



Flora and fauna and offsets assessment: Proposed
rezoning at Adelaide Street, Raymond Terrace.

FINAL REPORT

Prepared for de Witt Consulting

6 December 2016

ITEM 11 - ATTACHMENT 1
RAYMOND TERRACE.

PLANNING PROPOSAL - 251 ADELAIDE STREET

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- Stefan Rose (BioBanking assessment)

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Glossary

AoS	Assessment of Significance (7 part test)
APZ	Asset Protection Zone
BBAM	BioBanking Assessment Methodology
CBD	Central Business District
CKPoM	Comprehensive Koala Plan of Management
DEE	Department of the Environment and Energy
DPE	Department of Planning and Environment
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
FM Act	<i>Fisheries Management Act 1994</i>
KTP	Key Threatening Process
LEP	Local Environment Plan
NSW	New South Wales
NV Act	<i>Native Vegetation Act 2003</i>
NW Act	<i>Noxious Weeds Act 1993</i>
OEH	NSW Office of Environment and Heritage
Offset area	The terrestrial part of Lot 232 proposed for use to obtain biodiversity offsets
SEPP 44	State Environmental Planning Policy No. 44 – Koala Habitat Protection
SIS	Species Impact Statement
Study area	The area comprising the entire Lot 232 in which both the subject site and offset area are located
Subject site	The area of impact for the proposed residential development rezoning, i.e. the development site,
TSC Act	<i>Threatened Species Conservation Act 1995</i>

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Summary

Biosis Pty Ltd was commissioned by de Witt Consulting to undertake a flora and fauna assessment to support a planning proposal to rezone the north-western corner of Lot 232, DP 593512 at 251 Adelaide Street, Raymond Terrace (the subject site or development site) for residential development and to conserve the remaining area surrounding the lake (old sand quarry) as a biodiversity offset area. The study area (i.e. the area comprising both the subject site and proposed offset area) is located in the Port Stephens Local Government Area (LGA) approximately 2 kilometres south of Raymond Terrace town centre and approximately 17 kilometres north of the Newcastle central business district (CBD).

The subject site is a minor part of the study area which includes areas likely to be directly or indirectly affected by the residential development. The remainder of the study area is proposed as a potential biodiversity offset site. 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 proposal, 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 44.36 hectares of which 5.31 hectares is proposed for rezoning for residential development (subject site). A major portion of the study area is occupied by a large artificial lake, formed as part of previous sand mining within the property. Native vegetation surrounding the lake provides terrestrial habitat for a range of species and is intended to be rezoned for environmental protection and included in an offset area.

Ecological values

Key ecological values identified within the subject site include:

- 0.3 ha of native swamp forest vegetation in moderate-good condition.
- 3.78 ha of native derelict pine forest with regenerating native swamp forest elements in low condition.
- One Threatened ecological community (TEC), *Swamp Sclerophyll Forest on Coastal Floodplains and Freshwater Wetlands on Coastal Floodplain*, corresponding to the swamp forest vegetation community.
- Potential marginal foraging habitat for three threatened fauna species – Eastern Bentwing-bat, Little Bentwing-bat and Grey-headed Flying Fox (threatened biota).

Key ecological values identified within the offset area include:

- 11.32 ha of native swamp forest vegetation in moderate-good condition.
- 2.47 ha of cleared, highly disturbed habitat with regenerating native swamp forest elements in low condition.
- 1.67 ha of freshwater wetland habitat.
- Two TECs.
- Potential foraging or breeding/roosting habitat for nine threatened fauna species (threatened biota), including Koala.
- A large freshwater lake with fringing wetland and swamp forest vegetation.

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- Contribution to surrounding values, including connectivity of site to native vegetation mainly east and south of the study area.

Recommendations

The primary measure for the development to minimise impacts to ecological values on the site is to minimise and confine removal of native vegetation and habitat, thus avoiding disruption to the habitat linkage to the south of the subject site and protecting water quality in the offset area due to runoff from the site. To retain these values they need to be incorporated into the design process.

Vegetation losses are unavoidable for the development as proposed and the quantity and type of offsets required has been determined by the BioBanking Assessment Methodology (BBAM) (OEH 2014).

An offset strategy for the study area is proposed that fully balances the ecosystem credits required to compensate for residual impacts related to native vegetation clearing within the subject site with like-for-like credits available within the boundaries of the proposed offset area. This strategy has been determined objectively by the BBAM and the BioBanking Credit Calculator.

In summary, the ecosystem credit balance in relation to the proposed development within the study area is:

- 99 ecosystem credits required for loss of the swamp forest vegetation community from the subject site.
- 104 ecosystem credits created for management of like-for-like swamp forest vegetation of the same community in an offset area.

This gives a surplus or buffer of 5 ecosystem credits for the vegetation type impacted.

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 on site	Permit / approval required
Environment Protection and Biodiversity Conservation Act 1999	Grey-headed Flying-fox foraging habitat located within the study area, including minor elements of potential foraging habitat in the subject site. No additional Matters of National Significance or their habitat were located or expected to occur within the subject site.	Significant impact unlikely. No further assessment or referral required.

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Legislation / Policy	Relevant ecological feature on site	Permit / approval required
Threatened Species Conservation Act 1995	<p>Two Threatened Ecological Communities (TEC), <i>Swamp Sclerophyll Forest on Coastal Floodplains</i> and <i>Freshwater Wetlands on Coastal Floodplains</i> occur within the study area, but only the former occurs within the subject site and will be impacted by the proposal.</p> <p>The subject site contains minor elements of potential foraging habitat for the following listed threatened species: Grey-headed Flying-fox, Eastern Bentwing-bat and Little Bentwing-bat.</p> <p>The offset area also contains habitat for several threatened waterbird species and two threatened frog species, but this habitat would not be impacted by the proposed subdivision.</p>	<p>Due to predicted impacts on the TEC, an AoS has been undertaken for</p> <ul style="list-style-type: none"> Swamp Sclerophyll Forest on Coastal Floodplains (see Appendix 4). <p>Although potential minor foraging habitat occurs in the subject site for</p> <ul style="list-style-type: none"> Eastern Bentwing-bat Little Bentwing-bat Grey-headed Flying-fox <p>more extensive areas of superior quality habitat occur in the adjoining offset area, therefore significant impacts on these species are unlikely. No further assessment has been carried out.</p>
Environmental Planning & Assessment Act 1979	A threatened ecological community occurs within the subject site.	Impacts to the threatened ecological community present within the study area have been assessed through an AoS.
State Environmental Planning Policy No 44	SEPP44 applies to the current project as the subject site exceeds more than one hectare, is located within the Port Stephens Local Government Area and a development application will be made (SEPP 44, Section 6). However, no part of the subject site is mapped as Core or Preferred Koala Habitat according to SEPP44 or <i>Port Stephens Comprehensive Koala Plan of Management</i> (CKPoM) and no evidence of current Koala activity was recorded in the study area. The main areas of important habitat for this species and those mapped by the CKPoM as Preferred Habitat occurs in the offset area with buffer areas north and south of the lake. These areas are not affected by the proposal.	<p>As no Preferred Koala habitat will be impacted by the proposed rezoning, no further assessment or action in relation to SEPP44 or the CKPoM is required.</p> <p>The proposal is compliant with the Performance Criteria for Rezoning Requests specified in Appendix 2 of the CKPoM.</p> <p>The area to the south of the subject site in the offset area would serve as a corridor facilitating movement of the species through the site and to adjoining habitat.</p>
National Parks & Wildlife Act 1974	The project does not require the removal vegetation within a National	No permits or approvals are required under the current scope of works.

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Legislation / Policy	Relevant ecological feature on site	Permit / approval required
<i>Native Vegetation Act 2003</i>	Park. The project may require removal of a small area of native vegetation.	The local Hunter offices of Local Land Services should be contacted to ascertain any requirements for further approval for removal of native vegetation pursuant to the Act.
<i>Noxious Weeds Act 1993</i>	The following noxious weeds are present within the study area: <ul style="list-style-type: none"> ▪ Annual Ragweed ▪ Crofton Weed ▪ Fireweed ▪ Pampas Grass 	Control requirements for these noxious listed weeds are outlined in Table 22.

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

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1 Introduction

1.1 Project background

Biosis Pty Ltd was commissioned by de Witt Consulting to undertake a terrestrial flora and fauna assessment and BioBanking assessment of 251 Adelaide Street (Lot 232 DP 593512), Raymond Terrace. The study area is defined as the entire area of Lot 232, which is proposed for rezoning (Figure 1).

The study area comprises a development area within Lot 232 proposed for rezoning for residential development (the subject site or development site), with the remainder of the Lot proposed to be rezoned for Environmental Conservation as an offset area (Figure 2).

1.2 Scope of assessment

The objectives of this investigation are to:

- Describe the vascular flora (ferns, conifers, flowering plants) and vertebrate fauna (birds, mammals, reptiles, frogs, fish) habitat within the study area.
- Map native vegetation and other habitat features within the study area.
- Undertake a BioBanking Assessments as per the BBAM (OEH 2014) and including credit calculations of biodiversity credits required to compensate for impacts to biodiversity associated with development of the subject site and biodiversity credits to be generated by the creation of an offset area within the remaining portion of the study area.
- Review the implications of relevant biodiversity legislation and policy.
- Identify potential implications of the proposed development and provide recommendations to assist with development design.
- Recommend any further assessments of the site that may be required (such as targeted searches for threatened biota).

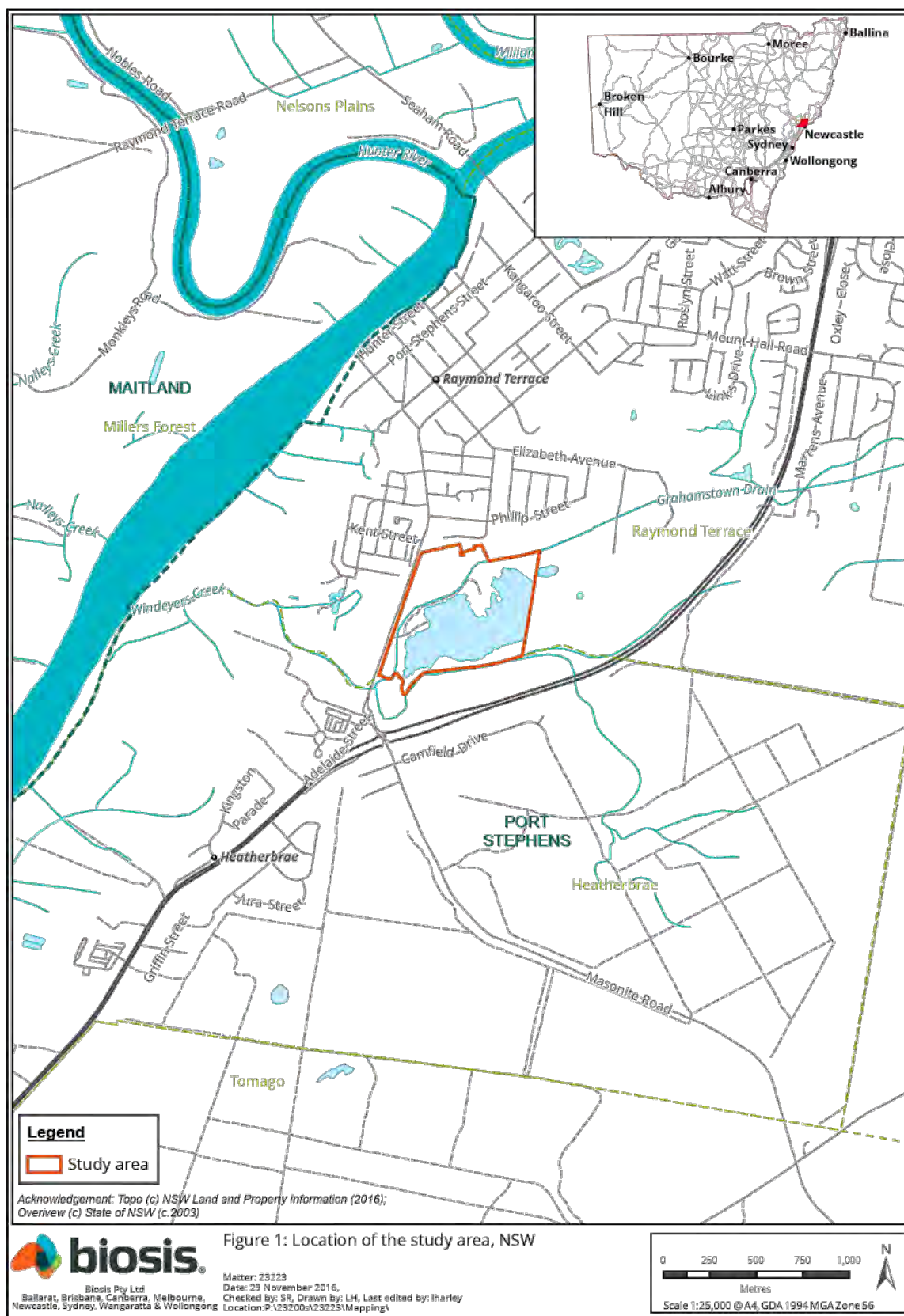
1.3 Location of the study area

The study area is located directly adjacent to the southern end of Raymond Terrace township and approximately 17 kilometres north of the Newcastle CBD (Figure 1). It encompasses approximately 44.36 hectares of private land and is currently zoned RU2 - Rural Landscape under the *Port Stephens Local Environmental Plan 2013*.

The study area is within the:

- Sydney Basin Bioregion
- Hunter River Basin (Hunter River catchment)
- Hunter / Central Rivers Catchment Management Area (CMA)
- Port Stephens Local Government Area (LGA).

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2 Methods

2.1 Literature and database review

In order to provide a context for the study area, information about flora and fauna from within 5 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) (TSC Act).
- PlantNET (The Royal Botanic Gardens and Domain Trust, (2013)) for Rare or Threatened Australian Plants (RoTAP).
- BirdLife Australia, the New Atlas of Australian Birds 1998-2013 (BA).

Other sources of biodiversity information:

- OEH Vegetation Information System (VIS) mapping through the Spatial Information eXchange (SIX) Vegetation Map Viewer (OEH 2016b), Three mapping studies were reviewed:
 - VIS Map 2225: *Vegetation Survey, Classification and Mapping of the Lower Hunter and Central Coast* (LHCCREMS 2003).
 - VIS Map 2227: *The Vegetation of the Central Hunter Valley, New South Wales* (Peake 2006).
 - VIS Map 3855: *Hunter Native Vegetation Mapping* (Roff et al. 2011).
- NSW Department of Primary Industries (DPI) *Noxious Weeds Act, 1993* (NW Act) listed weeds for the Port Stephens Council LGA (DPI 2016).

The following reports were also reviewed:

- Environmental Due Diligence Report – Phase 1 Environmental Site Assessment – 251 Adelaide Street, Raymond Terrace 2324. ERM 2011.
- NSW Scientific Committee final determinations for threatened biodiversity.

2.2 Site investigation

2.2.1 Flora assessment

A preliminary flora assessment was undertaken within the proposed development area on 22 April and 28 June 2016 to map vegetation communities and identify ecological constraints (Biosis 2016). This was supplemented by a full flora field assessment across the study area on 11 and 12 October 2016 using a combination of 20 x 50 metre plots and transects in accordance with the NSW BBAM (OEH 2014). Random meanders were used to identify and map the boundaries of vegetation types present within the study area. The appropriate number of vegetation survey plots/transects were completed within each vegetation zone in both the subject site and proposed offset area according to the BBAM (Figure 3). No targeted surveys for threatened flora species were undertaken, since none were considered likely to occur in the subject site, given the nature and condition of habitat available.

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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 vegetation type.

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 noxious weed infestations, evidence of management works, current grazing impacts and the regeneration capacity of the vegetation.

2.2.2 Fauna assessment

The study area was investigated on 22 April, 28 June and 10-11 October 2016 to determine its values for fauna. 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. This 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.

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

2.2.3 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 2017). Fauna survey was conducted under approval 11/355 from the NSW Animal Care and Ethics Committee (expiry date 31 January 2017).

2.3 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 biodiversity values of a site.

The current flora and fauna assessment was conducted in autumn, winter and spring, which is an optimal time for survey, covering a range of seasons. The fauna survey was limited to a habitat assessment and opportunistic observations, with no trapping or nocturnal surveys carried out.

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.

2.4 Mapping

A preliminary site plan for a proposed rezoning area (Masterplan SK2) was supplied by Phoenix Builders and Aerial photography by Near Maps (2016).

Mapping was conducted using hand-held (uncorrected) GPS 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.

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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.



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3 Legislative context

This section provides an overview of key biodiversity legislation and government policy considered in this assessment. Where available, links to further information are provided. This section does not describe the legislation and policy in detail and guidance provided here does not constitute legal advice.

3.1 Commonwealth

3.1.1 Environmental 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, migratory species and Ramsar wetlands. An assessment of potential impacts to all Matters of NES under the provisions of the EPBC Act is provided in Section 4.9.5.

3.2 State

3.2.1 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.

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Section 5A of the EP&A Act is an integral part of environmental impact assessment and requires proponents and consent authorities to consider if a development will have a significant effect on threatened species, populations or communities listed under the TSC Act and FM Act. The objective of the Assessment of Significance (AoS) (formally known as the "7-part test") is to improve the standard of, and make transparent, the considerations given to threatened species, populations and ecological communities, and their habitats, and Section 5A (and Section 94 of the TSC Act) outlines seven factors that must be taken into account. Typically, where any AoS determines that a development will result in a significant effect to a threatened species, population or community, a Species Impact Statement is required.

Note that these provisions would not apply if a formal BioBanking Statement were being sought.

State Environmental Planning Policies (Part 3, Division 2)

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. 14 – Coastal Wetlands

The study area is not within the catchment of any mapped SEPP 14 wetland. SEPP 14 would not be relevant to any development proposal.

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 study area is located within the Port Stephens LGA, a Schedule 1 listed Council. Therefore SEPP No. 44 is relevant to the current assessment and is discussed further in Section 4.9.4.

SEPP No. 71 – Coastal Protection

This policy applies to development of land within the coastal zone which is defined as extending from approximately one kilometre inland of any coastline, bay, estuary, lake or lagoon three nautical miles out to the edge of the State's coastal waters. The study area is not within the coastal zone according to Map 1 of the Greater Metropolitan Region relating to the NSW Coastal Protection Act 1979. SEPP 71 would not be relevant to development within the study area.

Local Environment Plans (Part 3, Division 4)

Local Environment Plans (LEP) 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.

The study area is subject to the *Port Stephens Local Environmental Plan* (LEP) 2013 and is currently zoned RU2 Rural Landscape.

The objectives of RU2 zoning are to:

- encourage sustainable primary industry production by maintaining and enhancing the natural resource base.

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- maintain the rural landscape character of the land.
- provide for a range of compatible land uses, including extensive agriculture.

3.2.2 Threatened Species Conservation Act 1995

The TSC 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 TSC Act are discussed in Section 4.9.1 together with an assessment of whether the project will result in a significant effect to these threatened species, populations and communities, with AoS provided in Appendix 5.

As noted above, this assessment pathway would not apply if a formal BioBanking Statement were being sought.

3.2.3 Native Vegetation Act 2003

The NV 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. Under the NV Act no clearing of native vegetation is allowed except in accordance with prior development consent from the relevant Council or under a Property Vegetation Plan (PVP) approved by the relevant Catchment Management Authority.

Port Stephens is one of the LGAs to which the NV Act applies. The lot on which the study area occurs is currently zoned RU2 Rural landscape, which is one of the zones to which the Act applies. Requirements under the Act are discussed further in section 4.9.2.

A BioBanking Statement, if sought, would not exempt approval for native vegetation clearing under NV Act.

3.2.4 Noxious Weeds Act 1993

The NW Act was enacted to provide for the identification, classification and control of noxious weeds. The NW Act aims to reduce the negative impact of weeds on the economy, community and environment of NSW by:

- Establishing control mechanisms to prevent the establishment of significant new weeds in NSW.
- Preventing, eliminating or restricting the spread of particular significant weeds in NSW.
- Effectively managing widespread significant weeds in NSW.

Plants declared as noxious weeds are currently listed under Noxious Weeds (Weed Control) Order 2014 published in the NSW Government Gazette No. 23. The NW Act is supported by a number of regulations and is administered by the DPI.

Noxious weeds are discussed further in Section 4.9.3.



4 Results

The ecological features of the study area are described below and mapped in Figure 3.

4.1 Landscape context

The study area occurs on low-lying, mostly flat land, most of which is swampy. The land slopes upwards very slightly towards the north-western corner of Lot 232, where the subject site is proposed.

The study area consists of disturbed native and exotic vegetation surrounding a large artificial freshwater lake. The subject site occurs on the most highly disturbed part of the study area, consisting predominantly of a derelict Slash Pine plantation with some regenerating native elements.

The remainder of the vegetation throughout the terrestrial parts of the study area consists of disturbed swamp forest or freshwater wetland vegetation that has been disturbed and is regenerating from previous sand quarry operations. Areas of cleared, slashed or weedy vegetation associated with the previous quarry operations occur mainly in the central and south-western parts of the study area. A slashed powerline easement also occurs throughout the subject site and along the western boundary of the study area.

Outside of the study area, land use is residential along its northern boundary, residential or rural to the west and undeveloped predominantly native vegetation to the south and east.

The study area was found to occur on low-lying, swampy land on Quaternary Sand deposits (Hawley *et al.* 1994).

The study area is directly linked to bushland consisting of swamp forest, with varying degrees of disturbance, to the south and east which provides connectivity to bushland facilitating the movement of fauna throughout the landscape. Figure 2 shows the connectivity of the study area to larger adjoining bushland areas.

4.2 Flora and fauna

Species recorded during the flora assessment are listed in Table A.1 of 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. No threatened flora species were recorded within the study area during the field investigations.

Two Endangered Ecological Communities (EECs) were recorded within the study area during the field assessment:

- *Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* was recorded in both the subject site and offset area.
- *Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* was recorded in the offset area only.

During the site investigation four noxious weeds as defined by DPI for the Port Stephens LGA were recorded. These noxious weeds are listed in section 4.9.3.

Pine tree plantations on the coast typically offer little habitat for native fauna, so apart from habitat for some birds the subject site portion of the study area is considered to be poor quality fauna habitat.

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While many of the pine trees had a diameter at breast height (dbh) of 30 centimetres or greater, as is typical of such trees, they contained no visible hollows. No nests were present, but there was extensive evidence in the form of chewed-up cones, of Yellow-tailed Black-cockatoos feeding on the pine cones and several Yellow-tailed Black-cockatoos were seen or heard within the site during the habitat assessment.

The *Freshwater wetlands on Coastal Floodplains* EEC and *Swamp Sclerophyll Forest on Coastal Floodplains* EEC which occur predominantly outside the subject site provide a greater variety of habitat features for local fauna. The waterbody itself, including fringing vegetation, also provides good habitat for native waterbirds, including threatened species. These are listed in section 4.4.

The Broad-leaved Paperbark trees, Coastal Banksias, Swamp Oak, Red Ash and wattles in the subject site offer some fauna habitat, particularly during peak flowering periods, when nectivores comprising birds and the Grey-headed Flying-foxes could forage on the abundant paperbark trees with diameters up to 50 centimetres. This area was also favoured by small birds.

The native vegetation scattered through the derelict Slash Pine Plantation also offers some habitat. The high level of weed invasion has resulted in dense understorey vegetation in some areas, also attractive to small birds.

Common fauna species observed within the study area during the habitat assessment were:

Birds

- Spangled Drongo
- Eastern Whipbird
- Willy Wagtail
- Grey Fantail
- Welcome Swallow
- Rainbow Lorikeet
- Silvereye
- Superb Blue Wren
- Superb Fairy Wren
- Eastern Yellow Robin
- Golden Whistler
- Brown Gerygone
- Australian Magpie
- Australian Raven
- Australasian Darter
- Purple Swamphen
- Pacific Black Duck
- Chestnut Teal
- Golden Whistler
- Eastern Spinebill

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- Masked Lapwing
- Red Wattlebird

A glimpse of an unidentified bird of prey was also recorded, however no bird of prey nests were observed in the study area.

Mammals

- Eastern Grey Kangaroo

Reptiles

- Red-bellied Black Snake
- Blue-tongued Lizard
- Eastern Water Skink

Large dragonflies were also observed near the northern margin of the lake.

Although the subject site does not contain any of the preferred food trees for Koala, the Broad-leaved Paperbark and Swamp Oak are both listed as tree species that may be important to Koalas in the Port Stephens Comprehensive Koala Plan of Management (CKPoM) (Port Stephens Council 2002). The main listed feed tree in the study area according to both SEPP44 and the CKPoM, Swamp Mahogany *Eucalyptus robusta*, occurs outside the subject site only. A few Swamp Mahogany trees were recorded in the central eastern section of the study area near Adelaide Street.

The Port Stephens CKPoM map indicates patches of preferred habitat with buffer areas on both the northern and southern side of the lake. The site currently allows movement across the site and would act as a corridor, however the dense patches of lantana and other weeds in many areas would make movement more difficult.

The study area appears to be largely devoid of tree hollows, reducing the likelihood of occurrence of hollow-dwelling arboreal mammals. Only one possible small hollow in a dead stag along the edge of Grahamstown Drain to the south of the subject site was observed. Although leaf litter and fallen branches were present no hollow logs were observed.

A list of threatened fauna recorded or predicted to occur in the local area is provided in Appendix 2, along with an assessment of the likelihood of the species occurring within the study area.

4.3 Vegetation communities and fauna habitat

The vegetation and fauna habitat throughout the majority of the study area has been modified by past disturbances which have included a pine plantation and an abandoned sand quarry.

The study area supports a range of ecological features including areas of native vegetation (swamp forest and freshwater wetlands), including areas of regenerating native vegetation currently in low condition, cleared and weedy areas scattered trees and a large artificial lake. The ecological features are outlined below, divided by the vegetation communities they occur in (refer also to Figure 3).

Table 1 Vegetation communities of the study area

Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Sawr Sedge swamp forest of the Central Coast and Lower North Coast

PCT ID	1717
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Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast	
Biometric vegetation type ID	HU931
Extent within study area	Approximately 11.71 hectares of this PCT in moderate-good condition was recorded within the study area, the majority of this occurring in the offset area. A further 6.25 hectares of this PCT was recorded in the study area in low condition. This occurred in the form of pine plantations with regenerating native species; or previously cleared and regenerating land from the abandoned sand quarry. The low condition variant of this PCT occurred in both the development and offset areas, with a slightly greater area in the development area.
Survey effort	Four plot/transects were completed in this PCT (Figure 3) – one in the development area and three in the offset area.
Condition	The community was recorded in two condition classes with different vegetation zones in the assessment: <ul style="list-style-type: none"> • 'Moderate to Good' condition with some recruitment of exotic species due to surrounding land use and associated past or ongoing impacts. The Ancillary Code used for this vegetation zone was 'Medium' (Plate 1). • 'Low' condition consisting of either pine plantations with regenerating native paperbarks and Swamp Oaks which occurred mostly in the subject site (Plate 2), or previously cleared and regenerating land associated with the abandoned sand quarry consisting of bare or weedy areas with a distinct presence of regenerating native overstorey species for this PCT, particularly Swamp Oak and paperbark.
Characteristic species used for identification of PCT	The overstorey species recorded within the community that align with the dominant species listed as characterising this PCT (Sivertsen <i>et al.</i> 2011; Somerville 2009) are Swamp Oak <i>Casuarina glauca</i> , Broad-leaved Paperbark <i>Melaleuca quinquenervia</i> , Swamp Mahogany <i>Eucalyptus robusta</i> , Cheese Tree <i>Glochidion ferdinandi</i> , Bordered Panic <i>Entolasia marginata</i> , Tall Saw Sedge <i>Gahnia clarkei</i> , Blady Grass <i>Imperata cylindrica</i> , Spiny-headed Mat-rush <i>Lomandra longifolia</i> and Blue Flax-lily <i>Dianella caerulea</i> .
Justification of evidence used to identify the PCT	Apart from species composition, the stated distribution and habitat information for the PCT as given in the OEH VIS Community Profile Report is highly consistent with the geographic location, habitat and floristics of the PCT at Raymond Terrace. The PCT is described as 'Myrtaceous Swamp Open Forests with a mid-stratum of small trees. The ground stratum is dense and dominated by wet-loving grasses and graminoid species. This community is common on coastal floodplains and poorly drained lowlands from the Broadwater to Fainford. It mainly occurs on unconsolidated sediments at elevations below 50m. More isolated examples occur as far south as Macmasters Beach.' Common weed species within the PCT are stated as being Lantana <i>Lantana camara</i> ; Cassia <i>Senna pendula</i> ; Carpet Grass <i>Axonopus fissifolius</i> ; Flatweed <i>Hypochaeris radicata</i> ; Whisky Grass <i>Andropogon virginicus</i> and Crofton Weed <i>Ageratina adenophora</i> . All of these weed species were recorded within the PCT. The study area is within one of the potential IBRA subregions, Mitchell Landscapes and LGAs in which the PCT is stated as occurring. In summary, the PCT appears to be a good match for the vegetation community that occurs in the study area.
Threatened ecological community status	Commonwealth EPBC Act: Not listed NSW TSC Act: <i>Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and SE corner bioregions</i> (Endangered).

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Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast

Plate 1: PCT 1717 -
Moderate-good
condition



Plate 2: PCT 1717 -
Low condition



Phragmites australis and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion

PCT ID	1071
Biometric vegetation type ID	HU673
Extent within study area	Approximately 1.67 hectares of this PCT was recorded within the study area as several separate patches, all within the offset area. None of the PCT occurred in the subject site.

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<i>Phragmites australis</i> and <i>Typha orientalis</i> coastal freshwater wetlands of the Sydney Basin Bioregion	
Survey effort	Two plot/transects were used in this PCT (Figure 3).
Condition	The community is generally in moderate to good condition with some recruitment of exotic species due to surrounding land use and associated edge impacts. Moderate-Good was the condition used in the credit calculator with no Ancillary Code.
Characteristic species used for identification of PCT	The key ground cover species recorded within the community that align with the dominant species listed as characterising this PCT according to the VIS Classification Profile are Common Reed <i>Phragmites australis</i> and Water Primrose <i>Ludwigia peploides</i> subsp. <i>montevidensis</i> . Another dominant species characterising the PCT, Broadleaf Cumbungi <i>Typha orientalis</i> appeared to be absent from the study area, but may have failed to disperse to the area and is likely to occur when the community attains greater maturity.
Justification of evidence used to identify the PCT	Apart from species composition, the stated distribution and habitat information for the PCT as given in the OEH VIS Community Profile Report is highly consistent with the geographic location, habitat and floristics of the PCT at Raymond Terrace. The key matching characteristics are its landscape position of man-made water bodies, drainage lines and depressions across a wide variety of environments. It includes modified former wetlands such as Hexham Swamp. It also occurs in original form in wide variety of situations associated with coastal plains, valleys, lagoons and other sites of poor drainage. The drainage depressions in the study area are most likely to be man-made rather than natural or original, and are a consequence of the history of landuse of the site as a sand quarry.
Threatened ecological community status	Commonwealth EPBC Act: Not listed NSW TSC Act: <i>Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions</i> (Endangered).
Plate 3: PCT 1071 – Moderate-good condition	

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4.4 Threatened biota

Threatened biota includes all flora and fauna species, populations and ecological communities listed under the EPBC Act and TSC 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). An assessment of the likelihood of these species occurring in the study area, and an indication of where within the subject site (i.e. which habitats or features of relevance to the species), is included.

No areas of critical habitat for flora or fauna have been declared within the study area.

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

A summary of those threatened fauna species and ecological communities recorded or with a medium or higher likelihood of occurring in the study area is provided in Table 2 below, with a further indication of likely presence in the subject site.

Table 2 Summary of threatened biota likely to occur in the study area

Species / community name	Subject site	Offset area	Habitat of value within the study area
Eastern Bentwing-bat	Yes*	Yes*	Possible marginal foraging habitat only occurs in the subject site. More extensive areas of foraging habitat occur in the offset area.
Little Bentwing-bat	Yes*	Yes*	Possible marginal foraging habitat only occurs in the subject site. More extensive areas of foraging habitat occur in the offset area.
Grey-headed Flying-fox	Yes*	Yes*	Dense stands of <i>Melaleuca</i> trees mainly in the offset area provide an important foraging resource during peak flowering times for a camp that is known to occur in the locality. This resource is much more limited in the subject site.
Koala	No	Yes	The subject site is likely to be too modified for the Koala to occur, but suitable feed trees and good connectivity occurs in the offset area south of the subject site.
Varied Sittella	No	Yes	Potentially suitable habitat occurs in the paperbark forests of the offset area only.
Australasian Bittern	No	Yes	Wetlands with permanent water and rushes occur around the edges of the lake in the offset area only.
Osprey	No	Yes	The required habitat of open water for foraging for the Osprey occurs in the offset area only.
Wallum Froglet	No	Yes	The most likely areas of suitable habitat occur within paperbark swamp around the fringes of the lake within the offset area only.
Green and Golden Bell Frog	No	Yes	Some of the fringing vegetation around the lake in the offset area may provide suitable habitat for this species.

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Species / community name	Subject site	Offset area	Habitat of value within the study area
Swamp Sclerophyll Forest on Coastal Floodplains	Yes	Yes	A total of 11.62 hectares of this TEC in moderate-to-good condition occurs in the study area, of which 0.30 hectares is present in the subject site. The community is heavily invaded by lantana and other weeds in many parts of the study area, particularly in the subject site.
Freshwater wetlands on Coastal Floodplains	No	Yes	A total of 1.67 hectares of this TEC in moderate-to-good condition occurs in the study area, all within the offset area. The community is regenerating from past sand mining disturbance and relatively species-poor, but not heavily invaded by weeds.

*Foraging resources only.

Given that an area of habitat for the Swamp Sclerophyll Forest on Coastal Floodplains TEC would ultimately be removed due to the proposed rezoning, an AoS for this ecological community has been carried out (Appendix 4). As noted previously, this is not required if a BioBanking Statement were to be applied for.

Although it has been determined that three threatened fauna species; Eastern Bent-wing Bat, Little Bent-wing Bat and Grey-headed Flying fox could forage in the limited resources within the subject site, there is no breeding or roosting habitat and the species are more likely to utilise the more extensive and better quality habitat of the offset area. Likewise for the Koala, superior foraging and connecting habitat and feed trees occur in the offset area. Hence, no AoSs have been completed for these species.

4.5 Biobanking calculation – subject site

Site values and results from the field and desktop investigations were entered into the BioBanking Credit Calculator (version 4.0) according to the BBAM as described below.

4.5.1 Landscape value

The subject site occurs entirely within the NSW North Coast IBRA bioregion and Hunter subregion. Most of the inner assessment circle is located within the Hunter IBRA subregion (Figure 4), however the majority of the southern half of the outer assessment circle is located within the Karuah Manning subregion. The Hunter subregion is the subregion used in this assessment.

The subject site occurs entirely within the Sydney-Newcastle Barriers and Beaches Mitchell Landscape, which is the Mitchell Landscape used in this assessment.

The smallest inner and outer assessment circles (100 hectare and 1000 hectare) were used, as the 1000 hectare assessment circle was sufficient to fit the study area. The assessment circles were both centered on the centre of the subject site.

Mapping of native vegetation within the assessment circles was undertaken using the *Greater Hunter Native Vegetation Mapping* (Roff et al. 2011) data, which is the most up-to-date and comprehensive local vegetation mapping study. The extent of native vegetation cover before development within both the outer and inner assessment circles was determined as the sum of areas of each of the native vegetation map units within each assessment circle.

To determine the extent of native vegetation cover after development, the extent of vegetation required for removal was subtracted from the extent of native vegetation cover before development. For the purpose of

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these calculations it was assumed that all vegetation would be cleared from the subject site. Table 3 provides a summary of the extent of native vegetation cover within the inner and outer assessments circles, before and after development. The removal of native vegetation due to the development has not altered the range into which the before and after development areas fall for the outer assessment circle, but for the inner assessment circle, the value falls from 11-15% before development to 6-10% after development.

Table 3 Extent of native vegetation cover before and after development

Assessment Circle	Before Development		After Development	
	Area (ha)	Per cent	Area (ha)	Per cent
Outer assessment circle	100.3	10.0	100.3	10.0
Inner assessment circle	13.2	13.2	10.2	10.2

The subject site does not support any of the following:

- An area identified as being part of a state significant biodiversity link.
- A riparian buffer 50 metres either side of a 6th order stream.
- A riparian buffer 50 metres around an important wetland or estuarine area.
- An area identified as being part of a regionally significant biodiversity link.
- A riparian buffer 20 metres either side of a 4th or 5th order stream,

Therefore, the proposed development will not impact on any state significant or regionally significant biodiversity links.

The subject site was assessed as being part of one connective link, with native vegetation to the south of the proposed development area providing connectivity with native vegetation that extends via expanses of vegetation to the east of the subject site, connecting via this link with native vegetation to the west of the development area, including native vegetation to the west of Adelaide Street (Figure 4). The connecting native vegetation was assessed as:

- >5-30 metres width.
- Overstorey Projective Foliage Cover at Benchmark both before and after development.
- Mid-storey/ground cover Projective Foliage Cover at <50% Benchmark both before and after development.
- Patch size was calculated by GIS using the rules for connecting native vegetation. None of the native vegetation mapped to the south of the Pacific Highway is considered connected due to the presence of the four-lane highway (defined as a hostile barrier). Accordingly, patch size was calculated as 55.8 hectares.

4.5.2 Vegetation zones

The PCT recorded within the subject site was stratified into two vegetation zones based on condition, as summarised in Table 4. Their distribution is shown in Figure 5.

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Table 4 Vegetation zones mapped within the study area

Vegetation zone	Plant community type [Ancillary Code]	Vegetation formation	Vegetation class	Biometric Vegetation Type	Area (ha)
1	PCT 1717: <i>Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast.</i> [Moderate/Good_Medium]	Forested Wetlands	Coastal Swamp Forests	HU931	0.30
2	PCT 1717: <i>Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast.</i> [Low condition]	Forested Wetlands	Coastal Swamp Forests	HU931	3.78
TOTAL					4.08





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4.5.3 Geographic / habitat features

An assessment of the occurrence of geographic habitat features, in accordance with Section 12 of the Credit Calculator Operational Manual (OEH 2016c) was undertaken, along with a determination of whether impacts to these habitat features will result from the proposed development. The species generated by the calculator associated with the BBAM, along with the results of this assessment, are outlined in Table 5.



Table 5 Assessment of geographic habitat features within the study area

Common name	Scientific name	Feature	Impact	Justification
Biconvex Paperbark	<i>Melaleuca biconvexa</i>	Swamps, swamp margins or creek edges	Yes	Swamps and swamp margins occur within the study area.
<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>	<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>	Land within northern section of sub-region, associated with poorly drained sand deposits within 10km radius of Kurri Kurri in Wyong CMA subregion	No	The land is not within 10km of Kurri Kurri in Wyong CMA subregion.
<i>Maundia triglochinos</i>	<i>Maundia triglochinos</i>	Swamps or shallow fresh water on clay	No	The study area does not occur on clay.
Charmhaven Apple	<i>Angophora inopina</i>	Land within 5 km of Wallaroo Nature Reserve in Upper Hunter CMA subregion	No	The study area is not within 5 km of Wallaroo Nature Reserve in Upper Hunter CMA subregion.
<i>Zannichellia palustris</i>	<i>Zannichellia palustris</i>	Land containing freshwater bodies	Yes	The study area contains a freshwater body.
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	Land containing escarpments, cliffs, caves, deep crevices, old mine shafts or tunnels.	No	The study area does not contain escarpments, cliffs, caves, deep crevices, old mine shafts or tunnels.



Common name	Scientific name	Feature	Impact	Justification
Common Planigale	<i>Planigale maculata</i>	Rainforest, eucalypt forest, heathland, marshland, grassland or rocky areas	No	No rainforest, eucalypt forest, heathland, marshland, grassland or rocky areas occur in the study area.
Wallum Froglet	<i>Crinia tinnula</i>	Land within 40 m of swamps, wet or dry heaths or sedge grasslands	Yes	The study area occurs within 40 m of a swamp.
Pale-headed Snake	<i>Hoplocephalus bitorquatus</i>	Land within 40 m of watercourses, containing hollow-bearing trees, loose bark and/or fallen timber	Yes	The study area is within 40 m of a watercourse, does not contain hollow-bearing trees or loose bark but does contain abundant fallen timber.
Black Bittern	<i>Ixobrychus flavicollis</i>	Land within 40 m of freshwater and estuarine wetlands, in areas of permanent water and dense vegetation or emergent aquatic vegetation	Yes	The study area occurs within 40 m of freshwater wetlands, including areas of permanent water associated with the lake, dense vegetation and some emergent aquatic vegetation.
Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>	Land within 40 m of freshwater or saline wetlands (eg saltmarsh, mangroves, mudflats, swamps, billabongs, floodplains, watercourse pools, wet heathland and/or farm dams)	Yes	The study area occurs within 40 m of swamps.



Common name	Scientific name	Feature	Impact	Justification
Broad-billed Sandpiper	<i>Limicola falcinellus</i>	Intertidal mudflats or sandflats within inlets, bays	No	The study area does not contain intertidal mudflats or sandflats within inlets, bays.
Comb-crested Jacana	<i>Irediparra gallinacea</i>	land within 40 m of permanent wetlands with a good surface cover of floating vegetation	No	The study area is within 40 m of permanent wetlands with a good surface cover of floating vegetation.
Eastern Osprey	<i>Pandion cristatus</i>	Land within 40 m of fresh/brackish/saline waters of larger rivers or creeks; estuaries, coastal lagoons, lakes and/or inshore marine waters	Yes	The study area is within 40 m of a freshwater lake.
Australasian Bittern	<i>Botaurus poiciloptilus</i>	Land east of Cessnock in Hunter CMA subregion	No	The study area is not east of Cessnock in Hunter CMA subregion.
Green-thighed Frog	<i>Litoria brevipalmata</i>	Land within 100 m of semi-permanent or ephemeral ponds or depressions containing leaf litter	Yes	The study area occurs within 100 m of semi-permanent or ephemeral ponds or depressions containing leaf litter.
Green and Golden Bell Frog	<i>Litoria aurea</i>	land within 100 m of emergent aquatic or riparian vegetation	Yes	The study area occurs within 100 m of emergent aquatic or riparian vegetation.

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A list of ecosystem credit species predicted to occur within the study area, based on the PCTs present and generated by the calculator associated with the BBAM (OEH 2014) is provided in Table 6. These species are all assumed to occur within the study area for the purpose of the calculation.

Table 6 Ecosystem credit species included in the credit calculation

Common Name	Scientific Name	Threatened species Offset Multiplier
Australian Painted Snipe	<i>Rostratula australis</i>	1.3
Black-tailed Godwit	<i>Limosa limosa</i>	2.6
Blue-billed Duck	<i>Oxyura australis</i>	1.3
Freckled Duck	<i>Stictonetta naevosa</i>	1.3
Little Lorikeet	<i>Glossopsitta pusilla</i>	1.8
Squirrel Glider	<i>Petaurus norfolcensis</i>	2.2
Swift Parrot	<i>Lathamus discolor</i>	1.3
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	2.2

The species with the highest Threatened Species (TS) offset multiplier is the Black-tailed Godwit with TS offset multiplier value of 2.6. However, given the quality of habitat in the subject site, most of the species in Table 6 are not considered likely to occur in the subject site, but could occur in the offset area (Appendix 2).

4.5.5 Species credit species

A list of species credit species (flora and fauna) predicted to occur within the study area, based on the PCT present, is provided in Table 7. The potential for each species to occur within the study area was assessed in accordance with Appendix 1 and Appendix 2 (based on results from previous and current field investigations and an assessment of the habitat available in the study area) and Section 6.5 of the BBAM (OEH 2014). While some of these species have potential to occur in the offset area, as discussed in section 4.4, none of the species credit species listed below are likely to occur in the subject site, since the habitat is considered to be 'substantially degraded' (OEH 2014). Therefore, species credits are not included as part of this assessment.

Table 7 Potential species credit species considered for inclusion in the credit calculation

Common Name	Scientific Name	Assessed as occurring in subject site?
Australasian Bittern	<i>Botaurus poiciloptilus</i>	No
Biconvex Paperbark	<i>Melaleuca biconvexa</i>	No
Black Bittern	<i>Ixobrychus flavicollis</i>	No
Black-eyed Susan	<i>Tetratheca juncea</i>	No
Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>	No

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Common Name	Scientific Name	Assessed as occurring in subject site?
Brush-tailed Phascogale	<i>Phascogale tapoatafa</i>	No
Charmhaven Apple	<i>Angophora inopina</i>	No
Eastern Pygmy-possum	<i>Cercartetus nanus</i>	No
Green and Golden Bell Frog	<i>Litoria aurea</i>	No
Green-thighed Frog	<i>Litoria brevipalmata</i>	No
Koala	<i>Phascolarctos cinereus</i>	No
Narrow Goodenia	<i>Goodenia macbarronii</i>	No
Pale-headed Snake	<i>Hoplocephalus bitorquatus</i>	No
Regent Honeyeater	<i>Anthochaera phrygia</i>	No
Rough Doubletail	<i>Diuris praecox</i>	No
Small Flower Grevillea	<i>Grevillea parviflora subsp. parviflora</i>	No
Tall Knotweed	<i>Persicaria ealator</i>	No
Trailing Woodruff	<i>Asperula asthenes</i>	No
Wallum Froglet	<i>Crinia tinnula</i>	No
-	<i>Zannichellia palustris</i>	No

4.5.6 Vegetation transect / plot details

A summary of the data collected from the BioBanking plots / transects for the BioBanking credit calculation is provided in Appendix 3.

4.5.7 Management Zones

Two management zone have been delineated (Table 8), corresponding to each vegetation zone. The zones are shown in Figure 5. For both Management Zones, it is assumed that the vegetation within the zones will be completely cleared for rezoning and ultimate development.

Table 8 Impacts within the Management Zones

Vegetation Zone	Plant Community Type	Level of impact	Management Zone	Area (ha)
1	PCT 1717: Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast. (Moderate-Good_Medium condition)	Total vegetation clearing	MZ1	0.30

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Vegetation Zone	Plant Community Type	Level of impact	Management Zone	Area (ha)
2	PCT 1717: <i>Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast.</i> (Low condition)	Total vegetation clearing	MZ2	3.78

All vegetation within Vegetation Zone 1 will be cleared, with all site attribute scores set to zero. Corresponding site attribute scores following development are provided in Table 9 (MZ1) and Table 10 (MZ2).

Table 9 Site attributes scores for vegetation within Vegetation Zone 1 (MZ1)

Site attribute	Current score (0-3)	Score with development (0-3)
Native plant species	2	0
Native over-storey cover	3	0
Native mid-storey cover	3	0
Native ground cover (grasses)	1	0
Native ground cover (shrubs)	0	0
Native ground cover (other)	3	0
Exotic plant cover	1	0
Number of trees with hollows	0	0
Overstorey regeneration	3	0
Total length of fallen logs	3	0
TOTAL SITE VALUE SCORE	71.33	0

Table 10 Site attributes scores for vegetation within Vegetation Zone 2 (MZ2) - low condition

Site attribute	Current score (0-3)	Score with development (0-3)
Native plant species	1	0
Native over-storey cover	0	0
Native mid-storey cover	2	0
Native ground cover (grasses)	0	0
Native ground cover (shrubs)	0	0
Native ground cover (other)	0	0

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Site attribute	Current score (0-3)	Score with development (0-3)
Exotic plant cover	0	0
Number of trees with hollows	0	0
Overstorey regeneration	2	0
Total length of fallen logs	3	0
TOTAL SITE VALUE SCORE	26.67	0

4.5.8 Threatened species survey results

No threatened species were recorded during the field surveys and for the purposes of this assessment, no species credit species are assessed in the credit calculation as occurring within the subject site. The potential presence of threatened flora species in the subject site is discounted by its 'substantially degraded' condition and the coverage of this area during field surveys.

A number of fauna species were rated as having a moderate or high likelihood of occurring in the habitats available within the entire study area (Appendix 2), but threatened species likely to occur within the subject site would be far fewer due to the predominantly low condition and 'substantially degraded' nature of the habitat within most of that area, assessed in section 4.4. For the purposes of this assessment, it can be validly assumed that if any threatened fauna species happened to occur or utilise the marginal habitats of the subject site, it would be in response to the limited foraging resources in the marginal habitat of the subject site only, and there would be sufficient alternative habitat of superior quality within the adjoining offset area. No species credits were calculated for this assessment.

4.5.9 Biodiversity credit requirements

A summary of the ecosystem credit requirements as determined by the credit calculator (version 4.0) is given in Table 11. The BioBanking Credit Report (Appendix 5) gives the offset options, consisting of either the same or closely related PCTs that can be used to offset the PCT impacted. The offsets must be located within the Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs. In this case, the same PCT can be offset within the same lot (the study area) in which the development is proposed.

Table 11 Credit summary - Ecosystem credits required

PCT	Area (ha)	Ecosystem Credits required	Red Flag
PCT 1717: Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast. [Moderate/Good_Medium condition]	0.30	17	Yes
PCT 1717: Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast. [Low condition]	3.78	82	No
TOTAL	4.08	99	

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RAYMOND TERRACE.**4.5.10 Red Flag issues**

Being an EEC, any impacts on PCT 1717 would trigger a Red Flag under the BBAM. If a BioBanking Statement were being sought, an application for a red flag variation would need to be made to the Chief Executive of OEH, with an assessment against relevant determinations set out in Section 9.2.4.1 and Section 9.2.6 of the BBAM (OEH 2014). The Chief Executive of OEH must determine that the viability of biodiversity values in the red flag area is low or not viable, and its contribution to regional biodiversity values is low depending on the following:

- (a) The condition of the vegetation
- (b) The size of the area of biodiversity values and its isolation
- (c) Current or proposed tenure and zoning under any relevant planning instrument
- (d) Current and proposed surrounding land use, and
- (e) Whether mechanisms and funds are available to manage low viability sites such that their viability is improved over time.

In this case, it is a very minimal portion of the subject site consisting of the PCT in Moderate-Good condition (0.30 ha) that would trigger a Red Flag. The majority of the vegetation to be impacted is the Low condition form of the PCT, and does not trigger a Red Flag. The PCT is completely offset in the offset area, and abundant alternative off-site areas of this PCT occur on adjacent land. Given these considerations, it is concluded that the viability biodiversity values of the red flag area and its contribution to regional biodiversity values is low. Accordingly, any application for a red flag variation for a BioBanking Statement with reference to the above considerations would be likely to be successful.

4.6 BioBanking calculation – offset site

Site values and results from the field and desktop investigations for a BioBank site in relation to the part of the study area that is intended to serve as an offset to the development were entered into the BioBanking Credit Calculator (version 4.0) according to the BBAM as described below.

4.6.1 Landscape value

The offset site occurs within the NSW North Coast IBRA bioregion and the Hunter subregion. The Hunter subregion covers the entire offset site and is the subregion used in this assessment.

The offset area occurs entirely within the Sydney-Newcastle Barriers and Beaches Mitchell Landscape, which is the Mitchell Landscape used in this assessment.

The smallest inner and outer assessment circles (100 hectare and 1000 hectare) were used, as the 1000 hectare assessment circle was sufficient to fit the study area. The assessment circles were both centered on the centre of the offset site (Figure 6).

Mapping of native vegetation within the assessment circles was undertaken using the *Greater Hunter Native Vegetation Mapping* (Roff et al. 2011) data, which is the most up-to-date and comprehensive local vegetation mapping study.

The extent of native vegetation cover before and after offset for both outer and inner assessment circles was determined as the sum of areas of each of the native vegetation map units listed above. The area of native vegetation required for removal on the subject site was subtracted from the extent of native vegetation

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mapped prior to development for calculation of the area of native vegetation in the outer assessment circle. It was assumed that the area of native vegetation to be offset would not change before and after offset.

Table 12 Extent of native vegetation cover before and after development

Assessment Circle	Before Development		After Development	
	Area (ha)	Per cent	Area (ha)	Per cent
Outer assessment circle	154.1	15.4	154.1	15.4
Inner assessment circle	26.7	26.7	26.7	26.7

The study area does not support any of the following:

- An area identified as being part of a state significant biodiversity link.
- A riparian buffer 50 metres either side of a 6th order stream.
- A riparian buffer 50 metres around an important wetland or estuarine area.
- An area identified as being part of a regionally significant biodiversity link.
- A riparian buffer 20 metres either side of a 4th or 5th order stream,

Therefore, the proposed offset site will not affect any state significant or regionally significant biodiversity links.

The offset site was assessed as being part of one connective link, connecting well to native vegetation to the east of the offset site. The most limiting connecting link is off-site to the west, on the opposite side of Adelaide Street where two narrow connections occur via separate links, one at the northern and one at the southern end of the offset area.

The connecting native vegetation was assessed as:

- >5-30 metres width.
- Overstorey Projective Foliage Cover at Benchmark both before and after Biobank.
- Mid-storey/ground cover Projective Foliage Cover at <50% Benchmark both before and after Biobank.
- Patch size was calculated by GIS using the rules for connecting native vegetation. None of the native vegetation mapped to the south of the Pacific Highway (south of the study area) is considered connected due to the presence of the four-lane highway (defined as a hostile barrier). Accordingly, patch size was calculated as 55.8 hectares.

4.6.2 Vegetation zones

The two PCTs recorded within the offset site were stratified into three vegetation zones based on condition, as summarised in Table 13. Their distribution is shown in Figure 7.

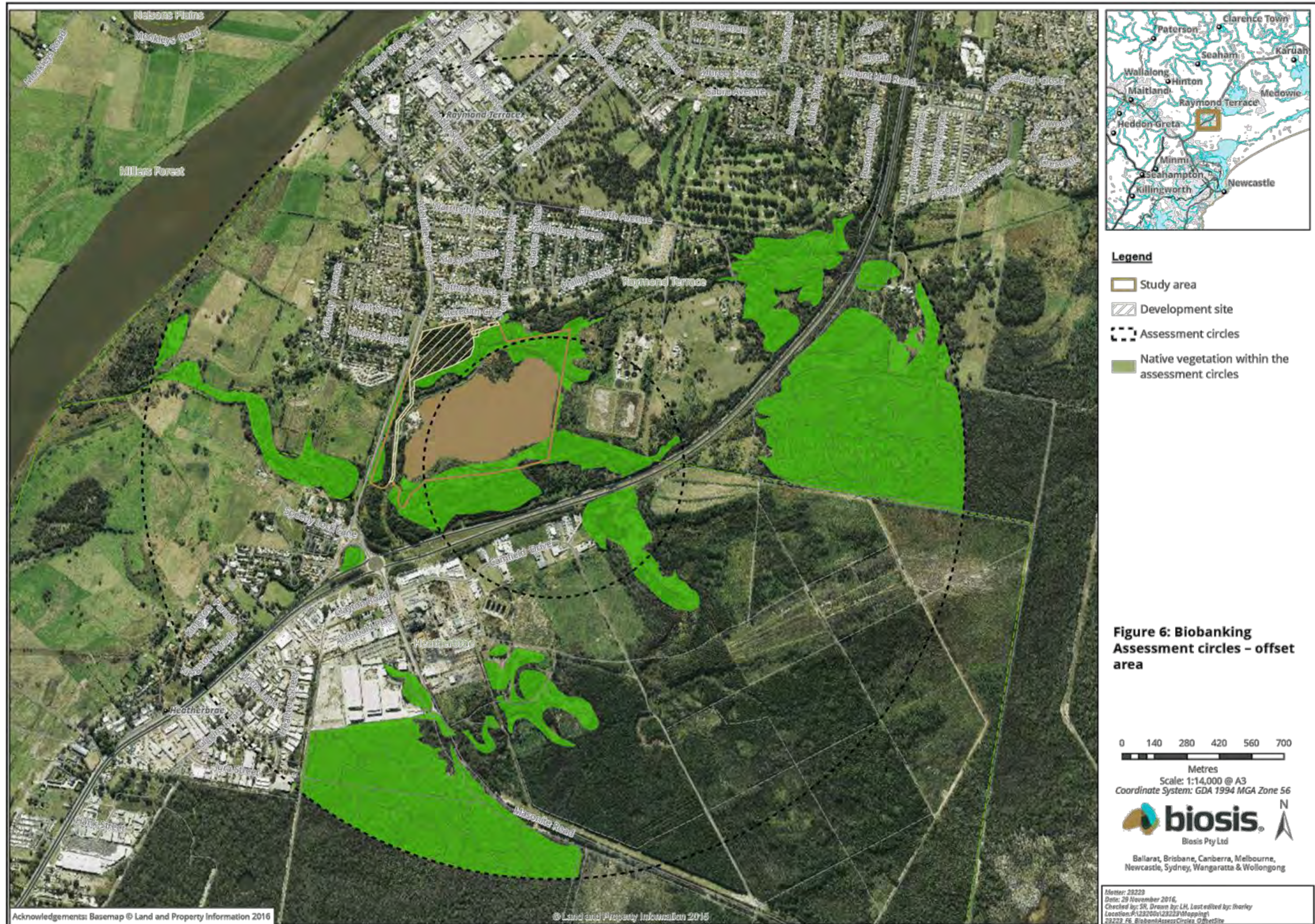
Table 13 Vegetation zones mapped within the offset site

Vegetation zone	Plant community type [Ancillary Code]	Vegetation formation	Vegetation class	Biometric Vegetation Type	Area (ha)
1	PCT 1717: <i>Broad-leaved</i>	Forested	Coastal	HU931	11.32

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Vegetation zone	Plant community type [Ancillary Code]	Vegetation formation	Vegetation class	Biometric Vegetation Type	Area (ha)
	<i>Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast.</i> [Moderate/Good_Medium]	Wetlands	Swamp Forests		
2	PCT 1717: <i>Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast.</i> [Low condition]	Forested Wetlands	Coastal Swamp Forests	HU931	2.47
3	PCT 1071: <i>Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion.</i> [Moderate/Good_Medium]	Freshwater Wetlands	Coastal Freshwater Lagoons	HU673	1.67
TOTAL					15.46





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4.6.3 Geographic / habitat features

An assessment of the occurrence of geographic habitat features, in accordance with Section 12 of the Credit Calculator Operational Manual (OEH 2016c) was undertaken, along with a determination of whether these habitat features will be affected in the proposed offset site. The species generated by the calculator associated with the BBAM, along with the results of this assessment are outlined in Table 14.



Table 14 Assessment of geographic habitat features within the offset site

Common name	Scientific name	Feature	Impact	Justification
Biconvex Paperbark	<i>Melaleuca biconvexa</i>	Swamps, swamp margins or creek edges	Yes	Swamps and swamp margins occur within the study area.
<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>	<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>	Land within northern section of sub-region, associated with poorly drained sand deposits within 10km radius of Kurri Kurri in Wyong CMA subregion	No	The land is not within 10km of Kurri Kurri in Wyong CMA subregion.
<i>Maundia triglochinos</i>	<i>Maundia triglochinos</i>	Swamps or shallow fresh water on clay	No	The study area does not occur on clay.
<i>Zannichellia palustris</i>	<i>Zannichellia palustris</i>	Land containing freshwater bodies	Yes	The study area contains a freshwater body.
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	Land containing escarpments, cliffs, caves, deep crevices, old mine shafts or tunnels.	No	The study area does not contain escarpments, cliffs, caves, deep crevices, old mine shafts or tunnels.
Common Planigale	<i>Planigale maculata</i>	Rainforest, eucalypt forest, heathland, marshland, grassland or rocky areas	No	No rainforest, eucalypt forest, heathland, marshland, grassland or rocky areas occur in the study area.



Common name	Scientific name	Feature	Impact	Justification
Wallum Froglet	<i>Crinia tinnula</i>	Land within 40 m of swamps, wet or dry heaths or sedge grasslands	Yes	The study area occurs within 40 m of a swamp.
Pale-headed Snake	<i>Hoplocephalus bitorquatus</i>	Land within 40 m of watercourses, containing hollow-bearing trees, loose bark and/or fallen timber	Yes	The study area is within 40 m of a watercourse, does not contain hollow-bearing trees or loose bark but does contain abundant fallen timber.
Black Bittern	<i>Ixobrychus flavicollis</i>	Land within 40 m of freshwater and estuarine wetlands, in areas of permanent water and dense vegetation or emergent aquatic vegetation	Yes	The study area occurs within 40 m of freshwater wetlands, including areas of permanent water associated with the lake, dense vegetation and some emergent aquatic vegetation.
Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>	Land within 40 m of freshwater or saline wetlands (eg saltmarsh, mangroves, mudflats, swamps, billabongs, floodplains, watercourse pools, wet heathland and/or farm dams)	Yes	The study area occurs within 40 m of swamps.
Broad-billed Sandpiper	<i>Limicola falcinellus</i>	Intertidal mudflats or sandflats within inlets, bays	No	The study area does not contain intertidal mudflats or sandflats within inlets, bays.
Comb-crested	<i>Irediparra gallinacea</i>	land within 40 m of permanent wetlands with a good surface cover	No	The study area is within 40 m of permanent wetlands with a good surface cover of floating vegetation.



Common name	Scientific name	Feature	Impact	Justification
Jacana		of floating vegetation		
Eastern Osprey	<i>Pandion cristatus</i>	Land within 40 m of fresh/brackish/saline waters of larger rivers or creeks; estuaries, coastal lagoons, lakes and/or inshore marine waters	Yes	The study area is within 40 m of a freshwater lake.
Australasian Bittern	<i>Botaurus poiciloptilus</i>	Land containing brackish or freshwater wetlands	Yes	The study area contains freshwater wetlands.
Green-thighed Frog	<i>Litoria brevipalmata</i>	Land within 100 m of semi-permanent or ephemeral ponds or depressions containing leaf litter	Yes	The study area occurs within 100 m of semi-permanent or ephemeral ponds or depressions containing leaf litter.
Green and Golden Bell Frog	<i>Litoria aurea</i>	land within 100 m of emergent aquatic or riparian vegetation	Yes	The study area occurs within 100 m of emergent aquatic or riparian vegetation.

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RAYMOND TERRACE.**4.6.4 Ecosystem credit species**

A list of ecosystem credit species predicted to occur within the study area, based on the PCTs present and generated by the calculator associated with the BBAM (OEH 2014) is provided in Table 15. An assessment of the likelihood of these species occurring in the study area is provided in Appendix 2.

Table 15 Ecosystem credit species included in the credit calculation

Common Name	Scientific Name	Threatened species Offset Multiplier
Australian Painted Snipe	<i>Rostratula australis</i>	1.3
Barking Owl	<i>Ninox connivens</i>	3.0
Black-tailed Godwit	<i>Limosa limosa</i>	2.6
Blue-billed Duck	<i>Oxyura australis</i>	1.3
Bush Stone-curlew	<i>Burhinus grallarius</i>	2.6
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	2.2
Eastern Freetail-bat	<i>Mormopterus norfolkensis</i>	2.2
Eastern Grass Owl	<i>Tyto longimembris</i>	1.3
Freckled Duck	<i>Stictonetta naevosa</i>	1.3
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	2.0
Glossy Black-Cockatoo	<i>Calyptorhynchus lathamii</i>	1.8
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	2.2
Little Eagle	<i>Hieraaetus morphnoides</i>	1.4
Little Lorikeet	<i>Glossopsitta pusilla</i>	1.8
Magpie Goose	<i>Anseranas semipalmata</i>	1.3
Spotted Harrier	<i>Circus assimilis</i>	1.4
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>	2.6
Squirrel Glider	<i>Petaurus norfolcensis</i>	2.2
Swift Parrot	<i>Lathamus discolor</i>	1.3
Varied Sittella	<i>Daphoenositta chrysoptera</i>	1.3
White-fronted Chat	<i>Epthianura albifrons</i>	0.8
Yellow-bellied Glider	<i>Petaurus australis</i>	2.3
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	2.2

The species with the highest Threatened Species (TS) offset multiplier is the Barking Owl with TS offset multiplier value of 3.0.

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RAYMOND TERRACE.**4.6.5 Species credit species**

The list of species credit species (flora and fauna) predicted to occur within the study area, based on the PCTs present, is the same as that obtained for the development site calculation and is presented in Table 7. Since it was determined that no species credit species are likely to be impacted in the development site and therefore require no special offsets due to the development, no species credits are considered for this calculation.

4.6.6 Vegetation transect / plot details

A summary of the data collected from the BioBanking plots / transects for the BioBanking credit calculation is provided in Appendix 3.

4.6.7 Management Zones

Three management zone have been delineated (Table 16), corresponding to each vegetation zone. The zones are shown in Figure 7. For all Management Zones, it is assumed that the default minimum management actions required for a BioBank site will be applied to obtain the respective biodiversity credits for each zone. A list of the standard management actions required to obtain ecosystem credits at a BioBank site is provided below:

- Management of grazing for conservation
- Weed control
- Application of ecological fire management
- Management of human disturbance
- Retention of regrowth and remnant native vegetation
- Replanting or supplementary planting where natural regeneration will not be sufficient
- Retention of dead timber
- Erosion control
- Retention of rocks

Table 16 Management Zones within the Offset Area

Vegetation Zone	Plant Community Type	Management Zone	Area (ha)
1	PCT 1717: <i>Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast.</i> (Moderate-Good_Medium condition)	MZ1	11.32
2	PCT 1717: <i>Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast.</i> (Low condition)	MZ2	2.47
3	PCT 1071: <i>Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion.</i> (Moderate-	MZ3	1.67

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Vegetation Zone	Plant Community Type	Management Zone	Area (ha)
	Good (Medium condition)		

4.7 Management zone scores

4.7.1 Assessment of changes in landscape attribute values for the BioBank site

BioBanking the site will not result in any change in the landscape attribute values for the as the following landscape attributes will remain the same before and after BioBanking:

- Percent native vegetation cover within both the outer and inner assessment circles will not change as most of the vegetation of the BioBank site is considered to be native vegetation prior to BioBanking.
- Connectivity value will not change as the existing surrounding development drives the connectivity attribute score.
- Strategic location of the BioBank site will not change.

4.7.2 Averted loss

The native vegetation within the BioBank site has been assessed as having a low risk of decline in the near future as quarrying activities have been abandoned, the site is fenced and mostly inaccessible and it is not likely to be subject to clearing of native vegetation or other disturbances.

4.7.3 Assessment of changes in biodiversity values for management zones within the BioBank site

Default changes in biodiversity values for management zones actions are detailed for MZ1 in Table 17, MZ2 in Table 18 and MZ3 in Table 19.

Table 17 Changes in biodiversity value scores for Offset Management Zone 1

Site attribute	Current score (0-3)	Averted loss score (0-3)	Default Increased Score (0-3)	Score with management (0-3)
Native plant species:	1	1	1.5	1.5
Native over-storey cover:	3	3	3	3
Native mid-storey cover:	2	2	3	3
Native ground cover (grasses):	3	2	3	3
Native ground cover (shrubs):	1	1	2	2
Native ground cover (other):	3	2	3	3
Exotic plant cover:	2	1.5	3	3
Number of trees with hollows:	0	0	0	0
Overstorey regeneration:	3	2	3	3
Total length of fallen logs:	3	2	3	3
Totals	66.22	7.22	82.00	82.00

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Table 18 Changes in biodiversity value scores for Offset Management Zone 2

Site attribute	Current score (0-3)	Averted loss score (0-3)	Default Increased Score (0-3)	Score with management (0-3)
Native plant species:	1	1	1.5	1.5
Native over-storey cover:	1	1	2	2
Native mid-storey cover:	1	1	2	2
Native ground cover (grasses):	3	2	3	3
Native ground cover (shrubs):	0	0	1	1
Native ground cover (other):	0	0	1	1
Exotic plant cover:	2	1.5	3	3
Number of trees with hollows:	0	0	0	0
Overstorey regeneration:	2	1.5	3	3
Total length of fallen logs:	0	0	0	0
Totals	30.00	2.39	56.44	56.44

Table 19 Changes in biodiversity value scores for Offset Management Zone 2

Site attribute	Current score (0-3)	Averted loss score (0-3)	Default Increased Score (0-3)	Score with management (0-3)
Native plant species:	3	3	3	3
Native over-storey cover:	3	3	3	3
Native mid-storey cover:	3	3	3	3
Native ground cover (grasses):	0	0	1	1
Native ground cover (shrubs):	0	0	0	0
Native ground cover (other):	1	1	2	2
Exotic plant cover:	3	2	3	3
Number of trees with hollows:	0	0	0	0
Overstorey regeneration:	3	2	3	3
Total length of fallen logs:	0	0	0	0
Totals	88.37	7.36	93.02	93.02

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RAYMOND TERRACE.**4.7.4 Threatened species survey results**

No threatened species were recorded during the field surveys and for the purposes of this assessment, no species credit species are assessed in the credit calculation as occurring within the proposed offset area, even though a number of fauna species were rated as having a moderate or high likelihood of occurring in the habitats available within the offset area (Appendix 2). However, since it was determined that no species credits require offsetting as a result of the development, no species credits were calculated for this assessment.

4.7.5 Biodiversity credits created by the offset area

A summary of the ecosystem credits that could potentially be created by the offset area as determined by the credit calculator is given in Table 20. The BioBanking Credit Report (Appendix 5) indicates that the offset area provides the appropriate matching PCT types to offset the PCTs that would be impacted in the subject site, and is located within the Hunter IBRA subregion, which is the same subregion as the proposed development.

Table 20 Credit summary – Ecosystem credits created in the offset area

PCT	Area (ha)	Ecosystem Credits created
PCT 1717: <i>Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast.</i> [Moderate/Good_Medium condition]	11.32	82
PCT 1717: <i>Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast.</i> [Low condition]	2.47	22
PCT 1071: <i>Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion</i> [Moderate/Good_Medium condition]	1.67	8
TOTAL	15.46	112

4.8 Overall BioBanking credit balance for the rezoning proposal in the study area

Of the PCTs recorded within the study area, the subject site would only impact PCT 1717: *Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast.* This occurs in both Moderate-Good and Low condition within both the subject site and the offset site. Therefore, the impacts due to the development as determined by the BBAM only need to be offset by one PCT in the offset area. This PCT can be in either Moderate-Good and Low condition if sufficient ecosystem credits are created in the offset area by standard management actions. Since no species credits are considered to be required due to the development, no additional management actions are required.

A summary of the credits required due to the development, and those potentially created in the offset area are given in Table 21.

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Table 21 Credit balance – Ecosystem credits required and created in the study area

PCT	Area (ha)		Ecosystem Credits		Credit balance
	Removed from Subject site	Available in offset site	Required by Subject site	Created in offset site	
PCT 1717: Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast. [Moderate/Good_Medium condition]	0.30	11.32	17	82	-
PCT 1717: Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast. [Low condition]	3.78	2.47	82	22	-
TOTAL PCT 1717	4.08	13.79	99	104	5 credit surplus

The summary shows that ecosystem credits required by the subject site can be fully offset within the remainder of the study area (the offset area) by a like-for-like PCT with a surplus of 5 credits for the PCT that would be impacted. The calculations were based on the assumptions that total removal of vegetation would occur from within the development footprint, and that standard management actions would be applied within the offset area to obtain the ecosystem credits potentially capable of being created.

The offset area also contains a relatively small area of PCT 1071: *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion which would not be impacted by the proposed rezoning. A total of 8 ecosystem credits of the PCT are available in the offset area, but are not required for offsetting of credits from the subject site.

4.9 Other Assessment Requirements

4.9.1 TSC Act

Two Threatened Ecological Communities (TEC), *Swamp Sclerophyll Forest on Coastal Floodplains* and *Freshwater Wetlands on Coastal Floodplains* occur within the study area, but only the former occurs within the subject site. The subject site contains minor elements of potential foraging habitat for Grey-headed Flying-fox, Eastern Bentwing-bat and Little Bentwing-bat.

The offset area also contains habitat for several threatened waterbird species and two threatened frog species, but this habitat would not be impacted by the proposed subdivision.

Due to predicted impacts on the TEC, an AoS has been undertaken for

- *Swamp Sclerophyll Forest on Coastal Floodplains* (see Appendix 4).

Although potential minor foraging habitat occurs in the subject site for

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- Eastern Bentwing-bat
- Little Bentwing-bat
- Grey-headed Flying-fox

more extensive areas of superior quality habitat occur in the adjoining offset area, therefore significant impacts on these species are unlikely and no further assessment is required.

4.9.2 Native Vegetation Act 2003

It has been determined that the majority vegetation within the subject site classified as low condition vegetation is not native vegetation as defined by the Act (no native overstorey and understorey <50% native cover), therefore the NV Act is not relevant to most of the vegetation clearing within this area.

The small area of vegetation in moderate-to-good condition to be cleared would qualify as native vegetation. Therefore, the Hunter Local Land Services office should be consulted for advice as to whether the NV applies to clearing the small area of native vegetation at this site.

4.9.3 Noxious Weeds Act 1993

Declared noxious weeds for Port Stephens Local Control Authority area identified in the study area from the current investigations are summarised in Table 22 together with the legal control requirements by landowners for these weeds on their land under the NW Act.

Table 22 Noxious weeds within the study area

Common Name	Class	Control Requirements
Annual Ragweed	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
Crofton Weed	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed</i>
Fireweed	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed</i>
Pampas Grass	3	Regionally Controlled Weed <i>The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed</i>

Treatment for the noxious weeds listed above is recommended within Department of Premier and Cabinet Weed Control Order (Department of Premier and Cabinet 2011).

4.9.4 State Environmental Planning Policy 44 - Koala Habitat Protection

SEPP 44 is relevant to the current proposal, but its assessment requirements locally are addressed in the Port Stephens LGA by the Port Stephens Comprehensive Koala Plan of Management (CKPoM) (Port Stephens Council 2002).

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In accordance with the Guidelines for Koala Habitat Assessments in the CKPoM, the following steps have been carried out:

- Step 1 Preliminary Assessment

The CKPoM mapping shows the subject site as *Link over Cleared* as a result of nearby mapped patches of Preferred Koala Habitat. While the site itself is not currently cleared land it has been cleared in the past and it does not currently provide Koala habitat.

None of the preferred koala food trees listed in the CKPoM are present on the site.

The subject site is 5.3 hectares in area so in accordance with the procedures in the CKPoM, Step 4 is the next relevant step.

- Step 4 Assessment of the Proposal

Under this step and since the project is a rezoning proposal, the Performance Criteria for Rezoning Requests (Appendix 2 of the CKPoM) are the relevant performance criteria. They are addressed below.

a) *Not result in development within areas of Preferred Koala Habitat or defined Habitat Buffers;*

Preferred Koala Habitat appears to be present within some parts the study area, but not the subject site. The subject site is not within areas of Preferred Koala Habitat or defined habitat buffers.

b) *Allow for only low impact development within areas of Supplementary Koala Habitat and Habitat Linking Areas;*

The subject site is mapped as *Link over Cleared* which is the lowest condition habitat linking area type. The proposed rezoning would permit some form of residential development in this area. Residential development in compliance with the Performance Criteria is expected to be low impact development at this site.

c) *Minimise the removal of any individuals of preferred koala food trees wherever they occur on the site.*

No preferred Koala food tree species occur on the subject site.

d) *Not result in development which would sever koala movement across the site. This should include consideration of the need for maximising tree retention on the site generally and for minimising the likelihood of impediments to safe/unrestricted koala movement.*

With the subject site being located on the southern edge of the urban area of Raymond Terrace township, the only Preferred Koala Habitat near the site is at the southern end of the study area. Although potential exists, there is very little incentive or opportunity for Koalas to move through the subject site to access good koala habitat areas.

The subject site is not likely to sever Koala movement through the area. Retention of trees or planting of locally indigenous tree species, as part of the landscaping of the area post construction may be possible. Such landscaping could include Koala food tree species however this may bring any Koalas that are attracted to the site into conflict with cars and dogs, so may be counter-productive.

It should be noted that the NSW Department of Planning and Environment (DPE) has proposed amendments to SEPP 44. Submissions on the proposed changes are currently being sought until 16 December 2016 and will be considered before the changes are finalised.

The key changes in the proposed amended SEPP relate to the:

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- definitions of koala habitat;
- list of tree species;
- list of councils; and
- development assessment process.

In particular, the proposed changes include:

- Replacement of the definitions of core koala habitat and potential koala habitat with definitions that identify the characteristics of plant communities which make up koala habitat and if there is evidence that koalas are present.
- These definitions will be supported by an updated list of tree species that reflects current scientific knowledge. None of the additional trees proposed for listing occur within the subject site.
- Port Stephens Council will be retained in the list of councils to which the SEPP applies.
- The proposed amendment of SEPP 44 will streamline the development assessment process. The updated process will require an applicant to establish whether a site contains koala habitat following an assessment of the vegetation as described in the guidelines.

DPE will also transfer the strategic planning outcomes in SEPP 44 to the Local Planning Directions under section 117 of the *Environmental Planning and Assessment Act 1979*.

Assuming the changes are adopted as planned with little amendment, the lack of potential or actual Koala habitat within the subject site is unlikely to change the conclusions made above.

4.9.5 EPBC Act

Potentially relevant Matters of NES as identified in the Protected Matters Report are summarised in Appendix 6. Following consideration of the likelihood of occurrence of threatened species and ecological communities listed under the Act (Appendices 1 and 2), only Grey-headed Flying-fox is considered likely to occur in the study area for foraging only. No camps or roosting/breeding habitat for the species occur in the study area.

EPBC Act Migratory Species recorded within 5 kilometres of the study area are summarised in Appendix 6. Some of the species listed could visit the wetland and aquatic habitats available within the offset area, but none are likely to be impacted by removal of habitat in the subject site.

No other Matters of NES are likely to be impacted by the proposal.

It is concluded that no significant impact will occur on any Matters of NES listed by the Act, therefore no referral under the Act is required.



5 Ecological impacts and recommendations

This section identifies the potential impacts of proposed development on the ecological values of the study area and includes recommendations to assist de Witt Consulting and Pheonix Builders to design a development to minimise impacts on biodiversity.

The principal means to reduce impacts on biodiversity values within the study area will be to minimise removal of native vegetation and habitat. The hierarchy of Avoid, Minimise and Mitigate has been followed prior to addressing the residual impacts by offsetting.

The proposed development has:

- Largely avoided the highest quality habitat within the study area by confining the proposed residential rezoning area to the low condition habitat of the pine forest plantation in the north-western corner of the lot and some areas of cleared, weedy vegetation.
- Minimised the area of impact on the areas of highest habitat value by careful design of the development footprint to impact almost entirely on low condition habitat of cleared, weedy land.
- Mitigated the impact on connectivity by retaining a 90 metre band of Moderate-Good condition vegetation between the subject site and the lake.

Under the current proposal, 4.08 hectares of vegetation would ultimately be removed or modified for an Asset Protection Zone (APZ), of which only 0.30 hectares is in moderate-good condition according to the BBAM definition.

The results of this flora and fauna assessment has been used to inform the design of the development. The design phase of the project, including management of the offset area, 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 23 below.



Table 23 Ecological values, impacts and recommendations

Ecological value	Impacts	Recommendations		
		Avoid	Minimise and mitigate	Offset
Native vegetation including trees	4.08 ha of mostly low condition native vegetation in the form of derelict pine plantation with regenerating elements of swamp forest vegetation will be cleared as an ultimate result of the rezoning proposal. Only 0.30 ha of this vegetation is in moderate-good condition as defined by the BBAM. The swamp forest community is a listed EEC under the NSW TSC Act. The majority of the area of EEC vegetation will be retained within the offset area. Habitat for a Freshwater wetland EEC occurs adjacent to the proposed rezoning area.	<p>Risk of impacts to the EECs in the adjoining retained habitat of the offset area can be managed by implementing appropriate safeguards in further planning and carrying out the clearing and construction works including:</p> <ul style="list-style-type: none"> Minimising clearing of native trees and vegetation as far as possible. Confining the area of clearing to the actual impact footprint by barriers or temporary fencing. 	<ul style="list-style-type: none"> Identify the locations of the EECs in the adjoining offset area (Figure 3) as 'No Go' zones in the project CEMP during the site induction. This should include discussion of the implications of the TSC Act should there be an incident that impacts on the EECs. Install appropriate exclusion fencing to the boundary of the retained native vegetation in the offset area with the area to be cleared where there is some potential for accidental encroachment. Include appropriate signage such as 'No Go Zone' or 'Environmental Protection Area'. 	<ul style="list-style-type: none"> Rezone the offset area for Environmental Conservation, place under an appropriate protective covenant and manage the area according to the requirements of a BioBank site.
Hollow-bearing trees	Few hollow bearing trees were recorded in the entire study area and few, if any, would be impacted in the subject site.	<ul style="list-style-type: none"> Carry out a pre-clearing inspection of potential hollow-bearing or habitat trees within the clearing area by a qualified fauna ecologist. 	<ul style="list-style-type: none"> A qualified and experienced fauna ecologist/ spotter-catcher should attend the site during vegetation clearing and rescue/ relocate any displaced or injured fauna. 	<ul style="list-style-type: none"> No offsets of hollow-bearing trees are likely to be required, unless occupied trees are identified during the pre-clearing inspection.
Water bodies (freshwater lake and associated	Sedimentation and pollution of waterbodies, wetlands and	<ul style="list-style-type: none"> Confine clearing operations to the development footprint 	<ul style="list-style-type: none"> Apply current best-practice sedimentation, siltation and 	<ul style="list-style-type: none"> Not applicable.



Ecological value	Impacts	Recommendations		
		Avoid	Minimise and mitigate	Offset
drainage lines, wetlands, soaks, etc.)	drainage lines in the offset area due to runoff from the subject site	itself using fencing and barriers as described above.	pollution controls (silt fences, detention basins etc.) to minimise silt and sediment entering waterways during construction and operation of the subdivision area.	
Plant diseases	Risk of introduction of plant pathogens, particularly Root-rot fungus <i>Phytophthora cinnamomi</i> or Myrtle rust fungus into the study area	<ul style="list-style-type: none"> Do not transport soil (fill) that has not been certified as disease-free into the subject site 	<ul style="list-style-type: none"> Decontaminate / wash down all vehicles, machinery and tools before working on site and follow all relevant plant pathogen management protocols. 	<ul style="list-style-type: none"> Not applicable.

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6 Conclusion

This report is an assessment of the potential impact of a rezoning proposal on biodiversity values within a parcel of land, and the opportunities for avoiding, minimising and mitigating and offsetting the impact in accordance with the EP&A Act, the TSC Act, the EPBC Act and the BBAM.

The proposed activities that will result in impacts to biodiversity include:

- Removal of an area of native vegetation mostly in low condition constituting a degraded and regenerating form of the EEC *Swamp Sclerophyll Forest on Coastal Floodplains* to accommodate the rezoning proposal.
- Minor removal of potential low quality fauna habitat within the subject site.

No threatened flora or fauna species or endangered populations listed under the EPBC Act or TSC Act were recorded during the field surveys.

Two of the vegetation communities mapped by Biosis within the study area are consistent with the final determinations for the EECs *Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* and *Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* under the TSC Act. Only *Swamp Sclerophyll Forest on Coastal Floodplains* occurs within the subject site, with a total of approximately 4.08 hectares (0.3 hectares in moderate-good condition and 3.78 hectares in low condition according to the BBAM definition) that would be removed as a consequence of the proposed rezoning.

For the reasons outlined in the Assessment of Significance, the proposed works, as currently designed, are deemed to not have a significant impact on the EEC *Swamp Sclerophyll Forest on Coastal Floodplains*.

Were the proposal to go ahead a number of safeguards to avoid, minimise and mitigate the above impacts have been included in Section 5 of this report including maximising retention and conservation of native vegetation, recommendations to maintain water quality in the offset area and recommendations regarding appropriate hygiene protocols for vegetation clearing and plant (refer to Table 23 for full details regarding proposal safeguards).

Following field investigations, the only EPBC Act listed threatened species determined to have a moderate likelihood of occurrence within the subject site is the Grey-headed Flying-fox.

This species plus the Eastern Bentwing-bat and Little Bentwing-bat as listed under the TSC Act are considered to have some potential to occur in the subject site due to the presence of minor foraging resources. However, more extensive and better quality resources occur in the offset area. An additional six threatened fauna species listed under the TSC Act are considered to have potential to occur in the offset area only.

Since no significant impact would occur on any threatened entity known or considered likely to occur in the subject site, no Species Impact Statement (SIS) is required.

Likewise, no referral under the EPBC Act is required.

An offset strategy proposed for the study area would fully balance the residual impacts of ecosystem credits required for native vegetation cleared from the subject site with like-for-like credits available within the offset area. This was determined by the BBAM and the BioBanking Credit Calculator with 99 credits required for the development and 104 credits of the same PCT available in the offset area, representing a surplus of 5 credits.

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Appendices

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Appendix 1 Flora

A1.1 Flora species recorded from the study area

Notes to tables:

EPBC Act: CR – Critically Endangered EN – Endangered VU – Vulnerable	TSC 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 V1 – vulnerable (Part 1, Schedule 2) <i>Codes identify the Legal Status of threatened biota within NSW under the TSC Act and the OEH Sensitive Species Data Policy (SSDP).</i>
Non-indigenous species # – Native species outside natural range ** – noxious weed species declared under the Noxious Weeds Act: N3 – Class 3 N4 – Class 4 N5 – Class 5	Noxious weed status: State prohibited species (Class 1) Regionally prohibited species (Class 2) Regionally controlled species (Class 3) Regionally restricted species (Class 4) Restricted plant (Class 5)

Table A.1 Flora species recorded from the study area

Status	Scientific name	Common name	Subject site	Offset area
Native Species				
	<i>Acacia binervata</i>	Two-veined Hickory	X	
	<i>Acacia falcata</i>	Falcate Wattle		X
	<i>Acacia irrorata</i> subsp. <i>irrorata</i>	Green Wattle	X	
	<i>Acacia longifolia</i> subsp. <i>longifolia</i>	Sydney Golden Wattle	X	X
	<i>Acacia podalyriifolia</i>	Queensland Silver Wattle	X	
	<i>Acmena smithii</i>	Lilly Pilly	X	
	<i>Alphitonia excelsa</i>	Red Ash	X	X
	<i>Astroloma pinifolium</i>	Pine Heath	X	
	<i>Banksia integrifolia</i>	Coastal Banksia	X	
	<i>Baumea rubiginosa</i>			X
	<i>Blechnum indicum</i>	Swamp Water Fern		X
	<i>Bolboschoenus</i> sp.	Marsh club-rush		X

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Status	Scientific name	Common name	Subject site	Offset area
	<i>Breynia oblongifolia</i>	Coffee Bush	X	
	<i>Callistemon salignus</i>	Willow Bottlebrush	X	
	<i>Calochlaena dubia</i>	Rainbow Fern	X	
	<i>Carex appressa</i>	Tall Sedge		X
	<i>Casuarina glauca</i>	Swamp Oak	X	X
	<i>Cayratia clematidea</i>	Native Grape		X
	<i>Cheilanthes sieberi</i>	Mulga Fern	X	
	<i>Commelina cyanea</i>	Native Wandering Jew	X	X
	<i>Cyathea australis</i>	Rough Treefern		X
	<i>Cymbopogon refractus</i>	Barbed Wire Grass	X	
	<i>Cynodon dactylon</i>	Common Couch	X	X
	<i>Cyperus flaccidus</i>	Lax Flat-sedge		X
	<i>Dillwynia retorta</i>	A Parrot Pea	X	
	<i>Drosera peltata</i>	A Sundew	X	
	<i>Eleocharis gracilis</i>			X
	<i>Entolasia marginata</i>	Bordered Panic	X	X
	<i>Eragrostis brownii</i>	Brown's Lovegrass		X
	<i>Eucalyptus robusta</i>	Swamp Mahogany		X
	<i>Gahnia clarkei</i>	Tall Saw-sedge	X	
	<i>Glochidion ferdinandi</i>	Cheese Tree	X	X
	<i>Goodenia bellidifolia</i>	-	X	
	<i>Grevillea robusta</i>	Silky Oak	X	
	<i>Hypolepis muelleri</i>	Harsh Ground Fern	X	X
	<i>Imperata cylindrica</i> var. <i>major</i>	Blady Grass	X	
	<i>Isachne globosa</i>	Swamp Millet		X
	<i>Isolepis inundata</i>			X
	<i>Juncus usitatus</i>			X
	<i>Kennedia rubicunda</i>	Dusky Coral Pea		X
	<i>Leucopogon juniperinus</i>	Prickly Beard-heath	X	
	<i>Ludwigia peploides</i> subsp.	Water Primrose		X

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Status	Scientific name	Common name	Subject site	Offset area
	<i>montevidensis</i>			
	<i>Melaleuca quinquenervia</i>	Broadl-eaved Paperbark	X	X
	<i>Melaleuca styphelioides</i>	Prickly-leaved Tea Tree		X
	<i>Monotoca elliptica</i>	Tree Broom Heath	X	
	<i>Oplismenus aemulus</i>	Basket Grass		X
	<i>Pandorea pandorana</i>	Wonga Wonga Vine	X	
	<i>Parsonsia straminea</i>	Common Silkpod	X	X
	<i>Persicaria decipiens</i>	Slender Knotweed		X
	<i>Persicaria strigosa</i>	Spotted Knotweed	X	X
	<i>Persoonia lanceolata</i>	Lance Leaf Geebung	X	
	<i>Philydrum lanuginosum</i>	Woolly Frogmouth		X
	<i>Phragmites australis</i>	Common Reed	X	X
	<i>Pteridium esculentum</i>	Bracken	X	X
	<i>Phyllanthus gunnii</i>	Scrubby Spurge	X	
	<i>Pittosporum undulatum</i>	Sweet Pittosporum	X	X
	<i>Pultenaea flexilis</i>	Graceful Bush-pea	X	
	<i>Schoenoplectus validus</i>	-	X	
	<i>Sporobolus creber</i>	Slender Rat's Tail Grass	X	
	<i>Themeda australis</i>	Kangaroo Grass		X
	<i>Viola hederacea</i>	Native Violet	X	X
Exotic species				
	<i>Acetosa sagittata</i>	Rambling Dock		X
N4	<i>Ageratina adenophora**</i>	Crofton Weed		X
	<i>Anagallis arvensis</i>	Scarlet Pimpernel		X
N5	<i>Ambrosia artemisiifolia**</i>	Annual Ragweed	X	
	<i>Andropogon virginicus</i>	Whisky Grass	X	X
	<i>Axonopus fissifolius</i>	Carpet Grass	X	X
	<i>Bidens pilosa</i>	Cobblers Pegs	X	X
	<i>Cinnamomum camphora</i>	Camphor Laurel	X	X
	<i>Conyza bonariensis</i>	Fleabane	X	X
N3	<i>Cortaderia selloana**</i>	Pampas Grass	X	X

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Status	Scientific name	Common name	Subject site	Offset area
	<i>Cotoneaster glaucophyllus</i>	Cotoneaster	X	
	<i>Cupressus</i> sp.	Cypress	X	
	<i>Cyperus eragrostis</i>	Umbrella Sedge		X
	<i>Ehrharta erecta</i>	Panic Veldtgrass	X	
	<i>Eragrostis curvula</i>	African Lovegrass	X	
	<i>Erythrina x sykesii</i>	Coral Tree	X	
	<i>Galinsoga parviflora</i>	Potato Climber		X
	<i>Galium aparine</i>	Goosegrass		X
	<i>Gamochaeta coarctata</i>	Cudweed		X
	<i>Geranium</i> sp.	Cultivated Geranium	X	
	<i>Harpephyllum caffrum</i>	Kaffir Plum	X	
	<i>Hypochaeris radicata</i>	Catsear	X	X
	<i>Ipomoea indica</i>	Morning Glory		X
	<i>Jacaranda mimosifolia</i>	Jacaranda	X	
	<i>Lagerstroemia indica</i>	Crepe Myrtle	X	
	<i>Lantana camara</i>	Lantana	X	X
	<i>Ligustrum sinense</i>	Small-leaved Privet	X	X
	<i>Macadamia tetraphylla</i>	Macadamia	X	
	<i>Medicago polymorpha</i>	Burr Medic		X
	<i>Megathyrsus maximus</i>	Guinea Grass	X	
	<i>Melinis repens</i>	Red Natal Grass	X	X
	<i>Nandina domestica</i>	Japanese Sacred Bamboo	X	
	<i>Nephrolepis cordifolia</i>	Fishbone Fern	X	
	<i>Ochna serrulata</i>	Mickey Mouse Plant	X	X
	<i>Olea europaea</i> subsp. <i>cuspidata</i>	African Olive	X	
	<i>Panicum maximum</i>	Guinea Grass		X
	<i>Paspalum dilatatum</i>	Paspalum		X
	<i>Paspalum urvillei</i>	Vasey Grass		X
	<i>Pennisetum clandestinum</i>	Kikuyu Grass		X
	<i>Pinus elliottii</i>	Slash Pine	X	

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Status	Scientific name	Common name	Subject site	Offset area
	<i>Plantago lanceolata</i>	Lamb's Tongues		x
	<i>Rosa rubiginosa</i>	Sweet Briar	x	x
	<i>Schefflera</i> sp.	Umbrella Tree	x	
	<i>Schinus areira</i>	Pepper Tree	x	
N4	<i>Senecio madagascariensis</i> **	Fireweed	x	x
	<i>Senna pendula</i>	Cassia	x	x
	<i>Setaria parviflora</i>	Pigeon Grass	x	
	<i>Sida rhombifolia</i>	Paddy's Lucerne	x	x
	<i>Solanum mauritianum</i>	Wild Tobacco	x	x
	<i>Solanum nigrum</i>	Blackberry Nightshade	x	x
	<i>Sonchus oleraceus</i>	Common Sowthistle		x
	<i>Syagrus romanzoffiana</i>	Cocos Palm	x	x
	<i>Richardia humistrata</i>	-	x	
	<i>Tradescantia fluminensis</i>	Trad	x	
	<i>Trifolium repens</i>	White Clover		x
	<i>Verbena bonariensis</i>	Purpletop		x

ITEM 11 - ATTACHMENT 1 PLANNING PROPOSAL - 251 ADELAIDE STREET
RAYMOND TERRACE.**A1.2 Threatened flora species and ecological communities**

The following table includes a list of the threatened flora species and ecological communities that have potential to occur within the study area. The list of species is sourced from the NSW BioNet Wildlife Atlas and the Protected Matters Search Tool (DEE; accessed on 18/04/2016).

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	<ul style="list-style-type: none"> 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 from the relevant catchment/basin.
Medium	<ul style="list-style-type: none"> Records of terrestrial biota within five 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	<ul style="list-style-type: none"> No records within five 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	<ul style="list-style-type: none"> 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, or predicted to occur, within 5 kilometres of the study area

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
<i>Commersonia prostrata</i>	Dwarf Kerrawang	EN	E1	2000	Low	Habitat is marginal and study area is too degraded.	Ground hugging shrub with populations sparsely distributed in the Southern Highlands, Southern Tablelands and the North Coast. Grows in gullies, along drainage lines and in disturbed areas in a variety of communities including Coastal Freshwater Wetlands of the Sydney Basin Bioregion, New England Dry Sclerophyll Forests, Temperate Montane Grasslands and Subalpine Grasslands. Grows in sand or peat soils.
<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid	VU	V	#	Low	No nearby records and habitat is marginal.	Orchid with a distribution spanning from Gibraltar Range National Park southwards to the coastal area near Orbost in Victoria. 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.
<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>		VU	V	2010	Negligible	Habitat is unsuitable.	Small to medium sized tree, growing in two metapopulations, the Kurri Kurri meta-population spans from Cessnock - Kurri Kurri in the north to Mulbring - Abedare in the south and the Tomago Sandbeds meta-population spans Salt Ash and Tanilba Bay in the north to Williamstown and Tomago in the south. Grows on wet sites subject to periodic inundation in Coastal Swamp Forests. Grows in deep, low nutrient sandy soils.
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Small-flower Grevillea	VU	V	2006	Negligible	Habitat is unsuitable.	Low spreading to erect shrub sporadically distributed throughout the Sydney Basin, most notably in the Picton, Appin and Bargo regions, in the Cessnock - Kurri Kurri area



Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
<i>Persicaria elatior</i>	Tall Knotweed	VU	V	2010	Low	Potential habitat is available, but species was not detected during surveys.	and isolated populations from Putty to Wyong and Lake Macquarie. Grows in Shale Sandstone Transition Forest, Kurri Sand Swamp Woodland, <i>Coymbia maculata</i> - <i>Angophora costata</i> Open Forest in the Dooralong Area, Sydney Sandstone Ridgetop Woodland at Wedderburn and Cooks River/Castlereagh Ironbark Forest at Kemp's Creek. Grows in sandy or light clay soils including tertiary alluviums over thin shales and lateritic ironstone gravels. Erect herb found growing in south-eastern NSW at Mount Dromedary, Moruya State Forest near Turlinjah, Upper Avon River catchment north of Robertson, Bermagui and Picton Lakes. Also grows in northern NSW around Raymond Terrace near Newcastle and Cherry Tree and Gibberagee State Forests in the Grafton area. Grows in damp places usually on the margins of waterbodies and in swamp forests in a variety of communities including Coastal Floodplain Wetlands, Coastal Swamp Forests, Eastern Riverine Forests, Coastal Freshwater Lagoons and Coastal Heath Swamps.
<i>Phaius australis</i>	Southern Swamp Orchid	EN	E1	#	Low	Potentially suitable habitat is present, but not detected	Terrestrial orchid with a distribution spanning from Queensland to Coffs Harbour in north-east NSW. Grows in coastal areas in swamps dominated by Broad-leaved Paperbark <i>Meleuca quinquenervia</i> and swampy forest situated at sea level in Coastal Dune Dry Sclerophyll Forests, Coastal Floodplain Wetlands, Coastal Swamp Forests, Wallum Sand Heaths, Dry Rainforests, Littoral Rainforests, North Coast Wet Sclerophyll Forests and Northern Escarpment Wet Sclerophyll Forests.



Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
<i>Tetratheca juncea</i>	Black-eyed Susan	VU	V	#	Negligible	Habitat is unsuitable.	Small shrub confined to the northern area of the Sydney Basin bioregion and the southern area of the North Coast bioregion in the Wyong, Lake Macquarie, Newcastle, Port Stephens, Great Lakes and Cessnock Local Government Areas. Found growing at well drained sites which experience annual rainfall levels between 1000 and 1200 mm at elevations below 200 metres in swampy heath and moist forests. Usually found growing in soils from the Awaba soil landscape comprising of low nutrient sandy, skeletal soils, sandy loam soils and clay soils on sandstone or conglomerate substrates.

* - habitat descriptions have been adapted by qualified ecologists from the DoE 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.

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Appendix 2 Fauna

A.1 Threatened fauna species

The following table includes a list of the significant fauna species that have potential to occur within the study area. The list of species is sourced from the NSW BioNet Wildlife Atlas, BirdLife Australia data search and the Protected Matters Search Tool (DEE; accessed on 08/04/2016).

Notes to table:

#	species predicted to occur by the DEE database (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
Year	recorded on databases listed above

Likelihood of occurrence	Potential criteria
High	<ul style="list-style-type: none"> 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 five kilometres or from the relevant catchment/basin.
Medium	<ul style="list-style-type: none"> Records of terrestrial species within five 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	<ul style="list-style-type: none"> No records within five 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Migratory or nomadic fauna species/individuals that may occur in the study area from time to time, but are not considered resident.



Table A.3 Threatened fauna species recorded, or predicted to occur, within 5 kilometres of the study area

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
Mammals							
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	VU	V	#	Low	No suitable roosting habitat near by.	Occurs from the Queensland border to Ulladulla, with largest numbers from the sandstone escarpment country in the Sydney Basin and Hunter Valley. 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 usually less than 10 individuals. Likely that it hibernates during the cooler months. The only known existing maternity roost is in a sandstone cave near Coonabarabran.
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	EN	V	#2016	Low	Suitable foraging habitat is present. Den sites are limited. The patch however is surrounded by busy roads or suburban development causing it to be fragmented from larger areas of bushland.	Occurs along the east coast of Australia and the Great Dividing Range. 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. Seventy per cent of the diet is medium-sized mammals, and also feeds on invertebrates, reptiles and birds. Individuals require large areas of relatively intact vegetation through which to forage. The home range of a female is between 180 and 1000 ha, while males have larger home ranges of between 2000 and 5000 ha.



Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle		V	2010	Low	Foraging may occur in the area, however unlikely to roost in the study area, due to the lack of hollows.	Distribution extending east of the Great Dividing Range throughout the coastal regions of NSW, from the Queensland border to the Victorian border. 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. Apparently hibernates in winter. Roosts in tree hollows and sometimes in buildings in colonies of between 3 and 80 individuals. Often change roosts every night. Forages for beetles, bugs and moths below or near the canopy in forests with an open structure, or along trails. Has a large foraging range, up to 136 ha. Records show movements of up to 12 km between roosting and foraging sites.
<i>Miniopterus australis</i>	Little Bentwing-bat		V	2010	Moderate	Foraging likely to occur in the area, however unlikely to roost in the study area, due to the lack of suitable caves or man-made structures.	Occurs from Northern Queensland to the Hawkesbury River near Sydney. Roost sites encompass a range of structures including caves, tunnels and stormwater drains. Young are raised by the females in large maternity colonies in caves in summer. Shows a preference for well timbered areas including rainforest, wet and dry sclerophyll forests, Melaleuca swamps and coastal forests. The Little Bentwing bat forages for small insects (such as moths, wasps and ants) beneath the canopy of densely vegetated habitats.
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat		V	2010	Moderate	Foraging likely to occur in the area, however unlikely to roost in the study area, due to the lack of suitable caves or man-made	Occurs from Victoria to Queensland, on both sides of the Great Dividing Range. 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