project:

- Anthropogenic climate change

The proposed Project is unlikely to contribute to the KTP “human caused climate change” due to the proposed Project not extending the currently approved life of the mine, and

there being no increase in the currently approved coal handling and coal transport volumes of 1.1 Mtpa. Any additional mining equipment required to support the proposed Project and ongoing operation of the Mannering Colliery is unlikely to have any significant increase in greenhouse gas emissions.

5 Legislative Considerations

5.1 State Environmental Planning Policy No. 44 – Koala Habitat Protection

Assessment of potential koala habitat under SEPP 44 requires the following steps be undertaken:

- a) Identification of “potential Koala Habitats” within the proposed development area; if the total tree cover contains 15% or more of the koala food tree species listed in Schedule 2 of SEPP 44 then it is deemed to be “potential” koala habitat. Identification of ‘potential koala habitat requires the determination of the presence of ‘core koala habitat’;
- b) Identification of “core Koala habitat” within the development area. “Core Koala habitat” is defined as an area of land with a resident population of koalas, evidenced by attributes such as breeding females (females with young), recent sightings and historical records of a Koala population;
- c) Identification of “core Koala habitat” will require that a plan of management must accompany the DA application;
- d) If the rezoning of lands, other than to environmental protection, involves potential or core Koala habitat then the Director of planning may require a local environmental study be carried out.

Wyong and Lake Macquarie LGAs are both listed on Schedule 1 of SEPP 44 and therefore the proposed Project is subject to SEPP 44 assessment. Areas of ‘potential koala habitat’ are likely to occur in parts throughout the PAA.

‘Core’ or ‘potential’ koala habitat may occur throughout the PAA especially within the *Swamp Sclerophyll Forest of the Floodplain of the North coast, Sydney basin and south east corner bioregions*. However, as negligible surface impacts (subsidence is predicted to be less than 20 millimetres and no surface cracking is expected) are expected, the proposed Project is unlikely to impact on any ‘potential’ or ‘core’ koala habitat areas that may occur within the PAA.

5.2 State Environmental Planning Policy No. 14 – Coastal Wetlands

SEPP 14 Wetland 889 occurs in patches within the PAA. As negligible surface impacts are expected to occur within the PAA, the proposed Project is unlikely to impact upon any SEPP 14 coastal wetlands.

5.3 Environment Protection and Biodiversity Conservation Act 1999

An *EPBC Act* Protected Matters Database Search was undertaken using the SEWPAC on-line database (accessed 27 June 2011 (Appendix 3)) to generate a list of relevant matters of National Environmental Significance (NES) within 10 kilometres of the PAA.

The matters of NES relevant to this flora and fauna assessment are:

- Wetlands of International Significance (RAMSAR sites);
- TECs;
- Threatened species;
- Migratory species; and
- Critical Habitats

Section 4 lists the threatened species, migratory species and TECs identified during the database search. Following is an assessment of whether the proposed Project is likely to impact on any of the above matters of NES.

5.3.1 Wetlands Protected by International Treaty (the RAMSAR convention)

No wetlands protected by international treaty (the RAMSAR convention) were identified during the *EPBC Act* Protected Matters Database Search.

5.3.2 Nationally Listed Threatened Species and Ecological Communities

As aforementioned, in **Section 4.1** only the threatened and migratory species which are considered to have potential to occur within the PAA are considered within this report. EPBC Protected Matters Database Search identified no TEC's and 25 threatened species as potentially occurring within 10 kilometres of the PAA. It should be noted that this total does not include marine species. The following *EPBC Act* listed species and communities were identified as potentially occurring within the PAA:

- 10 threatened flora species;
- 15 threatened fauna species; and
- No TEC's.

See **Section 4** for the listing of each individual species.

Negligible surface impacts are expected to occur as a result of the proposed Project. Surface subsidence will be limited to a maximum of 20 millimetres (Seedsman Geotechnics, 2011). No changes to sub-surface hydrology are expected. As negligible surface impacts are expected, the proposed Project is unlikely to impact upon any nationally listed threatened species or ecological communities.

5.3.3 Nationally Listed Migratory Species

A total of 38 migratory species (not including marine) listed under the *EPBC Act* have been recorded or have suitable habitat within the PAA. The proposed Project is unlikely

to substantially modify, destroy or isolate an area of important habitat, result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat or seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species.

EPBC Act Summary Statement:

As negligible surface impacts are expected to occur the proposed Project is unlikely to impact on any RAMSAR wetlands, national listed threatened species, ecological communities or migratory species, a referral of the proposed Project to SEWPAC is unlikely to be required.

5.4 Potential Impacts

5.4.1 Flora

The desktop assessment identified 17 threatened flora species, one endangered flora population and 5 Threatened Ecological Communities (TECs) as possibly occurring (EPBC Protected Matters Report (Appendix 3) and NSW Atlas of Wildlife search) within 10 kilometres of the PAA. Of the 17 threatened flora species, one has been recorded within the PAA, one is considered to potentially occur, 8 are considered likely to occur and 7 are considered unlikely to occur within the PAA. The single endangered population is considered likely to occur within the PAA. The five TECs have been mapped (House 2003, Bell 2002, Bell 2010) within the PAA.

Negligible surface impacts are expected to occur due to the proposed Project. Surface subsidence within the PAA will be limited to a maximum of 20 millimetres and no surface cracking is expected to occur. No changes to sub-surface hydrology are expected. As negligible surface impacts are expected to occur, including no impact to sub-surface hydrology, no impacts are expected on flora species, populations or communities within or adjacent to the PAA from the proposed Project.

5.4.2 Fauna

The desktop assessment also identified 63 threatened fauna and one threatened invertebrate species listed as potentially occurring (EPBC Protected Matters Report (Appendix 3) and NSW Atlas of Wildlife search) within 10 kilometres of the PAA. Of the 63 threatened fauna species, 11 have been recorded within the PAA, one is considered to potentially occur, 25 are considered likely to occur and 26 are considered unlikely (one threatened invertebrate is also considered unlikely) to occur within the PAA.

Negligible surface impacts are expected due to the proposed Project. Surface subsidence within the PAA will be limited to a maximum of 20 millimetres and no surface cracking is expected to occur. No changes to sub-surface hydrology are expected. As negligible surface impacts are expected to occur, including no impact to sub-surface hydrology, no impacts are expected on fauna species within or adjacent to the PAA from the proposed Project.

5.5 Vegetation Corridors

5.5.1 Lake Macquarie Native Vegetation and Corridors Mapping

The proposal is unlikely to affect or fragment any existing native vegetation corridors within or adjacent to the PAA as negligible surface subsidence (less than 20 millimetres) and no clearing of native vegetation is proposed.

5.5.2 Key Habitats and Corridors

Regional corridors are mapped within the PAA although these are unlikely to be affected as negligible surface subsidence (less than 20 millimetres) and no clearing of native vegetation is proposed.

5.6 Groundwater Dependant Ecosystems (GDEs)

There is no current GDE mapping that covers the PAA or surrounding lands, although five vegetation units mapped within the PAA (Riparian Melaleuca Swamp Woodland (NPWS 2000); Swamp Oak Rushland Forest (NPWS 2000, Bell 2010); Narrabeen Alluvial Sedge Woodland (Bell 2010 (EEC)); Swamp Mahogany – Paperbark Forest (NPWS 2000, Bell 2010); Narrabeen Impeded Wet Heath (Bell 2002 (EEC)) are likely to be influenced by groundwater or be partially groundwater dependent.

Any GDEs present within the PAA are unlikely to be impacted by the proposed Project.

5.7 Riparian Areas

The Project predicts less than 20 millimetres of surface subsidence under terrestrial habitat areas, which includes all land-based riparian areas and watercourses. Riparian ecology within terrestrial watercourses is therefore unlikely to be significantly impacted by the proposed Project due to the negligible surface subsidence predicted.

Mannering Colliery discharges water from the mine into an 'unnamed creek', which flows through sedimentation ponds and an artificial wetland before entering Lake Macquarie. Although this creek is not within the site boundary it should be noted that discharges of approximately 1 megalitre a day of mine water have been taking place for the past 45 years (Cumberland Ecology 2009).

These discharges are predicted to remain largely the same and within the guidelines stipulated under an Environment Protection Licence.

The continuation of water discharge is not expected to result in any adverse impacts upon any EECs. Monitoring of the hydrological and geomorphic status of the unnamed creek will be undertaken, to identify potential impacts to this watercourse. Should hydrological and geomorphic impacts be identified during the course of monitoring, an assessment of riparian vegetation condition and potential impacts associated with changes to hydrology and geomorphology would be undertaken. This approach will ensure that riparian

corridors, lacustrine habitats, coastal floodplains and estuarine environments are not adversely impacted by the proposal and any associated changes in mine water discharge.

5.8 Government Conservation Estates

Lake Macquarie State Recreation Area as listed under the *National Parks and Wildlife Act 1974 (NPWS Act)* occurs within the locality, with the closest being approximately 800m to the north-west. Due to the minimal direct surface impacts (such as land clearing) and the negligible surface subsidence levels proposed (less than 20 millimetres), the proposed Project is unlikely to significantly impact on any Government conservation estates.

6 Key Thresholds Assessment

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

Negligible terrestrial surface impacts are expected to occur as a result of the proposed Project. Surface subsidence will be limited to a maximum of 20 millimetres. No changes to sub-surface hydrology are expected and existing infrastructure at the Surface Facilities Area will be utilised to service the proposed Project. The proposed Project is expected to maintain biodiversity values within the PAA.

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

Negligible terrestrial surface impacts are expected to occur as a result of the proposed Project. Surface subsidence will be limited to a maximum of 20 millimetres. No changes to sub-surface hydrology are expected and existing infrastructure at the Surface Facilities Area will be utilised to service the proposed Project. The proposed Project is unlikely to reduce the long-term viability of a local population of any species, population or ecological community.

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

Negligible terrestrial surface impacts are expected to occur as a result of the proposed Project. Surface subsidence will be limited to a maximum of 20 millimetres. No changes to sub-surface hydrology are expected and existing infrastructure at the Surface Facilities Area will be utilised to service the proposed Project. The proposed Project is unlikely to accelerate the extinction of any species, population or ecological community or place them at risk of extinction.

- 4. Whether or not the proposed Project will adversely affect critical habitat.**

There is no declared "Critical Habitat" within the PAA, and as such the proposed Project will not adversely affect any such habitat.

7 Conclusion and Recommendations

7.1 Conclusion

The desktop assessment identified 17 threatened flora species, one endangered flora population, 5 threatened ecological communities (TECs) as possibly occurring within the Study Area (the Study Area comprises a 10 kilometre radius around the boundary of the PAA). Of the 17 threatened flora species, one has been recorded within the PAA, one is considered to potentially occur, 8 are considered likely to occur and 7 are considered unlikely to occur within the PAA. The single endangered population is considered likely to occur within the PAA. Five TECs have been mapped (House 2003, Bell 2002, Bell 2010) within the PAA.

The desktop assessment also identified 63 threatened fauna and one threatened invertebrate species listed as potentially occurring (EPBC Protected Matters Report (Appendix 3) and NSW Atlas of Wildlife search) within 10 kilometres of the PAA. Of the 63 threatened fauna species, 11 have been recorded within the PAA, one is considered to potentially occur, 25 are considered likely to occur and 26 are considered unlikely (one threatened invertebrate is also considered unlikely) to occur within the PAA.

Surface subsidence will be limited to a maximum of 20 millimetres. Minimal changes to sub-surface hydrology are expected and existing infrastructure at the Surface Facilities Area will be utilised to service the proposed Project. Due to the expected negligible surface impacts the proposed Project is unlikely to significantly impact on any species, population or ecological community listed under the *TSC Act*, *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* or SEPP 44.

7.2 Mitigation Measures

The following mitigation measures have been recommended to minimise the potential impacts of the proposed Project on flora and fauna species:

- In the event that any subsidence monitoring indicates that subsidence levels are greater than the 20 millimetres predicted under terrestrial areas, a review will be undertaken to identify any potential ecological impacts.

Due to the negligible terrestrial impacts predicted as part of the proposed Project, no further mitigation measures are recommended.

8 References

- Bell, S.A.J. (2002) *The Natural Vegetation of the Wyong Local Government Area, Central Coast, New South Wales: Vegetation Community Profiles*. For Wyong Shire Council by Eastcoast Flora Survey.
- Bell, S.A.J. (2010) *Vegetation Mapping of Lake Macquarie LGA: Stages 1 & 2*. For Lake Macquarie City Council by Eastcoast Flora Survey.
- Cardno Ecology Lab, (2011) *Mannering Colliery Extension Mining Aquatic Ecology Assessment*
- Cumberland Ecology (2009) *Ecological Assessment of Study Area, Mannering Colliery, Lake Macquarie NSW, Post Approval Ecological Assessment*
- DEC/DPI (2005) *Draft Guidelines for Threatened Species Assessment*. Department of Environment and Conservation and Department of Primary Industries.
- DECC (2007) *Threatened Species Assessment Guidelines – The Assessment of Significance*
- DEC (2004) *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities. Working Draft, November 2004*.
- House, S. (2003) *Lower Hunter & Central Coast Regional Biodiversity Conservation Strategy, Technical Report, Digital Aerial Photo Interpretation & Updated Extant Vegetation Community Map. Report to Lower Hunter & Central Coast Regional Environmental Management Strategy*. Callaghan, NSW.
- NPWS (2005) *Lake Macquarie State Conservation Area, Pulbah Island Nature Reserve and Moon Island Nature Reserve Plan of Management*. NSW National Parks and Wildlife Service.
- Scotts D. (2003). Key habitats and corridors for forest fauna: a landscape approach for conservation in north-east New South Wales. NSW NPWS Occasional Paper 32. NSW Department of Conservation and the Environment.
- Seedsman Geotechnics (2011) *Section 75W Assessment: Great Northern and Fassifern Seams*
- SNK (1999). *Flora Survey - Myuna Colliery Bushland Buffer*. SNK Environmental Services.

Appendix I

Likelihood of Occurrence Assessment

Likelihood of Occurrence Assessment

Each threatened species/population/community identified in **Section 4.1** is considered for its potential to occur in the PAA and the likely level of impact as a result of the proposed Project. This assessment deals with each species/population/community separately and identifies the ecological parameters of significance associated with the proposed Project. This assessment deals with the following heads of consideration in tabulated form:

'Species / Community' – Lists each threatened species/population/community known from the vicinity. The status of each threatened species under the *TSC Act* and the *EPBC Act* are also provided.

'Habitat Description' – Provides a brief account of the species/community and the preferred habitat attributes required for the existence/survival of each species/community. Habitat description data has been sourced from a variety of sources such as field guides, scientific publications and information on the OEI website. Individual references are not listed.

'Chance of Occurrence on Site' – Assesses the likelihood of each species/community to occur in the PAA in terms of the aforementioned habitat description and taking into account local habitat preferences, results of current field investigations, data gained from various sources (such as Atlas of NSW Wildlife, herbariums, etc.) and previously gained knowledge via fieldwork undertaken within other ecological assessments in the locality.

'Likely Level of Impacts from the proposed Project' – Assesses the likely level/significance of impacts to each species / community that would result from the proposed development, taking into account direct and indirect short and long-term impacts.

Table 8-1: Assessment of Likelihood of Occurrence of Threatened Species and Communities and Assessment of Potential Impacts

Species	Habitat Description and Known Populations	Likelihood of Occurrence	Potential for Impact
Plants			
<i>Acacia bynoeana</i> Bynoe's Wattle (E, V*)	Small, prostrate shrub found in low heath and open woodland, generally on loamy clays and sand. Occurs from the Lower Hunter south to Southern Highlands. Flowering occurs during the summer months (September to March) and is characterised by a single bright yellow, globular flower located within the leaf axil.	This species is recorded within 10km of the PAA (n = 63). There is potential habitat for this species to occur on site. It is therefore considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Angophora inopina</i> Charmhaven Apple (V, V*)	Small to medium tree found in shallow sandy soils in open woodland, swamp woodland and wet heath. The main occurrences of this species are in the Wyong and Lake Macquarie LGA's (from Charmhaven to Wyee and Morisset, and north to near Toronto), with disjunct populations also in Port Stephens LGA (south of Karuah).	This species was recorded within 10km of the PAA (n = 186). This species potentially occurs on site due to its abundance in the surrounding area and the mapped presence of MU 31 (Bell 2009, House 2003) on site which contains <i>A. inopina</i> as a dominant.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Caladenia tessellata</i> Thick Lip Spider Orchid (E, V*)	A small terrestrial orchid, which regrows its single leaf on an annual basis. It is known to occur in grassy woodland and locally it has potential to occur within Coastal Plains Scribbly Gum Woodland. Flowers from September to October and is known to flower particularly after fire.	This species was recorded within 10km of the PAA (n = 4). There is suboptimal habitat for it to occur on site, however due to its low abundance in surrounding areas it is considered unlikely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Callistemon linearifolius</i> (V)	Shrub that grows in dry sclerophyll forest on the coast and adjacent ranges. Re-sprouting / juvenile specimens difficult to distinguish from other <i>Callistemon</i> species such as <i>C. rigidus</i> (Stiff Bottlebrush) or <i>C. linearis</i> (Narrow-leaved Bottlebrush) without the aid of flowering parts. Significant populations recently found within the HEZ and Werakata National Park.	This species was recorded within 10km of the PAA (n = 12). There is potential habitat for this species to occur on site. Therefore it is considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Chamaesyce psammogeton</i> Sand Spurge (E)	Perennial prostrate herb, which grows in sand foredune vegetation near the sea and on exposed headlands often with <i>Spinifex sericeus</i> (Spinifex). It is thought that seed dispersal may come from beach to beach as the seed of <i>C. psammogeton</i> float. Found on the east coast from Qld to Jervis Bay NSW. There is one record of this species located east of Belmont.	This species was recorded within 10km of the PAA (n = 1). However the study area in the PAA does not contain foredune vegetation to provide potential habitat. It is therefore considered unlikely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.

Species	Habitat Description and Known Populations	Likelihood of Occurrence	Potential for Impact
<i>Cryptostylis hunteriana</i> Leafless-tongue Orchid (V, V*)	A very rare leafless, saprophytic orchid, which has a symbiotic relationship with a mycorrhizal fungi which provides the plant with all its nutrient requirements. This orchid remains underground for the majority of its lifecycle, flowering periodically, when conditions are optimal to reproduce. This species is extremely cryptic as it does not flower every year. This species is known to occur within a range of habitats including woodlands to swamp heaths. Within the Hunter region larger populations have been typically found in woodland dominated by <i>Eucalyptus racemosa</i> (Scribbly Gum) and prefers areas with an open grassy understorey. The species typically prefers moist sandy soils in sparse to dense heath and sedgeland, or moist to dry clay loams in coastal forests.	This species was recorded within 10km of the PAA (n = 25). There is suboptimal habitat for this species on the site. Therefore, given its rarity and minimal potential habitat, it is considered unlikely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Diuris praecox</i> Newcastle Doubletail (V, V*)	Found predominantly in coastal Eucalypt forests on hilltops or slopes which usually have a grassy to fairly dense understorey. This species has been recorded at a number of dry woodland locations near Nords Wharf and west of Dudley in the east of Lake Macquarie LGA.	This species was recorded within 10km of the PAA (n = 19). Potential habitat is available for this species on the study site. Therefore it is considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Eucalyptus camfieldii</i> Camfield's Stringybark (V, V*)	Tree or mallee to 10m high, but often less. Rare and localised, in coastal shrub heath on sandy soils on sandstone, often in areas of restricted drainage. Records from the Hunter Region largely in near coastal areas from the Port Stephens LGA to the Central Coast (Atlas of NSW Wildlife data). This species generally occurs mostly in small scattered stands near the boundary of tall coastal heaths and low open woodland of the slightly more fertile inland areas, with associated species including; stunted <i>E. oblonga</i> (Narrow-leaved Stringybark), <i>E. capitellata</i> (Brown Stringybark) and <i>E. haemastoma</i> (Scribbly Gum).	This species was recorded within 10km of the PAA (n = 6). Potential habitat is present on site. Therefore it is considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.

Species	Habitat Description and Known Populations	Likelihood of Occurrence	Potential for Impact
<i>Eucalyptus parramattensis</i> ssp. <i>decadens</i> Drooping Red Gum (V, V*)	<i>Eucalyptus parramattensis</i> ssp. <i>decadens</i> (Drooping Red Gum) generally occupies deep low nutrient sands, where water tables are high or in areas of periodic inundation. Can be found in dry sclerophyll woodland with heath understorey, usually a community dominant species. Little is known of the ecology and biology of this species.	This species was recorded within 10km of the PAA (n = 3) however they are located towards to boundary of the 10km. There is suboptimal habitat on site. Therefore it is considered unlikely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Genoplesium insignis</i> Variable Midge Orchid (E)	Recorded from four localities between Chain Valley Bay and Wyong in Wyong local government area. Grows in patches of <i>Themeda australis</i> (Kangaroo Grass) amongst shrubs and sedges in heathland and forest. Associated vegetation at Chain Valley Bay is described as dry sclerophyll woodland dominated by <i>Eucalyptus haemastoma</i> (Scribbly Gum), <i>Corymbia gummifera</i> (Red Bloodwood), <i>Angophora costata</i> (Smooth-barked Apple) and <i>Allocasuarina littoralis</i> (Black She-oak). Flowers September to October.	This species was recorded within 10km of the PAA (n = 2). Due to the rarity of this species and the suboptimal habitat available on the PAA it is considered unlikely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Grevillea parviflora</i> ssp. <i>parviflora</i> (V, V*)	Occurs in light, clayey soils in woodlands. Most plants appear capable of suckering from a rootstock. Relatively widespread within the Cessnock LGA. Occurs within Werakata National Park. Much confusion surrounds the taxonomy of this species and other similar <i>Grevillea</i> taxa and a NPWS-funded study of the species is currently in progress.	This species was recorded within 10km of the PAA (n = 25). Potential habitat occurs on the study area. Therefore it is considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Maundia triglochinos</i> (V)	Perennial rush with rhizomes about 5 millimetres thick and emergent tufts of spongy leaves, triangular in cross section, arising along their length. Grows in fresh water swamps, creeks and shallow freshwater 30 - 60 cm deep on heavy clay.	This species was recorded within 10km of the PAA (n = 5). Suboptimal habitat on study site. Therefore it is considered unlikely to occur.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.

Species	Habitat Description and Known Populations	Likelihood of Occurrence	Potential for Impact
<i>Melaleuca biconvexa</i> Biconvex Paperbark (V, V*)	A shrub to small tree, which grows in poorly drained areas from Jervis Bay to Port Macquarie. Records in the Hunter Region are confined to western Lake Macquarie (Atlas of NSW Wildlife data). It may occur in dense stands adjacent to watercourses, in association with other <i>Melaleuca</i> species or as an understorey species in wet forest.	This species was recorded within 10km of the PAA (n = 215). Due to its abundance in surrounding areas and potential vegetation to cohabit with, it is considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Pultenaea maritima</i> Coastal Headland Pea (V)	The species occurs in grasslands, shrub-lands and heath on exposed coastal headlands from Newcastle to Byron Bay in NSW. There are three records of this species south of Caves Beach.	This species was recorded within 10km of the PAA (n = 6) however the records were at the 10km boundary. There is suboptimal habitat for this species to occur on site. Therefore it is considered unlikely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Rutidosia heterogama</i> (V, V*)	Small asteraceous herb which grows in heath on sandy soils and moist areas in open forest. Has been recorded in disturbed areas along roadsides. Rediscovered in the Hunter Region growing in disturbed areas and adjacent parcels of bushland within the Cessnock LGA. Also known from within the Wyong LGA. In the Hunter Region prefers Spotted Gum/Ironbark Forest. One record of this species is located approximately 6 kilometres north-west of Wyee and another is located approximately 3 kilometres north-west of Mount Sugarloaf.	This species was recorded within 10km of the PAA (n = 177). There is potential habitat for this species to occur on site. Therefore it is considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Syzygium paniculatum</i> Magenta Lilly Pilly (V, V*)	A shrub to small tree, found in sub-tropical and littoral rainforest on sandy soils or sheltered gullies mostly near water courses. Distribution between Bulahdelah and Jervis Bay. Hunter Region records confined to the Lake Macquarie hinterland (Atlas of NSW Wildlife data).	This species was recorded within 10km of the PAA (n = 13). There are water courses on the PAA providing potential habitat for this species to occur on site. Therefore it is considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Tetradlea juncea</i> Black-eyed Susan (V, V*)	Occurs in a variety of forested and heathy habitats. Locally found in Open Forests and Woodlands with dense, undisturbed understorey, often in association with <i>Angophora costata</i> / <i>Corymbia gummifera</i> on slopes with south-easterly aspects.	This species was recorded on the PAA (Atlas of NSW Wildlife data n = 2) and within 10km of the PAA (n = 799).	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.

Species	Habitat Description and Known Populations	Likelihood of Occurrence	Potential for Impact
Frogs			
<i>Mixophyes balbus</i> Stuttering Frog (E, V*)	Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Breed in streams during summer after heavy rain, outside the breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor. Eggs are laid on rock shelves or shallow riffles in small, flowing streams.	This species was not recorded within 10km of the PAA, however, was identified by EPBC Protected Matters Report as likely to occur. Due to the lack of suitable habitat of deep leaf litter in rainforest and a lack of evidence for their presence, it is considered unlikely to occur on the study site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Mixophyes iterates</i> Giant Barred Frog (V,E*)	Mostly restricted to wet sclerophyll forest and rainforest, including Antarctic Beech forest. Usually found within close proximity to permanent running water. Hunter Region records are largely confined to the Watagan National Park and to the north of Heaton State Forest (Atlas of NSW Wildlife data).	This species was recorded within 10km of the PAA (n = 1). The habitat is suboptimal as leaf litter in wet sclerophyll forest does not occur. Therefore it is considered unlikely to occur on the study site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Litoria aurea</i> Green and Golden Bell Frog (E, V*)	Inhabits swamps, lagoons, streams and ponds as well as dams, drains and storm water basins. Thought to be displaced from more established sites by other frog species, thus explaining its existence on disturbed sites. Previously widespread within the region, but now sparsely distributed within the Lower Hunter and Central Coast areas. A relatively stable population occurs on Kooragang Island.	This species was recorded within 10km of the PAA (n = 2). Potential habitat does occur on site and the EPBC Protected Matters Report considers this species as likely to occur on site. Therefore, it is considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Litoria brevipalmata</i> Green-thighed Frog (V)	Occurs in a range of habitats in areas where surface water gathers after rains. Frogs mainly occur in rainforests and wet sclerophyll forests. Breeding occurs after rains in late spring and summer, frogs aggregate around grassy semi-permanent ponds and flood prone grassy areas. Frogs are thought to forage in leaf litter.	This species was recorded within 10km of the PAA (n = 4) however they were close to the 10km boundary. Due to their low abundance, distance from the PAA and suboptimal habitat on the study site, it is considered unlikely to occur.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Litoria littlejohni</i> Little John's Tree Frog (V, V*)	A pale brown frog with dark speckles which occurs along permanent rocky creeks with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops. Occurs on the plateaus and eastern plains of the Great Dividing Range. Records within the Hunter Region occur from within the Watagan State Forest.	This species was not recorded on or within 10km of the PAA. The EPBC Protected Matters Report classifies them as likely to occur, however suitable habitat does not occur on the PAA. Therefore, it is considered that this species is unlikely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.

Species	Habitat Description and Known Populations	Likelihood of Occurrence	Potential for Impact
<i>Heleioporus australiacus</i> Giant Burrowing Frog (V, V*)	The current distribution of <i>H. australiacus</i> is south-eastern NSW to Vic. Locally it occurs north to Jervis Bay, and is mostly restricted to sandy creek banks, often in association with crayfish burrows in this area. The northern population has a marked preference for sandstone ridge-top habitat and broader upland valleys. In these locations the frog is associated with small headwater creek lines and along slow flowing to intermittent creek-lines. <i>H. australiacus</i> is grey to dark chocolate brown or black above with a white belly, a few yellow spots along the flanks. During the summer, males call like an owl hoot, from burrows within creek banks. Females lay eggs in a foamy nest in the burrow, and the developing tadpoles are washed from the burrows into the creeks during heavy rain.	This species was not recorded on or within 10km of the PAA. The EPBC Protected Matters Report classifies this species as likely to occur, however there is suboptimal habitat available with a lack of sandstone ridge tops. Therefore, it is considered unlikely for this species to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Crinia tinnula</i> Wallum Froglet (V)	Occurs in coastal, low-lying acid Paperbark forest, within the 'wallum country' (often on sandy soils). Although some marginal potential habitat could exist within the Paperbark Swamp Forest, it is generally not typical of the wallum habitats preferred by this species. Regional records for this species are confined to three main areas; Lake Macquarie, Central Coast and Medowie and Port Stephens (Atlas of NSW Wildlife data).	This species was recorded within 10km of the PAA (n = 82). The records are in close proximity to the study site. There is Swamp Sclerophyll Forest on Coastal Floodplains EEC on the PAA which is suitable habitat for this species. Therefore, it is considered to potentially occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
REPTILES			
<i>Hoplocephalus bungaroides</i> Broad-headed Snake (E, V*)	Largely confined to Triassic sandstones, including the Hawkesbury, Narellan and Shoalhaven formations, within the coast and ranges. Nocturnal, sheltering in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring. Moves from the sandstone rocks to shelters in hollows in large trees within 200 m of escarpments in summer.	This species was not recorded on or within 10km of the PAA. The EPBC Protected Matters Report classifies this species as likely to occur, however due to this species' highly specialised niche requirements of sandstone rocks on exposed cliff edges, it is considered as unlikely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.

Species	Habitat Description and Known Populations	Likelihood of Occurrence	Potential for Impact
<i>Hoplocephalus stephensii</i> Stephens' Banded Snake (V)	A nocturnal, partly arboreal snake. It inhabits eucalypt forest and rainforest from Gosford (NSW) north to southern Queensland. This snake is usually found under loose bark on trees or in hollow limbs. The diet consists of lizards, frogs, birds and small mammals. Females reproduce every second year giving birth to an average of six live young in February-March. The average length of <i>Hoplocephalus stephensii</i> is 0.65 metres and colour pattern dark brown-grey with a series of narrow pale brownish cross-bands, and the belly is cream with dark spots. The sides and back of head are dark and white blotches mark the lips and side of head. This snake should be regarded as potentially dangerous, although it has not been attributed to any human fatalities.	This species was recorded within 10km of the PAA (n = 1). Suboptimal habitat on site with a lack of eucalypt forest and rainforest. Therefore this species is considered as unlikely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
Birds			
<i>Oxyura australis</i> Blue-billed Duck (V)	A frequenter of deep freshwater swamps with thick vegetation. This species is wholly aquatic, swimming low in the water along the edge of dense cover. It will fly if disturbed, but prefers to dive. Most birds will leave their breeding swamps in favour of larger more open swamps and lakes for over-wintering. Most birds will nest in <i>Typha</i> sp. (Cumbungi) over deep water during spring/summer. They will also nest in trampled <i>Muehlenbeckia</i> sp. (Lignum) and Eleocharis obicis (Spike-rush). In NSW mostly occurring within 300 kilometres of the Murray-Darling basin, but may occur in more coastal areas during dry inland conditions.	This species was recorded within 10km of the PAA (n = 1). The habitat on site is suboptimal, with a lack of deep freshwater swamps with dense vegetation which is preferred by this species. Therefore it is considered unlikely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Ephippiorhynchus asiaticus</i> Black-necked Stork (E)	Inhabits swamps associated with river systems and large permanent pools but sometimes appears on the coast or in estuaries. It has also been recorded on farm dams and sewage treatment ponds. Within the Hunter Region it occurs spasmodically on freshwater or estuarine wetlands, along coastal and near coastal environments such as Gloucester.	This species was recorded within 10km of the PAA (n = 27). Potential habitat does occur on the study. Therefore it is considered as likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.

Species	Habitat Description and Known Populations	Likelihood of Occurrence	Potential for Impact
<i>Ixobrychus flavicollis</i> Black Bittern (V)	Solitary species, living near water (estuarine to brackish) in mangroves and other trees which need to form only a narrow fringe of cover. A riparian species that occasionally ventures into the open within estuarine habitats. Sedentary resident along Dora and Stockton Creeks in western Lake Macquarie, also been recorded semi-regularly in the Paterson River but is likely to occur in any brackish to estuarine forested coastal creeks in the lower NSW coast.	This species was recorded within 10km of the PAA (n = 5). Brackish environments are present on the site offering potential habitat for this species. Therefore it is considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Lophoictinia isura</i> Square-tailed Kite (V)	Inhabits open forests and woodlands, particularly those on fertile soils with abundant passerines. They may also range in nearby open habitats but not into extensive treeless regions. This species is notably absent from alpine regions and small isolated remnant woodlands in large open areas. Has been recorded in suburbia hawking over yards looking for prey.	This species was recorded within 10km of the PAA (n = 2). Prey species including lizards, passerines, mammals and insects potentially occur on site. Suitable foraging habitat occurs on site. Therefore it is likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Heiraaetus morphnoides</i> Little Eagle (V)	Inhabits open eucalypt forest, woodland and open woodland. Birds of inland NSW can occur across riparian woodland and acacia woodland. Can be found across the mainland except the most densely forested areas of the great divide. It requires a tall living tree within a forested area for nesting. Occurs across the western slopes and southern, central and northern tablelands.	This species was recorded within 10km of the PAA (n = 5). Potential habitat occurs on site for this species. Terrestrial prey, such as rabbits potentially occur on site. The site would only be utilized intermittently if used. Therefore it is considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Pandion cristatus</i> Osprey (V)	Ospreys are found right around the Australian coast line, except for Victoria and Tasmania. They are common around the Northern coast, especially on rocky shorelines, islands and reefs. The species is uncommon to rare or absent from closely settled parts of south eastern Australia. There are a handful of records from inland areas.	This species was recorded within 10km of the PAA (n= 20). Because of their coastline and aquatic nature, this species could be found on the study site. It is considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Rostratula australis</i> Australian Painted Snipe (E, V*)	A small freshwater and estuarine wader, which prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. This species has been recorded in Pambalong N.R. and Ash Island and Lenaghan's Flat.	This species was not recorded on or within 10km of the study site. The EPBC Protected Matters Report states that this species may occur. Since there have been no previous records of occurrence it is unlikely that this species will occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.

Species	Habitat Description and Known Populations	Likelihood of Occurrence	Potential for Impact
<i>Burhinus grallarius</i> Bush Stone-curlew (E)	Prefers open woodland, dry watercourses with fallen branches, leaf litter and sparse grass. Also occurs in coastal scrub, mangrove fringes, golf courses, rail reserves, wooded remnants on roadsides, orchards and plantations. Largely nocturnal, being especially active on moonlit nights. Nests on the ground in a scrape or small bare patch.	This species has been recorded within 10km of the PAA (n = 1). There are no populations occurring in this area, with a remnant population of 14 individuals occurring on the Central Coast and another population in port Macquarie. It is therefore considered unlikely to occur on the study site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Xenus cinereus</i> Terek Sandpiper (V, M*)	Recorded on coastal mudflats, lagoons, creeks and estuaries. It favours muddy beaches near mangroves but may also be observed on rocky pools and coral reefs occasionally up to 10 kilometres inland around brackish pools. Generally roosts communally amongst mangroves or dead trees, often roosts with related wader species. In the Hunter Estuary sometimes roosts with <i>Tringa brevipes</i> (Grey-Tailed Tattlers) on rocky shore.	This species has not been recorded within a 10km Wildlife Atlas search; however roosting is known to occur within the area according to EPBC Protected Matters Report. It is considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Calidris tenuirostris</i> Great Knot (V, M*)	Large sandpiper visiting Australian coasts during the austral summer. <i>Calidris tenuirostris</i> habitats include coastal inlets, estuaries, bays, intertidal mudflats and sandbanks and lagoons. On occasion they can be found on inland fresh and salt water lakes. Also occasionally seen on rocky platforms on the coast.	This species was recorded within 10km of the PAA (n = 2). Known roosting sites have been documented. Potential habitat is present. Therefore it is considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Haematopus fuliginosus</i> Sooty Oystercatcher (V)	Marine, usually rock shoreline, high rocky islets, boulders below cliffs, wave-cut platforms and reefs. Also inhabits sandy beaches and coves between rocky headlands. Also occurs within closed estuarine habitats where rocky substrates are present.	This species was recorded within 10km of the PAA (n = 20). Potential habitat is present for foraging and roosting among the aquatic ecosystems. Therefore it is considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Haematopus longirostris</i> Pied Oystercatcher (V)	This species prefers undisturbed sandy shell-grit or pebble beaches, sandspits and sandbars, tidal mudflats and estuaries, coastal islands. Occasionally rocky reefs, shores rock-stacks, brackish or saline wetlands. Also grassy paddocks, golf-courses or parks near coast. Forages for molluscs, crustaceans, polychaetes, ascidians, echinoderms and small fish, probes for	This species was recorded within 10km of the PAA (n = 8). Estuaries and tidal mudflats are potential habitats on the site for this species. Therefore it is considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.

Species	Habitat Description and Known Populations	Likelihood of Occurrence	Potential for Impact
	worms in short wet grass. In the Hunter this species is relatively common in the Hunter Estuary in small numbers and more common on the open beaches and river mouths around sandspits.		
<i>Charadrius mongolus</i> Lesser Sand Plover Mongolian Plover (V, M*)	When in Australia, this migratory species inhabits sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats. Prey includes molluscs, worms, crustaceans and insects. Low numbers of this species visit the Hunter estuary during the austral summer.	This species has been recorded within 10km of the PAA (n = 3) and known roosting sites have been recorded within the area. Therefore it is considered likely to occur within the site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Sterna albifrons</i> Little Tern (E, M*)	Migratory bird from eastern Asia, which most commonly occurs in sheltered coastal environments. Has been recorded several kilometres from the sea in bays, harbours and estuaries. Occasionally recorded from offshore Islands and coral cays. <i>Sterna albifrons</i> nest in loose colonies in shelly beaches just above the high tide line. Feeding habitat consists of shallow channels and estuaries and the in the surf on the beach.	This species has been recorded within 10km of the PAA (n = 10). The EPBC Protected Matters Report states that this species may occur on site with sheltered estuaries occurring. Potential habitat is also present on site. Therefore it is considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Ptilinopus regina</i> Rose-crowned Fruit-Dove (V)	Generally lives in rainforest of many variations, though it also frequents brushes of coastal districts as well as Eucalypt forests and mangroves. Favoured rainforest habitat consists of sub-tropical to dry rainforest and quite commonly littoral rainforest. They feed entirely on fruit from vines, trees and shrubs and mostly feed in the tops of trees or just under the foliage,	This species has been recorded within 10km of the PAA (n = 3). However the habitat preference of this species is rainforest type ecosystem which does not occur on site. Therefore it is considered unlikely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.

Species	Habitat Description and Known Populations	Likelihood of Occurrence	Potential for Impact
	where the fruit grows. <i>Ptilinopus regina</i> can be locally nomadic according to fruiting or part migratory according to fruit ripening. In the Hunter most records have come from Littoral rainforest around Harrington and at Mungo Brush, also records in rainforest at Seal Rocks.		
<i>Ptilinopus superbus</i> Superb Fruit-dove (V)	Occurs in rainforest and similar closed forests including, monsoon forest, regrowth, lantana thickets and woodland adjoining rainforest at all altitudes. Forages high in the canopy eating fruits of figs and palms. A part-migratory species that migrates and south. In winter some birds migrate south to the area of the Hunter, Sydney, Illawarra and South Coast.	This species has been recorded within 10km of the PAA (n = 4). However the habitat preference of this species is rainforest type ecosystem which does not occur on site. Therefore it is considered unlikely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Calyptrorhynchus lathamii</i> Glossy Black-Cockatoo (V)	Occurs in forests and woodlands where it forages predominantly on Allocasuarina cones. Requires large Eucalypt tree hollows for nesting. Sparse occurrences on the valley floor, but resident in ranges and adjacent areas surrounding the Hunter Valley. Most commonly encountered around the south and south western areas of the lake and in the Watagan Mountains N.P. These locations have good stands of Allocasuarina sp., especially <i>Allocasuarina littoralis</i> (Black She-oak)	This species has been recorded within 10km of the PAA (n = 42). There is 0.5 ha of Swamp Oak Rushland Forest (MU40) on the PAA which is potential habitat containing Allocasuarinas and/or Casuarinas for this species. It is therefore considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Callocephalon fimbriatum</i> Gang Gang Cockatoo (V)	Found in the summer months in tall mountain forests and woodlands, and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas. Within the Hunter Region this species has been found in the Kurri Kurri/Cessnock area during winter and in the Watagan Mountains areas	This species was recorded within 10km of the PAA (n = 9). There is potential for this species to use on site vegetation for foraging whilst on migration. Therefore it is considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.

Species	Habitat Description and Known Populations	Likelihood of Occurrence	Potential for Impact
	during the summer.		
<i>Glossopsitta pusilla</i> Little Lorikeet (V)	<i>Glossopsitta pusilla</i> extends from Cairns to Adelaide coastally and to inland locations. Commonly found in dry, open eucalypt forests and woodlands. Can be found in roadside vegetation to woodland remnants. <i>G. pusilla</i> feeds on abundant flowering Eucalypts, but will also take nectar from Melaleuca sp and Mistletoe sp. <i>Eucalyptus albens</i> (White Box) and <i>E. meliodora</i> (Yellow Box) are favoured food sources on the western slopes in NSW. On the eastern slopes and coastal areas favoured food sources are <i>Corymbia maculata</i> (Spotted Gum), <i>E. fibrosa</i> (Broad-leaved Ironbark), <i>E. robusta</i> (Swamp Mahogany) and <i>E. pilularis</i> (Blackbutt). Nesting takes place in hollow bearing trees.	This species was recorded on the PAA (Atlas of NSW Wildlife data n = 1) and was recorded within 10km of the PAA (n = 37).). The various flowering Eucalypt species on site are considered suitable for both foraging and roosting.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Lathamus discolor</i> Swift Parrot (E, E*)	On the mainland this species frequents Eucalypt forests and woodlands with large trees having high nectar production during winter. Mainland winter foraging sites often vary from year to year. Nests only in Tasmania, but regularly visits the Hunter Region in winter. Visits the Hunter Region when food sources are abundant or food sources are lacking in other areas. Food sources used in the Hunter include <i>Eucalyptus robusta</i> (Swamp Mahogany) on the coast, and near coastal to inland <i>Lathamus discolor</i> uses <i>Corymbia maculata</i> (Spotted Gum), <i>E. fibrosa</i> (Broad-leaved Ironbark) and <i>E. crebera</i> (Narrow-leaved Ironbark). Occasional records have come from <i>E. alba</i> (White Box) and <i>E. sideroxylon</i> (Mugga Ironbark).	This species was recorded on the PAA (Atlas of NSW Wildlife data n = 1) and was recorded within 10km of the PAA (n = 92). The EPBC Protected Matters Report considers this species or habitat for the species as likely to occur. The PAA consists of flowering Eucalypts which is suitable foraging habitat for this species.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Neophema pulchella</i> Turquoise Parrot (V)	Inhabits forests and woodlands with suitable nest hollows and grassy foraging areas. Needs a sparse understorey as it refers to feed in the shade of trees and spend most of its time on the ground searching for seeds of grasses and herbaceous plants. Generally found in more western locations within the Hunter Region (found coastally north of Port Stephens), although some	This species has been recorded within 10km of the PAA (n = 3). All 3 observations were in close proximity to the PAA and potential foraging habitat of flowering Eucalypt species does occur. Therefore it is considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.

Species	Habitat Description and Known Populations	Likelihood of Occurrence	Potential for Impact
	isolated records from the forested areas within the Cessnock LGA do exist.		
<i>Ninox strenua</i> Powerful Owl (V)	Occurs in wet or dry sclerophyll forests and woodlands where suitable prey species occur (being predominantly arboreal mammals). Requires large hollows, usually in Eucalypt trees, for nesting. Roosts in dense vegetation within such areas. Roosts in dense vegetation within such species as <i>Syncarpia glomulifera</i> (Turpetine), <i>Allocasuarina littoralis</i> (Black She-Oak), <i>Acacia melanoxylon</i> (Blackwood), <i>Angophora floribunda</i> (Rough-barked Apple), <i>Exocarpus cupressiformis</i> (Cherry Ballart) and <i>Melaleuca nodosa</i> (Ball Honey myrtle). Many records across the Hunter region, a lot coastal.	This species has been recorded within 10km of the PAA (n = 38). There is potential habitat for roosting and foraging in ecosystems containing eucalypt and allocasuarina species. Terrestrial and arboreal prey is potentially present on site. Therefore it is considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Ninox connivens</i> Barking Owl (V)	Occurs mainly in dry sclerophyll woodland. Nests in large Eucalypt hollows, and roosts in hollows or thick vegetation. Can be found roosting in dense Acacia sp. and Casuarina sp. or the dense clumps of Eucalypt trees. Hunts a range of prey species including birds and both terrestrial and arboreal mammals. Spasmodic Hunter Region records are largely limited to the south-western ranges and adjacent forests on the valley floor. Records from Ellalong, Yengo N.P. and Wybong area (HBOC records).	This species has been recorded in a single event (n = 1) within 10km of the study site. Habitat within the study area is available across the entire study area for this species. There is potential for prey species (both terrestrial and arboreal) across the study area, as well as suitable hollow bearing trees, providing foraging, nesting and roosting habitat as part of a larger home range. However, this species is unlikely to occur based on local knowledge and only a single record in the locality.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Tyto novaehollandiae</i> Masked Owl (V)	Found in a range of habitats, locally within sclerophyll forests and woodlands where appropriate / preferred prey species occur (being predominantly terrestrial mammals). Requires large Eucalypt hollows for nesting and prefers to roost in these hollows as well.	This species was recorded within 10km of the PAA (n = 17). Potential habitat occurs within the site. Terrestrial and arboreal prey potentially occurs on site. Therefore it is considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Tyto tenebricosa</i> Sooty Owl	Occurs in wet Eucalypt forest and rainforest with tall emergent trees, often in easterly facing	This species was recorded within 10km of the PAA (n = 2). The habitat is suboptimal with	No predicted impact. Negligible surface impacts

Species	Habitat Description and Known Populations	Likelihood of Occurrence	Potential for Impact
(V)	gullies. Within these areas this species hunts for a range of mainly mammalian prey at all levels of the forest strata, even recorded feeding on ground. Roosts in tree hollow or dense canopy vegetation. Also nests in large Eucalypt tree hollows. Most Hunter records exist from the Watagan mountains (Atlas of NSW Wildlife data), but this species has also been observed to the southwest of Awaba.	this species preferring well vegetated gullies in tall wet forest. Therefore it is considered unlikely to occur on site.	are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Climacteris picumnus</i> Brown Treecreeper (V)	Frequents drier forests and woodlands, particularly open woodland lacking a dense understorey. Also found in grasslands in proximity to wooded areas where there are sufficient logs, stumps and dead trees nearby. Occasionally found in mallee and <i>Eucalyptus camaldulensis</i> (River Red Gum) forest bordering wetlands with an open understorey of <i>Acacia</i> sp., <i>Muehlenbeckia</i> sp. (Lignum), <i>Typha</i> sp. (Cumbungi) and <i>Poa</i> sp. (grasses). Feeds on invertebrate larvae and small insects, particularly ants. Utilises hollows for roosting/nesting.	This species was recorded within 10km of the PAA (n = 3). Potential habitat occurs on site. Therefore it is considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Anthochaera phrygia</i> Regent Honeyeater (E, E*)	Nomadic Honeyeater that disperses to non-breeding areas, including the coast, in winter, where flowering trees are sought. Within the region, mostly recorded in Box-Ironbark Eucalypt associations along creek flats, river valleys and foothills. Coastal swamp forests in Lower Hunter are used when more western resources fail. The main feed tree for coastal areas is <i>Eucalyptus</i>	This species was recorded on the PAA (Atlas of NSW Wildlife data n = 1) and was recorded within 10km of the PAA (n = 30). The EPBC Protected Matters Report considers this species or habitat for the species as likely to occur.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.

Species	Habitat Description and Known Populations	Likelihood of Occurrence	Potential for Impact
	<i>robusta</i> (Swamp Mahogany). Hunter records are more common in near coastal areas such as Cessnock LGA. Feed trees in this region are <i>Corymbia maculata</i> (Spotted Gum), <i>E. fibrosa</i> (Broad-leaved Ironbark), <i>E. crebra</i> (Narrow-leaved Ironbark) and various <i>stringybark</i> sp.. Nests mainly west of the divide, although local breeding attempts have occurred at Quorrobolong.		
<i>Petroica boodang</i> Scarlet Robin (V)	In NSW this species occupies open forests and woodlands from the coast to the inland slopes. Some dispersing birds may appear in autumn or winter on the eastern fringe of the inland plains. The Scarlet Robin breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within an open understorey of shrubs and grasses and sometimes in open areas. Abundant logs and coarse woody debris are important structural components of its habitat. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. It forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris.	This species has been recorded within 10km of the PAA (n = 3). Suboptimal habitat on site with a lack of dry eucalypt or temperate woodlands. Considered unlikely to occur.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Pomatostomus temporalis</i> <i>temporalis</i> Grey-crowned Babbler (eastern subspecies) (V)	Occupies open forests and woodlands, Acacia shrubland and adjoining farmland. Also Box-Gum Woodlands on the divide slopes and Box-Cypress Pine and open Box Woodlands on the plains. They feed on terrestrial invertebrates and insects on lower trunks and branches. Generally they prefer wooded areas with an intact ground cover, although in such areas as the Hunter Valley they	This species was recorded within 10km of the PAA (n = 3). Suboptimal habitat on site with no box species occurring and a lack of open woodlands. Considered unlikely to occur.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.

Species	Habitat Description and Known Populations	Likelihood of Occurrence	Potential for Impact
	occur in sparsely vegetated areas such as properties and golf courses. Appears unable to persist in cleared and highly fragmented habitats. Nest comprise of a dome shape stick nest which is often only a couple of metres from the ground in shrubs or Eucalypt saplings.		
<i>Chthonicola sagittata</i> Speckled Warbler (V)	Occupies Eucalypt and Cypress woodlands in drier coastal areas and on the western slopes of the Great Dividing Range. Appears unable to persist in districts where no forested fragments larger than 100 hectares remain. Occurs in the central and southern Hunter Region where suitable habitat exists. Associated with extensive stands of <i>Bursaria spinosa</i> (Blackthorn) in some areas.	This species was recorded within 10km of the PAA (n = 2). Suboptimal habitat on site with a lack of eucalypt and cypress woodlands. Considered unlikely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Epthianura albifrons</i> White-fronted Chat (V)	Occur in damp open habitats, especially near wetlands bordered by samphire (Halosarcia) or saltbush (Atriplex) and grasslands. Often occur in coastal, near coastal and inland areas in saltmarsh and other similar chenopod shrublands, such as around saltlakes and salt pans. Also occur round freshwater wetlands, especially in surrounding grassland, including pasture.	This species was recorded within 10km of the PAA (n = 3). Potential habitat occurs on site surrounding the salt lake and connecting estuaries. Therefore it is considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Daphoenositta chrysoptera</i> Varied Sittella (V)	This species inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. The Varied Sittella feeds on arthropods gleaned from crevices in rough or decortivating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy.	This species was recorded on the PAA (Atlas of NSW Wildlife data n = 2) and was recorded within 10km of the PAA (n = 26).	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Stagonopleura guttata</i> Diamond Firetail (V)	Occupies open woodlands / forests and associated habitats with grassy understorey. Generally found west of the Divide or in drier semi-coastal areas such as the upper Hunter Valley. Appears unable to persist in remnants less than 200ha. A small number of records exist from the Lower Hunter Region	This species was recorded within 10km of the PAA (n = 3). Suboptimal habitat on site with a lack of open woodland ecosystems. Therefore it is considered unlikely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Limicola falcinellus</i>	Can be found around the majority of the	This species was recorded within 10km of the	No predicted impact.

Species	Habitat Description and Known Populations	Likelihood of Occurrence	Potential for Impact
Broad-billed Sandpiper (V)	Australian coast, except for Tasmania, during the Australian summer. Range is extremely scattered. On the vast mudflats around Cairns in north Queensland, flocks of up to 80 birds may be seen feeding. In other areas around the coast of mainland Australia. Feeds on exposed flats of soft mud or wet sand at edges of coastal and near-coastal wetlands, often round channels on mudflats or in accumulated mud in swales between shell banks (Higgins and Davies 1996). Records have also come from some inland locations, with this species a regular visitor to all states each season. They mainly eat small crustaceans, molluscs and marine worms.	PAA (n = 2). Potential habitat on site with coastal channels and banks present. Therefore it is considered likely to occur on site.	Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Limicola limosa</i> Black-tailed Godwit (V)	Migratory species and begins arriving in Australia in August each year, from breeding grounds in Mongolia and eastern Siberia. Occur around coastal Australia and occasionally far inland. Habitat utilised includes tidal mudflats, river edges, sandy beaches, brackish swamps as well as the shallows of lakes, reservoirs and sewage farms. They are gregarious and occur singly or in small to large groups, numbering hundreds at favoured roosting sites (Higgins and Davies 1996). Usually do not call much outside the breeding season. Feed by probing their bills deep into the mud in search of crustaceans, molluscs and various aquatic worms. Often overwinter in Australia.	This species was recorded on a single event within 10km of the PAA (n = 1). Optimal habitat is present with shallows in brackish water bodies, river edges and sandy lake edges. Therefore it is considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
Mammals			
<i>Dasyurus maculatus maculatus</i> Spotted-tailed Quoll (V, E*)	Found in a variety of forested habitats. This species creates a den in fallen hollow logs or among rocky outcrops. Generally does not occur in otherwise suitable habitats that are in close proximity to urban development. Hunter Region records are largely confined to the surrounding ranges (Atlas of NSW Wildlife data).	This species has been recorded within 10km of the PAA (n = 8). EPBC Protected Matter Report also states this species or suitable habitat for this species to may occur within 10km. Therefore this species is considered to likely occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.

Species	Habitat Description and Known Populations	Likelihood of Occurrence	Potential for Impact
<i>Phascolarctos cinereus</i> Koala (V)	Occurs in forests and woodlands where it requires suitable feed trees (particular Eucalyptus spp.) and habitat linkages. Will occasionally cross open areas, although it becomes more vulnerable to predator attack and road mortality during these excursions. Records from the Lower Hunter Region are largely confined to the greater Port Stephens area, the Lake Macquarie hinterland and the Watagan Mountains, with a small number of records from Cessnock LGA (Atlas of NSW Wildlife data).	This species has been recorded within 10km of the PAA (n = 22). There is optimal habitat within the <i>Swamp Sclerophyll Forest of the Floodplain of the North coast, Sydney basin and south east corner bioregions</i> (MU37) on the site. Therefore it is considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Cercartetus nanus</i> Eastern Pygmy Possum (V)	Occurs from rainforest through sclerophyll forest to tree heath. Favoured food being banksias, myrtaceous shrubs and trees and insects. Nesting sites are generally in drier habitats. Records exist from the Watagan Mountains (Atlas of NSW Wildlife data).	This species has been recorded on a single occasion (n = 1) within 10km of the study site. Suboptimal habitat on site. Therefore it is considered unlikely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Petaurus norfolcensis</i> Squirrel Glider (V)	Occurs in eucalypt forests and woodlands where it feeds on sap exudates and blossoms. In these areas tree hollows are utilised for nesting sites. This species also requires winter foraging resources when the availability of normal food resources may be limited, such as winter-flowering shrub and small tree species. Widely distributed across the lower hunter region (Atlas of NSW Wildlife data).	This species was recorded on the PAA (Atlas of NSW Wildlife data n = 1) and within 10km of the PAA (n = 170). Optimal habitat is present on site with eucalypt species providing foraging and nesting habitats.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Petaurus australis</i> Yellow-bellied Glider (V)	Usually associated with tall, mature wet Eucalypt forest. Also known from tall dry open forest and mature woodland. The diverse diet of this species is primarily made up of Eucalypt nectar, sap, honey dew, manna and invertebrates found under decorticated bark and pollen. Tree hollows for nest sites are essential, as are suitable food trees in close proximity. Most records in the Lower	This species has been recorded within 10km of the PAA (n = 37). Eucalypt species present on site provide favourable habitat for foraging and nesting. Therefore it is considered to likely occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.

Species	Habitat Description and Known Populations	Likelihood of Occurrence	Potential for Impact
	Hunter Region occur in the Watagan Mountains and other areas exhibiting significant stands of forest (Atlas of NSW Wildlife data).		
<i>Potorous tridactylus</i> <i>tridactylus</i> Long-nosed Potoroo (V,V*)	Prefers cool rainforest, wet sclerophyll forest and heathland. Sleeps by day in a nest on the ground, and digs for succulent roots, tubers, fungi and subterranean insects. Some diggings seemingly attributable to this species may belong to <i>Isoodon macrourus</i> (Northern Brown Bandicoot). Records exist from the Karuah vicinity and the Gosford LGA (Atlas of NSW Wildlife data).	This species was not recorded on or within 10km of the study site. However the EPBC Protection Matters Report considers it a species that may occur within the area. Since there are no recordings and habitat is suboptimal it is considered unlikely to occur on the site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Petrogale penicillata</i> Brush-tailed Rock Wallaby (E, V*)	Occurs in forests and woodlands along the Great Divide and on the western slopes in escarpment country with rocky outcrops, steep rocky slopes, gorges, boulders and isolated rocky areas. The majority of populations favour north-facing aspects, but some southern aspects have been recorded. Apart from the critical rock structure <i>Petrogale penicillata</i> also requires adjacent vegetation types, associated types include, dense rainforest, wet sclerophyll, vine thicket, dry sclerophyll forest and open forest. They also require suitable caves and rocky overhangs for shelter and also for 'lookout' posts. Records exist from the Watagan Mountains where it is associated with the above habitats.	This species was not recorded on or within 10km of the study site. However the EPBC Protection Matters Report considers it a species that may occur within the area. Since there are no recordings and habitat is suboptimal with a lack of critical rock structures it is considered unlikely to occur on the site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Pteropus poliocephalus</i> Grey-headed Flying-fox (V, V*)	This species forages over a large area for nectar/fruits. Seasonally roosts in communal base camps situated within wet sclerophyll forests or rainforests. Frequently observed to forage in flowering Eucalypts. May occur anywhere within the Hunter Region where food or roosting resources are available.	This species was recorded on the PAA (Atlas of NSW Wildlife data n= 1) and was recorded within 10km of the PAA (n = 59). They have also been known to forage or breed within the area. Flowering Eucalypt species provide suitable foraging habitat for this species.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Saccolaimus flaviventris</i>	Range of habitats from rainforest to arid	This species was recorded within 10km of the	No predicted impact.

Species	Habitat Description and Known Populations	Likelihood of Occurrence	Potential for Impact
Yellow-bellied Sheathtail-bat (V)	shrubland, roosts in tree-hollows. A limited number of records occur on the central coast and the Lower Hunter Region (Atlas of NSW Wildlife data).	PAA (n = 4). Suboptimal habitat on site with a lack of rainforest or arid shrubland trees. Therefore it is considered unlikely to occur on site.	
<i>Mormopterus norfolkensis</i> Eastern Freetail-bat (V)	This species is distributed south of Sydney extending north into south-eastern Queensland. There are no records west of the Great Dividing Range. Most records of this species have been reported from dry Eucalypt forest and woodland. It is expected that open forested areas and the cleared land adjacent to bushland, constitutes important habitat for this species, It is a predominantly tree-dwelling species, roosting in hollows or behind loose bark in mature Eucalypts. Widely distributed across the Lower Hunter Region (Atlas of NSW Wildlife data).	This species was recorded on the PAA (Atlas of NSW Wildlife data n= 4) and was recorded within 10km of the PAA (n = 54). Optimal habitat occurs on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Chalinolobus dwyeri</i> Large-eared Pied Bat (V, V*)	This species forages in tall open forests and the edges of rainforest. It roosts in mine shafts and similar structures. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of <i>Hirundo ariel</i> (Fairy Martin), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded	This species has been recorded in a singular event (n = 1) within 10km of the study site. This species or habitat for this species may occur on site according to the EPBC Protection Matter Report. However, there are no caves or cliffs on site in which this species prefers. Therefore it is considered unlikely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.

Species	Habitat Description and Known Populations	Likelihood of Occurrence	Potential for Impact
	raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves. They remain loyal to the same cave over many years. Found in well-timbered areas containing gullies. The relatively short, broad wing combined with the low weight per unit area of wing indicates manoeuvrable flight. This species probably forages for small, flying insects below the forest canopy. Hunter Region records for this species are largely confined to the Watagan Mountains, but it has been recorded on the southern side of Port Stephens (Atlas of NSW Wildlife data).		
<i>Vespadelus trougtoni</i> Eastern Cave Bat (V)	A cave dweller, known from wet sclerophyll forest and tropical woodlands from the coast and Dividing Range to the drier forests of the semi-arid zone. It has been found roosting in small groups in sandstone overhangs, in mine tunnels and occasionally in buildings. In all situations, the roost sites are frequently in reasonably well-lit areas. The distribution of this species is largely to the north of the Hunter Region.	One recording of this species has been documented within 10km of the PAA (n = 1). There are no caves or cliffs on site in which this species prefers. Therefore it is considered unlikely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Miniopterus schreibersii</i> Eastern Bentwing-Bat (V)	This species utilises a range of habitats for foraging, including rainforest, wet and dry sclerophyll forests, woodlands and open grasslands. Requires caves or similar structures for roosting habitat. Widely distributed across the Lower Hunter Region (Atlas of NSW Wildlife data).	This species was recorded on the PAA (Atlas of NSW Wildlife data n= 7) and was recorded within 10km of the PAA (n = 48). There is potential habitat for this species to occur. Buildings on site may also provide roosting sites for this species.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Miniopterus australis</i> Little Bentwing-bat (V)	Prefers to forage in well-vegetated areas, such as within wet and dry sclerophyll forests and rainforests. Requires caves or similar structures for roosting habitat. Largely confined to more coastal areas in the Lower Hunter Region (Atlas of NSW Wildlife data).	This species was recorded on the PAA (Atlas of NSW Wildlife data n= 8) and was recorded within 10km of the PAA (n = 62). Suitable foraging habitat occurs on site in well-vegetated areas. Buildings on site may also provide roosting sites for this species.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Myotis macropus</i> Large-footed Myotis	Usually found near bodies of water, including estuaries, lakes, reservoirs, rivers and large	This species was recorded on the PAA (Atlas of NSW Wildlife data n= 3) and was	No predicted impact. Negligible surface impacts

Species	Habitat Description and Known Populations	Likelihood of Occurrence	Potential for Impact
(V)	streams, often in close proximity to their roost site. Although usually recorded foraging over wet areas, it also utilises a variety of wooded habitats adjacent to such areas including rainforest, wet and dry sclerophyll forest, woodland, and swamp forest. Roosts in small colonies of between 15 and several hundred individuals in caves, mines and disused railway tunnels.	recorded within 10km of the PAA (n = 35). The presence of water in close proximity to the site is a factor influencing the presence of this species, along with suitable habitat. Buildings on site may also provide roosting sites for this species.	are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Falsistrellus tasmaniensis</i> Eastern False Pipistrelle (V)	This species is found in a variety of forest types such as open forests, woodlands and wetter sclerophyll forests (usually with trees >20m). This species roosts in tree hollows. Appears to locally favour upland habitats. A limited number of records occur on the central coast and the Lower Hunter Region (Atlas of NSW Wildlife data).	This species was recorded on the PAA (Atlas of NSW Wildlife data n = 1) and was recorded within 10km of the PAA (n = 10). Potential habitat occurs on site. Buildings on site may also provide roosting sites for this species. Therefore it is considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Scoteanax rueppellii</i> Greater Broad-nosed Bat (V)	Forages in moister gullies and wet sclerophyll forests as well as in lightly wooded areas and open spaces/ecotones. This species roosts in tree hollows and is relatively widespread within the Lower Hunter Region (Atlas of NSW Wildlife data).	This species was recorded on the PAA (Atlas of NSW Wildlife data n = 2) and was recorded within 10km of the PAA (n = 41). Suitable habitat occurs on site. Therefore it is considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Phoniscus papuensis</i> (syn. <i>Kerivoula papuensis</i>) Golden-tipped Bat (V)	Rainforest, rainforest gullies within wet sclerophyll forests. Also records from recently logged dry sclerophyll forests. Hunter records west of Port Stephens and from the Watagan Mountains (Atlas of NSW Wildlife data).	This species has been recorded once (n = 1) within 10km of the study site. The preferred rainforest vegetation does not occur on site. Therefore it is considered unlikely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
<i>Psuedomys novaehollandiae</i> New Holland Mouse (V)	Across the species' range they are known to inhabit open heathlands, open woodlands with a heathland understorey and vegetated sand dunes.	This species was not recorded on or within 10km of the study site. However, the EPBC Protection Matter Report states that this species or habitat for this species is known to occur within the area. Since presence records do not exist and habitat is suboptimal, it is considered unlikely to occur on the site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
Invertebrates			

Species	Habitat Description and Known Populations	Likelihood of Occurrence	Potential for Impact
<i>Petalura gigantea</i> Giant Dragonfly (E)	<i>P. gigantea</i> has been recorded from permanent wetlands, both coastal and upland, from Moss Vale northwards to southern Queensland, but has not been recorded in most areas for many years. It needs areas of free water and open vegetation.	This species was recorded once (n = 1) within 10km of the study site. This species requires permanent wetlands which do not occur on the study site. It is therefore considered unlikely to occur on the site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres.
Endangered Populations			
<i>Eucalyptus parramattensis</i> subsp. <i>parramattensis</i> Endangered Population in Wyong and Lake Macquarie LGA's (E)	<i>Eucalyptus parramattensis</i> ssp. <i>parramattensis</i> is associated with low moist areas alongside drainage lines and adjacent to wetlands. It is often found in woodland on sandy soils. The endangered population occurs on sandy alluvium within a floodplain community which also supports <i>Eucalyptus robusta</i> (Swamp mahogany), <i>E. tereticornis</i> (Forest Red Gum), <i>E. gummifera</i> (Sydney Bloodwood) as well as <i>Melaleuca</i> (Paperbark) species. The species usually occurs from the Goulburn Valley on the Central West slopes to Hill Top on the Central Coast. The endangered population in the Lake Macquarie and Wyong local government areas is at the north-eastern limit of the species range and is quite separate from other known populations. The majority of the population occurs within Wyong in the Porter's Creek and the Wallarah Creek catchments.	This population was recorded within 10km of the PAA (n = 21). There is potential suitable habitat for this population to occur on site. Therefore it is considered likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres. This ecological community is unlikely to be affected by the proposed Project.
EECs			
Swamp Sclerophyll Forest of the Floodplains of the North Coast, Sydney Basin and Southeast Corner Bioregions (EEC)	Occurs in areas of impeded drainage near coastal swamps, lagoons and along drainage lines on alluvial flats of quaternary sands and sediments. Ranges from open forest to forest with <i>Eucalyptus robusta</i> and <i>Melaleuca quinquenervia</i> forming key diagnostic species in combination or monospecific stands. Four variations have been identified within	Lake Macquarie City Council lists this EEC as occurring within their local Government Area. Based on vegetation mapping it is likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres. This ecological community is unlikely to be affected by

Species	Habitat Description and Known Populations	Likelihood of Occurrence	Potential for Impact
	this community.		the proposed Project.
River-Flat Forest on Coastal Floodplains on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and Southeast Corner Bioregions (EEC)	Occurs on low relief areas of the Lake Macquarie foreshore. Forms a fringe on flats and gentle rises behind the lake fringing Swamp Oak Rushland Forest. <i>Eucalyptus teretecornis</i> , <i>Angophora floribunda</i> and <i>Eucalyptus resinifera</i> subsp <i>resinifera</i> usually dominate the tree canopy. Shares similar plant species to MU 5 –Alluvial Tall Moist Forest or MU 23- Swamp Mahogany-Paperbark Forest.	Lake Macquarie City Council lists this TEC as occurring within their Local Government Area and at least some vegetation within the PAA is likely to be commensurate with this EEC. Based on vegetation mapping it is likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres. This ecological community is unlikely to be affected by the proposed Project.
Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bio-regions (EEC)	This community is dominated by <i>Casuarina glauca</i> (Swamp Oak) and is associated with periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains, typically occurring on grey-black clay-loams and sandy loams. Usually occurring below 20m altitude. Corresponds to HOUSE (2003) Map Units (MU) 40 – Swamp Oak Rushland Forest and MU 41 – Swamp Oak Sedge Forest.	Lake Macquarie City Council lists this TEC as occurring within their Local Government Area and at least some vegetation within the PAA is likely to be commensurate with this TEC. Based on vegetation mapping it is likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres. This ecological community is unlikely to be affected by the proposed Project.
Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions (EEC)	Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner occurs in the intertidal zone on the shores of estuaries and lagoons, including when they are intermittently closed along the NSW coast. Corresponds to the Lower Hunter Central Coast Regional Biodiversity Conservation Strategy (LHCCREMS) Map Unit (MU) 47a - Saltmarsh.	Lake Macquarie City Council lists this TEC as occurring within their Local Government Area. Some vegetation within the PAA may be commensurate with this TEC as it has been mapped as occurring on the PAA. Based on vegetation mapping it is likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres. This ecological community is unlikely to be affected by the proposed Project.
Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bio-regions (EEC)	Associated with periodic or semi-permanent inundation by freshwater, although there may be minor saline influence in some wetlands. They typically occur on silts, muds or humic loams in depressions, flats, drainage lines, backswamps, lagoons and lakes associated with coastal floodplains. Wetlands or parts of wetlands that lack standing water most of the time are usually	Lake Macquarie City Council lists this TEC as occurring within their Local Government Area. Some vegetation within the PAA may be commensurate with this TEC as it has been mapped as occurring on the PAA. Based on vegetation mapping it is likely to occur on site.	No predicted impact. Negligible surface impacts are expected to occur. Subsidence is predicted to be less than 20 millimetres. This ecological community is unlikely to be affected by the proposed Project.

Species	Habitat Description and Known Populations	Likelihood of Occurrence	Potential for Impact
	dominated by dense grassland or sedgeland vegetation, often forming a turf less than 0.5 metre tall and dominated by amphibious plants including <i>Paspalum distichum</i> (Water Couch), <i>Leersia hexandra</i> (Swamp Ricegrass) and <i>Carex appressa</i> (Tall Sedge). Wetlands or parts of wetlands subject to regular inundation and drying may include large emergent sedges over 1 metre tall, such as <i>Baumea articulate</i> (Jointed Twig-rush), <i>Eleocharis equisetina</i> and <i>Lepironia articulata</i> . Corresponds to House (2003) Map Unit (MU) 46 – Freshwater Wetland Complex.		

Notes: (V) = Vulnerable species listed under the *TSC Act*.
(E) = Endangered species listed under the *TSC Act*.
(CE) = Critically Endangered species listed under the *TSC Act*.
(PD) = Preliminary Determination of listing under the *TSC Act*.
(V*) = Vulnerable species listed under the *EPBC Act*.
(E*) = Endangered species listed under the *EPBC Act*.
(CE*) = Critically Endangered species listed under the *EPBC Act*.
(M*) = Migratory species listed under the *EPBC Act*.

Appendix 2

Staff Qualifications



Curriculum Vitae

TOBY LAMBERT

Senior Ecologist / Senior Project Manager

Newcastle, NSW

Bachelor of Environmental Science, University of Newcastle, 1993 - 1996

Accredited BioBanking Assessor, Tafe NSW – Ryde, 2009

NSW Driver's Licence (Class C)

OH&S Induction Training (Green Card)

NPWS Scientific Investigation Licence and NSW Animal Ethics Research Authority

AREAS OF EXPERTISE:

Toby has over fourteen years experience in undertaking and managing a diverse array of ecological and environmental surveys and assessments. As a Senior Ecologist – Senior Project Manager, he supervises all facets of flora and fauna assessment and related reports: planning, supervision of field and reporting staff, project scheduling, budget management, liaising with clients and Government departments and providing advice of all kinds. He has also been called upon to prepare expert evidence for matters at the NSW Land and Environment Court. Toby has produced ecological and environmental documentation for private and public projects ranging in complexity. These include a number of wind farms throughout Australia and New Zealand, coal mines and a range of infrastructure projects within the Hunter region. Toby has also managed ecological master planning for residential projects in Sydney, the Central Coast and the Hunter. Toby's fields of expertise are Environmental Impact Assessment and mediation, flora, fauna and habitat survey method, design and identification, detailed understanding of legislation and threatened species issues, terrestrial fauna surveys and project management. He has experience in conducting comprehensive fauna surveys and preparing related documentation in a broad array of environments throughout New South Wales, with most projects located in the greater Sydney area, Blue Mountains, Central Coast, Hunter and Forster / Great Lakes regions. Toby has also undertaken ecological projects in Western Australia, Queensland, the ACT and New Zealand.

SELECTED PROJECT EXPERIENCE:

Ecology

- **Hunter Economic Zone Industrial Estate** - Project Manager for the environmental component of the development of the Hunter Economic Zone industrial estate at Kurri Kurri, to be the largest industrial estate in NSW.
- **Centennial Coal** - Environmental Project Manager for consultancy works to Centennial Coal covering a broad range of disciplines, but primarily focussed on ecological impact assessments, monitoring and management at six coal mines in the western Blue Mountains and Lake Macquarie NSW.
- **Peabody Energy Australia** - Senior Project Manager for project specific and ongoing monitoring requirements for Wambo Coal Mine at Warkworth in the Upper Hunter Valley. Toby liaises directly with the Environmental Manager of the mine in relation to requirements to fulfil consent conditions for the ongoing development and operation of the project.
- **Allco Wind Energy** - This involved undertaking fauna surveys for a 100 turbine wind farm on the North Island of New Zealand and coordinating other ecological specialists to prepare an ecological impact assessment for submission to Taranaki Council. Aspects included regular liaison with the Department of Conservation regarding issues of significance, survey methodology, and mitigation and management measures to protect significant ecological features. Local bird groups were also involved and Toby was involved in the public consultation sessions.



Curriculum Vitae

- CONTINUED -

- **Stockland Wallarah Peninsula** - This Lake Macquarie, NSW project required a multi-disciplinary approach to an innovative residential proposal on environmentally sensitive land. Project management of, and participation in, a large and diverse planning team were major features of this work. Toby was a pivotal member of the project management team that provided the detailed ecological input and advice that was required from the early stages of the planning process to the point of submission to determining authorities. The proposal required sophisticated and creative impact assessment and reporting. Toby made a major contribution to the production of a series of comprehensive ecological reports that ensured the ecological integrity of the site was maintained in the post-development landscape.

PREVIOUS EXPERIENCE:

Senior Project Manager - Cumberland Ecology, Epping **2005**

Duties included flora and fauna surveying and survey design; overseeing and contribution to the preparation of complex ecological and environmental reports for both small and large projects; flora and fauna surveying and survey design; liaison with both the private sector and federal, state and local government departments.

Principal Consultant / Co-Founder - Keystone Ecological, Kariong **2004 - 2005**

Preparation and development of Keystone Ecological Flora and Fauna Impact Assessment report format; development of client database, including organisation of promotional material, logo design and customer relations; administration including preparation of quotes and invoices and organising accounts and BAS statements; Flora and fauna surveying and survey design; along with Anabat II Data Analysis.

Project Manager - Ecology - Conacher Travers Environmental, Somersby **1998 - 2004**

Supervision of flora and fauna survey design; report quality control; production of technical reports such as Review of Environmental Factors, Flora & Fauna Assessments, Statement of Environmental Effects, Species Impact Statements and Plans of Management, Land and Environment Court Evidence preparation, EPBC Act Referrals and Preliminary Information preparation; Flora & fauna surveying; liaison with Department of Environment and Conservation, Department of Environment and Heritage, Department of Infrastructure, Planning and Natural Resources, Department of Agriculture, Local Governments and private clients; Anabat II Data Analysis; Water Testing; Data Recording and Statistical Analysis.

Volunteer for Green and Golden Bell Frog Survey - Australian Museum, North Avoca **1999 - 2001**

Survey and searches for the endangered species Green & Golden Bell Frog; assisting in weighing, measuring and micro-chipping frogs for on-going research purposes.

Environmental Scientist - Australian Defence Industries (ADI), St Marys **1998**

Bore Water Sampling; statistical analysis of test results; and report production.

Environmental Scientist - Anne Clements & Associates, North Sydney **1997**

Field Assistant to Botanist and data recording.

Research Assistant - University of Newcastle **1996**

Initiation of design of final year project for Biology Dept; research into fire regimes on species composition & regeneration in open woodland; use of advanced scientific equipment including infra red gas analyser in the field, and replication of experiments using computer database; theoretical knowledge on soils, nutrient cycles & vegetation types.

MEMBERSHIPS & ACHIEVEMENTS:

- Ecological Consultants Association of NSW (ECA) – Council Member
- Newcastle Green Drinks for Environmental Professionals organising committee



Curriculum Vitae

ARNE BISHOP

Field Ecologist

Newcastle, NSW

Bachelor of Environmental Science/Landscape Architecture, University of Canberra, 2009

Cert IV Horticulture (Landscape) Canberra Institute of Technology, 2003.

Cert III Horticulture (Landscape), Canberra Institute of Technology, 2002.

Cert II Australian Land Conservation and Restoration, Conservation Volunteers Australia, 2001.

NSW Driver's Licence (Class C)

AREAS OF EXPERTISE:

Arne began paid employment in environmental management as a part time field assistant for Alison Rowell Environmental Consultancy in 1999. This role included working on flora and fauna surveys, and habitat/vegetation assessment and mapping. The knowledge and experience Arne gained from this role progressed and developed into a sub-consultancy role with full time employment over spring- summer every year.

In 2001 Arne completed a six month environmental traineeship with Green Corps. This course involved learning about environmental issues and how best to manage them in a practical sense. Arne performed duties such as: pest and weed identification and control; bush regeneration; and natural area restoration.

In addition to the above, Arne has also completed several contracts as an environmental consultant for Eco Logical Australia, assisting with threatened species identification and monitoring on a range of projects. All of these roles have been focused on collating and interpreting scientific information in order to produce recommendations on and resolutions to environmental issues.

SELECTED PROJECT EXPERIENCE:

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

PREVIOUS EXPERIENCE:

Part-time field assistant/consultant – Alison Rowell

1999 - 2010

This role included working on flora and fauna surveys, and habitat/vegetation assessment and mapping. The knowledge and experience I have gained from this role has progressed and developed into a sub-consultancy role with full time employment over spring- summer every year.

Environmental consultancy work - Eco Logical Australia

2008 - 10

Arne completed several contracts as an environmental consultant for Eco Logical Australia, assisting with threatened species identification and monitoring on a range of projects.

Green Corps Traineeship - Conservation Volunteers Australian (CVA)

2001



Curriculum Vitae

- CONTINUED -

Arne received accredited practical and theoretical training in; First Aid (Level 2, St Johns); Occupational Health and Safety and Environmental Concepts. This training contributed to Certificate II in Australian Land Conservation and Restoration.

MEMBERSHIPS & ACHIEVEMENTS:

- § Award of Excellence for first place in Conservation Biology and Genetics – University of Canberra.
- § Landscape Functional Analysis Training

Appendix 3

EPBC Protected Matters Report



Australian Government

Department of Sustainability, Environment,
Water, Population and Communities

EPBC Act Protected Matters Report: Coordinates

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information about the EPBC Act including significance guidelines, forms and application process details can be found at <http://www.environment.gov.au/epbc/assessmentsapprovals/index.html>

Report created: 27/06/11 13:27:04



[Summary](#)

[Details](#)

[Matters of NES](#)

[Other matters protected by
the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

Buffer: 10.0Km

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see <http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html>.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Significance (Ramsar Wetlands):	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	None
Threatened Species:	47
Migratory Species:	57

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage/index.html>

Please note that the current dataset on Commonwealth land is not complete. Further information on Commonwealth land would need to be obtained from relevant sources including Commonwealth agencies, local agencies, and land tenure maps.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at <http://www.environment.gov.au/epbc/permits/index.html>.

Commonwealth Lands:	2
Commonwealth Heritage Places:	None
Listed Marine Species:	77
Whales and Other Cetaceans:	12

Critical Habitats:	None
Commonwealth Reserves:	None

Report Summary for Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

Place on the RNE:	2
State and Territory Reserves:	3
Regional Forest Agreements:	1
Invasive Species:	17
Nationally Important Wetlands:	3

Details

Matters of National Environmental Significance

Threatened Species		[Resource Information]
Name	Status	Type of Presence
BIRDS		
Anthochaera phrygia Regent Honeyeater [82338]	Endangered	Species or species habitat likely to occur within area
Diomedea exulans antipodensis Antipodean Albatross [82269]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans gibsoni Gibson's Albatross [82271]	Vulnerable	Species or species habitat may occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Pterodroma neglecta neglecta Kermadec Petrel (western) [64450]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta salvini Salvin's Albatross [82343]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophrys impavida		

Campbell Albatross [82449]	Vulnerable	Species or species habitat may occur within area
FISH		
Prototroctes maraena		
Australian Grayling [26179]	Vulnerable	Species or species habitat may occur within area
FROGS		
Heleioporus australiacus		
Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat likely to occur within area
Litoria aurea		
Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat may occur within area
Litoria littlejohni		
Littlejohn's Tree Frog, Heath Frog [64733]	Vulnerable	Species or species habitat may occur within area
Mixophyes balbus		
Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat likely to occur within area
Mixophyes iteratus		
Giant Barred Frog, Southern Barred Frog [1944]	Endangered	Species or species habitat likely to occur within area
MAMMALS		
Chalinolobus dwyeri		
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat may occur within area
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat may occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Petrogale penicillata		
Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area
Potorous tridactylus tridactylus		
Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat may occur within area
Pseudomys novaehollandiae		
New Holland Mouse [96]	Vulnerable	Species or species habitat known to occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
PLANTS		
Acacia bynoeana		
Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat likely to occur within area
Angophora inopina		
[64832]	Vulnerable	Species or species habitat likely to occur within area

[Caladenia tessellata](#)

Thick-lipped Spider-orchid,
Daddy Long-legs [2119]

Vulnerable

Species or species habitat likely to occur within area

[Cryptostylis hunteriana](#)

Leafless Tongue-orchid [19533]

Vulnerable

Species or species habitat may occur within area

[Diuris praecox](#)

Newcastle Doubletail [55086]

Vulnerable

Species or species habitat likely to occur within area

[Eucalyptus camfieldii](#)

Camfield's Stringybark [15460]

Vulnerable

Species or species habitat likely to occur within area

[Grevillea parviflora subsp. parviflora](#)

Small-flower Grevillea [64910]

Vulnerable

Species or species habitat likely to occur within area

[Melaleuca biconvexa](#)

Biconvex Paperbark [5583]

Vulnerable

Species or species habitat known to occur within area

[Syzygium paniculatum](#)

Magenta Lilly Pilly, Magenta
Cherry, Pocket-less Brush
Cherry, Scrub Cherry, Creek
Lilly Pilly, Brush Cherry
[20307]

Vulnerable

Species or species habitat likely to occur within area

[Tetraloche juncea](#)

Black-eyed Susan [21407]

Vulnerable

Species or species habitat likely to occur within area

REPTILES

[Caretta caretta](#)

Loggerhead Turtle [1763]

Endangered

Species or species habitat known to occur within area

[Chelonia mydas](#)

Green Turtle [1765]

Vulnerable

Species or species habitat known to occur within area

[Dermochelys coriacea](#)

Leatherback Turtle, Leathery
Turtle, Luth [1768]

Endangered

Species or species habitat likely to occur within area

[Eretmochelys imbricata](#)

Hawksbill Turtle [1766]

Vulnerable

Species or species habitat known to occur within area

[Hoplocephalus bungaroides](#)

Broad-headed Snake [1182]

Vulnerable

Species or species habitat likely to occur within area

[Natator depressus](#)

Flatback Turtle [59257]

Vulnerable

Species or species habitat known to occur within area

SHARKS

[Carcharias taurus \(east coast population\)](#)

Grey Nurse Shark (east coast
population) [68751]

Critically
Endangered

Species or species habitat may occur within area

[Carcharodon carcharias](#)

Great White Shark [64470]

Vulnerable

Species or species habitat may occur within area

[Pristis zijsron](#)

Green Sawfish, Dindagubba,
Narrowsnout Sawfish [68442]

Vulnerable

Species or species habitat may occur within area

[Rhincodon typus](#)

Whale Shark [66680]

Vulnerable

Species or species habitat may occur within area

Migratory Species**[Resource Information]**

Name

Status

Type of Presence

Migratory Marine Birds[Apus pacificus](#)

Fork-tailed Swift [678]

Species or species habitat may occur within area

[Ardea alba](#)Great Egret, White Egret
[59541]

Species or species habitat may occur within area

[Ardea ibis](#)

Cattle Egret [59542]

Species or species habitat may occur within area

[Diomedea antipodensis](#)

Antipodean Albatross [64458]

Species or species habitat may occur within area

[Diomedea gibsoni](#)

Gibson's Albatross [64466]

Species or species habitat may occur within area

[Macronectes giganteus](#)

Southern Giant-Petrel [1060]

Endangered

Species or species habitat may occur within area

[Macronectes halli](#)

Northern Giant-Petrel [1061]

Vulnerable

Species or species habitat may occur within area

[Sterna albifrons](#)

Little Tern [813]

Species or species habitat may occur within area

[Thalassarche bulleri](#)

Buller's Albatross [64460]

Vulnerable

Species or species habitat may occur within area

[Thalassarche cauta \(sensu stricto\)](#)Shy Albatross, Tasmanian Shy
Albatross [64697]

Species or species habitat may occur within area

[Thalassarche impavida](#)

Campbell Albatross [64459]

Species or species habitat may occur within area

[Thalassarche salvini](#)

Salvin's Albatross [64463]

Species or species habitat may occur within area

[Thalassarche steadi](#)

White-capped Albatross [64462]

Species or species habitat may occur within area

Migratory Marine Species[Balaenoptera edeni](#)

Bryde's Whale [35]

Species or species habitat may occur within area

[Caperea marginata](#)

Pygmy Right Whale [39]

Species or species habitat may occur within area

[Carcharodon carcharias](#)

Great White Shark [64470]

Vulnerable

Species or species habitat may occur within area

[Caretta caretta](#)

Loggerhead Turtle [1763]

Endangered

Species or species habitat known to occur within area

[Chelonia mydas](#)

Green Turtle [1765]

Vulnerable

Species or species habitat known to occur within area

[Dermochelys coriacea](#)Leatherback Turtle, Leathery
Turtle, Luth [1768]

Endangered

Species or species habitat likely to occur within area

[Eretmochelys imbricata](#)

Hawksbill Turtle [1766]

Vulnerable

Species or species habitat known to occur within area

Eubalaena australis		
Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Lagenorhynchus obscurus		
Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca		
Killer Whale, Orca [46]		Species or species habitat may occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus		
White-throated Needletail [682]		Species or species habitat may occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis		
Black-faced Monarch [609]		Breeding may occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Breeding likely to occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Breeding may occur within area
Xanthomyza phrygia		
Regent Honeyeater [430]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Roosting known to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres		
Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba		
Sanderling [875]		Roosting known to occur within area
Calidris canutus		
Red Knot, Knot [855]		Roosting known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]		Roosting known to occur within area
Calidris ruficollis		
Red-necked Stint [860]		Roosting known to occur within area

Calidris tenuirostris Great Knot [862]	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Roosting known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Roosting known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]	Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]	Roosting known to occur within area
Limosa limosa Black-tailed Godwit [845]	Roosting known to occur within area
Numenius madagascariensis Eastern Curlew [847]	Roosting known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]	Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]	Roosting known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]	Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]	Roosting known to occur within area
Rostratula benghalensis s. lat. Painted Snipe [889]	Species or species habitat may occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]	Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]	Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [[Resource Information](#)]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land - Australian Postal Commission

Commonwealth Land - Australian Telecommunications Commission

Listed Marine Species [[Resource Information](#)]

Name	Status	Type of Presence
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Birds

Actitis hypoleucos Common Sandpiper [59309]	Roosting known to occur within area
Apus pacificus Fork-tailed Swift [678]	Species or species habitat may occur within area
Ardea alba	

Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres		
Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba		
Sanderling [875]		Roosting known to occur within area
Calidris canutus		
Red Knot, Knot [855]		Roosting known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]		Roosting known to occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Roosting known to occur within area
Calidris ruficollis		
Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris		
Great Knot [862]		Roosting known to occur within area
Charadrius bicinctus		
Double-banded Plover [895]		Roosting known to occur within area
Charadrius mongolus		
Lesser Sand Plover, Mongolian Plover [879]		Roosting known to occur within area
Charadrius ruficapillus		
Red-capped Plover [881]		Roosting known to occur within area
Diomedea antipodensis		
Antipodean Albatross [64458]		Species or species habitat may occur within area
Diomedea gibsoni		
Gibson's Albatross [64466]		Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Roosting known to occur within area
Gallinago megala		
Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura		
Pin-tailed Snipe [841]		Roosting likely to occur within area
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Heteroscelus brevipes		
Grey-tailed Tattler [59311]		Roosting known to occur within area
Himantopus himantopus		
Black-winged Stilt [870]		Roosting known to occur within area
Hirundapus caudacutus		
White-throated Needletail [682]		Species or species habitat may occur within area
Lathamus discolor		
Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Limosa lapponica		
Bar-tailed Godwit [844]		Roosting known to occur within area

Limosa limosa		Black-tailed Godwit [845]	Roosting known to occur within area
Macronectes giganteus		Southern Giant-Petrel [1060]	Species or species habitat may occur within area
Macronectes halli	Endangered	Northern Giant-Petrel [1061]	Species or species habitat may occur within area
Merops ornatus	Vulnerable	Rainbow Bee-eater [670]	Species or species habitat may occur within area
Monarcha melanopsis		Black-faced Monarch [609]	Breeding may occur within area
Myiagra cyanoleuca		Satin Flycatcher [612]	Breeding likely to occur within area
Numenius madagascariensis		Eastern Curlew [847]	Roosting known to occur within area
Numenius minutus		Little Curlew, Little Whimbrel [848]	Roosting likely to occur within area
Numenius phaeopus		Whimbrel [849]	Roosting known to occur within area
Pluvialis fulva		Pacific Golden Plover [25545]	Roosting known to occur within area
Pluvialis squatarola		Grey Plover [865]	Roosting known to occur within area
Rhipidura rufifrons		Rufous Fantail [592]	Breeding may occur within area
Rostratula benghalensis s. lat.		Painted Snipe [889]	Species or species habitat may occur within area
Sterna albifrons		Little Tern [813]	Species or species habitat may occur within area
Thalassarche bulleri		Buller's Albatross [64460]	Species or species habitat may occur within area
Thalassarche cauta (sensu stricto)	Vulnerable	Shy Albatross, Tasmanian Shy Albatross [64697]	Species or species habitat may occur within area
Thalassarche impavida		Campbell Albatross [64459]	Species or species habitat may occur within area
Thalassarche salvini		Salvin's Albatross [64463]	Species or species habitat may occur within area
Thalassarche steadi		White-capped Albatross [64462]	Species or species habitat may occur within area
Tringa stagnatilis		Marsh Sandpiper, Little Greenshank [833]	Roosting known to occur within area
Xenus cinereus		Terek Sandpiper [59300]	Roosting known to occur within area
Fish			
Acentronura tentaculata		Shortpouch Pygmy Pipehorse [66187]	Species or species habitat may occur within area
Festucalex cinctus		Girdled Pipefish [66214]	Species or species habitat may occur within area
Filicampus tigris			

Tiger Pipefish [66217] Heraldia nocturna	Species or species habitat may occur within area
Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227] Hippichthys penicillus	Species or species habitat may occur within area
Beady Pipefish, Steep-nosed Pipefish [66231] Hippocampus abdominalis	Species or species habitat may occur within area
Bigbelly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233] Hippocampus whitei	Species or species habitat may occur within area
White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240] Histiogamphelus briggsii	Species or species habitat may occur within area
Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242] Lissocampus runa	Species or species habitat may occur within area
Javelin Pipefish [66251] Maroubra perserrata	Species or species habitat may occur within area
Sawtooth Pipefish [66252] Notiocampus ruber	Species or species habitat may occur within area
Red Pipefish [66265] Phyllopteryx taeniolatus	Species or species habitat may occur within area
Common Seadragon, Weedy Seadragon [66268] Solegnathus spinosissimus	Species or species habitat may occur within area
Spiny Pipehorse, Australian Spiny Pipehorse [66275] Solenostomus cyanopterus	Species or species habitat may occur within area
Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183] Solenostomus paegnius	Species or species habitat may occur within area
Rough-snout Ghost Pipefish [68425] Solenostomus paradoxus	Species or species habitat may occur within area
Ornate Ghostpipefish, Harlequin Ghost Pipefish, Ornate Ghost Pipefish [66184] Stigmatopora argus	Species or species habitat may occur within area
Spotted Pipefish, Gulf Pipefish [66276] Stigmatopora nigra	Species or species habitat may occur within area
Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277] Syngnathoides biaculeatus	Species or species habitat may occur within area
Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]	Species or species habitat may occur within area

[Trachyrhamphus bicoarctatus](#)

Bentstick Pipefish, Bend Stick
Pipefish, Short-tailed Pipefish
[66280]

Species or species habitat may occur within area

[Urocampus carinirostris](#)

Hairy Pipefish [66282]

Species or species habitat may occur within area

[Vanacampus margaritifer](#)

Mother-of-pearl Pipefish
[66283]

Species or species habitat may occur within area

Mammals[Arctocephalus forsteri](#)

New Zealand Fur-seal [20]

Species or species habitat may occur within area

[Arctocephalus pusillus](#)

Australian Fur-seal,
Australo-African Fur-seal [21]

Species or species habitat may occur within area

Reptiles[Caretta caretta](#)

Loggerhead Turtle [1763] Endangered

Species or species habitat known to occur within area

[Chelonia mydas](#)

Green Turtle [1765] Vulnerable

Species or species habitat known to occur within area

[Dermochelys coriacea](#)

Leatherback Turtle, Leathery
Turtle, Luth [1768] Endangered

Species or species habitat likely to occur within area

[Eretmochelys imbricata](#)

Hawksbill Turtle [1766] Vulnerable

Species or species habitat known to occur within area

[Natator depressus](#)

Flatback Turtle [59257] Vulnerable

Species or species habitat known to occur within area

[Pelamis platurus](#)

Yellow-bellied Seasnake [1091]

Species or species habitat may occur within area

Whales and Other Cetaceans**[Resource Information]**

Name	Status	Type of Presence
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Mammals[Balaenoptera acutorostrata](#)

Minke Whale [33]

Species or species habitat may occur within area

[Balaenoptera edeni](#)

Bryde's Whale [35]

Species or species habitat may occur within area

[Caperea marginata](#)

Pygmy Right Whale [39]

Species or species habitat may occur within area

[Delphinus delphis](#)

Common Dolphin, Short-beaked
Common Dolphin [60]

Species or species habitat may occur within area

[Eubalaena australis](#)

Southern Right Whale [40] Endangered

Species or species habitat likely to occur within area

[Grampus griseus](#)

Risso's Dolphin, Grampus [64]

Species or species habitat may occur within area

[Lagenorhynchus obscurus](#)

Dusky Dolphin [43]

Species or species habitat may occur within area

[Megaptera novaeangliae](#)

Humpback Whale [38]

Vulnerable

Species or species habitat known to occur within area

[Orcinus orca](#)

Killer Whale, Orca [46]

Species or species habitat may occur within area

[Stenella attenuata](#)

Spotted Dolphin, Pantropical
Spotted Dolphin [51]

Species or species habitat may occur within area

[Tursiops aduncus](#)

Indian Ocean Bottlenose
Dolphin, Spotted Bottlenose
Dolphin [68418]

Species or species habitat likely to occur within area

[Tursiops truncatus s. str.](#)

Bottlenose Dolphin [68417]

Species or species habitat may occur within area

Extra Information

Places on the RNE

[Resource Information]

Note that not all Indigenous sites may be listed.

Name

Status

Natural

[Possum Park NSW](#)

Indicative Place

Historic

[Morisset Showground NSW](#)

Indicative Place

State and Territory Reserves

[Resource Information]

Munmorah, NSW

Lake Macquarie, NSW

Colongra Swamp, NSW

Regional Forest Agreements

[Resource Information]

Note that all areas with completed RFAs have been included.

[North East NSW RFA, New South Wales](#)

Invasive Species

[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name

Status

Type of Presence

Mammals

[Capra hircus](#)

Goat [2]

Species or species habitat may occur within area

[Felis catus](#)

Cat, House Cat, Domestic Cat
[19]

Species or species habitat likely to occur within area

[Oryctolagus cuniculus](#)

Rabbit, European Rabbit [128]

Species or species habitat likely to occur within area

[Sus scrofa](#)

Pig [6]

Species or species habitat may occur within area

[Vulpes vulpes](#)

Red Fox, Fox [18]

Species or species habitat likely to occur within area

Plants

[Alternanthera philoxeroides](#)

Alligator Weed [11620]

Species or species habitat may occur within area

[Asparagus asparagoides](#)

Bridal Creeper, Bridal Veil

Creeper, Smilax, Florist's

Smilax, Smilax Asparagus

[22473]

Species or species habitat may occur within area

[Chrysanthemoides monilifera](#)

Bitou Bush, Boneseed [18983]

Species or species habitat may occur within area

[Genista sp. X Genista monspessulana](#)

Broom [67538]

Species or species habitat may occur within area

[Lantana camara](#)

Lantana, Common Lantana,

Kamara Lantana, Large-leaf

Lantana, Pink Flowered

Lantana, Red Flowered Lantana,

Red-Flowered Sage, White

Sage, Wild Sage [10892]

Species or species habitat likely to occur within area

[Lycium ferocissimum](#)

African Boxthorn, Boxthorn

[19235]

Species or species habitat may occur within area

[Nassella trichotoma](#)

Serrated Tussock, Yass River

Tussock, Yass Tussock,

Nassella Tussock (NZ) [18884]

Species or species habitat may occur within area

[Pinus radiata](#)

Radiata Pine Monterey Pine,

Insignis Pine, Wilding Pine

[20780]

Species or species habitat may occur within area

[Rubus fruticosus aggregate](#)

Blackberry, European

Blackberry [68406]

Species or species habitat likely to occur within area

[Salix spp. except S.babylonica, S.x calodendron & S.x reichardtiji](#)

Willows except Weeping

Willow, Pussy Willow and

Sterile Pussy Willow [68497]

Species or species habitat may occur within area

[Salvinia molesta](#)

Salvinia, Giant Salvinia,

Aquarium Watermoss, Kariba

Weed [13665]

Species or species habitat may occur within area

[Ulex europaeus](#)

Gorse, Furze [7693]

Species or species habitat may occur within area

Nationally Important Wetlands

[Resource Information]

[Tuggerah Lake, NSW](#)

[Colongra Swamp, NSW](#)

[Budgewoi Lake Sand Mass, NSW](#)

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites;
- seals which have only been mapped for breeding sites near the Australian continent.

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-33.16149 151.5201

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Department of Environment, Climate Change and Water, New South Wales](#)
- [-Department of Sustainability and Environment, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment and Natural Resources, South Australia](#)
- [-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts](#)
- [-Environmental and Resource Management, Queensland](#)
- [-Department of Environment and Conservation, Western Australia](#)

- [-Department of the Environment, Climate Change, Energy and Water](#)
- [-Birds Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-SA Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Atherton and Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [-State Forests of NSW](#)
- [-Other groups and individuals](#)

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

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