Attachment 4 - Flora and Fauna Assessment

510 Beach Road, Berry:
Flora and fauna assessment

FINAL REPORT

Prepared for Richard Hall

23 February 2018

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- NSW Department of Primary Industries Fisheries for access to the predicted distribution maps for threatened species and fish communities.

Biosis staff involved in this project were:

- Bianca Klein and James Lidsey (field investigation)
- Gareth Davies (mapping)
- Rebecca Dwyer (project management and quality assurance)

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Summary

Biosis Pty Ltd was commissioned by Richard Hall to undertake a flora and fauna assessment of land proposed for rezoning & subsequent subdivision at 510 Beach Road, Berry (subject site). The subject site is located on land utilised as farmland approximately five kilometres east of Berry and approximately 60 kilometres south of the Wollongong central business district (CBD).

The subject site, defined by the extent of proposed works, is surrounded by the study area which includes adjacent areas likely to be directly or indirectly affected by the proposed development. This assessment approach has been undertaken to allow for assessment of both the subject site as well as any additional areas in the broader study area which are likely to be affected by the proposed works, either directly or indirectly. Identified constraints will be used to guide detailed design, with an emphasis on avoiding impacts where feasible.

The study area encompasses 74 hectares; 23 hectares of which supports native vegetation, while the remaining area consists of cleared, exotic pasture as well as the homestead in the north-west of the study area.

Ecological values

Key ecological values within the study area include:

- 23 hectares of native vegetation consisting of a range of community types, including four Threatened Ecological Communities (TECs):
  - *Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions* (Endangered, *Biodiversity Conservation Act 2016*) (BC Act)
  - *River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions* (Endangered, BC Act)
  - *Lowland Grassy Woodland in the South East Corner Bioregion* (Critically Endangered, *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act); Endangered, BC Act)
  - *Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions* (Endangered, BC Act)
- Nine hollow-bearing trees.
- The northern edge of Coomonderry Swamp, a significant Coastal Wetland, occurs within the southern boundary of the study area.
- Three ponds and/or farm dams forming a low potential dispersal corridor for the Green and Golden Bell Frog in the broader landscape.
- Habitat for threatened biota including:
  - Green and Golden Bell Frog
  - Hollow roosting Microbats
  - Water birds and woodland birds

Recommendations

The primary measure for the development to minimise impacts to ecological values on the site is to minimise removal of native vegetation, and avoiding unnecessary impacts to adjacent Endangered Ecological Communities during works. Coomonderry Swamp in the southern extent of the study area has been identified as the most significant ecological feature within the study area, and appropriate safeguards will need to be implemented during the proposed works to avoid indirect impacts to the Swamp.

Government legislation and policy

An assessment of the project against key biodiversity legislation and policy is provided and summarised below.

Legislation / Policy	Relevant ecological feature	Permit / approval required
Environment Protection and Biodiversity Conservation Act 1999	Low potential dispersal habitat for the Green and Golden Bell Frog in the form of three farm dams is present within the study area. Marginal foraging habitat for a suite of birds and bats is located within the study area.	A Significant Impact Criteria assessments was undertaken for the Green and Golden Bell Frog; the project will not result in a significant impact to this species (refer to Appendix 3). 0.29 hectares, only, of vegetation will be removed, therefore not forming critical habitat for EPBC Act listed species.
Biodiversity Conservation Act 2016	Four Threatened Ecological Communities (TECs) occur. The study area also contains habitat for 25 threatened fauna species.	Biosis has undertaken an Assessment of Significance under Section 5A of the EP&A Act for the Bangalay Sand Forest TEC (Appendix 4). A significant effect on the TEC will not occur as a result of the project. Biosis reviewed the native vegetation clearance thresholds for the property under the Biodiversity Offset Scheme and confirmed that the project will not exceed the maximum threshold of 1ha of clearing. The vegetation to be removed does not constitute limiting critical habitat for threatened fauna.

Legislation / Policy	Relevant ecological feature	Permit / approval required
Fisheries Management Act 1994	No threatened fish are likely to occur within the waterways of the study area.	N/A
Environmental Planning & Assessment Act 1979	Threatened species and ecological communities occur.	Biosis has assessed impacts to the following threatened species and communities present or likely to occur by undertaking AoSs for the following (Appendix 4): • River Flat Eucalypt Forest EEC • Green and Golden Bell Frog • Seven microchiropteran bat species
Water Management Act 2000	Coomonderry Swamp occurs within the study area.	No disturbances within the vicinity of Coomonderrry Swamp are proposed, as such a controlled activity permit is not required.
State Environmental Planning Policy No 14 Coastal Wetlands	The project will be undertaken within a mapped Coastal Wetland zone (Coomonderry Swamp).	No disturbances within the vicinity of Coomonderrry Swamp are proposed.
State Environmental Planning Policy No 44 Koala Habitat Protection	SEPP44 applies to the current project as it exceeds more than one hectare, is located within the Shoalhaven Local Government Area and a development application will be made (SEPP 44, Section 6). Approximately 2 hectares of Potential Koala habitat according to SEPP44 have been mapped within the study area and will not be impacted by the proposal. The study area does not support Core Koala Habitat.	A Plan of Management is not required as no vegetation mapped to be Potential Koala Habitat will be impacted upon by the project.
Biosecurity Act 2015	The following priority weeds are present: • Blackberry Rubus fruticosus agg • Fireweed Senecio madagascariensis • Giant Parramatta Grass *Sporobolus fertilis*	Control requirements for these priority listed weeds is outlined in Section 4.2.

Note: Guidance provided in this report does not constitute legal advice.

1 Introduction

1.1 Project background

Biosis Pty Ltd was commissioned by Richard Hall to undertake a biodiversity development assessment of the subject site and broader study area for the proposed rezoning & subdivision at 510 Beach Road, Berry (Lot 4 DP834254) (Figure 1). The project will be assessed under Part 4, Section 5AA of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

The study area occurs within land with a minimum lot size of 40 hectares under the *Shoalhaven City Council Local Environmental Plan 2014*, as such, the allotment of land (73.98 hectares) will result in a vegetation clearance threshold stipulated under the *Biodiversity Conservation Regulation 2017* as 1 hectare. The project will not require clearing of more than 1 hectare (0.29ha) of native vegetation, therefore the provision of biodiversity offsets under the NSW Biodiversity Offsets Scheme will not be required. However, a standard flora and fauna assessment is still required as part of a Development Application (DA) to Shoalhaven City Council.

Coomonderry Swamp, within the southern extent of the study area, is mapped as land constituting 'high biodiversity value' under the NSW Biodiversity Value Map (Department of Planning and Environment 2017). Coomonderry Swamp does not fall within the proposed development footprint and actions to mitigate indirect impacts have been recommended in this report. For this reason, a Biodiversity Development Assessment Report is not required.

1.2 Scope of assessment

The objectives of this investigation are to:

- Describe the presence or likely occurrence of threatened biota or suitable habitat for such based on the survey findings, as listed under the EPBC Act, BC Act and/or FM Act. Species of particular note included:
  - Green and Golden Bell Frog *Litoria aurea* known to occur in Coomonderry Swamp.
  - Five threatened microbats; Eastern Freetail-bat *Mormopterus norfolkensis*, Yellow-bellied Sheahtail Bat *Saccolaimus flaviventris*, Large-eared Pied Bat *Chalinolobus dwyeri*, Eastern Bentwing-bat *Miniopterus schreibersii oceanensis* and Southern Myotis *Myotis macropus*.
  - Grey-headed Flying Fox *Pteropus poliocephalus*.
  - Twelve avifauna including threatened and migratory species; Little Lorikeet *Glossopsitta pusilla*, Little Eagle *Hieraaetus morphnoides*, Black Bittern *Ixobrychus flavicollis*, Spotted Harrier *Circus assimilis*, Varied Sittella *Daphoenositta chrysoptera*, Fork-tailed Swift *Apus pacificus*, Great Egret *Ardea modesta*, Australasian Bittern *Botaurus poiciloptilus*, Blue-billed Duck *Oxyura australis*, Glossy Ibis *Plegadis falcinellus*, Australian Painted Snipe *Rostratula australis* and Marsh Sandpiper *Tringa stagnatilis*.
- Map native vegetation and other habitat features including hollow-bearing trees (HBTs) and water bodies.
- Assess Plant Community Types (PCTs) in the study area, including condition, and assessment of the presence of any Threatened Ecological Communities (TECs).

- Review the implications of relevant biodiversity legislation and policy.
- Identify potential implications of the proposed development and provide recommendations to assist with development design.

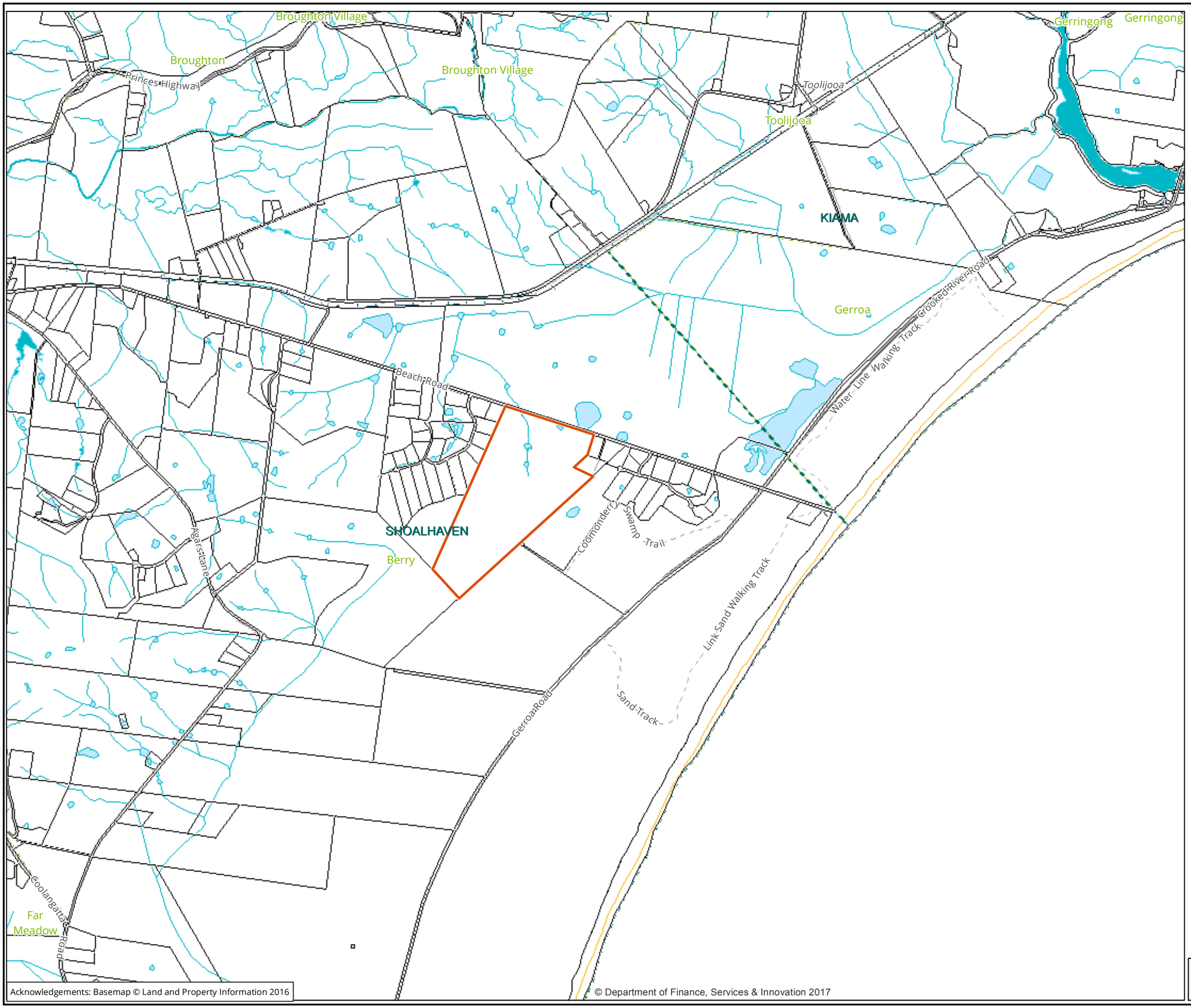
1.3 Location of the study area

The study area is located approximately five kilometres east of Berry and approximately 60 kilometres south of the Wollongong CBD (Figure 1). It encompasses 74 hectares; 23 hectares of which supports native vegetation, while the remaining area consists of cleared, exotic pasture as well as an existing dwelling and farm sheds in the north-west of the study area. The study area currently falls within two zones under the Shoalhaven LEP; the land in the north of the study area is zoned RU1 Primary Production and the land in the south is zoned E2 Environmental Conservation.

The majority of the study area consists of erosional-derived alluvial soils over Budgong Sandstone (Hazelton 1992; Bowman et al. 1972) within the Kiama Coastal Slopes Mitchell's Landscapes.

The study area is within the:

- Sydney Basin Bioregion
- Shoalhaven Catchment
- South East Local Land Services (LLS) Management Area
- Shoalhaven City Council Local Government Area (LGA).



Legend

Study area

Figure 1 Locality of study area

0 250 500 750 1,000 1,250

Metres

Scale: 1:25,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

Biosis Pty Ltd

Albury, Ballarat, Melbourne,
Newcastle, Sydney, Wangaratta & Wollongong

Matter: 25603
Date: 26 September 2017,
Checked by: JL, Drawn by: GD, Last edited by: gdavies
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2 Legislative context

This section provides an overview of key biodiversity legislation and government policy considered in this assessment. This section does not describe the legislation and policy in detail and guidance provided here does not constitute legal advice.

2.1 Commonwealth

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act is the Australian Government's key piece of environmental legislation. The EPBC Act applies to developments and associated activities that have the potential to significantly impact on Matters of National Environmental Significance (NES) protected under the Act.

Nine Matters of NES are identified under the EPBC Act:

- world heritage properties
- national heritage places
- wetlands of international importance (also known as 'Ramsar' wetlands)
- nationally threatened species and ecological communities
- migratory species
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mining)
- a water resource, in relation to coal seam gas development and large coal mining development.

Under the EPBC Act, activities that have potential to result in significant impacts on Matters of NES must be referred to the Commonwealth Minister for the Environment for assessment.

Matters of NES relevant to the current project include nationally threatened species and ecological communities, and migratory species. Threatened species and ecological communities protected by the EPBC Act are outlined in Sections 4.2, 4.3 and 4.4, and summarised in Section 4.5. Significant impact criteria (SIC) assessments are provided in Appendix 3.

An assessment of potential impacts to all Matters of NES under the provisions of the EPBC Act, and whether referral of the project to the Commonwealth Minister for the Environment for assessment is provided in Section 6.1.

2.2 State

2.2.1 Environmental Planning and Assessment Act 1979

The EP&A Act was enacted to encourage the proper consideration and management of impacts of proposed development or land-use changes on the environment (both natural and built) and the community. The EP&A Act is administered by the NSW Department of Planning and Environment (DP&E).

The EP&A Act provides the overarching structure for planning in NSW and is supported by other statutory environmental planning instruments. Sections of the EP&A Act of primary relevance to the natural environment are outlined further below.

Assessment of Significance

Section 5AA of the EP&A Act requires proponents and consent authorities to consider if a development will have a significant effect on threatened species, populations or communities listed under the *Biodiversity Conservation Act 2016* (BC Act) and *Fisheries Management Act 1994* (FM Act).

Part 7.3 of the BC Act outlines five factors that must be taken into account in an Assessment of Significance (formally known as the "7-part test"). Where any Assessment of Significance (AoS) determines that a development will result in a significant effect to a threatened species, population or community a Species Impact Statement (SIS) or preparation of a Biodiversity Development Application Report (BDAR) is required.

Threatened species, populations and communities listed under the BC Act and FM Act are discussed in Sections 4.2, 4.3 and 4.4 and summarised in Section 4.5. Assessments of Significance are provided in Appendix 4.

An assessment of whether the project will result in a significant effect to any threatened species, populations or communities listed under the BC Act or FM Act, and whether an SIS or preparation of a BDAR is required, is provided in Section 6.2.

State Environmental Planning Policies

State Environmental Planning Policies (SEPPs) are environmental planning instruments under the EP&A Act that outline policy objectives relevant to State or regional environmental planning issues. There are over 65 SEPPs; however, only those relevant to the proposed development have been considered and are detailed below.

SEPP No. 44 – Koala Habitat Protection

SEPP No. 44 aims to encourage the conservation and management of natural vegetation areas that provide habitat for Koalas to ensure permanent free-living populations will be maintained over their present range and to reverse the current trend of koala-population decline. It applies to areas of native vegetation greater than one hectare and in councils listed in Schedule 1 to the SEPP.

The project is within Shoalhaven LGA, a Schedule 1 listed Council. Therefore SEPP No. 44 is relevant to the current assessment and is discussed further in Section 4.5

SEPP No. 14 Coastal Wetlands

SEPP No. 14 aims to ensure that coastal wetlands are preserved and protected, and applies to areas mapped as Coastal Wetlands under the SEPP. Under the SEPP, a consent authority must consider the environmental effects a development will have on Coastal Wetlands.

The southern extent of the study area encompasses Coomonderry Swamp, mapped as Coastal Wetlands under the SEPP. An assessment of the project against the objectives of the SEPP is provided in Section 6.1.

Local Environment Plans

Local Environment Plans (LEPs) are created by Councils in consultation with their community and guide planning decisions for LGAs. They apply either to the whole or part of a LGA and make provision for the protection or utilisation of the environment through zoning of land and development controls.

Elements of the Shoalhaven LEP land zoning objectives are relevant to this assessment and are discussed further in Section 6.2.

Development Control Plans

Development Control Plans (DCPs) are developed by Council and provides detailed planning and design guidelines to support the planning controls in the LEP. DCPs identify additional development controls and standards for addressing development issues at a local level and can be applied more flexibly than a LEP.

The Shoalhaven Development Control Plan (DCP) is relevant to the current project. Elements of the DCP relevant to this assessment are discussed further in Section 6.2.

2.2.2 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) is the key piece of legislation providing for the protection and conservation of biodiversity in NSW through the listing of threatened species, populations and communities, key threatening processes and critical habitat for threatened species, populations and communities. Impacts to threatened species, populations and communities are assessed under Section 5A of the EP&A Act (see above).

Threatened species, populations and communities listed under the BC Act are discussed in Sections 4.2 and 4.3 and summarised in Section 4.5. Assessments of Significance are provided in Appendix 4.

An assessment of whether the project will result in a significant effect to these threatened species, populations and communities is summarised in Section 6.3.

2.2.3 Local Land Services Act 2013

The Local Land Services Act (LLS Act) provides for, encourages and promotes the management of native vegetation on a regional basis and regulates the clearing of native vegetation on land in NSW. The project is subject to the provisions of the LLS Act, and approval for clearing of native vegetation is required. Clearing will be subject to a development consent under the EP&A Act. Provisions of the LLS Act relative to the study area is outlined in Section 6.4.

2.2.4 Biosecurity Act 2015

The *Biosecurity Act 2015* (Biosecurity Act) came into effect as of 1 July 2017 and repeals the *Noxious Weeds Act 1993*. The Biosecurity Act outlines biosecurity risks and impacts, which in relation to the current assessment includes those risks and impacts associated with weeds. A biosecurity risk is defined as the risk of a biosecurity impact occurring, which for weeds includes:

- The introduction, presence, spread or increase of a pest into or within the State or any part of the State.
- A pest plant has the potential to:
  - Out-compete other organisms for resources, including food, water, nutrients, habitat and sunlight.
  - Harm or reduce biodiversity.

The Biosecurity Act introduces the concept of Priority Weeds. A priority weed is any weed identified in a local strategic plan, for a region that includes that land or area, as a weed that is or should be prevented, managed, controlled or eradicated in the region. Where a local strategic plan means a local strategic plan approved by the Minister under Division 2 of Part 4 of the *Local Land Services Act 2013*.

The Biosecurity Act also introduces the General Biosecurity Duty, which states:

All plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

Priority Weeds are discussed further in Section 4.2.

2.2.5 Water Management Act 2000

The *Water Management Act 2000* (WM Act) provides for the sustainable and integrated management of the state's water for the benefit of both present and future generations based on the concept of ecologically sustainable development. Under the WM Act an approval is required to undertake controlled activities on waterfront land, unless that activity is otherwise exempt under Section 91E. Waterfront land is defined within the Act as the bed of any river, lake or estuary and any land within 40 meters of the river banks, lake shore or estuary mean high water mark.

An assessment of whether a Controlled Activity Approval from the NSW Department of Primary Industries is required under the WM Act is provided in Section 6.5.

2.2.6 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) provides for the protection and conservation of aquatic species and their habitat throughout NSW. Impacts to threatened species, populations and communities, and critical habitats listed under the FM Act must be assessed through the Assessment of Significance process under Section 5A of the EP&A Act (see above). If assessment under Section 5A of the EP&A Act determines a project is likely to result in a significant effect to threatened species, populations or communities then a Species Impact Statement (SIS) or a BDAR should be prepared.

Threatened species, populations and communities listed under the FM Act are discussed in Section 4.4 and summarised in Section 4.5.

An assessment of the waterways is provided in Section 4.4. An assessment of the project against the objectives of the FM Act is provided in Section 6.6.

3 Methods

3.1 Literature and database review

In order to provide a context for the study area, information about flora and fauna from within 10 kilometres (the 'locality') was obtained from relevant public databases. Records from the following databases were collated and reviewed:

- Department of the Environment and Energy (DEE) Protected Matters Search Tool for matters protected by the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- NSW BioNet - *the database for the Atlas of NSW Wildlife*, Office of Environment and Heritage (OEH) (BC Act).
- The NSW Department of Primary Industries (DPI) Spatial Data Portal for FM Act listed threatened species, populations and communities.
- BirdLife Australia, the New Atlas of Australian Birds 1998-2013 (BA).

Database searches were undertaken in September 2017.

Other sources of biodiversity information:

- Relevant vegetation mapping, including:
  - Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands (SCIVI) (Tozer et al. 2010).
  - Biometric vegetation types of the Shoalhaven, Eurobodalla and Bega Valley local government areas. VIS_ID 3900. (OEH, 2013).

The following reports were also reviewed:

- *The Illawarra Shoalhaven Regional Plan 2015* (NSW Government, 2015).
- *Water Cycle Management Study, Rezoning of Part of Lot 4 DP 834254 - Draft* (SEEC 2015)
- NSW Scientific Committee final determinations for threatened biodiversity.

3.2 Site investigation

3.2.1 Flora assessment

The flora assessment was undertaken on 29 September 2017 in accordance with the Biodiversity Assessment Methodology (BAM) and random meanders to determine the vegetation types present. The methodology aligns with the flora survey requirements outlined in Chapter 5 of *Threatened Species Survey and Assessment: Guidelines for Development and Activities* (OEH 2014).

General classification of native vegetation in NSW used in this report is based on the classification system in Keith (2004) which uses three groupings of vegetation: vegetation formation, vegetation class and vegetation type, with vegetation type the finest grouping. The grouping referred to in this report is Plant Community Type (PCT) as defined by the BAM.

The vegetation types were stratified into PCTs broadly based on previous vegetation mapping, and the vegetation boundaries marked with a hand-held GPS in the field. Appropriate PCTs were selected on the basis

of species composition and structure, known geographical distribution, landscape position, underlying geology, soil type, and any other diagnostic features.

A list of flora species was compiled for each vegetation type. Records of threatened flora species will be submitted to OEH for incorporation into the BioNet Wildlife Atlas.

The general condition of native vegetation was observed as well as the effects of current seasonal conditions. Notes were made on specific issues such as priority weed infestations, evidence of management works, current grazing impacts and the regeneration capacity of the vegetation.

3.2.2 Fauna assessment

The study area was investigated on 29 September 2017 to determine its values for terrestrial and aquatic fauna habitat. These were determined primarily on the basis of the types and qualities of habitat(s) present. All species of fauna observed during the assessment were noted and active searching for fauna was undertaken. The fauna survey methodology is largely consistent with the requirements outlined in Chapter 5 of *Threatened Species Survey and Assessment: Guidelines for Development and Activities* (OEH 2014); however, modifications are outlined below in Table 1.

Methods included direct observation, searching under rocks and logs, examination of tracks and scats and identifying calls. Particular attention was given to searching for threatened biota and their habitats. Fauna species were recorded with a view to characterising the values of the site and the investigation was not intended to provide a comprehensive survey of all fauna that has potential to utilise the site over time.

Table 1 Biosis' fauna survey methodology in accordance with OEH (2014) survey methodology guidelines and reasoning for variations.

Target fauna group	OEH (2014) survey requirements	Biosis survey methodology	Justification
Amphibians	Diurnal and nocturnal census involving a combination of: - Minimum 1 hour of daytime searches for tadpoles and adult frogs within suitable habitat. - Listening for calls, call playback and spotlighting. - Wetland habitats should be visited on two separate nights for 30 minutes each.	- Identified and mapped areas of suitable habitat and low potential dispersal corridors within the study area, particularly in mind of the Green and Golden Bell Frog. - Site investigation was undertaken in daylight hours, therefore calling was minimal.	- Previous records of the Green and Golden Bell frog occur within the study area and surrounding locality, therefore the presence of this species was assumed. - An indication of the likelihood of occurrence of other frog species can be reliably predicted based on habitat quality present within the study area.
Reptiles	- Active searching, pitfall trapping and spotlighting (ideally in warmer months).	- Recorded incidental sightings during walkover of the entire study area over seven daylight hours.	- Targeted surveys and trapping were not undertaken as no threatened reptile species are known to occur in the locality.

Target fauna group	OEH (2014) survey requirements	Biosis survey methodology	Justification
Diurnal birds	- Area search method (200m x 500m). - Sight and call identification. - For wetlands; one hour observations at dusk/dawn. - Hollow watches.	- Recorded incidental sightings during walkover of the entire study area over seven daylight hours.	- More focused, targeted surveys were not undertaken in the wetland area as the proposed development footprint does not directly impact this area. - Hollow watching was not undertaken as no HBTs are proposed to be impacted upon by the development.
Nocturnal birds	- Call playback. - Spotlighting.	- Recorded incidental sightings during walkover of the entire study area over seven daylight hours.	- No hollows identified during the survey were classed as suitable habitat for nocturnal birds including threatened owl species.
Mammals (excluding bats)	- Search for evidence of tracks, scats and scratches. - Spotlighting. - Call playback. - Trapping.	- Searched for evidence of tracks, scats and scratches.	- Nocturnal surveys and/or trapping was determined to be negligible for the project based on the low likelihood of impacts to threatened mammal species with the potential of occurring in the study area (Appendix 2).
Bats	- Spotlighting. - Ultrasonic echolocation detection using Anabats. - Harp or bat trapping.	- Identified and mapped HBTs and areas of suitable roosting and/or foraging habitat.	- HBTs identified within the study area will not be impacted upon by the proposed development.
Invertebrates	- Unique methodology applies to specific Families.	- Searched for incidental occurrences during standard fauna survey.	- Based on preliminary background research no threatened invertebrates are likely to occupy the study area.

Fauna records will be submitted to OEH for incorporation into the NSW BioNet Wildlife Atlas.

3.2.3 Permits and licences

The flora and fauna assessment was conducted under the terms of Biosis' Scientific Licence issued by the Office of Environment and Heritage under the *National Parks and Wildlife Act 1974* (SL100758, expiry date 31 March 2018). Fauna survey was conducted under approval 11/355 from the NSW Animal Care and Ethics Committee (expiry date 31 January 2018).

3.3 Limitations

Ecological surveys provide a sampling of flora and fauna at a given time and season. There are a number of reasons why not all species will be detected at a site during survey, such as species dormancy, seasonal conditions, ephemeral status of waterbodies and migration and breeding behaviours of some fauna. In many cases these factors do not present a significant limitation to assessing the overall ecological values of a site.

The current flora and fauna assessment was conducted in spring, which is an optimal time for survey. The survey effort was sufficient to assess the general values of the study area.

Database searches, and associated conclusions on the likelihood of species to occur within the study area, are reliant upon external data sources and information managed by third parties.

3.4 Mapping

Aerial photography and site plans (DA Plan 14141) was supplied by Richard Hall Near Maps (2014).

Mapping was conducted using hand-held (uncorrected) Tablet Personal Computer units (GDA94) and aerial photo interpretation. The accuracy of this mapping is therefore subject to the accuracy of the GPS units (generally ± 7 metres) and dependent on the limitations of aerial photo rectification and registration.

Mapping has been produced using a Geographic Information System (GIS). Electronic GIS files containing the relevant flora and fauna spatial data are available to incorporate into design concept plans. However this mapping may not be sufficiently precise for detailed design purposes.

4 Results

The ecological values of the study area are described below and mapped in Figure 2and Figure 3 for flora and fauna, respectively.

4.1 Landscape context

The project area is predominantly cleared of native vegetation with current land uses consisting of agricultural land including areas used for cattle grazing. Outside of the study area, land use is agricultural and extensive past clearing of native vegetation.

The dominant geology present is Budgong Sandstone of the Kiama Coastal Soil Landscape (Bowman et al. 1972), with soils characteristically well-structured red-brown loams (Mitchell 2002). Quaternary alluvium derived soils are more prominent in the south of the study area where soils grade into organic rich quartz sands typical of the Seven Mile Barrier Soil Landscape (Mitchell 2002).

The study area occurs within 500 metres west of Seven Mile Beach National Park, but is not directly linked to form a continuous bushland corridor due to the extent of clearing. The native patch of vegetation termed 'Jim's Bush' in the east of the study area provides connectivity to the National Park facilitating the movement of fauna throughout the landscape. The southern boundary of the study area incorporates the northern edge of Coomonderry Swamp, a significant wetland for Green and Golden Bell Frog habitat. Cleared, agricultural landscapes surround the study area to the north and west. Figure 1 Location of the study area illustrates the locality of the study area in the broader landscape.

4.2 Flora and fauna

Species recorded during the flora assessment are listed in Appendix 1 (flora). Unless of particular note, these species are not discussed further. A list of threatened biota recorded or predicted to occur in the local area is also provided in those appendices, along with an assessment of the likelihood of the species occurring within the study area.

Three exotic species listed under the *Biosecurity Act 2015* for Priority listed weeds for the South East LLS were identified in the study area:

- Blackberry *Rubus fruticosus* agg.
  - Mandatory measure: *This plant must not be imported into the State or sold*.
- Fireweed *Senecio madagascariensis*
  - Regional recommended measure: *Land managers should mitigate the risk of new weeds being introduced to their land.*
- Giant Parramatta Grass *Sporobolus fertilis*
  - Regional recommended measure: *Land managers should mitigate the risk of new weeds being introduced to their land. Plant should not be bought, sold, grown, carried or released into the environment.*

Species recorded during the fauna assessment are listed in Appendix 2. Unless of particular note, these species are not discussed further. A list of threatened biota recorded or predicted to occur in the local area is

also provided in those appendices, along with an assessment of the likelihood of the species occurring within the project area.

4.3 Vegetation communities

The vegetation and fauna habitat throughout the majority of the study area has been modified by past disturbances which have included clearance for agricultural uses, particularly dairy farming.

The study area supports a range of ecological values including areas of native vegetation (Derived Swamp Oak Forest, Bangalay Sand Forest, Red Gum Grassy Woodland, Freshwater Wetlands on Coastal Floodplains, Illawarra Escarpment Blackbutt Forest and Illawarra Gully Wet Forest), scattered trees, water bodies and wetlands. The ecological values are outlined below, divided by the vegetation communities they occur in (refer also to Figure 2):

Table 2 Vegetation communities of the study area

Derived Swamp Oak Forest	
PCT	1232 - *Swamp Oak floodplain Swamp Forest, Sydney Basin Bioregion and South East Corner Bioregion*
% cleared value of PCT	95
Extent within study area	Approximately 1.6 hectares of Derived Swamp Oak Forest was recorded, consisting of three isolated clumps and a narrow linear patch along the western boundary fence of the property.
Description	This community occupies poorly drained substrates that are periodically inundated by fresh or brackish water. The canopy was dominated by Swamp Oak *Casuarina glauca*, with Swamp Paperbark *Melaleuca ericifolia* occupying the midstory in low abundances. The groundcover of this community was highly degraded, consisting of Kikuyu *Pennisetum clandestinum* and scattered Common Rush *Juncus usitatus*. This community provides marginal fauna habitat.
Condition	The community was in low condition due to the extent of clearing and high proportion of exotic groundcover.
Associated soils, rainfall and landscape position	It is not restricted to particular substrates, but is commonly associated with floodplains with sand deposits. Derived Swamp Oak Forest is preferenced by changes in soil salinity as a result of alterations to water table levels following widespread clearing. This community usually occurs below 100 metres above sea level (ASL).
Threatened ecological community	Commonwealth EPBC Act: Not listed NSW BC Act: *Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions* (Endangered) Justification: The combination of the aforementioned floristic composition, underlying soils and landscape position are consistent with the Final Determination for this EEC (NSW Threatened Species Scientific Commission 2005). Despite the degraded condition of the community, it still meets the criteria for the Endangered Ecological Community (EEC), but in low condition.

Derived Swamp Oak Forest	

Bangalay Sand Forest (BC Act)	
PCT	SR512/PCT659 Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
% cleared value of PCT	50
Extent within study area	Approximately 1.2 hectares of Bangalay Sand Forest is present, restricted to one patch in the north-western extent of the study area adjacent to Beach Road.
Description	This community is found on deep, freely draining sandy soils in relatively flat areas within a few kilometres of the coast at altitudes below 100 metres above sea level. The most abundant canopy species included Rough-Barked Apple *Angophora floribunda* and Blackbutt *Eucalyptus pilularis*, with Bangalay *Eucalyptus botryoides* and Thin-leaved Stringybark *Eucalyptus eugenioides* also present. The midstory consisted of mesic species including regenerating Lilly Pilly *Acmena smithii*, Swamp Oak and Veined Mock-Olive *Notelaea venosa*. The groundcover consisted of predominantly native species including Common Rush, Maidenhair Fern *Adiantum aethiopicum* and Kidney Weed *Dichondra repens*, and the climber Common Silkpod *Marsdenia rostrata.* Exotic species including the Priority Listed weeds Fireweed *Senecio madagascariensis* and Giant Parramatta Grass *Sporobolus fertilis* were prominent in the groundcover. This community had a limited potential to provide nesting and foraging habitat for woodland birds and small arboreal mammals including gliders.
Condition	The community was generally in moderate condition due to its small area and fragmented position in the landscape. The native species diversity was moderate and there is evidence of native regeneration, despite a high presence of exotic species.
Associated soils, rainfall and landscape position	This community occurs on a geological gradient of Quaternary alluviums and Budgong Sandstone in the study area. Generally this community is associated with free draining to damp sandy loams in coastal areas. Typically occurs below 100 metres ASL.

Threatened ecological community	Commonwealth EPBC Act: Not listed NSW BC Act: *Bangalay Sand Forest on Coastal Floodplains of the, Sydney Basin and South East Corner Bioregions* (Endangered) Justification: The combination of the aforementioned floristic composition, underlying soils and landscape position are consistent with the Final Determination for this EEC (NSW Threatened Species Scientific Commission 2011).
Bangalay Sand Forest	

Red Gum Grassy Woodland – moderate condition (BC Act)	
PCT	838 - *Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion*
% cleared value of PCT	85
Extent within study area	Approximately 1.2 hectares of moderate condition Red Gum Grassy Woodland occurs in one linear patch on the north-eastern boundary adjacent to Beach Road.
Description	This community is found on soils overlying Budgong Sandstone on areas of higher elevation within the study area, predominantly restricted to the north-east. The canopy was dominated by Forest Red Gum *Eucalyptus tereticornis,* Rough-Barked Apple and Thin-Leaved Stringybark. The midstory is modified, but regenerating mesic shrubs including Sweet Pittosporum *Pittosporum undulatum* and Muttonwood *Myrsine howittiana* were present. Spiny-Headed Mat Rush *Lomandra longifolia* occurs in the understorey in amongst exotic species Giant Parramatta Grass, *Sida rhombifolia* Paddy's Lucerne and Kikuyu.
Condition	The community was in moderate condition; as characterised by an intact canopy and midstory of native trees and shrubs above a degraded groundcover dominated by exotic grasses.
Associated soils, rainfall and landscape position	This community typically occurs on lower slopes in coastal rainshadow valleys, below 350 metres ASL on a range of substrates including alluvial and fine-grained sedimentary substrates.

Threatened ecological community	Commonwealth EPBC Act: *Lowland Grassy Woodland in the South East Corner Bioregion* (Critically Endangered) NSW BC Act: *Lowland Grassy Woodland in the South East Corner Bioregion* (Endangered) Justification: The community present in the study area does not meet the condition threshold for the EPBC Act listed Critically Endangered Ecological Community (CEEC) outlined in the Conservation Advice; as the groundcover consisted of < 30% native vegetation. However; the aforementioned floristic composition, soils and landscape are consistent with the criteria outlined in the Final Determination under the BC Act (TSSC 2007).
Moderate condition Red Gum Grassy Woodland	

Red Gum Grassy Woodland – low condition (BC Act)	
PCT	838 - *Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion*
% cleared value of PCT	85
Extent within study area	Low condition Red Gum Grassy Woodland covers approximately 0.8 hectares, located adjacent to the existing house to the east and west.
Description	The canopy consisted of Forest Red Gum, Rough-Barked Apple and Blackbutt. The midstory was absent due to past clearing. The groundcover was dominated by exotic species, particularly Kikuyu and Paddy's Lucerne.
Condition	This community was in low condition due to the dominance of exotic groundcover species.
Associated soils, rainfall and landscape position	This community typically occurs on lower slopes in coastal rainshadow valleys, below 350 metres ASL on a range of substrates including alluvial and fine-grained sedimentary substrates.

Threatened ecological community	Commonwealth EPBC Act: *Lowland Grassy Woodland in the South East Corner Bioregion* (Critically Endangered) NSW BC Act: *Lowland Grassy Woodland in the South East Corner Bioregion* (Endangered) Justification: The community present in the study area does not meet the condition threshold for the EPBC Act listed CEEC outlined in the Conservation Advice; the groundcover consists of < 30% native vegetation. However; the aforementioned floristic composition, soils and landscape are consistent with the criteria outlined in the Final Determination under the BC Act (TSSC 2007).
Low condition Red Gum Grassy Woodland	

Freshwater Wetlands on Coastal Floodplains	
PCT	781 - *Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion*
Extent within study area	Approximately 20.3 hectares of Freshwater Wetlands is present within the southern extent, forming part of Coomonderry Swamp which extends further south. This area will not be directly impact upon by the project.
Description	This community is found in inundated wet depressions, with some saline influence due to its close proximity to the coast. Species present in the study area included Swamp Oak in the canopy; Swamp Paperbark in the midstory and *Carex* sp., *Cyperus* sp., Slender Knotweed *Persicaria decipiens* and Saltwater Couch *Sporobolus virginicus* in the ground cover. Common paddock weeds including Bulbous Canary Grass *Phalaris aquatica* have integrated into the edge of the wetland.
Condition	The community was generally in good condition due to the high abundance of native species and quality of adjoining habitat in the form of Coomonderry Swamp further south.
Associated soils, rainfall and landscape position	Freshwater Wetlands on Coastal Floodplains typically occur on silts, muds or humic loams in depressions associated with coastal floodplains below 20 metres ASL.
Threatened ecological community	Commonwealth EPBC Act: Not listed NSW BC Act: *Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions* (Endangered) Justification: The landscape position, soils and floristic assemblage is consistent with that outlined in the Final Determination for the EEC (TSSC 2005)

Freshwater Wetlands on Coastal Floodplains	
Picture: Freshwater Wetlands on Coastal Floodplains	

Illawarra Escarpment Blackbutt Forest	
PCT	1844 - *Illawarra Escarpment Blackbutt Forest*
% cleared value of PCT	NA
Extent within study area	Approximately 2.2 hectares of Illawarra Escarpment Blackbutt Forest occurs in the western extent of 'Jim's Bush'.
Description	This community occurs on gently sloping ground, grading towards a depression that is periodically inundated and waterlogged. The community present was in the form of an open woodland with a canopy dominated by Blackbutt and Grey Ironbark *Eucalyptus paniculata,* lacking a distinct midstory; however, regenerating mesic shrubs including Black Plum *Diospyros australis*, Featherwood *Polyosma cunninghamii* and Hairy Clerodendrum *Clerodendrum tomentosum* were present. Vines including Bearded Tylophora and Old Man's Beard *Clematis aristata* were also present. The groundcover was dominated by Tall Sedge and Tussock Grass, as well as Paddy's Lucerne and Panic Veldt Grass.
Condition	This community was in moderate condition given the intact native canopy and diverse groundlayer. The prevalence of Paddy's Lucerne and exotic grasses lowers the condition for this community
Associated soils, rainfall and landscape position	This community typically occurs on lower slopes in coastal rainshadow valleys, below 350 metres ASL on a range of substrates including alluvial and fine-grained sedimentary substrates.
Threatened ecological community	Commonwealth EPBC Act: Not listed NSW BC Act: Not listed

Illawarra Escarpment Blackbutt Forest	

Illawarra Gully Wet Forest	
PCT	694 - *Blackbutt - Turpentine - Bangalay moist open forest on sheltered slopes and gullies, southern Sydney Basin Bioregion*
% cleared value of PCT	50
Extent within study area	Illawarra Gully Wet Forest covers approximately 0.7ha, located in the northern section of 'Jim's Bush'.
Description	This community occurs on slightly undulating terrain, subject to occasional waterlogging. The canopy was dominated by Turpentine *Syncarpia glomulifera* and Blackbutt. The midstory consisted of regenerating Turpentine and Eucalypts, as well as dense infestations of Paddy's Lucerne. The groundcover consisted of diverse native species including, in order of cover abundance; Tall Sedge *Carex appressa*, Tussock Grass *Poa labillardieri*, and the exotic Panic Veldt Grass *Ehrharta erecta*. Vines present included Bearded Tylophora *Tylophora barbata* and Scrambling Lily *Geitonoplesium cymosum*.
Condition	This community was in moderate condition given the intact native canopy and diverse groundlayer. The prevalence of Paddy's Lucerne lowers the condition for this community.
Associated soils, rainfall and landscape position	This community typically occurs on fertile soils and very high mean annual rainfall. Most locations are close to the open ocean extending from sea level to the top of the escarpment at elevations around 250 metres ASL.
Threatened ecological community	Commonwealth EPBC Act: Not listed NSW BC Act: Not listed

Illawarra Gully Wet Forest	

Cleared/Exotic Pasture	
PCT	NA
% cleared value of PCT	NA
Extent within study area	The majority of the study are (> 50%) is cleared land.
Description	Cleared land dominated by exotic pasture species including Kikuyu, Perrenial Ryegrass *Lolium perenne* and Plantain *Plantago lanceolata*. Scattered paddock trees including Rough-Barked Apple and Blackbutt occur throughout the study area.
Condition	Highly degraded.
Associated soils, rainfall and landscape position	NA
Threatened ecological community	Commonwealth EPBC Act: Not listed NSW BC Act: Not listed

Cleared/exotic pasture with scattered paddock trees	

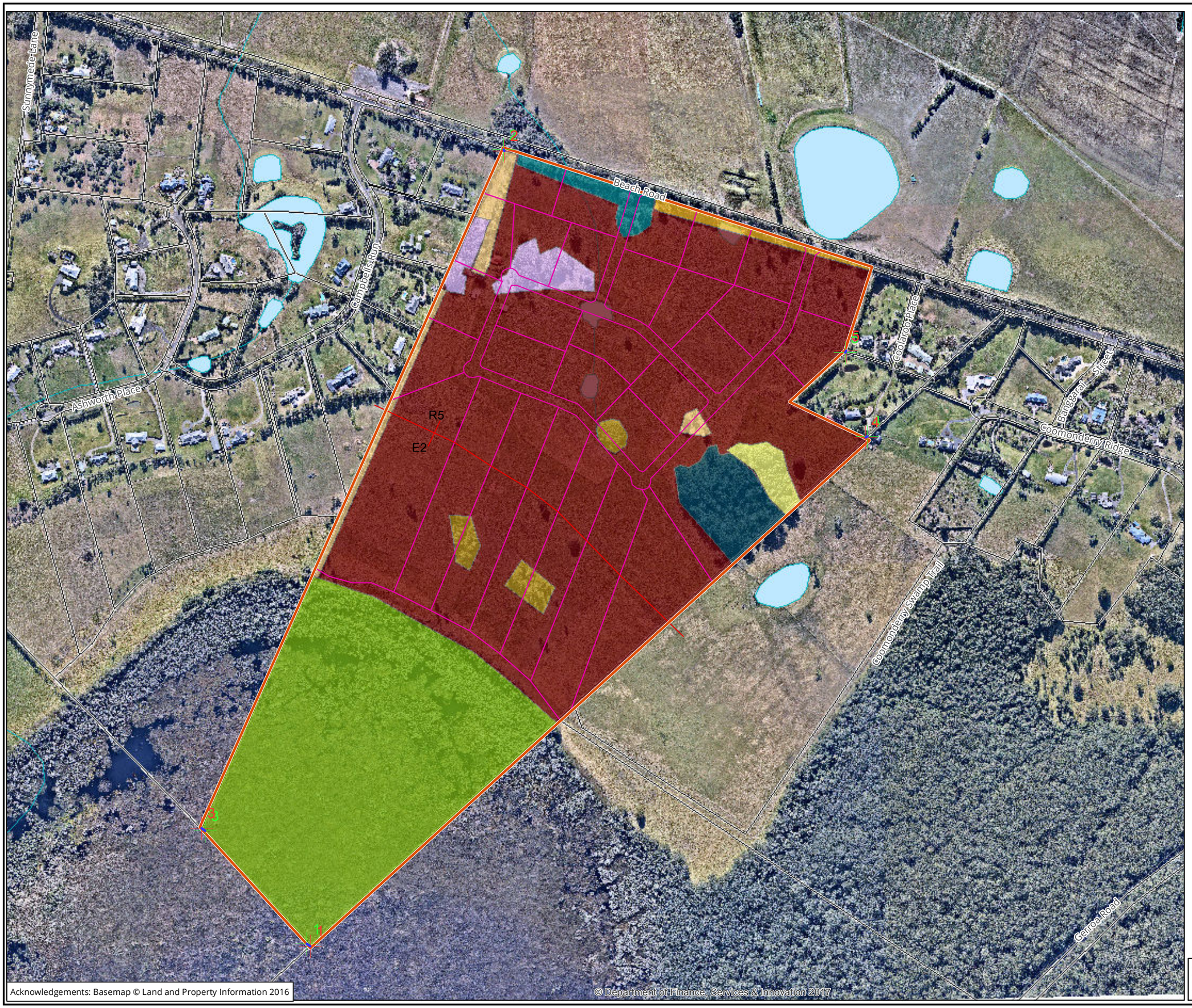
Landscaped/planted Vegetation	
PCT	NA
% cleared value of PCT	NA
Extent within study area	Confined to the garden within the exiting dwelling zone and linear strips along the main driveway.
Description	Consists of planted rows of indigenous and non-indigenous trees including Silky Oak *Grevillea robusta,* Bamboo and Cypress *Cupressus* sp.
Condition	This community is considered low condition habitat for native biota.
Associated soils, rainfall and landscape position	NA
Threatened ecological community	Commonwealth EPBC Act: Not listed NSW BC Act: Not listed

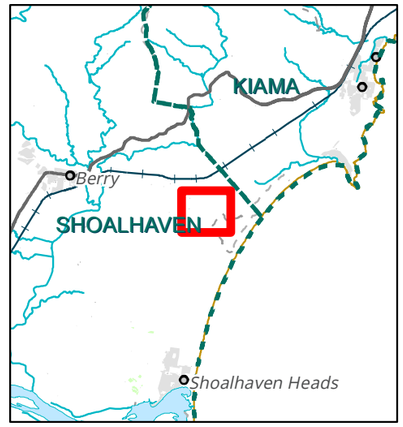
Landscaped/planted vegetation	

4.4 Aquatic habitats

Aquatic habitats within the study area include Coomonderry Swamp in the southern extent, and three farm dams intersected by an ephemeral first order watercourse (Strahler 1952) scattered within the remainder of the study area. Coomonderry Swamp is a protected wetland, exhibiting high conservation value as it provides habitat for a diverse array of biota including the threatened Green and Golden Bell Frog. The three farm dams are highly degraded and do not constitute quality habitat for aquatic biota. The vegetation surrounding the dams consisted of scattered patches of Bulrush *Typha orientalis*, Common Rush *Juncus* sp. and sedges including *Carex* sp. scattered amongst a groundcover of exotic paddock grasses including Kikuyu.

An assessment of potential indirect impacts to aquatic habitats, particularly Coomonderry Swamp, as a result of the project is provided in Table 5.





Legend

- Study area
- Development footprint - Indicative

Vegetation communities

- Bangalay Sand Forest
- Derived swamp oak forest
- Freshwater Wetlands on Coastal Floodplains
- Illawarra Escarpment Blackbutt Forest
- Illawarra gully wet forest
- Red Gum Grassy Woodland – low condition
- Red Gum Grassy Woodland – moderate condition
- Landscaped/Planted Vegetation
- Cleared/Exotic Pasture

Figure 2 Flora ecological values

0 60 120 180 240 300

Metres
Scale: 1:6,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Biosis Pty Ltd

Albury, Ballarat, Melbourne,
Newcastle, Sydney, Wangaratta & Wollongong

Matter: 25603
Date: 27 October 2017,
Checked by: CFV, Drawn by: GD, Last edited by: gdavies
Location:\\bio-data-01\matters$\25600s\25603\Mapping\25603_F2_Flora

Acknowledgements: Basemap © Land and Property Information 2016

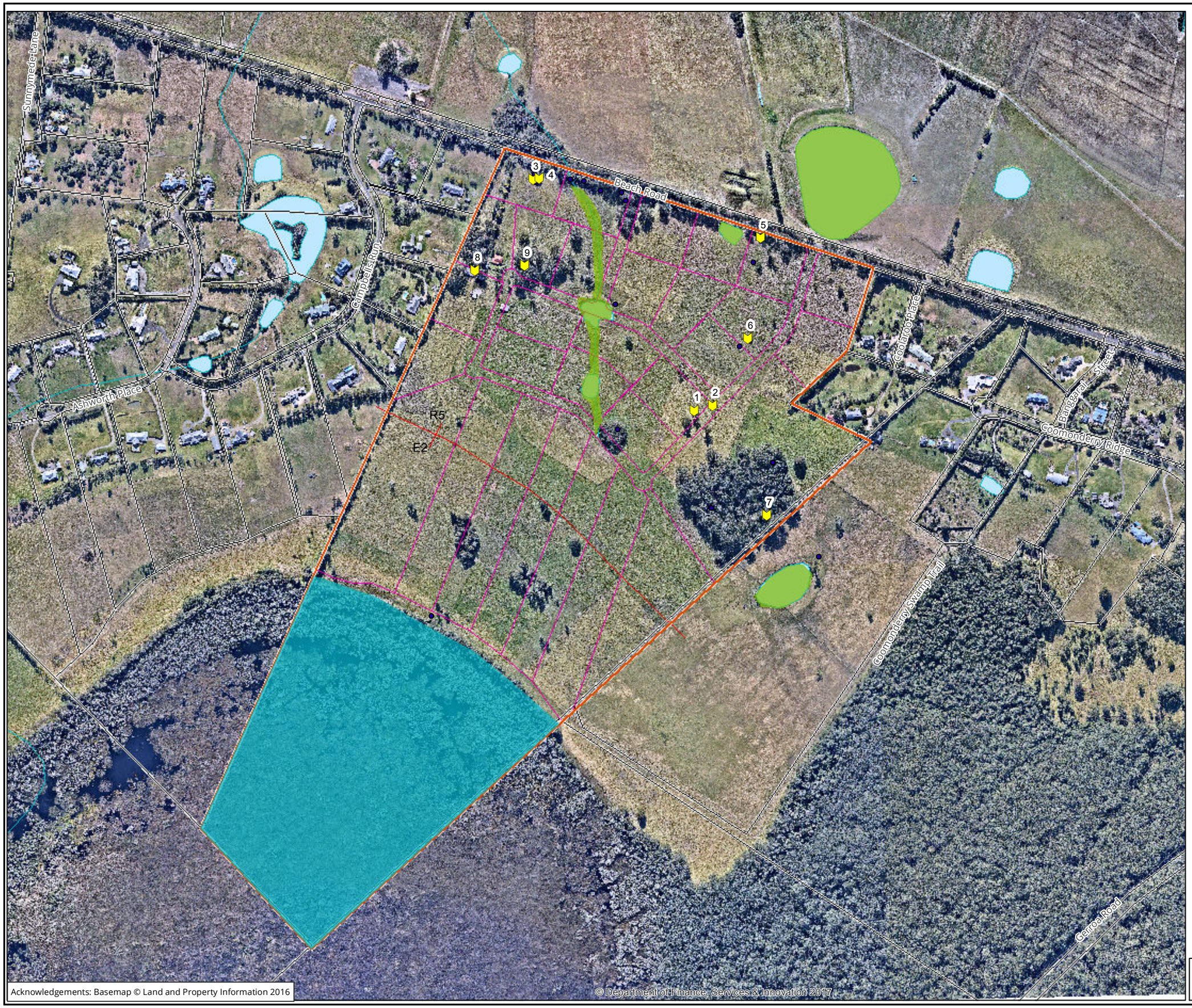


Figure 2 Fauna ecological values

4.5 Threatened biota

Threatened biota includes all flora and fauna species, populations and ecological communities listed under the EPBC Act, BC Act and FM Act. Lists of threatened biota recorded or predicted to occur within five kilometres of the study area are provided in Appendix 1 (flora) and Appendix 2 (fauna).

No threatened flora were identified as likely to occur within the study area. Below, Table 3 discusses the specific fauna outlined by Shoalhaven City Council to address the likelihood of impact.

Threatened fauna, previously recorded within the study area (OEH Wildlife Atlas) include; Green and Golden Bell Frog Litoria aurea and Australasian Bittern *Botaurus poiciloptilus*. Three hollow roosting microbats (Yellow-bellied Sheathtail Bat *Saccolaimus flaviventris*, Greater Broad-nosed Bat *Scoteanax rueppellii* and East Coast Freetail Bat *Mormopterus norfolkensis*)

Table 3 Assessment of likely impact on specific species identifed by Shoalhaven City Council.

Species name	EPBC status	BC / FM status	Relevance to study area and potential for impact
Amphibians			
Green and Golden Bell Frog	VU	V	The local population for this species occurring in Coomonderry have the potential to utilise the dams within the study area during times of peak movement. The most recent record of this species within the locality is from 2015 and the dams in the study area are provide low quality dispersal habitat for the Green and Golden Bell Frog. The dispersal habitat is located 300 metres north of the Coomonderry Swamp with no interconnecting drainage lines and unlikely to be used by the species. In addition, due to the lack of emergent vegetation (such as species from the *Typha* genus), the dams within the study area are not considered to provide breeding habitat for the species. Due to the proximity of known breeding population in Coomonderry Swamp and the low potential for the dams within the study area to provide potential dispersal corridors for the species, an Assessment of Significance (AoS) 5 part test under the BC Act and Significant impact criteria (SIC) assessment under the EPBC Act have been prepared in Appendix 3 and 4.
Mammals			
Eastern Bentwing-bat		V	The study area provides foraging habitat for this species and with numerous recent records occur within the locality it is considered likely that the species occurs in the study area. Caves and man-made structures are primarily used for roosting and breeding occurs in maternity caves, therefore the study area provides foraging habitat only for this species. Eastern Bentwing-bat is a highly mobile species, commonly foraging above the tree tops. As limited vegetation is proposed for removal, the potential impacts to this species are considered low. An Assessment of Significance 5 part test under the BC Act has been prepared in Appendix 4 to address impacts to foraging habitat.

Species name	EPBC status	BC / FM status	Relevance to study area and potential for impact
Eastern Freetail-bat		V	The study area provides foraging habitat within forested areas and roosting habitat in the form of hollow bearing trees. With numerous records in the locality, it is likely that this species may occur in the study area. As limited vegetation is proposed for removal and no hollow bearing trees will be removed, the potential impacts to this species are considered low. An Assessment of Significance 5 part test under the BC Act has been prepared in Appendix 4 to address impacts to foraging habitat.
Greater Broad-nosed Bat		V	The study area provides roost habitat in the form of hollow bearing trees and riparian corridors surrounding the study area provide foraging habitat for this species. With many records in the locality to the north of the study area it is it is likely that this species may occur in the stud area. As no hollow bearing trees will be removed, the potential impacts to this species are considered low, as all hollow bearing trees within the study areas will be retained. An Assessment of Significance 5 part test under the BC Act has been prepared in Appendix 4 to address impacts to foraging habitat.
Grey-headed Flying-fox	V	V	Flowering Eucalyptus trees provide foraging habitat for this species. With numerous recent records surrounding the study area it is likely that this species occurs in the study area on occasion to feed. As limited vegetation is proposed for removal the potential impacts to this species are considered low.
Large-eared Pied Bat	VU	V	This species is known to roost in caves, crevices, under bridges and in old buildings and mine workings. Females are known to breed in maternity roosts in the form of sandstone caves and overhangs, with individuals returning to the same breeding location across multiple years. No suitable roosting or breeding habitat was located in the study area. Forested areas of the study area may be utilised for foraging purposes by this species. Low likelihood of occurrence.
Southern Myotis		V	The study area provides roost habitat in the form of hollow bearing trees and water bodies surrounding the study area provide foraging habitat for this species. With many records in the locality to the north of the study area it is it is likely that this species may occur in the study area. As no hollow bearing trees will be removed, the potential impacts to this species are considered low. An Assessment of Significance 5 part test under the BC Act has been prepared in Appendix 4 to address impacts to foraging habitat.
Yellow-bellied Sheathtail-bat		V	The study area provides roost habitat in the form of hollow bearing trees and the species is known to foraging in a wide range of habitats with and without trees. The species has been recorded in the locality on a number of occasions previously, therefore with foraging and roosting habitat present is likely that Yellow-bellied Sheathtail-bat occur in the study area. As limited vegetation is proposed for removal and no hollow bearing trees will be removed, the potential impacts to this species are considered low. An Assessment of Significance 5 part test under the BC Act has been prepared in Appendix 4 to address impacts to foraging habitat.
Birds			

Species name	EPBC status	BC / FM status	Relevance to study area and potential for impact
Australasian Bittern	V	E1	Wetland area within the northern edge of Coomonderry Swamp in the south of the study area contains suitable wetland habitat for this species. Recent records occur to the north of Coomonderry Swamp within 600 metres of the study area. This species has a high likelihood of occurring in the Freshwater Wetlands on Coastal Floodplains associated with Coomonderry Swamp. As Coomonderry Swamp and associated vegetation will not be impacted directly, the potential impacts to this species are considered low.
Australian Painted Snipe	E1	E1	Wetland area within the northern edge of Coomonderry Swamp in the south of the study area contains suitable wetland habitat for this species. This species has a moderate likelihood of occurring in the Freshwater Wetlands on Coastal Floodplains associated with Coomonderry Swamp. As Coomonderry Swamp and associated vegetation will not be impacted directly, the potential impacts to this species are considered low.
Black Bittern		E1	As this species inhabits terrestrial and estuarine wetlands such as flooded grasslands, forests, and has been recorded previously in the locality there is moderate potential that is would occur in the Freshwater Wetlands on Coastal Floodplains associated with Coomonderry Swamp. As Coomonderry Swamp and associated vegetation will not be impacted directly, the potential impacts to this species are considered low.
Blue-billed Duck		V	Wetland area within the northern edge of Coomonderry Swamp in the south of the study area contains suitable wetland habitat for this species. This species has a moderate likelihood of occurring in the Freshwater Wetlands on Coastal Floodplains associated with Coomonderry Swamp. As Coomonderry Swamp and associated vegetation will not be impacted directly, the potential impacts to this species are considered low.
Fork-tailed Swift	Mi		There are no significant threats to the Fork-tailed Swift in Australia. Potential threats include habitat destruction and predation by feral animals. Due to the wide range of the species the potential impacts are thought to be negligible (Birdlife International 2009b).
Glossy Ibis	Mi		Wetland area within the northern edge of Coomonderry Swamp in the south of the study area contains suitable wetland habitat for this species. This species has a high likelihood of occurring in the Freshwater Wetlands on Coastal Floodplains associated with Coomonderry Swamp. As Coomonderry Swamp vegetation will not be impacted directly, the potential impacts to this species are considered low.
Great Egret	Mi		Wetland area within the northern edge of Coomonderry Swamp in the south of the study area contains suitable wetland habitat for this species. This species has a moderate likelihood of occurring in the Freshwater Wetlands on Coastal Floodplains associated with Coomonderry Swamp. As Coomonderry Swamp and associated vegetation will not be impacted directly, the potential impacts to this species are considered low.

Species name	EPBC status	BC / FM status	Relevance to study area and potential for impact
Little Lorikeet		V	It is considered moderately likely that this species may occur in the study area. Recent records for the species occur in the locality within close proximity of the study area. The mature trees in the Derived Swamp Oak Forest, River-Flat Eucalypt Forest, Red Gum Grassy Woodland, Illawarra Escarpment Blackbutt Forest and Illawarra Gully Wet Forest provide foraging habitat for this species and hollow bearing trees provide small hollows as breeding habitat. As no hollow bearing trees are proposed to be removed and the extent of native vegetation removal is limited potential impacts to this species are considered low.
Little Eagle		V	A number of records for this species occur around the study area and the species is known to use riparian woodlands. No nests were observed during field surveys. It there is moderate likelihood that individuals may occur on occasion in the Freshwater Wetlands on Coastal Floodplains associated with Coomonderry Swamp. As Coomonderry Swamp and associated vegetation will not be impacted directly, the potential impacts to this species are considered low.
Marsh Sandpiper	Mi		Wetland area within the northern edge of Coomonderry Swamp in the south of the study area contains suitable wetland habitat for this species. This species has a high likelihood of occurring in the Freshwater Wetlands on Coastal Floodplains associated with Coomonderry Swamp. As Coomonderry Swamp and associated vegetation will not be impacted directly, the potential impacts to this species are considered low.
Spotted Harrier		V	Spotted Harrier has a moderate likelihood of occurrence within the study area as the species may forage within the locality. No evidence of nests were identified on site, as the majority of woodland areas are proposed to be retained the potential impacts to this species area considered low.
Varied Sittella		V	Suitable for this species occurs in the small clusters of rough barked trees in the study area. As Varied Sittella is found in eucalypt woodlands and forests throughout their range and with records for this species within the locality there is a moderate likelihood that this species occurs in the study area. As the majority of woodland areas are proposed to be retained the potential impacts to this species are considered low.

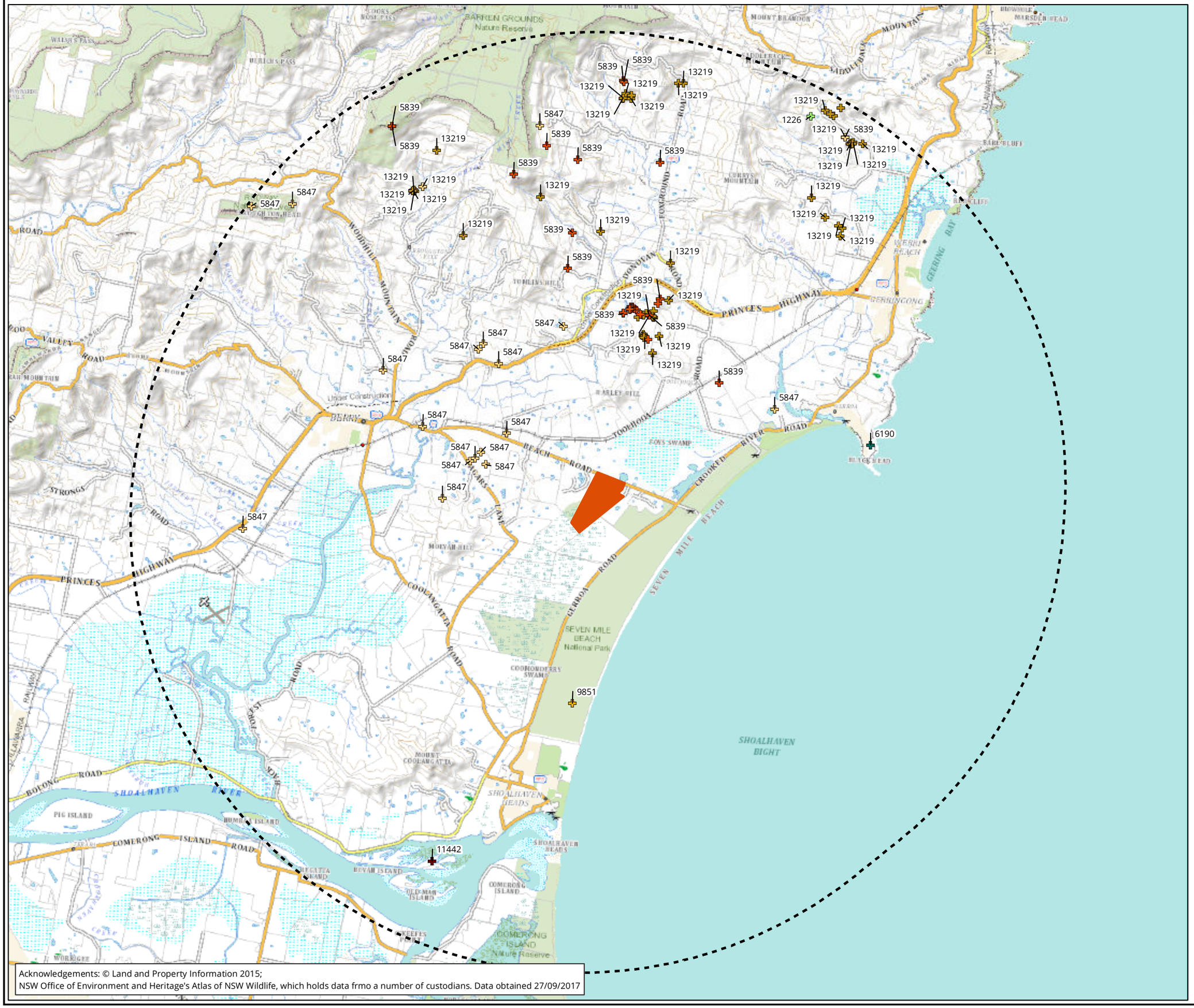
Hollow-bearing Trees

A total of nine HBTs were identified during the site investigation, a number of threatened species previously listed may utilise these hollows and therefore and are therefore a valuable ecological asset.

None of the Hollow-bearing trees are proposed to be removed at this current stage of the development.

Migratory Species

Known habitats for migratory species have been considered and are considered and addressed in Appendix 2.



Acknowledgements: © Land and Property Information 2015;
NSW Office of Environment and Heritage's Atlas of NSW Wildlife, which holds data frmo a number of custodians. Data obtained 27/09/2017

* Record is listed as sensitive under OEH's Sensitive Species Data Policy and cannot be shown at this scale

Figure 4: Threatened Flora within 10km of the StudyAreaSearch study area

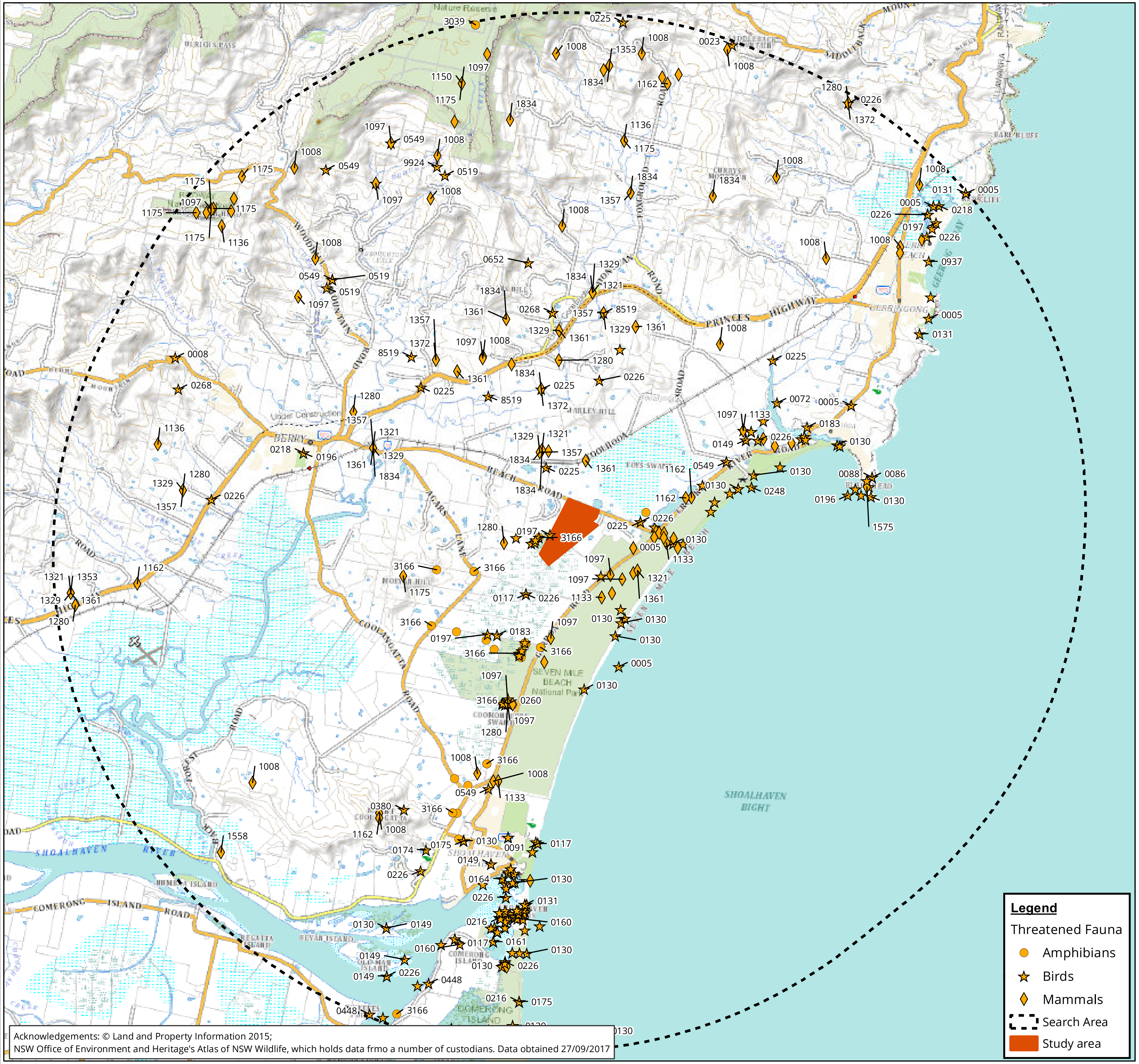
0 800 1,600 2,400 3,200 4,000

Metres
Scale: 1:80,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Melbourne, Sydney,Wangaratta & Wollongong

Matter: StudyAreaSearch
Date: 27 September 2017,
Checked by: 27/09/2017, Drawn by: AutoGen, Last edited by: gdavies
Location:\\bio-data-01\matters$\25600s\25603\Mapping\25603_F4_ThrFlora_autoGen



Acknowledgements: © Land and Property Information 2015;
NSW Office of Environment and Heritage's Atlas of NSW Wildlife, which holds data frmo a number of custodians. Data obtained 27/09/2017

Species list

Amphibians

3039 - Littlejohn's Tree Frog
3166 - Green and Golden Bell Frog

Birds

0005 - Little Penguin
0008 - Australian Brush-turkey
0023 - Superb Fruit-Dove
0067 - Little Shearwater
0072 - Flesh-footed Shearwater
0086 - Wandering Albatross
0088 - Black-browed Albatross
0089 - Yellow-nosed Albatross
0091 - Shy Albatross
0117 - Little Tern
0130 - Pied Oystercatcher
0131 - Sooty Oystercatcher
0138 - Hooded Plover
0139 - Lesser Sand-plover
0141 - Greater Sand-plover
0149 - Eastern Curlew
0152 - Black-tailed Godwit
0160 - Terek Sandpiper
0161 - Curlew Sandpiper
0164 - Red Knot
0165 - Great Knot
0166 - Sanderling
0167 - Broad-billed Sandpiper
0174 - Bush Stone-curlew
0175 - Beach Stone-curlew
0183 - Black-necked Stork
0196 - Black Bittern
0197 - Australasian Bittern
0216 - Blue-billed Duck
0218 - Spotted Harrier
0225 - Little Eagle
0226 - White-bellied Sea-Eagle
0230 - Square-tailed Kite
0230 - Square-tailed Kite*
0241 - Osprey
0241 - Osprey*
0246 - Barking Owl*
0248 - Powerful Owl
0248 - Powerful Owl*
0250 - Masked Owl*
0260 - Little Lorikeet
0265 - Glossy Black-Cockatoo*
0268 - Gang-gang Cockatoo
0268 - Gang-gang Cockatoo*
0305 - Orange-bellied Parrot*
0309 - Swift Parrot
0309 - Swift Parrot*
0380 - Scarlet Robin
0405 - Olive Whistler
0448 - White-fronted Chat
0519 - Eastern Bristlebird
0519 - Eastern Bristlebird*
0549 - Varied Sittella
0603 - Regent Honeyeater
0652 - Diamond Firetail
0929 - Southern Giant Petrel
0937 - Northern Giant-Petrel
0974 - Southern Royal Albatros
8519 - Dusky Woodswallow
8684 - Gould's Petrel
8913 - Eastern Ground Parrot
8913 - Eastern Ground Parrot*
9924 - Sooty Owl
9924 - Sooty Owl*
9926 - Grey Ternlet

Mammals

1008 - Spotted-tailed Quoll
1013 - Subantarctic Fur-seal
1097 - Long-nosed Bandicoot
1133 - Greater Glider
1136 - Yellow-bellied Glider
1150 - Eastern Pygmy-possum
1162 - Koala
1175 - Long-nosed Potoroo
1280 - Grey-headed Flying-fox
1321 - Yellow-bellied Sheathtail-bat
1329 - Eastern Freetail-bat
1353 - Large-eared Pied Bat
1357 - Southern Myotis
1361 - Greater Broad-nosed Bat
1372 - Eastern False Pipistrelle
1558 - Dugong
1575 - Humpback Whale
1834 - Eastern Bentwing-bat

Reptiles

2676 - Broad-headed Snake*

* Record is listed as sensitive under OEH's Sensitive Species Data Policy and cannot be shown at this scale

Figure 5: Threatened Fauna within 10km of the StudyAreaSearch study area

0 770 1,540 2,310 3,080 3,850

Metres

Scale: 1:77,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Melbourne, Sydney,Wangaratta & Wollongong

Matter: 15743
Date: 27 September 2017,
Checked by: 27/09/2017, Drawn by: SMV, Last edited by: gdavies
Location:\\bio-data-01\matters$\25600s\25603\Mapping\25603_F5_ThrFauna_autoGen

5 Ecological impacts and recommendations

This section identifies the potential impacts of the proposed rezoning & subsequent subdivision on the ecological values of the study area and includes recommendations to assist Richard Hall to design a subdivision to avoid and minimise impacts on ecological values.

The principal means to reduce impacts on ecological values will be to minimise any removal of native vegetation and habitat. Under the current proposal, 0.29 hectares of Bangalay Sand Forest EEC is proposed to be removed.

The results of this flora and fauna assessment should therefore be used to inform the final design of the development. The design phase of the project is critical to determining specifics of how ecological values will be incorporated and managed within the development.

A summary of potential implications of development of the study area and recommendations to minimise impacts during the design phase of the project is provided in Table 4 below.

Table 4 Assessment under the BC Act

Criteria	Threshold	Subject site	BDAR+/ SIS* required
Vegetation clearing	1 hectare	0.29 ha of native vegetation	Area of removal is less than the threshold, a BDAR and offsetting is not required.
Biodiversity values map	Occurs within layer - Land excluded from LLS Act	N/A	No
Significance test for impact (Part 7 of the BC Act)	Significant impact under 5 – Part Test for impacts to threatened biota.		
KEY: + Biodiversity Development Assessment Report, * Species Impact Statement			

Table 5 Ecological values, impacts and recommendations

Ecological value (Figures 2 and 3)	Impacts	Recommendations	
		Avoid	Minimise and mitigate
Native vegetation including 'Jim's Bush'	A maximum of 0.29 hectares of native vegetation in the form of EEC Bangalay Sand Forest will be cleared as part of the current proposal.	Not feasible to avoid removal of part of the EEC. The AoS (Appendix 4) did not result in a significant effect on the EEC. Relocating the proposed access road to avoid Bangalay Sand Forest EEC will instead impact on *Lowlands Grassy Woodland* EEC. Jim's Bush will be retained.	• Every effort will be made to retain trees wherever possible. • Identify boundaries of the remaining Bangalay Sand Forest EEC as a 'No Go Zone' prior to vegetation removal. • Identify the locations the adjacent Lowland Grassy Woodland EEC and 'Jim's Bush' as 'No Go' zones prior to vegetation removal. • Install appropriate exclusion fencing to the boundary of the EECs and any construction areas where there is some potential for accidental encroachment. Include appropriate signage such as 'No Go Zone' or 'Environmental Protection Area'.
Hollow-bearing trees	One out of nine HBTs are proposed to be removed (HBT number 2 will likely be removed, Figure 3).	HBTs not within proposed road access will be avoided.	• Pre-clearance inspection of hollows by an Ecologist for fauna and/or signs of fauna activity is recommended prior to tree removal.
Waterways (creeks, dams, etc.)	Three farm dams will be removed.	It is not practical to retain the dams under the current development plan.	The dams provide marginal aquatic habitat; however, Biosis recommends an Ecologist to be on-site during the de-watering process for fauna salvage purposes.

Ecological value (Figures 2 and 3)	Impacts	Recommendations	
		Avoid	Minimise and mitigate
Wetlands	Coomonderry Swamp will be subject to indirect impacts including: • Hydrological changes and water contamination • Erosion/increased sediment build-up	A conservation zone of approximately 150 metres (or in line with the set-backs established by the two neighboring subdivisions) from Coomonderry Swamp will be provided to avoid direct impacts.	Indirect impacts will be mitigated by following these actions: • All access tracks should be located away from the Swamp • Wastewater treatment facilities need to be constructed away from the swamp to avoid potential water contamination. • Appropriate development buffers (100 metres) are to be installed near low lying Lots and drainage channels (SEEC 2015). • Risk of indirect impacts from stormwater run-off is low based on the proposed subdivision plan (SEEC 2015). • Appropriate sediment controls are to be implemented during construction works to avoid erosion, sediment accumulation and the spread of weeds.
Habitat connectivity	Removal of dams that have a potential to provide dispersal habitat for Green and Golden Bell Frogs through a fragmented landscape.	Not feasible under current development plan.	Avoid dam-dewatering during periods of peak Green and Golden Bell Frog dispersal; in summer months, especially following rain to minimise direct impact to frogs.

6 Assessment against key biodiversity legislation

6.1 Environment Protection and Biodiversity Conservation Act 1999

An assessment of the impacts of the proposed development on Matters of NES, against heads of consideration outlined in Commonwealth of Australia (2013) was prepared to determine whether referral of the project to the Commonwealth Minister for the Environment is required. Matters of NES relevant to the project are summarised in Table 6.

Table 6 Assessment of the project against the EPBC Act

Matter of NES	Project specifics	Assessment against Commonwealth of Australia (2013)
Threatened species (flora and fauna)	8 flora species and 25 fauna species have been recorded or are predicted to occur in the locality. An assessment of the likelihood of these species occurring in the study area is provided in Appendix 1 (flora) and Appendix 2 (fauna). This assessment indicates that of these, 9 fauna species are considered to have a medium or greater likelihood of occurrence within the study area. No species listed under the EPBC Act were recorded within the study area.	An Assessment against the Significant Impact Criteria (CoA 2013) has been prepared for the Green and Golden Bell Frog (Appendix 3). A significant impact on the viability of the species will not result from the current project; potential dispersal habitat, only, will be impacted upon.
Migratory species	18 migratory species have been recorded or are predicted to occur in the locality (Appendix 2).	While some of these species would be expected to use the study area on occasions, some may do so regularly and others may be resident, the study area does not provide important habitat for an ecologically significant proportion of any of these species.
Wetlands of international importance (Ramsar sites)	There are 12 Ramsar sites in NSW, the closest one being the Towra Point Nature Reserve on the Kurnell Peninsula in Sydney.	The study area does not flow directly into a Ramsar site and the development is not likely to result in a significant impact.

On the basis of criteria outlined in Commonwealth of Australia (2013) it is considered unlikely that a significant impact on a Matter of NES would result from the project.

6.2 Environmental Planning and Assessment Act 1979

An assessment of the project against the relevant sections of the EP&A Act is provided below.

State Environmental Planning Policies

SEPP No. 14 Coastal Wetlands

The southern extent of the study area encompasses Coomonderry Swamp, mapped as Coastal Wetlands under the SEPP. The SEPP aims to preserve and protect Coastal Wetlands. The project will result in indirect impacts to Coomonderry Swamp, including:

- Changes in hydrology and sediment movement

Richard Hall will implement the following safeguards to avoid and minimise impacts to Coomonderry Swamp:

- All access tracks are to be located away from the Swamp.
- Ensure all wastewater treatment facilities are suitable for lot-specific periodic inundation patterns and hydrological flows, this is particularly relevant to low-lying areas.
- Implement appropriate sediment and erosion controls during construction.

Provided the safeguards listed above are implemented, the project will be consistent with the objectives of the SEPP.

SEPP No. 44 – Koala Habitat Protection

The study area is located within the Shoalhaven LGA, a Schedule 1 listed Council. Therefore SEPP No. 44 is relevant. The vegetation community of Red Gum Grassy Woodland on the northern boundary of the study area does possess areas with 15% or greater cover of Forest Red Gum *Eucalyptus tereticornis*, which is a listed feed tree species for the South Coast Koala Management Area (KMA) under *The NSW recovery plan for the Koala (2008)*, therefore the study area contains 'Potential Koala Habitat'.

Results from the field investigation identified no evidence of Koala presence (scats or scratch marks). Within the locality of the study area, Koalas have recently been recorded west of the escarpment in the Mount Kembla area, however has rarely been recorded in the Illawarra floodplain and not in recent times.

The subject site is not considered to support Core Koala Habitat and a Plan of Management is not required.

Local Environment Plans

The study area is subject to the Shoalhaven Local Environment Plan and is predominantly zoned Primary Production RU1, with Coomonderry Swamp zoned Environmental Conservation E2 (SLEP 2014). The relevant objectives of the zones are to:

- RU1
  - *To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.*
  - *To encourage diversity in primary industry enterprises and systems appropriate for the area.*
  - *To minimise the fragmentation and alienation of resource lands.*
  - *To minimise conflict between land uses within this zone and land uses within adjoining zones.*
  - *To conserve and maintain productive prime crop and pasture land.*
  - *To conserve and maintain the economic potential of the land within this zone for extractive industries*
- E2
  - *To protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values.*

- *To prevent development that could destroy, damage or otherwise have an adverse effect on those values.*
- *To protect water quality and the ecological integrity of water supply catchments and other catchments and natural waterways.*
- *To protect the scenic, ecological, educational and recreational values of wetlands, rainforests, escarpment areas and fauna habitat linkages.*
- *To conserve and, where appropriate, restore natural vegetation in order to protect the erosion and slippage of steep slopes.*

The project is considered consistent with the objectives of the relative zoning respective to biodiversity values.

Development Control Plans

Elements of the Shoalhaven DCP relevant to the project include:

- Riparian Lands and Watercourses as Riparian Land (Coomonderry Swamp):
  - Coomonderry swamp will not be directly impacted upon by the project.
  - See Section 5 above for recommended measures to mitigate indirect impacts including hydrological changes from increased run-off, and sediment movement and accumulation in low-lying areas.
- Significant vegetation under the Shoalhaven DCP Biodiversity layer applies to Coomonderry Swamp and the patch of vegetation termed 'Jim's Bush'
  - This area was assessed during the flora survey and was not found to consist of any EECs. Also, the project will not be removing vegetation from this area.
- Acid Sulphate Soils; Class 2 (Coomonderry Swamp)
  - No soil disturbance will occur within the vicinity of Coomonderry Swamp.

6.3 Biodiversity Conservation Act 2016

An assessment of the likelihood of threatened biota occurring within the study area is provided in Appendix 1 (flora) and Appendix 2 (fauna) along with an assessment of whether the project has potential to result in a significant effect. These assessments determined that 25 species have a medium or greater likelihood of occurring within the study area. Assessments of Significance (AoS) have been prepared for the threatened biota that are deemed likely to be subject to negative impacts and are provided in Appendix 4. These include Bangalay Sand Forest EEC, Green and Golden Bell Frog and microchiropteran bats; Large-eared Pied-bat, Eastern False Pipistrelle, Eastern Bentwing-bat, Eastern Freetail-bat, Southern Myotis, Yellow-bellied Sheathtail-bat and Greater Broad-nosed bat.

Assessments of Significance indicate that a significant effect is not likely to result from the proposal. A Species Impact Statement is therefore not required.

Biodiversity Offsets Scheme

Coomonderry Swamp, within the southern extent of the study area, is mapped as land constituting 'high biodiversity value' under the NSW Biodiversity Value Map (Department of Planning and Environment 2017). Coomonderry Swamp does not fall within the proposed development footprint and actions to mitigate

indirect impacts have been recommended in this report. For this reason, a Biodiversity Development Assessment Report is not required.

Furthermore, the project is unlikely to result in a significant effect to threatened biota, consideration of the Biodiversity Scheme is not warranted.

6.4 Local Land Services Act 2013

The project is subject to the provisions of the LLS Act, and approval for clearing of native vegetation is required. Clearing will be subject to a development consent under the EP&A Act. The study area is not mapped within the Sensitive or Vulnerable Regulated Land layers under Native Vegetation Regulatory Map (OEH 2017). Provisions of the LLS Act do not apply to Coomonderry Swamp in the south of the study area, as it is protected under the BC Act as an area of high conservation value.

6.5 Water Management Act 2000

The Riparian Corridors within the study area have been assessed in relation to the WM Act and Guidelines for Riparian Corridors on Waterfront Land (Office of Water, 2012). The NSW Department of Primary Industries (DPI) - Water recommends riparian widths based on watercourse order under the Strahler method. The watercourse identified intersecting two of the three dams; providing potential dispersal habitat for Green and Golden Bell Frog (Figure 3), was classified as a first order stream. Therefore, the watercourse requires a riparian corridor width of 10 metres from the 'top of bank' on either side respectively.

Given that the Project would be undertaken within 40 metres of a waterway, and therefore a controlled activity approval would be required under Section 91 of the WM Act.

Works are not proposed within 40 metres of Coomonderry Swamp. Indirect impacts to the wetland as a result of the proposed works, however, will need to be avoided and/or minimised using appropriate measures. Recommendations to mitigate impacts to the wetland are outlined in Table 5.

6.6 Fisheries Management Act 1994

Two threatened fish species; Macquarie Perch and Australian Grayling occur in rivers and streams within the locality of the study area. An assessment of the likelihood of these species determined that no suitable habitat features are present within the study area, therefore these species are unlikely to occupy the area (Appendix 2).

The project will not result in impacts to fish passage, and assessment by NSW Fisheries is not required.

7 Conclusion

This report is an assessment of the potential impact of the proposed development at 510 Beach Road, Berry (Lot 4 DP834254) on ecological values within the locality in accordance with the EP&A Act, FM Act, WM Act, BC Act and the EPBC Act.

The proposed activities that will result in impacts to ecological values include:

- Removal of a maximum of 0.29 hectares of native vegetation consisting of:
  - Bangalay Sand Forest EEC
  - Limited foraging habitat for a range of threatened fauna listed in Section 4.5.
- Removal of three farm dams which provide low potential dispersal habitat for the threatened Green and Golden Bell Frog.

The 0.29 hectares of vegetation to be removed within the study area has been assessed by Biosis to be consistent with the final determination for the EEC *Bangalay Sand Forest of the Sydney Basin and Southeast Corner Bioregion* under the BC Act. A total of approximately 1.2 hectares of Bangalay Sand Forest was identified within the study area. For the reasons outlined in the Assessment of Significance (Appendix 4), the proposed works, as currently designed, are deemed not to have a significant.

Vegetation consistent with the final determination for the EEC *Lowland Grassy Woodland in the Southeast Corner Bioregion* under the BC Act is also present within the study area; of which 1.2 hectares was assessed to be in moderate condition and 0.8 hectares in low condition. No vegetation removal within the EEC will be undertaken.

Three isolated patches of vegetation amounting to approximately 1.6 hectares consistent with the final determination for the EEC *Swamp Oak Floodplain Forest in the Southeast Corner Bioregion* under the BC Act is also present within the study area. No vegetation removal within the EEC will be undertaken.

Coomonderry Swamp, a significant Coastal Wetland, also consistent with the final determination for the BC Act listed EEC *Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion*, accounts for 20.3 hectares within the southern extent of the property. A conservation buffer zone of approximately 150 metres (or in line with the set-backs established by the two neighboring subdivisions) will be applied to the Swamp and potential adverse indirect impacts will be mitigated for. Therefore, potential impacts to Coomonderry Swamp are considered negligible.

A number of safeguards to avoid, minimise and mitigate the above impacts have been included in Section 5 of this report including exclusion fencing and recommendations regarding appropriate erosion control and wastewater management practises.

Following field investigations, the following EPBC Act listed threatened fauna species were determined to have a moderate likelihood of occurrence within the study area; Green and Golden Bell Frog, Large-eared Pied-Bat, Spotted-tailed Quoll, Southern Brown Bandicoot, Greater Glider, Long-nosed Potoroo, Grey-headed Flying-fox, Australian Bittern, Swift Parrot and Eastern Curlew. An additional 17 species listed under the BC Act were also considered to have a moderate likelihood of occurrence in the study area; Masked Owl, Powerful Owl, Barking Owl, Swift Parrot, Diamond Firetail, Blue-billed Duck, Eastern False Pipistrelle, Little Lorikeet, Black-necked Stork, Dusky Woodswallow, Greater Broad-nosed Bat, Yellow-bellied Sheathtail-bat, Yellow-bellied Glider, Greater Glider, Southern Myotis, Eastern Freetail-bat and Eastern Bentwing-bat. Assessments of significance were carried out for fauna species to which the proposal was considered likely to impact on

limiting foraging resources. These assessments concluded the proposal is unlikely to have a significant impact on any BC or EPBC Act listed fauna species. Safeguards specific to the removal of threatened and general fauna species habitat have been included in Section 5 of this report, including supervision of dam-dewatering.

Overall, this project will not significantly impact upon threatened communities or biota. Mitigation actions for the avoidance of indirect impacts to ecological values need to be implemented.

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Appendices

Appendix 1 Flora

Flora species recorded from the study area

Status – EPBC Act: CE – Critically Endangered EN – Endangered VU – Vulnerable	**Status – BC Act:** E1 – endangered species (Part 1, Schedule 1) E2 – endangered population (Part 2, Schedule 1) E4 – presumed extinct (Part 4, Schedule 1) E4A – critically endangered V – vulnerable (Part 1, Schedule 2)
Status – Exotic # – Native species outside natural range * – priority weed species declared under the Biosecurity Act 2015	

Table A.1 Flora species recorded from the study area

Status	Scientific name	Common name
	Native species	
	Acmena smithii	Lilly Pilly
	Adiantum aethiopicum	Maidenhair Fern
	Angophora floribunda	Rough-barked Apple
	Carex appressa	Tall Sedge
	Clematis aristata	Old Man's Beard
	Clerodendrum tomentosum	Hairy Clerodendrum
	Commelina cyanea	Native Wandering Jew
	Dichondra repens	Kidney Weed
	Diospyros australis	Black Plum
	Doodia aspera	Prickly Rasp Fern
	Entolasia marginata	Bordered Panic
	Eucalyptus botryoides	Bangalay
	Eucalyptus eugenioides	Thin-leaved Stringybark
	Eucalyptus paniculata	Grey Ironbark
	Eucalyptus pilularis	Blackbutt
	Eucalyptus punctata	Grey Gum
	Eucalyptus saligna x botryoides	Wollongong Woollybutt
	Eucalyptus tereticornis	Forest Red Gum
	Eustrephus latifolius	Wombat Berry
	Geitonoplesium cymosum	Scrambling Lily

Status	Scientific name	Common name
	Imperata cylindrica	Blady Grass
	Juncus usitatus	Common Rush
	Lomandra longifolia	Spiny-headed Mat Rush
	Lophostemon confertus	Brush Box
	Marsdenia rostrata	Common Silkpod
	Melaleuca ericifolia	Swamp Paperbark
	Melaleuca linariifolia	Narrow-leaved Paperbark
	Microlaena stipoides	Weeping Grass
	Myrsine howittiana	Muttonwood
	Notelaea venosa	Veined Mock-olive
	Oplismenus imbecillis	Basket Grass
	Parsonsia straminea	Common Silkpod
	Persicaria decipiens	Knotweed
	Pittosporum undulatum	Sweet Pittosporum
	Poa labillardieri	Tussock Grass
	Polyosma cunninghamii	Featherwood
	Pseuderanthemum variabile	Pastel Flower
	Rubus parvifolius	Native Raspberry
	Solanum prinophyllum	Forest Nightshade
	Syncarpia glomulifera	Turpentine
	Tylophora barbata	Bearded Tylophora
	Typha orientalis	Bulrush
	Veronica plebeia	Trailing Speedwheel
	Exotic species	
	Cinnamomum camphora	Camphor Laurel
	Cupressus sp.	Cypress Pine
	Ehrharta erecta	Panic Veldt Grass
	Grevillea robusta	Silky Oak
	Lolium perenne	Perennial Ryegrass
	Pennisetum clandestinum	Kikuyu
	Phalaris aquatica	Bulbous Canary Grass
	Plantago lanceolata	Plantain
*	*Rubus fruticosus* agg.	Blackberry

Status	Scientific name	Common name
*	*Senecio madagascariensis*	Fireweed
	Sida rhombifolia	Paddy's Lucerne
*	*Sporobolus*	Giant Parramatta Grass

Threatened flora species and ecological communities

The following table includes a list of the threatened flora species that have potential to occur within the study area. The list is based on database searches outlined in Section 3.1.

Flora likelihood of occurrence (LOO) table

Conservation status – EPBC Act:	**Conservation status – BC Act:**
CR – Critically Endangered EN – Endangered VU – Vulnerable	E1 – endangered species (Part 1, Schedule 1) E2 – endangered population (Part 2, Schedule 1) E4 – presumed extinct (Part 4, Schedule 1) E4A – critically endangered V1 – vulnerable (Part 1, Schedule 2)
Most recent record # species predicted to occur by the PMST (not recorded on other databases). ## species predicted to occur based on natural distributional range and suitable habitat despite lack of records in the databases searched. 2017 recorded during current survey.	

Examples of criteria for determining the likelihood of occurrence for threatened biota as a guide for writing the rationale for likelihood have been listed below.

Likelihood of occurrence	Potential criteria for likely occurrence in study area
Recorded	• Recorded in the study area during current assessment. • Records in study area, as indicated by background research.
High	• Species/ecological communities recorded in study area during current or previous assessment/s. • Aquatic species recorded from connected waterbodies in close proximity to the study area during current or previous assessment/s. • Sufficient good quality habitat is present in study area or in connected waterbodies in close proximity to the study area (aquatic species). • Study area is within species natural distributional range (if known). • Species has been recorded within <five kilometres or 10 kilometres> or from the relevant catchment/basin.
Medium	• Records of terrestrial biota within <five kilometres or 10 kilometres> of the study area or of aquatic species in the relevant basin/neighbouring basin. • Habitat limited in its capacity to support the species due to extent, quality, or isolation.
Low	• No records within <five kilometres or 10 kilometres> of the study area or for aquatic species, the relevant basin/neighbouring basin. • Marginal habitat present (low quality & extent). • Substantial loss of habitat since any previous record(s).
Negligible	• Habitat not present in study area • Habitat for aquatic species not present in connected waterbodies in close proximity to the study area. • Habitat present but sufficient targeted survey has been conducted at an optimal time of year and species wasn't recorded.

Table A.2 Threatened flora species recorded / predicted to occur within 10 kilometres of the study area

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
Chamaesyce psammogeton	Sand Spurge		E1	1987	Negligible	Suitable habitat not present within the study area.	Grows on exposed headlands, fore dunes or pebbly strand-lines near the sea in a variety of communities including South Coast Sands Dry Sclerophyll Forests, Sydney Coastal Heaths, and Maritime Grasslands. Grows in sand soils.
Cryptostylis hunteriana	Leafless Tongue Orchid	VU	V	#	Negligible	Suitable habitat not present within the study area. Small patches of low condition Forested Wetlands are too degraded to provide habitat for this species.	Grows in a variety of communities including Sydney Coastal Dry Sclerophyll Forests, Coastal Heath Swamps, New England Dry Sclerophyll Forests and Sydney Coastal Heaths. Grows in sandy soils.
Cynanchum elegans	White-flowered Wax Plant	EN	E1	1992#	Low	Study area occurs south of the southern-most range extent of this species. The highly disturbed condition of the understorey of the Grassy Woodland vegetation patches within the study area do not provide suitable habitat.	Grows in rainforest gully scrub and scree slope on the edge of dry rainforests in a variety of communities including Coastal Floodplain Wetlands, Maritime Grasslands, Coastal Valley Grassy Woodlands and Northern Hinterland Wet Sclerophyll Forests.
Daphnandra johnsonii		E	E1	2016	Negligible	Study area lacks sufficient rocky outcrops. Soils within the study area are predominantly sandy,	Found on rocky sites along gullies near creeks, in disturbed areas, and along the margins of Dry Rainforest, Subtropical Rainforest and North Coast Wet Sclerophyll Forests. Grows in

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
						alluvial deposits.	loams and clay loams derived from volcanic and sedimentary substrates.
Genoplesium baueri	Bauer's Midge Orchid	EN	E1	#	Negligible	Suitable habitat not present within the study area.	Grows on moss gardens in a variety of communities including Sydney Coastal Dry sclerophyll Forests, Sydney Coastal Heaths, Sydney Montane Heaths, Southern Lowland Wet Sclerophyll Forests and Sydney Hinterland Dry Sclerophyll Forests. Grows on sandstone substrates
Lastreopsis hispida	Bristly Shield Fern		E1	1884	Negligible	The study area occurs outside of the known distribution for this species. The most recent record in the locality was over 100 years ago.	Grows in gullies in a variety of communities including Eastern Riverine Forests, Northern Warm Temperate Forests, Southern Warm Temperate Forests and Southern Escarpment Wet Sclerophyll Forests. Grows in moist, hummus rich soils.
Melaleuca biconvexa	Biconvex Paperbark	VU	V	#	Low	The study area occurs outside of the known distribution for this species. However, potential habitat is present within the study area in the form of Floodplain Swamp Forest and Grassy Woodlands. Soils present are consistent with the preferred soil type of this species.	Grows in damp places, often near streams or low lying areas on low slopes or sheltered aspects in a variety of communities including Hunter-Macleay Dry Sclerophyll Forests, Coastal Swamp Forests, Coastal Floodplain Wetlands, Coastal Freshwater Lagoon and North Coast Wet Sclerophyll Forests. Grows in alluvial soils.
Pimelea spicata	Spiked Rice-	EN	E1	1999#	Negligible	The study area occurs	Grows in Maritime Grasslands and Coastal

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
	flower					outside of the known distribution for this species. The disturbed condition of the Grassy Woodlands present within the study area do not provide suitable habitat. Also, preferred clay soils are not present.	Valley Grassy Woodlands including Cumberland Plain Woodlands and Moist Shale Woodlands within the Cumberland Basin and in Coast Banksia Open Woodland Coastal Grasslands in the Illawarra region. Grows on well-structured clay soils.
Pterostylis gibbosa	Illawarra Greenhood	EN	E1	#	Low	Suitable habitat in the form of Open Woodland on poorly drained alluvial soils is present within the study area. Commonly associated species Spotted Gum and White Feather Honey-myrtle are not present. Duplex, red brown loam soils are absent.	Found growing amongst grasses on flat or gently sloping land with poor drainage in woodland dominated by Forest Red Gum *Eucalyptus tereticornis*, Woolybutt *E. longifolia*, and White Feather Honey-myrtle *Melaleuca decora*. In Nowra, the orchid can be found growing in association with Spotted Gum *Corymbia maculata*, Forest Red Gum and Grey Ironbark *E. paniculata*. Grows in red brown loam soils.
Solanum celatum			E1	1932	Negligible	Suitable habitat not present within the study area.	Found growing on hills, slopes, disturbed sites and rainforest clearings in Central Gorge Dry Sclerophyll Forests, Dry Rainforests and North Coast Wet Sclerophyll Forests.
Syzygium paniculatum	Magenta Lilly Pilly	VU	E1	#	Negligible	Suitable habitat not present within the study area.	On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. Found growing on stabilized dunes near the sea in South Coast Sands Dry

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
							Sclerophyll Forests, Coastal Swamp Forests, Coastal Headland Heaths, Littoral Rainforests, Northern Hinterland Wet Sclerophyll Forests and Southern Lowland Wet Sclerophyll Forests. Grows on grey sandy, gravelly, silty or clay soils over sandstone substrates.
Thesium australe	Austral Toadflax	VU	V	#	Negligible	The study area occurs outside of the known distribution for this species. Also, suitable habitat is not present within the study area (absence of Kangaroo Grass).	A root parasite found growing on damp sites in grassland, grassy woodlands and coastal headlands often in association with Kangaroo Grass *Themeda triandra* in a variety of communities including New England Dry Sclerophyll Forests, Western Slopes Grasslands, Northern Tableland Wet Sclerophyll Forests, Brigalow Clay Plain Woodlands, Subalpine Woodlands and Maritime Grasslands.
Zieria granulata	Illawarra Zieria	EN	E1	2016	Negligible	Despite presence of Grassy Woodlands within the study are, dry ridge tops and rocky outcrops are absent.	Found growing on dry ridge tops and rocky outcrops as well as disturbed areas such as roadside verges in Coastal Valley Grassy Woodlands, Southern Montane Heaths. Dry Rainforests, Southern Warm Temperate Rainforests, Subtropical Rainforests, Southern Tableland Wet Sclerophyll Forests and North Coast Wet Sclerophyll Forests. Grows in shallow, volcanic soils on Bumbo latite or on Quaternary sediments.

Appendix 2 Fauna

Fauna species recorded from the study area

Status – EPBC Act:	**Status – BC Act:**
CE – Critically Endangered	E1 – endangered species (Part 1, Schedule 1)
EN – Endangered	E2 – endangered population (Part 2, Schedule 1)
VU – Vulnerable	E4 – presumed extinct (Part 4, Schedule 1)
	E4A – critically endangered
	V – vulnerable (Part 1, Schedule 2)

Table A.3 Vertebrate fauna recorded from the study area (current assessment)

Scientific name	Common name	Commonwealth status	NSW status
Birds			
Trichoglossus haematodus	Rainbow Lorikeet	-	-
Sturnus tristis	Common Myna	-	-
Cracticus tibicen	Australian Magpie	-	-
Platycercus elegans elegans x adscitus eximius	Crimson/Eastern Rosella	-	-
Grallina cyanoleuca	Magpie-lark	-	-
Artamus personatus	Masked Woodswallow	-	-
Corvus coronoides	Australian Raven	-	-
Threskiornis spinicollis	Straw-necked Ibis	-	-
Eolophus roseicapillus	Galah	-	-
Manorina melanocephala	Noisy Miner	-	-
Cacatua galerita	Sulphur-crested Cockatoo	-	-
Aviceda subcristata	Pacific Baza	-	-
Haliastur sphenurus	Whistling Kite	-	-
Rhipidura leucophrys	Willie Wagtail	-	-
Anthochaera chrysoptera	Little Wattlebird	-	-
Hirundo neoxena	Welcome Swallow	-	-
Frogs			
Litoria fallax	Eastern Dwarf Tree Frog	-	-

Threatened fauna species

The following table includes a list of the threatened fauna species that have potential to occur within the study area. The list is based on database searches outlined in Section 3.1.

Fauna likelihood of occurrence (LOO) table

Conservation status – EPBC Act:	**Conservation status – BC Act:**
CR – Critically Endangered EN – Endangered VU – Vulnerable	E1 – endangered species (Part 1, Schedule 1) E2 – endangered population (Part 2, Schedule 1) E4 – presumed extinct (Part 4, Schedule 1) E4A – critically endangered V1 – vulnerable (Part 1, Schedule 2)
Most recent record # species predicted to occur by the PMST (not recorded on other databases). ## species predicted to occur based on natural distributional range and suitable habitat despite lack of records in the databases searched. 2017 recorded during current survey.	

Examples of criteria for determining the likelihood of occurrence for threatened biota as a guide for writing the rationale for likelihood have been listed below.

Likelihood of occurrence	Potential criteria
High	• Species recorded in study area during current or previous assessment/s. • Aquatic species recorded from connected waterbodies in close proximity to the study area during current or previous assessment/s. • Sufficient good quality habitat is present in study area or in connected waterbodies in close proximity to the study area (aquatic species). • Study area is within species natural distributional range (if known). • Species has been recorded within <5 or 10 kilometres > or from the relevant catchment/basin.
Medium	• Records of terrestrial species within <5 or 10 kilometres > of the study area or of aquatic species in the relevant basin/neighbouring basin. • Habitat limited in its capacity to support the species due to extent, quality, or isolation.
Low	• No records within <5 or 10 kilometres > of the study area or for aquatic species, the relevant basin/neighbouring basin. • Marginal habitat present (low quality & extent). • Substantial loss of habitat since any previous record(s).
Negligible	• Habitat not present in study area • Habitat for aquatic species not present in connected waterbodies in close proximity to the study area. • Habitat present but sufficient targeted survey has been conducted at an optimal time of year and species wasn't recorded.
Transient/ Nomadic	• Migratory or nomadic fauna species/individuals that may occur in the study area from time to time, but are not considered resident.

Table A.4 Threatened fauna species recorded, or predicted to occur, within 10 kilometres of the study area

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
Mammals							
Arctocephalus tropicalis	Subantarctic Fur-seal	EN		2012	Negligible	Oceanic species.	Most subantarctic fur-seals spend much of their time at sea during winter and spring. These fur-seals are opportunistic pelagic foragers that generally feed in areas of high productivity, including oceanographic fronts; their diet consists of various fish, cephalopods, and crustaceans.
Cercartetus nanus	Eastern Pygmy-possum		V	2015	Low	Suitable habitat features are not present within the study area.	Inhabits rainforest through to sclerophyll forest and tree heath. Banksias and myrtaceous shrubs and trees are a favoured food source. Soft fruits are eaten when flowers are unavailable and it also feeds on insects. Will often nest in tree hollows, but can also construct its own nest. Individuals will use a number of different hollows and an individual has been recorded using up to 9 nest sites within a 0.5 ha area over a 5 month period.
Chalinolobus dwyeri	Large-eared Pied Bat	VU	V	2014#	Moderate	Breeds in caves so the study area may only be used for foraging. Suitable breeding habitat features are not present within the study area. Foraging habitat is present. As limited vegetation is proposed for removal and no hollow	Primarily found in dry sclerophyll forests and woodlands, but also found in rainforest fringes and subalpine woodlands. Forages on small, flying insects below the forest canopy. Roosts in colonies of between three and 80 in caves, Fairy Martin nests and mines, and beneath rock overhangs, but

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
						bearing trees will be removed, the potential impacts to this species is considered low.	usually less than 10 individuals.
Dasyurus maculatus	Spotted-tailed Quoll	EN	V	2010#	Moderate	Suitable habitat features are not present within the study area.	Uses a range of habitats including sclerophyll forests and woodlands, coastal heathlands and rainforests. Occasional sightings have been made in open country, grazing lands, rocky outcrops and other treeless areas. Habitat requirements include suitable den sites, including hollow logs, rock crevices and caves, an abundance of food and an area of intact vegetation in which to forage.
Dugong dugong	Dugong	M	E1	1989	Negligible	Oceanic species.	Major concentrations of Dugongs occur in wide shallow protected bays, wide shallow mangrove channels and in the lee of large inshore islands. Will also occupy deeper waters if their sea grass food is available. Shallow waters such as tidal sandbanks and estuaries have been reported as sites for calving.
Falsistrellus tasmaniensis	Eastern False Pipistrelle		V	2008	Moderate	The study area provides foraging habitat within forested areas around Coomonderry swamp and roosting habitat in the form of hollow bearing trees. With numerous records in the locality, it is highly likely that this species	Prefers wet high-altitude sclerophyll and coastal mallee habitat, preferring wet forests with a dense understorey but being found in open forests at lower altitudes. Roosts in tree hollows and sometimes in buildings in colonies of between 3 and 80 individuals. Often change roosts every night. Forages for

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
						may occur in the study area. As limited vegetation is proposed for removal and no hollow bearing trees will be removed, the potential impacts to this species is considered low.	beetles, bugs and moths below or near the canopy in forests with an open structure, or along trails between roosting and foraging sites.
Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)	VU	V	#	Moderate	Open forest habitat and sandy friable soils occur in patches throughout the study area and within the vegetation surrounding Coomonderry Swamp in the south of the study area. No evidence in the form of conical holes were observed during the field investigation however it is considered moderately likely that this species may occur within vegetation occurring in the study area particularly in the south of the study area. The area of highest quality habitat for this species occurs in the Freshwater Wetlands on Coastal Floodplains associated with Coomonderry Swamp. As Coomonderry Swamp and associated vegetation is zoned E2 this area will not be impacted directly and the	This species prefers sandy soils with scrubby vegetation and/or areas with low ground cover that are burn from time to time. A mosaic of post fire vegetation is important for this species.

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
						potential impacts to this species are considered low.	
Megaptera novaeangliae	Humpback Whale	VU, M	V	2006	Negligible	Oceanic species.	A marine species that has a worldwide distribution. It has a circumpolar distribution in the Southern Hemisphere .
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat		V	2016	Moderate	The study area provides foraging habitat within forested areas and roosting habitat in the form of hollow bearing trees. As limited vegetation is proposed for removal and no hollow bearing trees will be removed, the potential impacts to this species is considered low.	Forms large maternity roosts (up to 100,000 individuals) in caves and mines in spring and summer. Individuals may fly several hundred kilometres to their wintering sites, where they roost in caves, culverts, buildings, and bridges. They occur in a broad range of habitats including rainforest, wet and dry sclerophyll forest, paperbark forest and open grasslands.
Mormopterus norfolkensis	Eastern Freetail-bat		V	2008	Moderate	The study area provides foraging habitat within forested areas and roosting habitat in the form of hollow bearing trees. As limited vegetation is proposed for removal and no hollow bearing trees will be removed, the potential impacts to this species is considered low.	Most records are from dry eucalypt forests and woodland. Individuals tend to forage in natural and artificial openings in forests, although it has also been caught foraging low over a rocky river within rainforest and wet sclerophyll forest habitats. The species generally roosts in hollow spouts of large mature eucalypts (including paddock trees), although individuals have been recorded roosting in the roof of a hut, in wall cavities, and under metal caps of telegraph poles.
Myotis macropus	Southern Myotis		V	2014	Moderate	The study area provides foraging habitat in the form of dams within the study area and roosting	Roosts in caves, mines or tunnels, under bridges, in buildings, tree hollows, and even in dense foliage. Colonies occur close to

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
						habitat in the form of hollow bearing trees. As limited vegetation is proposed for removal and no hollow bearing trees will be removed, the potential impacts to this species is considered low.	water bodies, ranging from rainforest streams to large lakes and reservoirs.
Petauroides volans	Greater Glider	VU	E2	2006#	Moderate	With recent records to the east of the study area within vegetation that connects to the study area it is likely that Greater Glider could occur in the study area on occasion. Therefore there is a moderate likelihood that this species occurs in the study area. As the majority of the forested areas in the study area will be retained potential impacts to this species is considered low.	Inhabits a variety of eucalypt forests and woodlands. Presence and density of Greater Gliders is related to soil fertility, eucalypt tree species, disturbance history and density of suitable tree hollows. Feeds exclusively on eucalypt leaves, buds, flowers and mistletoe.
Petaurus australis	Yellow-bellied Glider		V	2011	Moderate	As the study area is connected to forests to the east that contain suitable habitat for this species it is likely that individuals may move through the study area on occasion. Therefore there is a moderate likelihood that this species occurs in the study area. As the majority of the forested	Restricted to tall native forests in regions of high rainfall along the coast of NSW. Preferred habitats are productive, tall open sclerophyll forests where mature trees provide shelter and nesting hollows. Critical elements of habitat include sap-site trees, winter flowering eucalypts, mature trees suitable for den sites and a mosaic of different forest types.

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
						areas in the study area will be retained potential impacts to this species is considered low.	
Phascolarctos cinereus	Koala	VU	V	2017#	Low	Results from the field investigation identified no evidence of Koala presence (scats or scratch marks). Within the locality of the study area, Koala's have recently been recorded west of the escarpment in the Mount Kembla area, however has rarely been recorded in the Illawarra floodplain and not in recent times.	Koalas feed almost exclusively on eucalypt foliage, and their preferences vary regionally. Primary feed trees include *Eucalyptus robusta, E. tereticornis, E. punctata, E. haemostoma* and *E. signata*. They are solitary with varying home ranges.
Potorous tridactylus	Long-nosed Potoroo	VU	V	2016#	Moderate	Suitable habitat occurs in the vegetation surrounding and connected to Coomonderry Swamp in the south of the study area. Often digs small holes in the ground in a similar way to bandicoots. No evidence in the form of diggings was observed during the field investigation however it is considered moderately likely that this species may occur within the Freshwater Wetlands on Coastal Floodplains associated with Coomonderry Swamp. As Coomonderry Swamp	Usually found within 50 km of the coast. Inhabits coastal heath and wet and dry sclerophyll forests. Generally found in areas with rainfall greater than 760 mm. Requires relatively thick ground cover where the soil is light and sandy.

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
						and associated vegetation is zoned E2 this area will not be impacted directly and the potential impacts to this species are considered low.	
Pseudomys novaehollandiae	New Holland Mouse	VU		#	Low	Suitable habitat features are not present within the study area.	The New Holland Mouse is known to inhabit open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes. It lives predominantly in burrows shared with other individuals.
Pteropus poliocephalus	Grey-headed Flying-fox	VU	V	2017#	Moderate	Flowering Eucalyptus trees provide foraging habitat for this species. With numerous recent records surrounding the study area it is highly likely that this species occurs in the study area on occasion to feed. As limited vegetation is proposed for removal the potential impacts to this species is considered low.	This species is a canopy-feeding frugivore and nectarivore of rainforests, open forests, woodlands, melaleuca swamps and banksia woodlands. Roosts in large colonies, commonly in dense riparian vegetation.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat		V	2007	Moderate	The study area provides roost habitat in the form of hollow bearing trees and the species is known to foraging in a wide range of habitats with and without trees. The species has been recorded in the locality on a number of occasions previously, therefore	Found throughout NSW in habitats including wet and dry sclerophyll forest, open woodland, acacia shrubland, mallee, grasslands and desert. They roost in tree hollows in colonies and have also been observed roosting in animal burrows, abandoned Sugar Glider nests, cracks in dry clay, hanging from buildings and under slabs

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
						with foraging and roosting habitat present is highly likely that Yellow-bellied Sheathtail-bat occur in the study area. As limited vegetation is proposed for removal and no hollow bearing trees will be removed, the potential impacts to this species is considered low.	of rock. Forages for insects above the canopy in forests.
Scoteanax rueppellii	Greater Broad-nosed Bat		V	2013	Moderate	The study area provides roost habitat in the form of hollow bearing trees and riparian corridors surrounding the study area provide foraging habitat for this species. With many records in the locality to the north of the study area it is it is highly likely that this species may occur in the study area. As no hollow bearing trees will be removed, the potential impacts to this species is considered low.	Occurs in woodland and rainforest, preferring open habitats or openings in wetter forests. Often hunts along creeks or river corridors. Preys upon beetles and other large, flying insects, other bats and spiders. Roosts in hollow tree trunks and branches.
Birds							
Anthochaera phrygia	Regent Honeyeater	CE	E4A	1993#	Low	Suitable habitat features are not present within the study area.	Regent Honeyeaters are semi-nomadic, occurring in temperate eucalypt woodlands and open forests. Most records are from box-ironbark eucalypt forest associations and wet lowland coastal forests. Nectar and fruit from mistletoes are also eaten. This

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
							species usually nest in tall mature eucalypts and sheoaks.
Ardenna carneipes	Flesh-footed Shearwater	M	V	2009#	Low	Suitable habitat features are not present within the study area.	The Flesh-footed Shearwater is an oceanic species usually found beyond the edge of the continental shelf.
Artamus cyanopterus cyanopterus	Dusky Woodswallow		V	2007	Moderate	Potential foraging habitat for this species occurs in the open woodland areas. It is considered moderate likelihood that this species occurs in the study area. As the majority of woodland areas are proposed to be retained the potential impacts to this species area considered low.	Primarily inhabits dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. It has also been recorded in shrublands, heathlands and very occasionally in moist forest or rainforest. Also found in farmland, usually at the edges of forest or woodland.
Botaurus poiciloptilus	Australasian Bittern	EN	E1	2015#	High	Wetland area within the northern edge of Coomonderry Swamp in the south of the study area contains suitable wetland habitat for this species. Recent records occur to the north of Coomonderry Swamp within 600 metres of the study area. This species has a high likelihood of occurring in the Freshwater Wetlands on Coastal Floodplains associated with Coomonderry Swamp. As Coomonderry Swamp	The Australasian Bittern is often found in terrestrial and estuarine wetlands, generally where there is permanent water with tall, dense vegetation including *Typha sp.* and *Eleoacharis sp.*

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
						and associated vegetation is zoned E2 this area will not be impacted directly and the potential impacts to this species are considered low.	
Burhinus grallarius	Bush Stone-curlew		E1	1998	Low	Suitable habitat features are not present within the study area	The Bush Stone-curlew occurs in lightly timbered open forest and woodland, or partly cleared farmland with remnants of woodland, with a ground cover of short sparse grass and few or no shrubs where fallen branches and leaf litter are present.
Calidris alba	Sanderling	M	V	2011	Low	Suitable habitat features are not present within the study area	Occurs on the coast mostly on open sand beaches exposed to open sea-swells.
Calidris canutus	Red Knot	EN, M		2015#	Low	Suitable habitat features are not present within the study area	Typically located within intertidal mudflats, sandflats and sandy beaches of sheltered coasts. Occasionally found on sandy open beaches or shallow pools, or in saline wetlands close to the coast.
Calidris ferruginea	Curlew Sandpiper	CE, M	E1	2015#	Low	Suitable habitat features are not present within the study area	Inhabits sheltered intertidal mudflats. Also non-tidal swamps, lagoons and lakes near the coast. Infrequently recorded inland.
Calidris tenuirostris	Great Knot	CE, M	V	2014	Low	Suitable habitat features are not present within the study area	Mainly found on intertidal mudflats, sandflats and sandy beaches.
Callocephalon fimbriatum	Gang-gang Cockatoo		V	2012	Low	Suitable habitat features are not present within the study area	In summer, occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. Also occurs occasionally in temperate or regenerating forest. In winter,

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
							occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. It requires tree hollows in which to breed.
Calyptorhynchus lathami	Glossy Black-Cockatoo		V	2015		Suitable habitat features in the form of *Allocasuarina* were identified on site, inspection revealed no evidence (chewed fruit) surrounding the base of any *Allocasuarina*. Species may occur on site on occasion to forage but would provide marginal foraging habitat in relation to the landscape.	Inhabits forest with low nutrients, characteristically with key *Allocasuarina* species. Tends to prefer drier forest types. Often confined to remnant patches in hills and gullies. Breeds in hollows stumps or limbs, either living or dead.
Charadrius leschenaultii	Greater Sand-plover	VU, M	V	2011	Low	Suitable habitat features are not present within the study area	Entirely coastal in NSW, foraging on intertidal sand and mudflats in estuaries and roosting during high tide on sandy beaches or rocky shores. Individuals have been recorded on inshore reefs, rock platforms, small rocky islands and sand cays on coral reefs, within Australia. Occasional sightings have also occurred on near-coast saltlakes, brackish swamps, shallow freshwater wetlands and grassed paddocks.
Charadrius mongolus	Lesser Sand-plover	EN, M	V	2011	Low	Suitable habitat features are not present within the study area	In Australia, the species is known to favour coastal environs including beaches, mudflats

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
							and mangroves. Within NSW, individuals have been observed on intertidal sand and mudflats in estuaries or roosting on sandy beaches or rocky shores at high tide.
Circus assimilis	Spotted Harrier		V	2012		Spotted Harrier has a moderate likelihood of occurrence within the study area as the species may forage within the locality. No evidence of nests were identified on site, as the majority of woodland areas are proposed to be retained the potential impacts to this species area considered low.	The Spotted Harrier is found throughout Australia but rarely in densely forested and wooded habitat of the escarpment and coast. Preferred habitat consists of open and wooded country with grassland nearby for hunting. Habitat types include open grasslands, acacia and mallee remnants, spinifex, open shrublands, saltbush, very open woodlands, crops and similar low vegetation. The Spotted Harrier is more common in drier inland areas, nomadic part migratory and dispersive, with movements linked to the abundance of prey species. Nesting occurs in open or remnant woodland and unlike other harriers, the Spotted Harrier nests in trees.
Daphoenositta chrysoptera	Varied Sittella		V	2005		Suitable for this species occurs in the small clusters of rough barked trees in the study area. As Varied Sittella is found in eucalypt woodlands and forests throughout their range and with records for this species within the locality there is a moderate	The Varied Sittella is a sedentary species which inhabits a wide variety of dry eucalypt forests and woodlands, usually with either shrubby understorey or grassy ground cover or both, in all climatic zones of Australia. Usually inhabits areas with rough-barked trees, such as stringybarks or ironbarks, but also in mallee and acacia woodlands,

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
						likleyhood that this species occurs in the study area. As the majority of woodland areas are proposed to be retained the potential impacts to this species area considered low.	paperbarks or mature Eucalypts. It builds a cup-shaped nest of plant fibres and cobweb in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.
Dasyornis brachypterus	Eastern Bristlebird	EN	E1	2015#	Low	Suitable habitat features are not present within the study area	Found in coastal woodlands, dense scrub and heathlands, particularly where it borders taller woodlands.
Diomedea epomophora	Southern Royal Albatros	VU, M		2008	Low	Suitable habitat features are not present within the study area	The Royal Albatross is moderately common throughout the year in offshore waters of southern Australia, mostly off southeastern NSW, Victoria and Tasmania.
Diomedea exulans	Wandering Albatross	VU, M	E1	2009	Low	Suitable habitat features are not present within the study area	A marine, pelagic and aerial species. Versatile feeders in pelagic and shelf waters. Breeds on subantarctic and antarctic islands.
Ephippiorhynchus asiaticus	Black-necked Stork		E1	1974	Moderate	Black-necked Stork has been historically been recorded in Coomonderry Swamp. Suitable habitat for this species within the study area only occurs in the Freshwater Wetlands on Coastal Floodplains on the south west of the study area associated within Coomonderry Swamp. It is considered moderately likley that this species occurs in the study area. As Coomonderry Swamp	Found in swamps, mangroves and mudflats. Can also occur in dry floodplains and irrigated lands and occasionally forages in open grassy woodland. Nests in live or dead trees usually near water.

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
						and associated vegetation is zoned E2 this area will not be impacted directly and the potential impacts to this species are considered low.	
Epthianura albifrons	White-fronted Chat		V	2015		This species has been recorded in Coomonderry Swamp previously and with numerous records around the mouth of the Shoalhaven river. Species is known to forage within salt marsh and occurs in damp open habitats along the coast. It is considered moderately likely that this species would occur in the Freshwater Wetlands on Coastal Floodplains associated with Coomonderry Swamp that extends into the study area. As Coomonderry Swamp and associated vegetation is zoned E2 this area will not be impacted directly and the potential impacts to this species are considered low.	The White-fronted Chat is found in damp open habitats, particularly wetlands containing saltmarsh areas that are bordered by open grasslands or lightly timbered lands. Along the coastline, they are found in estuarine and marshy grounds with vegetation less than 1 m tall. The species is also observed in open grasslands and sometimes in low shrubs bordering wetland areas.
Esacus magnirostris	Beach Stone-curlew		E4A	2007	Low	Suitable habitat features are not present within the study area	Beach Stone-curlews are found exclusively along the coast, on a wide range of beaches, islands, reefs and in estuaries, and may often be seen at the edges of or near

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
							mangroves. They forage in the intertidal zone of beaches and estuaries, on islands, flats, banks and spits of sand, mud, gravel or rock, and among mangroves. Beach Stone-curlews breed above the littoral zone, at the backs of beaches, or on sandbanks and islands, among low vegetation of grass, scattered shrubs or low trees; also among open mangroves.
Glossopsitta pusilla	Little Lorikeet		V	2010	Moderate	It is considered moderately likely that this species may occur in the study area. Recent records for the species occur in the locality within close proximity of the study area. The mature trees in the Derived Swamp Oak Forest, River-Flat Eucalypt Forest, Red Gum Grassy Woodland, Illawarra Escarpment Blackbutt Forest and Illawarra Gully Wet Forest provide foraging habitat for this species and hollow bearing trees provide small hollows as breeding habitat. As no hollow bearing trees are proposed to be removed and the extent of native vegetation removal is limited potential	Mostly occur in dry, open eucalypt forests and woodlands. They feed primarily on nectar and pollen in the tree canopy. Nest hollows are located at heights of between 2 m and 15 m, mostly in living, smooth-barked eucalypts.

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
						impacts to this species area considered low.	
Haematopus fuliginosus	Sooty Oystercatcher		V	2014	Low	Suitable habitat features are not present within the study area	The Sooty Oystercatcher is found on undisturbed tidal rocks on ocean shores and islands. Occasionally it is observed on sandspits and mudflats. It forages on exposed rock or coral at low tide for limpets and mussels. The Sooty Oystercatcher breeds in spring and summer almost exclusively offshore or on isolated promontories
Haematopus longirostris	Pied Oystercatcher		E1	2015	Low	Suitable habitat features are not present within the study area	An intertidal forager found on undisturbed sandy beaches and spits, tidal mudflats and estuaries. The Pied Oystercatcher is restricted to the littoral zone of beaches and estuaries, nesting on the ground above the tideline. A pair will re-nest in the same spot each year, rarely shifting their territory. Occasionally the Pied Oystercatcher is found in paddocks near the coast.
Haliaeetus leucogaster	White-bellied Sea-Eagle		V	2015	Low	With numerous recent records for this species recorded around the study area it is moderately likely that an individual will perch or pass through the study area. There were no nests observed during the site inspection so this	A migratory species that is generally sedentary in Australia, although immature individuals and some adults are dispersive. Found in terrestrial and coastal wetlands; favouring deep freshwater swamps, lakes and reservoirs; shallow coastal lagoons and saltmarshes. It hunts over open terrestrial

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
						species may use trees/stags in the study area to perch. Potential impacts to this species are considered low.	habitats. Feeds on birds, reptiles, fish, mammals, crustaceans and carrion. Roosts and makes nest in trees.
Hieraaetus morphnoides	Little Eagle		V	2012	Low	A number of records for this species occur around the study area and the species is known to use riparian woodlands. No nests were observed during field surveys. It there is moderate likelihood that individuals may occur on occasion in the Freshwater Wetlands on Coastal Floodplains associated with Coomonderry Swamp. As Coomonderry Swamp and associated vegetation is zoned E2 this area will not be impacted directly and the potential impacts to this species are considered low.	The Little Eagle is most abundant in lightly timbered areas with open areas nearby providing an abundance of prey species. It has often been recorded foraging in grasslands, crops, treeless dune fields, and recently logged areas. The Little Eagle nests in tall living trees within farmland, woodland and forests.
Ixobrychus flavicollis	Black Bittern		V	1990	Low	As this species inhabits terrestrial and estuarine wetlands such as flooded grasslands, forests, and has been recorded previously in the locality there is moderate potential that is would occur in the Freshwater Wetlands on Coastal Floodplains associated	The Black Bittern inhabits terrestrial and estuarine wetlands such as flooded grasslands, forests, woodlands, rainforests and mangroves with permanent water and dense waterside vegetation. It typically roosts on the ground or in trees during the day and forages at night on frogs, reptiles, fish and invertebrates. The breeding season

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
						with Coomonderry Swamp. As Coomonderry Swamp and associated vegetation is zoned E2 this area will not be impacted directly and the potential impacts to this species are considered low.	extends from December to March. Nests are constructed of reeds and sticks in branches overhanging the water.
Lathamus discolor	Swift Parrot	CE	E1	2014#	Moderate	It is considered moderately likely that this species may occur in the study area. Recent records for the species occur in the locality within close proximity of the study area. The mature trees in the Derived Swamp Oak Forest, River-Flat Eucalypt Forest, Red Gum Grassy Woodland, Illawarra Escarpment Blackbutt Forest and Illawarra Gully Wet Forest provide foraging habitat for this species and hollow bearing trees provide small hollows as breeding habitat. As no hollow bearing trees are proposed to be removed and the extent of native vegetation removal is limited potential impacts to this species area considered low.	The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen and associated insects. The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Commonly used lerp infested trees include Grey Box *E. microcarpa*, Grey Box *E. moluccana* and Blackbutt *E. pilularis*. This species is migratory, breeding in Tasmania and also nomadic, moving about in response to changing food availability.
Limicola falcinellus	Broad-billed Sandpiper	M	V	2004	Low	Suitable habitat features are not present within the study area	Occurs in sheltered parts of coasts, such as estuaries, harbours, embayments and

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
							lagoons, which have shell or sandbanks nearby.
Limosa lapponica baueri	Bar-tailed Godwit	VU		#	Low	Suitable habitat features are not present within the study area	The bar-tailed godwit (western Alaskan) occurs mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It has also been recorded in coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats.
Limosa lapponica menzbieri	Bar-tailed Godwit	CE		#	Low	Suitable habitat features are not present within the study area	The bar-tailed godwit (northern Siberian) occurs mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It has also been recorded in coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats.
Limosa limosa	Black-tailed Godwit	M	V	2002	Low	Suitable habitat features are not present within the study area	The Black-tailed Godwit is a migratory wading bird that breeds in Mongolia and Eastern Siberia and flies to Australia for the southern summer, arriving in August and leaving in March. In NSW, it is most frequently recorded at Kooragang Island

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
							(Hunter River estuary), with occasional records elsewhere along the coast, and inland.
Lophoictinia isura	Square-tailed Kite		V	2015	Low	Suitable habitat features are not present within the study area	Typically inhabits coastal forested and wooded lands of tropical and temperate Australia. In NSW it is often associated with ridge and gully forests dominated by *Eucalyptus longifolia*, *Corymbia maculata, E. elata*, or *E. smithii*. Individuals appear to occupy large hunting ranges of more than 100 km2. They require large living trees for breeding, particularly near water with surrounding woodland/forest close by for foraging habitat. Nest sites are generally located along or near watercourses, in a tree fork or on large horizontal limbs.
Macronectes giganteus	Southern Giant Petrel	EN, M	E1	2009	Low	Suitable habitat features are not present within the study area	The Southern Giant-Petrel is a marine species found throughout the Antarctic to subtropical waters occasionally venturing to inshore waters.
Macronectes halli	Northern Giant-Petrel	VU, M	V	2007	Low	Suitable habitat features are not present within the study area	Marine, pelagic species found mainly in subantarctic waters.
Neophema chrysogaster	Orange-bellied Parrot	CE, M	E4A	1986#	Low	Suitable habitat features are not present within the study area	Adult birds depart Tasmania for the mainland in February. The first adults begin leaving the mainland for Tasmania in September with the last birds having

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
							departed by November. It is a coastal species inhabiting saltmarshes, sedgeplains, coastal dunes, pastures, shrublands and moorlands, generally within 10 km of the coast. Critical winter habitat for the species includes natural saltmarshes dominated by *Sarcocornia quinqueflora* (Beaded Glasswort) and *Sclerostegia arbuscula* (Shrubby Glasswort), as well as the associated grassy or weedy pastures.
Ninox connivens	Barking Owl		V	1996	Moderate	No large hollows suitable for large forest owls occur in the study area. Good habitat for the species occurs in forest to the east of the study area, therefore only foraging habitat for this species occurs in the study area. It is considered moderately likely that this species may occur in the study area on occasion and potential impacts to this species is considered low.	Generally found in open forests, woodlands, swamp woodlands, farmlands and dense scrub. Can also be found in the foothills and timber along watercourses in otherwise open country. Territories are typically 2000 ha in NSW habitats. Hunts small arboreal mammals or birds and terrestrial mammals when tree hollows are absent.
Ninox strenua	Powerful Owl		V	2015	Moderate	No large hollows suitable for large forest owls occur in the study area. Good habitat for the species occurs in forest to the east of the study area, therefore only	The Powerful Owl occupies wet and dry eucalypt forests and rainforests. It may inhabit both un-logged and lightly logged forests as well as undisturbed forests where it usually roosts on the limbs of dense trees

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
						foraging habitat for this species occurs in the study area. It is considered moderately likely that this species may occur in the study area on occasion and potential impacts to this species is considered low.	in gully areas. Large mature trees with hollows at least 0.5 m deep are required for nesting. Nest trees for this species are usually emergent with a diameter at breast height of at least 100 cm. It has a large home range of between 450 and 1450 ha.
Numenius madagascariensis	Eastern Curlew	CE, M		2015#	Low	Suitable habitat features are not present within the study area	Occurs in sheltered coasts, especially estuaries, embayments, harbours, inlets and coastal lagoons with large intertidal mudflats or sandflats often with beds of seagrass.
Oxyura australis	Blue-billed Duck		V	1985	Moderate	Wetland area within the northern edge of Coomonderry Swamp in the south of the study area contains suitable wetland habitat for this species. This species has a moderate likelihood of occurring in the Freshwater Wetlands on Coastal Floodplains associated with Coomonderry Swamp. As Coomonderry Swamp and associated vegetation is zoned E2 this area will not be impacted directly and the potential impacts to this species are considered low.	Birds disperse during the breeding season to deep swamps up to 300 km away. It is generally only seen in coastal areas during summer. Prefers large permanent wetlands, feeding on the bottom of swaps.
Pachycephala olivacea	Olive Whistler		V	1993	Low	Suitable habitat features are not present within the study area	The Olive Whistler inhabits the wet forests on the ranges of the east coast. It is found in

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
							a range of habitats including alpine thickets, wetter rainforest/woodlands, riparian vegetation and heaths.
Pachyptila turtur subantarctica	Fairy Prion (southern)	VU		#	Low	Suitable habitat features are not present within the study area	Fairy Prions (including other subspecies) are often beachcast on the south-eastern coast of Australia, and are commonly seen offshore over the continental shelf and over pelagic waters.
Pandion cristatus	Osprey	M	V	2013#	Low	Suitable habitat features are not present within the study area	Found in coastal waters, inlets, estuaries and offshore islands. It is water-dependent, hunting for fish in clear, open water. The Osprey occurs in terrestrial wetlands, coastal lands and offshore islands. It is a predominantly coastal species, generally using marine cliffs as nesting and roosting sites. Nests can also be made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.
Petroica boodang	Scarlet Robin		V	2002	Low	Suitable habitat features are not present within the study area	The Scarlet Robin inhabits dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. During autumn and winter it moves to more open and cleared areas. The Scarlet Robin forages amongst logs and woody debris for insects. The nest is an open cup of

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
							plant fibres and cobwebs, sited in the fork of a tree.
Pezoporus wallicus wallicus	Eastern Ground Parrot		V	2016	Low	Suitable habitat features are not present within the study area	The Eastern Ground Parrot is found in high rainfall, high density, low coastal heathlands and Sedgelands. Feeds mostly on seeds from a large range of plant species.
Procelsterna cerulea	Grey Ternlet		V	2008	Low	Suitable habitat features are not present within the study area	Occurs on tropical or subtropical islands on rock stacks with cliffs where it roosts on cliffs. Usually found in nearshore waters. Feeds on small fish, crustaceans and squid taken from the water's surface.
Pterodroma leucoptera leucoptera	Gould's Petrel	EN, M	V	2001	Low	Suitable habitat features are not present within the study area	The Gould's Petrel is a marine species which only comes to shore to breed. It breeds exclusively on Cabbage Tree Island, 1.4 km offshore from Port Stephens and on nearby Boondelbah Island.
Ptilinopus superbus	Superb Fruit-Dove		V	2009	Low	Suitable habitat features are not present within the study area	The Superb Fruit Dove is found in rainforests, closed forests (including mesophyll vine forests) and sometimes in eucalypt and acacia woodlands with fruit-bearing trees. It forages in the canopy of fruiting trees such as figs and palms.
Puffinus assimilis	Little Shearwater		V	2002	Low	Suitable habitat features are not present within the study area	The Little Shearwater is a pelagic marine species found in subantarctic and subtropical (occasionally tropical) waters and

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
							often seen in continental shelf waters. It breeds on subtropical and subantarctic islands.
Rostratula australis	Australian Painted Snipe	EN	E1	#		Wetland area within the northern edge of Coomonderry Swamp in the south of the study area contains suitable wetland habitat for this species. This species has a high likleyhood of occurring in the Freshwater Wetlands on Coastal Floodplains associated with Coomonderry Swamp. As Coomonderry Swamp and associated vegetation is zoned E2 this area will not be impacted directly and the potential impacts to this species are considered low.	Usually found in shallow inland wetlands including farm dams, lakes, rice crops, swamps and waterlogged grassland. They prefer freshwater wetlands, but have been recorded in brackish waters. Forages on mud-flats and in shallow water. Feeds on worms, molluscs, insects and some plant-matter.
Stagonopleura guttata	Diamond Firetail		V	2016	Moderate	As there are historical records in the locality and this species is found in riparian areas and wooded farmland it is likely that the species may move through the study area for foraging purposes. It is considered moderately likely that they may occur in the study area. Diamond Firetail is likely to forage in the	The Diamond Firetail is widely distributed, found in a range of habitat types including open eucalypt forest, mallee and acacia scrubs. Often occur in vegetation along watercourses. Feeds exclusively on the ground on ripe grass and herb seeds, green leaves and insects.

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
						open understory of the woodland parts of the study area and the majority of woodland areas are proposed to be retained the potential impacts to this species area considered low.	
Sternula albifrons	Little Tern	M	E1	2015	Low	Suitable habitat features are not present within the study area	The Little Tern favours sheltered coasts, harbours, bays, lakes, inlets, estuaries, coastal lagoons and ocean beaches especially with sand-spits and sand islets. It forages over shallow waters close inshore or over sandbars and reefs.
Thalassarche cauta	Shy Albatross	VU, M	V	2010	Low	Suitable habitat features are not present within the study area	The Shy Albatross is a marine pelagic species inhabiting sub-Antarctic and subtropical waters, spending the majority of their time at sea. Occasionally it is observed in continental shelf waters in bays and harbours.
Thalassarche chlororhynchos	Yellow-nosed Albatross	VU, M		2009	Low	Suitable habitat features are not present within the study area	A marine pelagic species which visits the south-east coast of Australia.
Thalassarche melanophris	Black-browed Albatross	VU, M	V	2010	Low	Suitable habitat features are not present within the study area	Inhabits Antarctic, subantarctic and subtropical waters. Although generally pelagic the species also occurs on the continental shelf and can be seen from land.
Thinornis rubricollis	Hooded Plover	VU	E4A	2001	Low	Suitable habitat features are not present within the study area	In south-eastern Australia Hooded Plovers prefer broad sandy beaches, with a wide

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
							wave-wash zone for feeding, beachcast seaweed, and sparsely vegetated sand-dunes for shelter and nesting. Hooded Plovers are also found on tidal bays and estuaries, rock platforms, rocky or sand-covered reefs, near-coastal saline and freshwater lakes and lagoons, often with saltmarsh.
Tyto novaehollandiae	Masked Owl		V	1980	Moderate	No large hollows suitable for large forest owls occur in the study area. Good habitat for the species occurs in forest to the east of the study area, therefore only foraging habitat for this species occurs in the study area. It is considered moderately likely that this species may occur in the study area on occasion and potential impacts to this species is considered low.	The Masked Owl is found in range of wooded habitats that provide tall or dense mature trees with hollows suitable for nesting and roosting. It is mostly seen in open forests and woodlands adjacent to cleared lands. Prey includes hollow-dependent arboreal marsupials and terrestrial mammals.
Tyto tenebricosa	Sooty Owl		V	2008	Low	Suitable habitat features are not present within the study area	The Sooty Owl is often found in tall old-growth forests, including temperate and subtropical rainforests. It is mostly found on escarpments with a mean altitude <500 m. This species nests and roosts in hollows of emergent trees, mainly eucalypts often located in gullies.

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
Xenus cinereus	Terek Sandpiper	M	V	2011	Low	Suitable habitat features are not present within the study area	Mainly found on saline intertidal mudflats in sheltered estuaries, embayments, harbours and lagoons.
Frogs							
Heleioporus australiacus	Giant Burrowing Frog	VU	V	#	Low	Suitable habitat features are not present within the study area	Prefers hanging swamps on sandstone shelves adjacent to perennial non-flooding creeks. Can also occur within shale outcrops within sandstone formations. Known from wet and dry forests and montane woodland in the southern part range. Individuals can be found around sandy creek banks or foraging along ridge-tops during or directly after heavy rain. Males often call from burrows located in sandy banks next to water. Spends the majority of its time in non-breeding habitat 20-250m from breeding sites.
Litoria aurea	Green and Golden Bell Frog	VU	E1	2015#	High	The local population for this species occurring in Coomonderry Swamp which is an important population. This population have the potential to utilise the dams within the study area during times of peak movement. However, the dispersal habitat is located 300 metres north of the Swamp with no interconnecting drainage lines	Most existing locations for the species occur as small, coastal, or near coastal populations. The species is found in marshes, dams and stream sides, particularly those containing bullrushes or spikerushes. Preferred habitat contains water bodies that are unshaded, are free of predatory fish, have a grassy area nearby and have diurnal sheltering sites nearby such as vegetation or rocks, although the

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
						and has a low likelihood to be used by the species. In addition, due to the lack of emergent vegetation (such as species from the *Typha* genus), the dams within the study area are not considered to provide breeding habitat for the species.	species has also been recorded from highly disturbed areas including disused industrial sites, brick pits, landfill areas and cleared land.
Litoria littlejohni	Littlejohn's Tree Frog	VU	V	1993#	Low	Suitable habitat features are not present within the study area	Occurs in wet and dry sclerophyll forests and heath communities associated with sandstone outcrops between 280 and 1000 m. Littlejohn's Tree Frog prefers permanent and semi-permanent rock flowing streams, but individuals have also been collected from semi-permanent dams with some emergent vegetation. Forages both in the tree canopy and on the ground, and has been observed sheltering under rocks on high exposed ridges during summer. Eggs and tadpoles are most often recorded in slow-flowing pools that receive extended exposure to sunlight.
Fish							
Macquaria australasica	Macquarie perch	EN	FE	#	Low	Suitable habitat features are not present within the study area	Macquarie perch are found in both river and lake habitats, especially the upper reaches of rivers and their tributaries.

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking and potential impact for species with a moderate or above likelihood	Habitat description*
		EPBC	BC				
Prototroctes maraena	Australian Grayling	VU	FE	#	Low	Suitable habitat features are not present within the study area	Grayling is a diadromous species; migrating between freshwater streams and the ocean. This species has been found in clear, gravel-bottomed streams with alternating pools and riffles, and granite outcrops, and also in muddy-bottomed, heavily silted habitats.
Reptiles							
Hoplocephalus bungaroides	Broad-headed Snake	VU	E1	2009	Low	Suitable habitat features are not present within the study area	Mainly occurs in association with communities occurring on Triassic sandstone within the Sydney Basin. Typically found among exposed sandstone outcrops with vegetation types ranging from woodland to heath. Within these habitats they generally use rock crevices and exfoliating rock during the cooler months and tree hollows during summer.

* - habitat descriptions have been adapted by qualified ecologists from the DEE Species Profile and Threats (SPRAT) Database, OEH Threatened Species online profiles and the NSW Scientific Committee final determinations for listed species, references within the above table are provided within the report reference list.

Migratory species (EPBC Act listed)

Includes records from the following sources:

- NSW BioNet Wildlife Atlas (refer to Section 3.1)
- DEE database (accessed on 27/09/2017)
- BirdLife Australia data search
- Current survey

Bold denotes species recorded in the study area during the current assessment.

Table A.5 Migratory fauna species recorded or predicted to occur within 10 kilometres of the study area

Scientific name	Common name	Most recent record
Mammals		
Dugong dugon	Dugong	1989
Megaptera novaeangliae	Humpback Whale	2006
Birds		
Actitis hypoleucos	Common Sandpiper	2000#
Anous stolidus	Common Noddy	1987
Apus pacificus	Fork-tailed Swift	2007#
Ardea ibis	Cattle Egret	2012
Ardea modesta	Eastern Great Egret	2015
Ardenna carneipes	Flesh-footed Shearwater	2009#
Ardenna grisea	Sooty Shearwater	2008
Ardenna pacifica	Wedge-tailed Shearwater	2015
Ardenna tenuirostris	Short-tailed Shearwater	2010
Arenaria interpres	Ruddy Turnstone	2011
Branta canadensis	Canada Goose	2002
Calidris acuminata	Sharp-tailed Sandpiper	2015#
Calidris alba	Sanderling	2011
Calidris canutus	Red Knot	2015#
Calidris ferruginea	Curlew Sandpiper	2015#
Calidris melanotos	Pectoral Sandpiper	#
Calidris ruficollis	Red-necked Stint	2015
Calidris tenuirostris	Great Knot	2014

Scientific name	Common name	Most recent record
Charadrius bicinctus	Double-banded Plover	2015
Charadrius leschenaultii	Greater Sand-plover	2011
Charadrius mongolus	Lesser Sand-plover	2011
Charadrius veredus	Oriental Plover	2013
Chlidonias leucopterus	White-winged Black Tern	2004
Cuculus optatus	Oriental Cuckoo	#
Diomedea epomophora	Southern Royal Albatros	2008
Diomedea exulans	Wandering Albatross	2009
Gallinago hardwickii	Latham's Snipe	2012#
Gelochelidon nilotica	Gull-billed Tern	2014
Hirundapus caudacutus	White-throated Needletail	2015#
Hydroprogne caspia	Caspian Tern	2015
Limicola falcinellus	Broad-billed Sandpiper	2004
Limosa lapponica	Bar-tailed Godwit	2015#
Limosa limosa	Black-tailed Godwit	2002
Macronectes giganteus	Southern Giant Petrel	2009
Macronectes halli	Northern Giant-Petrel	2007
Merops ornatus	Rainbow Bee-eater	1994
Monarcha melanopsis	Black-faced Monarch	2010#
Myiagra cyanoleuca	Satin Flycatcher	2010#
Neophema chrysogaster	Orange-bellied Parrot	1986#
Numenius madagascariensis	Eastern Curlew	2015#
Numenius phaeopus	Whimbrel	2014
Pandion cristatus	Osprey	2013#
Plegadis falcinellus	Glossy Ibis	2014
Pluvialis fulva	Pacific Golden Plover	2015
Pluvialis squatarola	Grey Plover	2009
Pterodroma leucoptera leucoptera	Gould's Petrel	2001
Rhipidura rufifrons	Rufous Fantail	2010#
Stercorarius parasiticus	Arctic Jaeger	2013
Stercorarius pomarinus	Pomarine Jaeger	2009

Scientific name	Common name	Most recent record
Sterna hirundo	Common Tern	2015
Sternula albifrons	Little Tern	2015
Symposiachrus trivirgatus	Spectacled Monarch	#
Thalassarche cauta	Shy Albatross	2010
Thalassarche chlororhynchos	Yellow-nosed Albatross	2009
Thalassarche melanophris	Black-browed Albatross	2010
Tringa brevipes	Grey-tailed Tattler	2011
Tringa nebularia	Common Greenshank	2000#
Tringa stagnatilis	Marsh Sandpiper	1985
Xenus cinereus	Terek Sandpiper	2011

* - habitat descriptions have been adapted by qualified ecologists from the DSEWPaC Species Profile for listed migratory species, references within the above table are provided within the report reference list

Appendix 3 Significant Impact Criteria assessments – Commonwealth EPBC Act

Litoria aurea (Green and Golden Bell Frog)

Green and Golden Bell Frog *Litoria aurea* is listed as a vulnerable threatened species under the EPBC Act. Green and Golden Bell Frog is an endangered species listed under the BC Act and as a vulnerable species under the EPBC Act.

This species was once common throughout its range between Brunswick Head and Victoria and as far west as Bathurst. The species is now estimated to be absent from at least 90% of this area in fragmented habitat (DECC 2005).

Green and Golden Bell Frog is found in a wide range of still or slow flowing water bodies. It inhabits marshes, dams and stream-sides, particularly those containing Bulrushes *Typha* spp. or Spikerushes *Eleocharis* spp. (DECCW 2010a) It also inhabits many disturbed sites, including abandoned mines and quarries. Breeding habitat in NSW includes water bodies that are still, shallow, ephemeral, unpolluted (but the frog can be found in polluted habitats), unshaded, with aquatic plants and free from predatory fish (DEWHA 2010). In addition to aquatic breeding sites Green and Golden Bell Frogs utilise terrestrial habitats, generally peripheral to breeding habitat, for foraging and / or refuge. Green and Golden Bell Frogs appear to favour terrestrial areas with extensive grassy areas and an abundance of shelter sites such as rocks and logs. Refuge habitat is required by the species during periods of metabolic quiescence particularly during the cooler parts of the year but also when not diurnally active or seeking shelter from adverse conditions or predators (DEC 2005).

There are a number of recognised threats impacting the Green and Golden Bell Frog including: habitat loss, modification and disturbance, predation of tadpoles by Plague Minnow *Gambusia holbrooki*, spread of amphibian chytrid fungus, high frequency fire within foraging, refuge habitat and predation by introduced fauna and herbicides and other weed-control measures (DECCW 2010a).

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

Criterion a: lead to a long-term decrease in the size of an important population of a species

The Green and Golden Bell Frog population at Coomonderry Swamp is listed as a 'Key Population' (OEH 2007).

The removal of low potential dispersal habitat to the north of Coomonderry Swamp is unlikely to have a significant impact on the life cycle of the Green and Golden Bell Frog such that it would lead to a long-term decrease in the size of an important population. The amount of potential dispersal habitat that would be lost is small relative to the amount of potential habitat in the locality. Coomonderry Swamp extends 5 kilometres south of the study area, providing higher quality habitat. Therefore, it is unlikely the species would use this potential dispersal habitat as it is located 300 metres north of the Swamp with no interconnecting drainage lines. For this reason, the species is unlikely to be dependent on the habitat within the study area.

Criterion b: reduce the area of occupancy of an important population

The population at Coomonderry Swamp is an important population.

A small are of low potential dispersal habitat has been identified in the study area. However, it is unlikely the species would use this potential dispersal habitat as it is located 300 metres north of the Swamp with no interconnecting drainage lines, and Coomonderry Swamp extends 5 kilometres south of the study area,

providing higher quality habitat. Therefore, the proposal is unlikely to reduce the area of occupancy of an important population.

Criterion c: fragment an existing important population into two or more populations

The proposed works are unlikely to fragment the important population at Coomonderry Swamp. The removal of three farm dams for the proposed development has been identified to provide low potential dispersal habitat for the Green and Golden Bell Frog. The potential dispersal habitat as it is located 300 metres north of the Swamp with no interconnecting drainage lines, and Coomonderry Swamp extends to the south providing higher quality habitat. Therefore the removal of the dams would not fragment the existing population into two or more populations.

Criterion d: adversely affect habitat critical to the survival of a species

Three farm dams within the study area do not constitute critical habitat for the Green and Golden Bell Frog. The proposed works will not adversely affect habitat critical to the survival of this species.

Criterion e: disrupt the breeding cycle of an important population

The removal of low potential dispersal habitat is unlikely to disrupt the breeding cycle of the important population at Coomonderry Swamp. The potential dispersal habitat as it is located 300 metres north of the Swamp with no interconnecting drainage lines, and Coomonderry Swamp extends to the south providing higher quality habitat. It is highly unlikely these farm dams would be used as breeding habitat due to the lack of emergent vegetation and higher quality breeding habitat within Coomonderry Swamp. Therefore, the removal of dams is unlikely to disrupt the long term breeding cycles of the population.

Criterion f: modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;

The three dams do not form quality habitat for the Green and Golden Bell frog.

Criterion g: Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;

The proposal would not result in invasive species, such as weeds or pest species that would be harmful to the Green and Golden Bell Frog.

Criterion h: Introduce disease that may cause the species to decline;

The proposed works would be unlikely to introduce a disease that may cause this species to decline.

Criterion i: Interfere substantially with the recovery of the species;

Low potential dispersal habitat only will be removed by the project. This will not substantially interfere with the species' recovery.

Conclusion

Based on the above assessment it is concluded that the proposed works is unlikely to have a significant impact on a population of Green and Golden Bell Frog. As such, no referral to the Commonwealth Department of Environment for assessment and approval by the Environment Minister is recommended.

Appendix 4 Assessments of Significance

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats.

Bangalay Sand Forest Endangered Ecological Community (EEC)

Bangalay Sand Forest of the Sydney basin and South East Corner occurs on deep, freely draining sandy soils in relatively flat areas within a few kilometres of the coast at altitudes below 100 metres above sea level. The community typically has a dense to open tree canopy ranging from 5-20 metres tall. The dominant canopy species is commonly Bangalay *Eucalyptus botryoides*, while Blackbutt *Eucalyptus pilularis* and Lilly Pilly *Acmena smithii* occurring in more sheltered locations. The community consists of an open sclerophyllous shrub layer with species including Old Man Banksia *Banksia serrata* and Coast Teatree *Leptospermum laevigatum*, or a mesic shrub layer of Coffee Bush *Breynia oblongifolia* and Sweet Pittosporum *Pittosporum undulatum*, or a combination of both. Reflecting the variation that exists in canopy and mid-strata species depending on location, the groundcover can also vary from open to dense. Common species occupying the ground layer include; Blue Flax Lillies *Dianella* spp., Spiny-headed Mat-Rush *Lomandra longifolia*, Kidney Weed *Dichondra repens,* Whiteroot *Pratia* purpurascens, and grasses such as Blady Grass *Imperata cylindrica*, Weeping Grass *Microlaena stipioides* and Kangaroo Grass *Themeda australis.* Vines and scramblers including Common Silkpod *Marsdenia rostrata* and *Glycine clandestina* commonly occur in this community. The highly variable forms of this community are driven by levels of disturbance including clearing, fire and weed invasion (TSSC 2011).

Bangalay Sand Forest EEC has been mapped within the study area. The proposed works will include the following impacts to the EEC;

- Removal of 0.29 ha of Bangalay Sand Forest

A number of measures have been included in this report to reduce potential impacts to surrounding vegetation and to assist in the long-term survival for this endangered ecological community.

The following is to be taken into account for the purposes of determining whether the proposed subdivision is likely to significantly affect the Bangalay Sand Forest EEC within the study area.

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

Bangalay Sand Forest EEC is not a threatened species and therefore this question does not apply.

(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

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

Factors likely to have an adverse effect on the extent of Bangalay Sand Forest EEC include pressures associated with human recreational activities in coastal areas; such as habitat degradation, increased risk of bushfires and weed invasion.

Bangalay Sand Forest has been mapped as a linear strip along the northern section of the study area boundary, totalling 1.2 hectares. Under the proposed works 0.29 hectares of mapped Bangalay Sand Forest

will be impacted. The removal of 0.29 hectares of Bangalay Sand Forest within the broader landscape is not considered likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

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

The proposed vegetation removal works will impact on 0.29 hectares of Bangalay Sand Forest. This is equal to the removal of approximately 25% of the community within the study area. For this reason, it is not considered likely that the proposed vegetation removal works will substantially or adversely modify the composition of the Bangalay Sand Forest such that its local occurrence is likely to be placed at risk of extinction.

Additionally, Seven Mile Beach National Park is located within 200 metres to the east of the study area and supports 36.28 hectares of Bangalay Sand Forest in better condition relative to the patch to be cleared.

(c) in relation to the habitat of a threatened species or ecological community:

- ***(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and***

The proposed actions will result in the removal of 0.29 hectares of Bangalay Sand Forest EEC. These impacts are relatively small in comparison to the areas of Bangalay Sand Forest identified within the local occurrence.

- ***(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and***

The 0.29 hectares of Bangalay Sand Forest to be removed occurs as part of a narrow linear strip of 1.2 hectares bordered by a road to the north and agricultural land to the south, therefore is currently already fragmented in the broader landscape. The removal of vegetation from this patch will not result in further fragmentation or isolation of Bangalay Sand Forest.

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

The patch of Bangalay Sand Forest EEC in which these trees occur has been mapped surrounding Coomonderry Swamp to the south, forming a larger patch of approximately 5 hectares in size. The removal of 0.29 hectares of vegetation will not affect the long-term survival of Bangalay Sand Forest in the locality.

(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

Bangalay Sand Forest EEC is not a declared area of outstanding biodiversity value.

(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

One Key Threatening Processes (KTP), clearing of native vegetation, is relevant to the proposed works with respect to Bangalay Sand Forest EEC.

Although the removal of 0.29 ha is proposed within an area mapped as Bangalay Sand Forest EEC, the 75% of the EEC within the study area will be retained and protected. Appropriate measures should be implemented

to reduce the compaction of soils, habitat disturbance, or the spread of weed propagules during and post-construction.

Conclusion

The proposed works will result in the removal of 0.29 hectares within a larger patch of Bangalay Sand Forest EEC consisting of 1.2 hectares within the study area, and part of a broader landscape containing greater than 30 hectares of better condition Bangalay Sand Forest. The proposed vegetation removal is not considered to significantly impact on Bangalay Sand Forest EEC in the locality. Consequently, a SIS or BDAR is not required for the proposal with respect to this EEC.

Green and Golden Bell Frog (*Litoria aurea*)

Green and Golden Bell Frog *Litoria aurea* is an endangered species listed under the BC Act and as a vulnerable species under the EPBC Act.

This species was once common throughout its range between Brunswick Head and Victoria and as far west as Bathurst. The species is now estimated to be absent from at least 90% of this area in fragmented habitat (DECC 2005).

Green and Golden Bell Frog is found in a wide range of still or slow flowing water bodies. It inhabits marshes, dams and stream-sides, particularly those containing Bulrushes *Typha* spp. or Spikerushes *Eleocharis* spp. (DECCW 2010a). It also inhabits many disturbed sites, including abandoned mines and quarries. Breeding habitat in NSW includes water bodies that are still, shallow, ephemeral, unpolluted (but the frog can be found in polluted habitats), unshaded, with aquatic plants and free from predatory fish (DEWHA 2010). In addition to aquatic breeding sites Green and Golden Bell Frogs utilise terrestrial habitats, generally peripheral to breeding habitat, for foraging and / or refuge. Green and Golden Bell Frogs appear to favour terrestrial areas with extensive grassy areas and an abundance of shelter sites such as rocks and logs. Refuge habitat is required by the species during periods of metabolic quiescence particularly during the cooler parts of the year but also when not diurnally active or seeking shelter from adverse conditions or predators (DEC 2005).

There are a number of recognised threats impacting the Green and Golden Bell Frog including: habitat loss, modification and disturbance, predation of tadpoles by Plague Minnow *Gambusia holbrooki*, spread of amphibian chytrid fungus, high frequency fire within foraging, refuge habitat and predation by introduced fauna and herbicides and other weed-control measures (DECCW 2010a).

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

Impacts that would be likely to impact upon the life cycle of Green and Golden Bell Frogs to the extent that a viable local population would be placed at risk of extinction would include loss or disturbance of suitable breeding habitat and the use of herbicide and weed-control measures.

Green and Golden Bell Frogs need various habitats for different aspects of their life cycle including foraging, breeding, over-wintering and dispersal. They will also use different habitats or habitat components on a temporal or seasonal basis (DEWHA 2010).

The proposal will result in disturbance to low potential dispersal habitat for the Green and Golden Bell Frog. Potential breeding and foraging habitat is present within Coomonderry Swamp to the south of the study area but would not be impacted by the proposal.

The potential dispersal habitat as it is located 300 metres north of the Swamp with no interconnecting drainage lines, and Coomonderry Swamp extends to the south providing higher quality habitat. It is highly unlikely these farm dams would be used as breeding habitat due to the lack of emergent vegetation and higher quality breeding habitat within Coomonderry Swamp. Therefore, the removal of dams is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species.

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

This is not an endangered population.

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

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

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

This is not an endangered ecological community.

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

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

The proposal will result in the removal of low potential dispersal habitat only for this species. The dispersal habitat to be removed is in the form of three dams, providing low quality habitat and a movement corridor away from Coomonderry Swamp. The potential dispersal habitat as it is located 300 metres north of the Swamp with no interconnecting drainage lines, and Coomonderry Swamp extends to the south providing higher quality habitat.

(ii)Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The proposed works are unlikely to fragment the important population at Coomonderry Swamp. The removal of three farm dams for the proposed development has been identified to provide low potential dispersal habitat for the Green and Golden Bell Frog. The potential dispersal habitat as it is located 300 metres north of the Swamp with no interconnecting drainage lines, and Coomonderry Swamp extends to the south providing higher quality habitat. Therefore the removal of the dams would not fragment or isolated from other areas of habitat.

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

The proposal will result in the removal of low potential dispersal habitat for this species. Coomonderry Swamp extends to the south providing higher quality habitat which is considered important to the species, however it will not be impacted by the proposal. The potential dispersal habitat as it is located 300 metres north of the Swamp with no interconnecting drainage lines, and is therefore not considered important to the long term survival of the species.

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

Coomonderry Swamp will not be directly impacted upon by the project.

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

A draft recovery plan has been prepared for the Green and Golden Bell Frog. The specific objectives of this plan relate to securing and managing existing populations, ex-situ conservation and further research. The proposed works do not conflict with any of these priority actions.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Two key threatening processes are relevant to this proposal with respect to the Green and Golden Bell Frog. These include:

- Clearing of native vegetation.

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

The proposal will result in the removal of low potential dispersal habitat for this species. However, this habitat is highly degraded located 300 metres north of the Swamp with no interconnecting drainage lines. Coomonderry Swamp extends to the south providing higher quality habitat, however it will not be impacted by the proposal. Therefore it is unlikely that the proposal would exacerbate this KTP with regards to the Green and Golden Bell Frog.

Approximately 150 metre buffer zone to any development has been proposed surrounding Coomonderry Swamp and indirect impacts to hydrology within the study area will be mitigated as per the recommendations provided in this report. This will reduce the potential for changes to flow regimes and hence impacts on potential habitat for the Green and Golden Bell Frog.

Conclusions

The proposal is considered unlikely to have a significant impact on the Green and Golden Bell Frog for the following reasons:

- Habitat removal is minimal and of poor condition compared to that remaining within the study area.
- The dispersal habitat is located 300 metres north of the Swamp with no interconnecting drainage lines and unlikely to be sued by the species.
- Areas of higher quality habitat potential habitat are present in Coomonderry Swamp which extend to the south and will not be impacted by the proposal.

Consequently, a SIS or BDAR is not required for the proposal with respect to this species

Microchiropteran bat foraging habitat.

Large-eared Pied-bat *Chalinolobus dwyeri*

The Large-eared Pied Bat is a cave-roosting species, roosting communally during the day near the entrances of caves, crevices in cliffs, mines, tunnels, culverts, and the disused bottle-shaped mud nest of the *Hirundo ariel* (Fairy Martin) (DERM 2011). Its flight pattern is relatively slow, and only moderately maneuverable. They forage predominantly below the canopy level and also low along creek beds (Hoye & Dwyer 1995).

This species is threatened by a number of processes including clearing or isolation of forest and woodland foraging habitats near cliffs, caves and old mine workings and damage to roosting and maternity sites.

Large-eared Pied Bat was not recorded during the surveys as no targeted survey was undertaken. There are known records of the species within 5 kilometres of the study area (OEH 2017). There is potential for the study area to be used occasionally by this species for foraging, although it is unlikely that individuals rely upon resources in the study area.

Eastern False Pipistrelle *Falsistrellus tasmaniensis*

Eastern False Pipistrelle is listed as Vulnerable under Schedule 2 of the BC Act. The species is wide-ranging, occurring along the southeast coast of Australia with records indicating that its distribution extends from south-east Queensland to Victoria, but is also found in Tasmania. The species is known to occur in sclerophyll forests stretching from the Great Dividing Range to the coastline, with a general preference for wet habitats where trees are higher than 20 metres (OEH 2017).

Roosting occurs in usually in hollow trunks of eucalyptus trees, typically in single sex colonies, but roosting in caves, under loose bark and occasionally in old wooden buildings is not uncommon. Their flight pattern is

high and fast with foraging taking place within or just below the tree canopy feeding on an array of invertebrates and insects (OEH 2017).

Eastern False Pipistrelle is threatened by a number of processes including loss of trees for foraging and hollow-bearing trees for roosting, disturbance to winter roosting and breeding sites, and application of pesticides in or adjacent to foraging areas (OEH 2017).

Eastern False Pipistrelle was not recorded during survey (no targeted survey was undertaken). There are known records of the species within 5 kilometres of the study area (OEH 2015a). There is potential for the study area to be used occasionally by this species for foraging, although it is unlikely that individuals rely upon resources in the study area.

Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*

Eastern Bentwing-bat is listed as a vulnerable species under the BC Act. This species occupies a range of forested environments (including wet and dry sclerophyll forests), along the coastal portion of eastern Australia, and through the Northern Territory and Kimberley area (subject to subdivision of this species) (OEH 2017).

This species has a fast, level flight exhibiting swift shallow dives. It forages from just above the tree canopy, to many times the canopy height in forested areas, and will utilise open areas where it is known to forage at lower levels. Moths appear to be the main dietary component. This highly mobile species is capable of large regional movements in relation to seasonal differences in reproductive behaviour and winter hibernation. Though individuals often use numerous roosts, it congregates in large numbers at a small number of nursery caves to breed and hibernate. Although roosting primarily occurs in caves, it has also been recorded in mines, culverts, stormwater channels, buildings, and occasionally tree-hollows. This species occupies a number of roosts within specific territorial ranges usually within 300 kilometres of the maternity cave, and may travel large distances between roost sites (OEH 2017).

Eastern Bentwing-bat is threatened by a number of processes including loss of foraging habitat, damage to or disturbance of roosting caves (particularly during winter or breeding), application of pesticides in or adjacent to foraging areas, and predation by feral cats and foxes (OEH 2017).

Eastern Bentwing-bat was not recorded during the surveys (no targeted survey was undertaken). There are known records of the species within 5 kilometres of the study area (OEH 2017). There is potential for the study area to be used occasionally by this species for foraging, although it is unlikely that individuals rely upon resources in the study area.

Eastern Freetail-bat *Mormopterus norfolkensis*

Eastern Freetail-bat is listed as vulnerable under the BC Act. It is found along the east coast from south Queensland to southern NSW in dry eucalypt forests, woodlands, swamp forests and mangrove forests where they forage for insects among canopy gaps and on edges of vegetation and mainly roost in hollow-bearing trees. This species will utilise paddock trees and remnant vegetation in farmland where these are in proximity to larger forest remnants. This species usually forages within a few kilometres of its roost (OEH 2017).

Eastern Freetail Bat is threatened by a number of processes including loss of trees for foraging and hollow-bearing trees for roosting, and application of pesticides in or adjacent to foraging areas (OEH 2017).

Eastern Freetail Bat was not recorded during the surveys as no targeted survey was undertaken. There are known records of the species within 5 kilometres of the study area (OEH 2017). There is potential for the study area to be used occasionally by this species for foraging, although it is unlikely that individuals rely upon resources in the study area.

Southern Myotis *Myotis macropus*

Southern Myotis is listed as vulnerable under the BC Act. The species will occupy most habitat types such as mangroves, paperbark swamps, riverine monsoon forest, rainforest, wet and dry sclerophyll forest, open woodland and River Red Gum woodland, as long as they are close to water. While roosting is most commonly associated with caves, this species has been observed to roost in tree hollows, amongst vegetation, in clumps of Pandanus, under bridges, in mines, tunnels and stormwater drains. However the species apparently has specific roost requirements, and only a small percentage of available caves, mines, tunnels and culverts are used (OEH 2017).

Southern Myotis was not recorded during the surveys as no targeted survey was undertaken. There are known records of the species within 5 kilometres of the study area (OEH 2017). There is potential for the study area to be used occasionally by this species for foraging, although it is unlikely that individuals rely upon resources in the study area.

Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*

Yellow-bellied Sheathtail-bat is listed as vulnerable under the BC Act. It is found throughout NSW in habitats including wet and dry sclerophyll forest, open woodland, acacia shrubland, mallee, grasslands and desert. They roost in tree hollows in colonies and have also been observed roosting in animal burrows, abandoned Sugar Glider nests, cracks in dry clay, hanging from buildings and under slabs of rock. Forages for insects above the canopy in forests.

Yellow-bellied Sheathtail-bat was not recorded during the surveys as no targeted survey was undertaken. There are known records of the species within 5 kilometres of the study area (OEH 2017). There is potential for the study area to be used occasionally by this species for foraging, although it is unlikely that individuals rely upon resources in the study area.

Greater Broad-nosed Bat *Platyrrhinus vittatus*

Greater broad-nosed Bat is listed as vulnerable under the BC Act. It prefers habitat in woodland and rainforest, preferring open habitats or openings in wetter forests. Often hunts along creeks or river corridors. Preys upon beetles and other large, flying insects, other bats and spiders. Roosts in hollow tree trunks and branches.

With many records in the locality to the north of the study area it is it is highly likely that this species may occur in the study area.

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

Impacts likely to have an adverse effect on the life cycle of Large-eared Pied Bat, Eastern False Pipistrelle, Eastern Bentwing-bat, Eastern Freetail-bat, Southern Myotis, Yellow-bellied Sheathtail-bat and Greater Broad-nosed bat include impacts that result in the loss of significant areas of foraging habitat, the loss of roosting habitat (hollow-bearing trees), and use of pesticides in or adjacent to foraging areas.

The proposal would remove 0.29 hectares of native vegetation, while leaving the majority of existing native vegetation intact. No roosting habitat would be impacted.

The removal of potential foraging habitat is unlikely to have a significant impact on life cycle of Large-eared Pied Bat, Eastern False Pipistrelle, Eastern Bentwing-bat, Eastern Freetail-bat, Southern Myotis Yellow-bellied Sheathtail-bat and Greater Broad-nosed bat such that a viable local population of these species would be placed at risk of extinction. The amount of potential foraging habitat that would be lost is small relative to the amount of potential habitat in the locality. There is foraging habitat only within the subject site. No roosting or

breeding habitat would be impacted. There is high quality habitat is available in the surrounding landscape, therefore these species are considered likely to use the study area on an occasional basis and would not be dependent on the foraging resources within the study area.

Therefore, the proposed development is unlikely to have an adverse effect on the life cycle of Large-eared Pied Bat, Eastern False Pipistrelle, Eastern Bentwing-bat, Eastern Freetail-bat, Southern Myotis, Yellow-bellied Sheathtail-bat and Greater Broad-nosed bat such that a viable local population of these species is likely to be placed at the risk of extinction.

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

Large-eared Pied Bat, Eastern False Pipistrelle, Eastern Bentwing-bat, Eastern Freetail-bat, Southern Myotis, Yellow-bellied Sheathtail-bat and Greater Broad-nosed bat are not an endangered population.

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

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

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

Large-eared Pied Bat, Eastern False Pipistrelle, Eastern Bentwing-bat, Eastern Freetail-bat, Southern Myotis, Yellow-bellied Sheathtail-bat and Greater Broad-nosed bat are not an endangered ecological community.

d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposal would remove 0.29 hectares of native vegetation, while leaving the majority of existing native vegetation intact. No roosting habitat would be impacted. These species are likely to use the study area on an occasional basis and would not be dependent on the foraging resources within the study area.

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

The proposed works is unlikely to fragment or isolate areas of potential foraging habitat. The area of habitat that would be impacted for the proposed development is already fragmented. Removal of small areas of native vegetation would not fragment the habitat of such wide-ranging and mobile species. Therefore, the proposal will not isolate any currently connecting areas of potential habitat.

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

Given the highly mobile nature of these species and the fact that the vegetation to be removed on site does not represent primary roosting or foraging habitat and extensive areas of habitat are present adjacent to the study area and within the locality, the habitat to be removed is unlikely to be important to the long-term survival of these species.

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

No critical habitat has been declared for Large-eared Pied Bat, Eastern False Pipistrelle, Eastern Bentwing-bat, Eastern Freetail-bat, Southern Myotis, Yellow-bellied Sheathtail-bat and Greater Broad-nosed.

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

No recovery plan or threat abatement plan of relevance to Large-eared Pied Bat, Eastern False Pipistrelle, Eastern Bentwing-bat, Eastern Freetail-bat, Southern Myotis, Yellow-bellied Sheathtail-bat and Greater Broad-nosed bat has been prepared.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Key threatening processes of relevance to the Large-eared Pied Bat, Eastern False Pipistrelle, Eastern Bentwing-bat, Eastern Freetail-bat, Southern Myotis, Yellow-bellied Sheathtail-bat and Greater Broad-nosed bat, include the clearing of native vegetation.

The proposal would not result in the clearing of roosting habitat however, would result in a small disturbance to an area of marginal foraging habitat. As discussed above this disturbance is considered minor due to the nature of the disturbance, the size of this habitat relative to the large home ranges of these species, and the areas of habitat in the surrounding landscape available to these highly mobile species.

Conclusion

The proposal is unlikely to constitute a significant impact on Large-eared Pied Bat, Eastern False Pipistrelle, Eastern Bentwing-bat, Eastern Freetail-bat, Southern Myotis, Yellow-bellied Sheathtail-bat and Greater Broad-nosed bat given that:

- Area of vegetation to be removed is very small (0.29 hectares of native vegetation and 0.03 hectares of aquatic habitat in the form of three farm dams).
- No roosting/breeding habitat will be impacted.
- These species are highly mobile and forages widely.
- The proposal would not fragment or isolate habitat for these species
- Potential habitat for these species would remain adjacent to the site and is present throughout the locality.

Consequently, a SIS or BDAR is not required for the proposal with respect to these species.