Appendix E Biodiversity Assessment Report

SMEC

Member of the Surbana Jurong Group

Eurobodalla Southern Storage

Biodiversity Assessment Report

Prepared for: Eurobodalla Shire Council

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Abbreviations & Acronyms

Abbreviation / Acronym	Description
a.s.l	above sea level
BAR	Biodiversity Assessment Report
BBAM	BioBanking Assessment Methodology
BBCC	BioBanking Credit Calculator
BC Act	*Biodiversity Conservation Act 2016*
BOM	Bureau of Meteorology
BOS	Biodiversity Offset Strategy
CEEC	Critically Endangered Ecological Community
DoEE	Commonwealth Department of the Environment & Energy
DP&E	NSW Department of Planning and Environment
DPI	NSW Department of Primary Industries
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESS	Eurobodalla Southern Storage
FBA	Framework for Biodiversity Assessment
FM Act	NSW *Fisheries Management Act 1994*
GDE	Groundwater Dependent Ecosystem
GIS	Geographic Information System
GPS	Global Positioning System
IBRA	Interim Biogeographic Regionalisation of Australia
LGA	Local Government Area
MNES	Matters of National Environmental Significance
NSW	New South Wales

Abbreviation / Acronym	Description
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
RL	Reduced Level
ROTAP	Rare or Threatened Australian Plants
SEARs	Secretary's Environmental Assessment Requirements
SEC	South East Corner
SSD	State Significant Development
SSDA	State Significant Development Application
TEC	Threatened Ecological Community
TSC Act	NSW *Threatened Species Conservation Act 1995*
VIS 2.1	Vegetation Information System

1. Introduction

1.1. Purpose

This Biodiversity Assessment Report (BAR) has been prepared by SMEC Australia Pty Ltd on behalf of Eurobodalla Shire Council (Council).

Council is proposing to build a 3000ML water storage located on an unnamed third order ephemeral stream, about 950 metres east of the Tuross River. The purpose of this BAR is to address the requirements of the Framework for Biodiversity Assessment (FBA; OEH 2014), developed for Major Projects, and to address the biodiversity matters raised in the Secretary's Environmental Assessment Requirements (SEARs).

1.2. Project Description

1.2.1. Overview

The proposed Eurobodalla Southern Storage (ESS) is required to provide drought security to the water supply system, ensuring the long-term water supply for the Eurobodalla regional area while complying with the water sharing plans that guarantee environmental flows to the Tuross River. Raw water would be extracted from the Tuross River from a new river intake pump station, as well as the existing bore field, for transfer to the new storage.

1.2.2. Location

This report details the biodiversity characteristics within and around an unnamed third order ephemeral stream about 950 metres east of and flowing into the Tuross River. The proposal location is approximately 30 kilometres south of Moruya within the Eurobodalla Local Government Area (LGA). The subject site is located around a north facing valley within Bodalla State Forest; it is bound to the north by a private residence, to the west and south-west by Bullocky's Hut Road, and to the south-east and east by Big Rock Road and Cpt3007/3 Road. Details of the location of the proposed ESS are provided in Figure 1-1 to Figure 1-3.

1.2.3. Key features of the project

Key features of the operational stage of the project are formed of two components; off stream storage and ancillary infrastructure. Details of each component are provided below:

Off stream storage

Key features of the off-stream storage include:

- 3000 megalitre capacity at Full Supply Level (FSL)
- A 370 metre long embankment wall that is 36 metres in height and 20 metres in width located on an unnamed tributary of the Tuross River
- Construction of a spillway to allow the storage to safely pass flood events to the Tuross River
- Erosion control structures located downstream of the spillway to dissipate energy from spillway flows during flood events to reduce scour and erosion to the existing gully and neighbouring property
- Inlet works to convey and dissipate raw water transferred from the river intake pump station through a pipeline constructed along the left abutment to the storage
- Outlet works to allow transfer of water from the storage to the existing water treatment plant (WTP)

- Outlet tower and tower access bridge
- A new storage access road that is one kilometre in length and extends from Eurobodalla Road opposite of the existing WTP to the proposed storage location
- Construction of a boat ramp at the storage for maintenance and water quality monitoring
- Construction of safety and perimeter fencing at the storage
- Instrumentation to monitor seepage, embankment pore water pressures, reservoir levels and water quality
- A consequence category of "High C" for both flood and sunny day scenarios in accordance with the ANCOLD Guidelines on the consequence categories of dams (2012).

Ancillary infrastructure

Key features of the ancillary facilities include:

- New river intake pump station with a total river extraction capacity of 26 megalitres per day. This can be made up of a combination of flows from the river intake (up to 26 megalitres) or the bore field (up to 6 megalitres).
- Installation of the following new pipelines:
    - A pipeline with a capacity of 26 megalitres per day to transfer raw water from the existing river intake pump station to the storage inlet chute
    - A pipeline cross connection with a capacity of six megalitres per day providing connection to supply water from the storage to the balance tank at the existing WTP
    - A pipeline connection from the existing bore field pipeline to the river intake pump station.
- New access road that is about 170 metres in length and would provide a route for vehicles to exit the new river intake pump station
- Provisions for power supply including the construction of a new sub-station located near the storage and new powerline from the WTP.

All of the features above are hereby referred to as the 'operational footprint'.

In addition, to facilitate construction of the features within the operational footprint, the following features will be required during the construction phase:

- Three construction compounds
- Cofferdam
- Two quarry areas

These construction features are hereby referred to as the 'construction footprint'. An indicative layout of the operational and construction footprints is shown in Figure 1-4 below.

1.2.4. Identification of Development Site Footprint

The development site is defined as the boundary of the operational footprint and all of the land within. The development site includes areas that will be impacted by the proposed ESS and areas retained following construction. The development site footprint has been identified in Figure 1-1 to Figure 1.4 below.

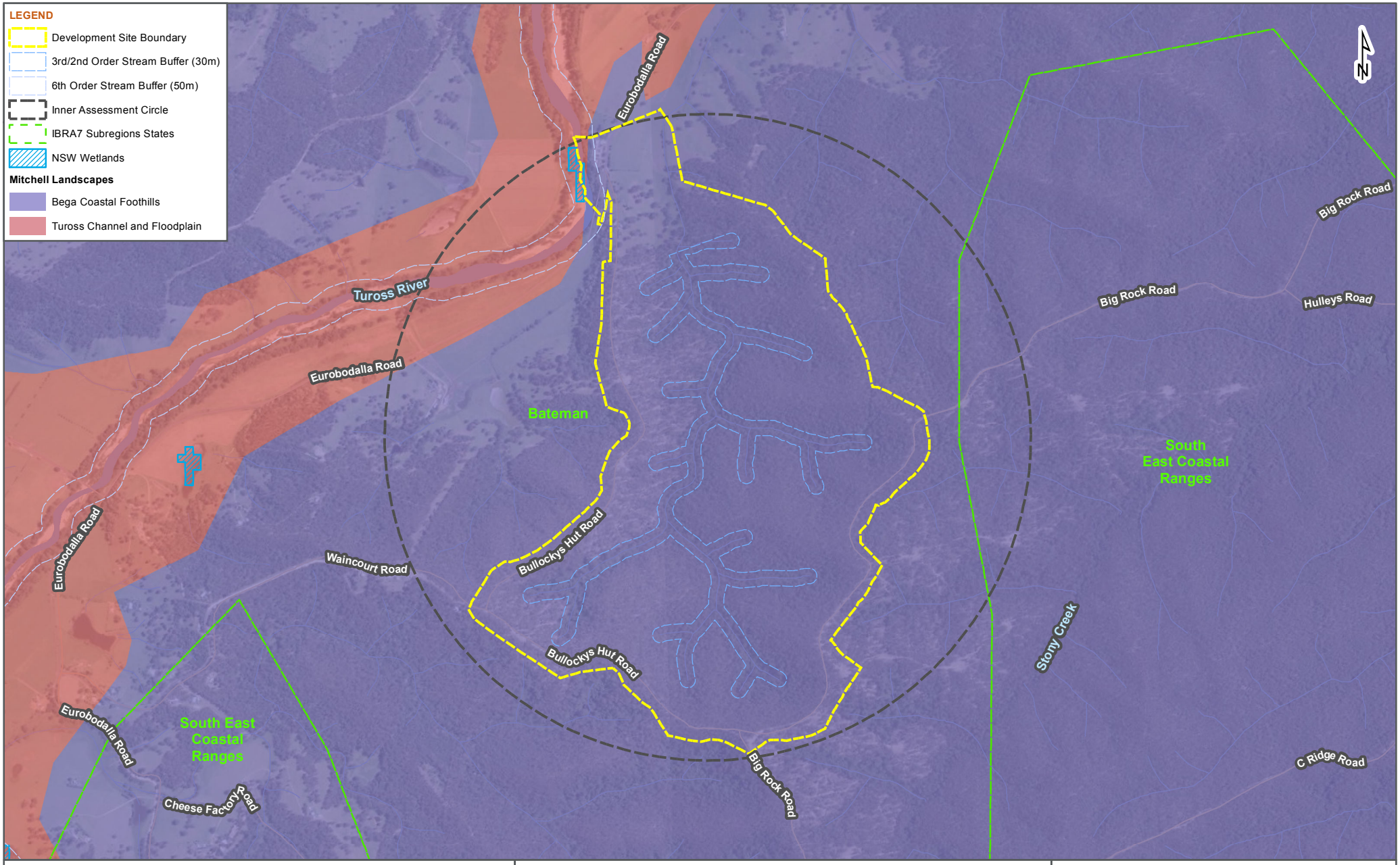

FIG NO. 1-1 **FIGURE TITLE** Site Map

DATE 16/08/2018

0 100 200 400 600
1:20,000 Metres

PAGE SIZE A4

COORDINATE SYSTEM GDA 1994 MGA Zone 56

PROJECT NO. 30012127 **PROJECT TITLE** Eurobodalla Southern Storage Water Supply Project - BAR

CREATED BY FN12672

SOURCES Roadnet MDS 2017, public NSW
Imagery: © Department of Finance, Services & Innovation 2018

SMEC

Location: \\AUMBFPV002\projects\Projects\30012127 - Eurobodalla Storage\09 GIS, Photos & Graphics\01 GIS\Maps\BAR\30012127_Fig_1_1_BAR_SiteMap.mxd

Last updated by: FN12672 on 16/08/2018 at 11:00

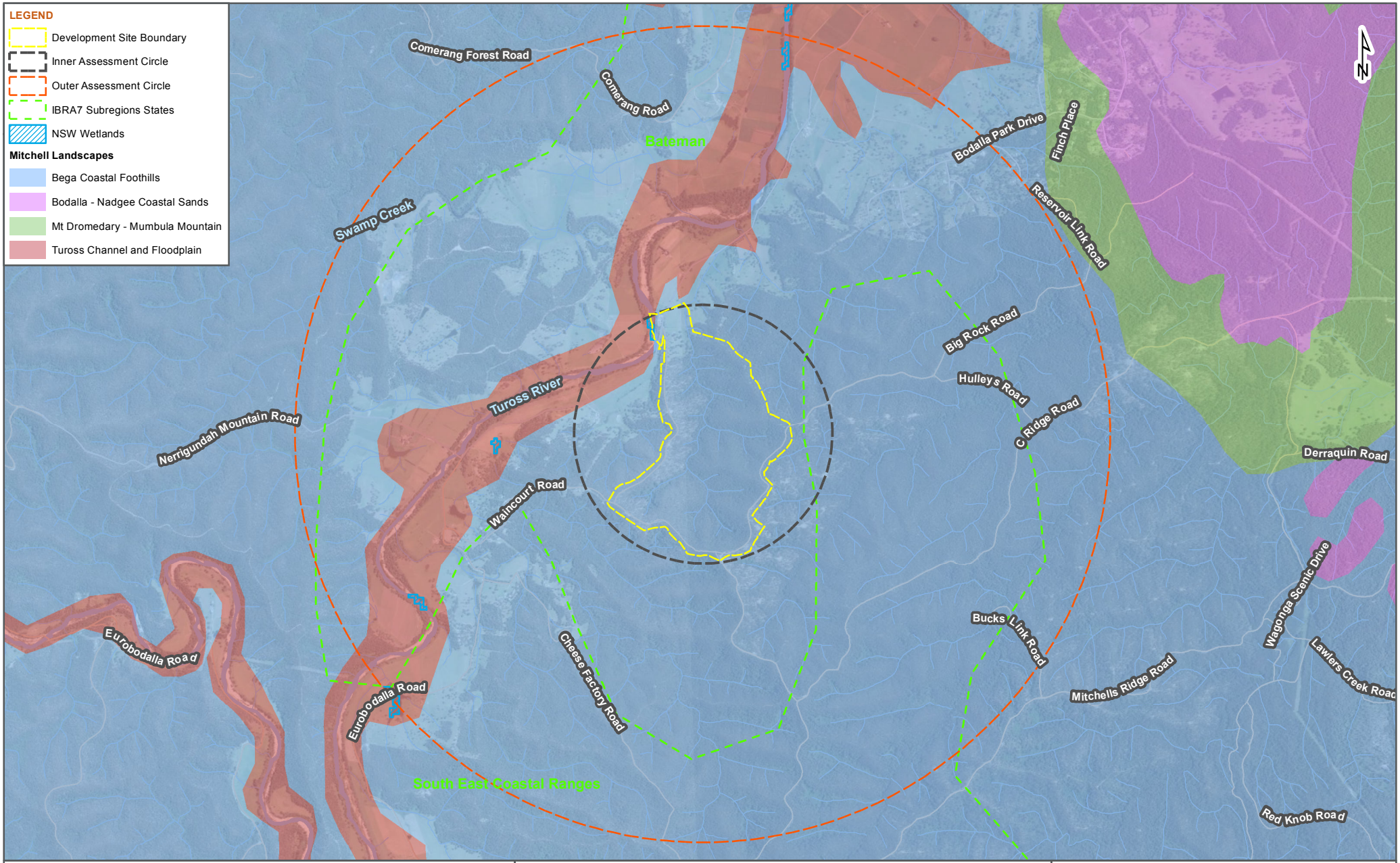

FIG NO. 1-2 **FIGURE TITLE** Location Map - Landscape

DATE 16/08/2018

0 250 500 1,000 1,500
1:50,000 Metres

PAGE SIZE A4

COORDINATE SYSTEM GDA 1994 MGA Zone 56

PROJECT NO. 30012127 **PROJECT TITLE** Eurobodalla Southern Storage Water Supply Project - BAR

CREATED BY FN12672

SOURCES Roadnet MDS 2017, public NSW
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Location: \\AUMBFPV002\projects\Projects\30012127 - Eurobodalla Storage\09 GIS, Photos & Graphics\01 GIS\Maps\BAR\30012127_Fig_1_2_BAR_LocnLand.mxd

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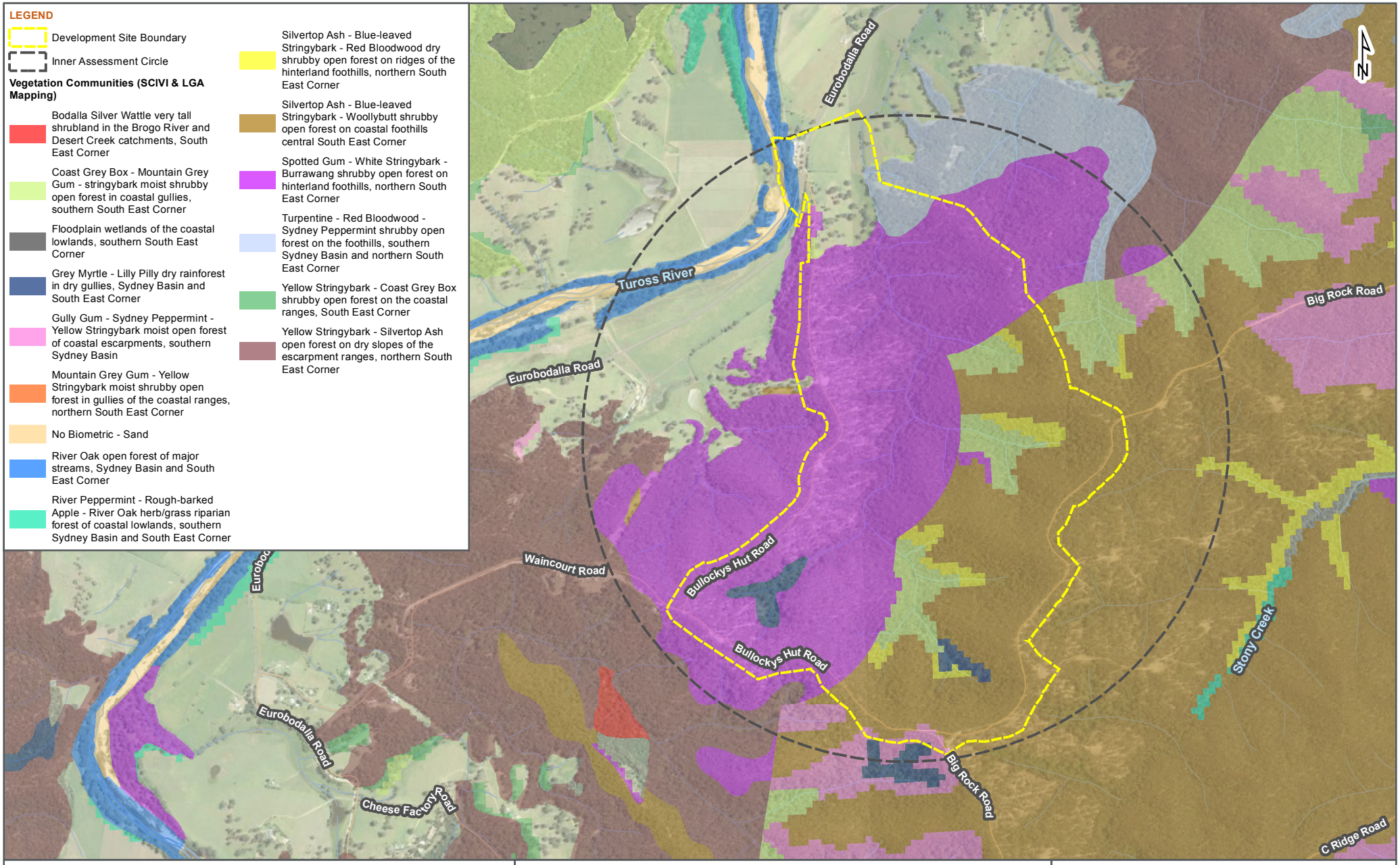

FIG NO. 1-3 **FIGURE TITLE** Location Map - Vegetation

DATE 16/08/2018

0 100 200 400 600
1:20,000 Metres

PAGE SIZE A4

COORDINATE SYSTEM GDA 1994 MGA Zone 56

PROJECT NO. 30012127 **PROJECT TITLE** Eurobodalla Southern Storage Water Supply Project - BAR

CREATED BY FN12672

SOURCES Roadnet MDS 2017, public NSW
Imagery: © Department of Finance, Services & Innovation 2018

Location: \\AUMBFPV002\projects\Projects\30012127 - Eurobodalla Storage\09 GIS, Photos & Graphics\01 GIS\Maps\BAR\30012127_Fig_1_3_BAR_LocnVege.mxd

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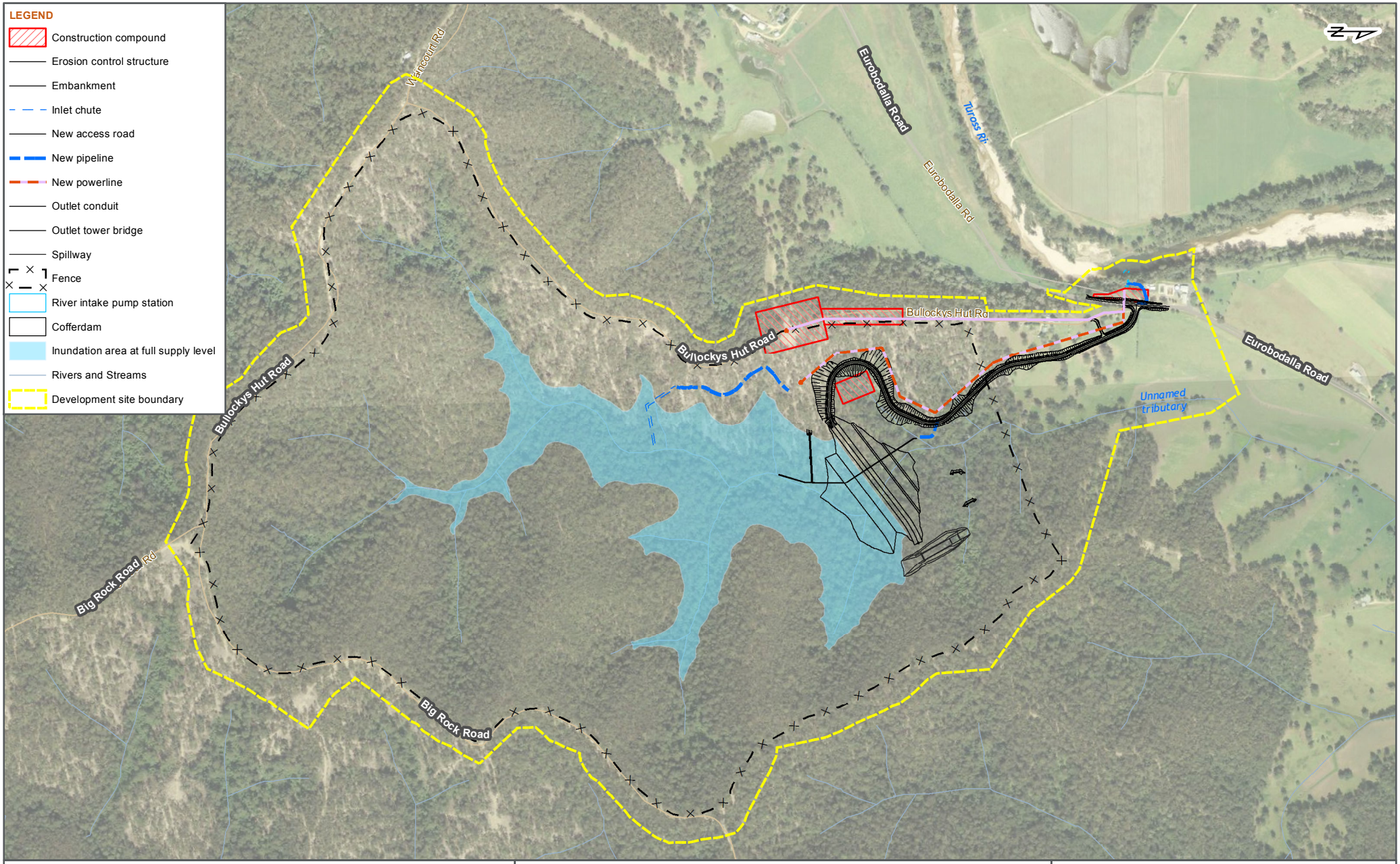

FIG NO. 1-4 **FIGURE TITLE** Indicative layout of the development site

DATE 16/08/2018

0 50 100 200 300
1:12,000 Metres

PAGE SIZE A4

COORDINATE SYSTEM GDA 1994 MGA Zone 56

PROJECT NO. 30012127 **PROJECT TITLE** Eurobodalla Southern Storage Water Supply Project - BAR

CREATED BY FN12672 **SOURCES** Roadnet MDS 2017, public NSW
Imagery: © Department of Finance, Services & Innovation 2018

Location: \\AUMBFPV002\projects\Projects\30012127 - Eurobodalla Storage\09 GIS, Photos & Graphics\01 GIS\Maps\BAR\30012127_Fig_1_4_BAR_IndDevt.mxd

Last updated by: FN12672 on 16/08/2018 at 10:59

1.3. General Description of Development Site

1.3.1. Landform, Geology and Soils

The development site is located around a steep, north-facing valley within Bodalla State Forest. The elevation along the ridges of the development site ranges from between 130 metres and 150 metres above sea level (a.s.l) while the lowest portions of the gully in the north of the development site are approximately 10 metres a.s.l. The slopes within the western half of the gully are steeper and more sheltered than those located within the eastern half of the gully.

The mean rainfall for Bodalla Post Office, 6.5 kilometres away to the northeast at approximately 50 metres a.s.l is 971.4 millimetres (Bureau of Meteorology: bom.gov.au).

The Soil Landscapes of Narooma 1:100,000 soil landscape sheet (Tulau 2002) has mapped three soil landscapes within the development site as outlined in Table 1-1 below.

Table 1-1 Soil Landscape Description

Soil Landscape	Description
Murrah	Rolling low hills to hills on Ordovician sediments and metasediments, with a local relief of 50m - 150m and slopes moderately inclined (10-32%) at a height of between 0m – 336m a.s.l. The soils consist of moderately deep, moderately well-drained to imperfectly drained yellow podzolic soils on both the crests, lower sloped, and drainage depressions.
Tanja	Undulating rises to low hills on Ordovician sediments and metasediments, with a local relief of 20m – 150m and sloped gently to moderately inclined (3-32%) at a height of between 2m – 150m a.s.l. The soils consist of moderately deep, moderately well-drained to imperfectly drained yellow podzolic soils on both the crests, lower slopes, and drainage depressions.
Towamba River	Narrow, high energy floodplains on course Quaternary alluvium at an elevation of 0m - 200m. Soils associated with this soil landscape are deep (>150cm), well drained Alluvial Soils.

1.3.2. Vegetation

The total area within the development site is 226.83 hectares. Vegetation within the development site can be classified into five native vegetation classes and one exotic vegetation type (Keith 2004).

- Southern Lowland Wet Sclerophyll Forests
- South Coast Wet Sclerophyll Forests
- Dry Rainforests
- Eastern Riverine Forests
- Exotic pasture.

Of the total vegetation coverage within the Project boundary 97 per cent is mapped as native vegetation.

1.3.3. Hydrology

The development site is located on an unnamed tributary of the Tuross River; the tributary has a total catchment area of 4.6 square kilometres (SMEC, 2017b). Of that catchment, the proposed ESS will cover a smaller portion of the that tributary with a catchment area of 1.6 square kilometres. The overall catchment ranges in elevation from approximately Reduced Level (RL) 1 metre at the confluence with the Tuross Rover to RL 153 metres, and consists of a predominantly forested area, with approximately 15 per cent used for lowland farming.

Within the development site, there is an unnamed third order ephemeral tributary consisting of three main tributaries, with number of additional smaller tributaries, originating within the steep gullies. These tributaries link up and drain via a single channel onto shallow pasture land. The stream bed and banks are characterised by fine sand and soil, which suggests that discharge rates are considerably lower at the bottom of the catchment. The stream eventually discharges into the Tuross River.

The Tuross River is located to the west and north, at a distance of between 250 metres and 1.7 kilometres as the river meanders through the valley.

1.3.4. Land Uses

As previously discussed, the development site is located within Bodalla State Forest which is utilised by NSW Forestry Corporation for timber harvesting. Consequently, much of the vegetation has been subject to timber harvesting as evidenced by sawn stumps and trunks remaining post-harvest. *The Harvest Plan for Bodalla State Forest – Compartments 3007, 3008 & 3016* (NSW Forestry Corporation, 2013), within which the development site occurs, outlines the areas and methodology for timber harvesting to be completed between 2013 and 2023. The 'Harvest Plan Operational Map' (NSW Forestry Corporation, 2013) shows that the timber harvesting with heavy machinery is allowed within the western valley slopes of the development site, while the eastern valley slopes of the development site have been declared 'excluded forest'. The reason for this classification has not been described within the Harvest Plan for the area, but may relate to the steepness of the land and potential erosion issues if disturbed. While the current harvest plan has only been in effect for 4 years, it appears from on ground and aerial imagery observations that a similar harvesting regime has been in place for many years. The vegetation along the western slopes is substantially more open and lacking lower vegetation strata, which is consistent with a regular disturbance event such as harvesting. Furthermore, the majority of canopy trees within this area are of an intermediate growth stage, again suggesting that a regular disturbance event has occurred. The vegetation within 5 metres to 25 meters (depending on stream order) surrounding the unnamed ephemeral stream and tributaries appears to be relatively intact both structurally and floristically, and contains a large proportion of the subject site's large hollow bearing trees. This suggests that little or no harvesting has occurred within the valley floor.

1.4. Information Sources

1.4.1. Database Analysis

The following databases were used in the preparation of this report:

- NSW Office of Environment and Heritage (OEH) BioBanking Credit Calculator (http://www.environment.nsw.gov.au/bbccapp/ui/mynews.aspx). Last accessed 15th November 2017
- NSW OEH Atlas of NSW Wildlife Database http://www.threatenedspecies.environment.nsw.gov.au/index.aspx. Last accessed 15th September 2017
- NSW OEH's Threatened Species Profile Database

- VIS 2.1 Vegetation Classification Database (OEH, 2017). Last accessed 7 August 2017.
- Department of the Environment and Energy Protected Matters Search Tool (DotEE, 2017). Last accessed 15th September 2017.
- DotEE Species Profiles and Threats database (SPRAT) http://www.environment.gov.au/cgi-bin/sprat/public/sprat.plDepartment of Sustainability, Environment, Water, Population and Communities (DSEWPC) EPBC Act Species Profiles and Threats Database (SPRAT).
- NSW Flora Online Search – Rare or Threatened Australian Plants (ROTAP) species (The Royal Botanic Gardens and Domain Trust, 2016)
- NSW Department of Primary Industry (DPI) WeedWise, South East region
- Bureau of Meteorology (BOM) Atlas of Groundwater Dependent Ecosystems
- DotEE of the Directory of Important Wetlands. Last accesses 20th September 2017.

1.4.2. Literature Review

Several biodiversity investigations have been previously undertaken for the storage facility. The following reports were reviewed in the preparation of this report:

- Preliminary Flora and Fauna Overview – Eurobodalla Shire Water Supply Southern Storages Sites (NGH Environmental, 2005)
- Draft Flora and Fauna Impact Assessment – Off-stream Storage, Stony Creek Site 2 (NGH Environmental, 2006)
- Off-Stream Storage Stony Creek Site 2, Eurobodalla Shire Regional Water Supply Scheme: Flora and Fauna Impact Assessment (NGH Environmental, 2007a)
- Off-Stream Storage Stony Creek Site 2, Eurobodalla Shire Regional Water Supply Scheme: Species Impact Statement (NGH Environmental, 2007b)
- Eurobodalla Southern Storage Geotechnical Investigations – Biodiversity Technical Report (SMEC, 2017a).

In addition to the literature review of previous biodiversity investigations listed above, the following sources of information were reviewed as part of the assessment:

- Descriptions for NSW (Mitchell) Landscapes, Version 2 (DECC, 2004)
- Landscapes (Mitchell) of NSW – Version 3. GIS dataset (DECC, 2004)
- Native vegetation of southeast NSW: a revised classification map for the coast and eastern tablelands. Version 1.0. (Tozer *et al*., 2010)
- Compilation Map: Biometric vegetation types and endangered ecological communities of the Shoalhaven, Eurobodalla & Bega Valley local government areas. A living map. Version 2.0 (OEH, 2013)
- Matters of National Environmental Significance Significant Impact Assessment Guidelines 1.1 (DoE, 2013)
- Framework for Biodiversity Assessment (OEH, 2014)
- NSW Biodiversity Offsets Policy for Major Projects (OEH, 2014)
- Aerial maps, proposal layers and environmental layers provided by Eurobodalla Shire Council and OEH.

1.4.3. Aerial Photography

The aerial imagery used was SIXmaps imagery managed by the Department of Lands, dated 4-01-2014.

2. Legislation and Policies

2.1. Commonwealth

2.1.1. Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) would only become relevant if it was considered that an impact on a 'Matters of National Environmental Significance (MNES)' was likely, thus providing a trigger for referral of the proposal to the Department of the Environment and Water, Heritage and the Arts (now Department of the Energy and Environment).

Matters of national environmental significance identified in the Act are:

- World heritage properties
- National heritage places
- Ramsar wetlands
- Nationally threatened species and communities
- Migratory species protected under international agreements
- The Commonwealth marine environment
- Nuclear actions.

Several MNES were recorded within the current surveys including:

- *Monarcha melanopsis* Black-faced Monarch
- *Rhipidura rufifrons* Rufous Fantail
- *Hirundapus caudacutus* White-throated Needletail.

In addition, four Threatened Ecological Communities (TECs) are known or predicted to occur within the 10 kilometre search radius: Illawarra and South Coast Lowland Forest and Woodland Ecological Community, Lowland Grassy Woodland in the South East Corner Bioregion, Natural Temperate Grassland of the South Eastern Highlands, and Subtropical and Temperate Coastal Saltmarsh. These species and communities were targeted as part of the development site survey work.

2.1.2. Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy

Under the *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy*, environmental offsets are actions taken to counterbalance significant residual impacts on MNES. Offsets are used as a last resort in instances where an action will give rise to residual impacts, even after the application of management measures.

The environmental offsets policy came into force in October 2012 and provides guidance on the role of offsets in environmental impact assessments and how DoEE considers the suitability of a proposed offset package (SEWPaC 2012). According to the policy, an offsets package is a *"suite of actions that a proponent undertakes in order to compensate for the residual significant impact of a project"* (SEWPaC 2012). It can comprise a combination of direct offsets and other compensatory measures such as research or education programs.

2.2. New South Wales

2.2.1. Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is the overarching planning legislation in NSW that provides for the creation of planning instruments that guide land use. The EP&A Act also provides for the protection of the environment, including the protection and conservation of native animals and plants. This includes threatened species, populations and ecological communities, and their habitats of biodiversity values, as listed in the NSW *Threatened Species Conservation Act 1995* (TSC Act) and NSW *Fisheries Management Act 1994* (FM Act). It is noted that the *Biodiversity Conservation Act 2016* (BC Act) came into effect on 25th August 2017, repealing and replacing the TSC Act, but retaining the threatened species listings. The EIS and this associated Biodiversity Assessment Report were substantially commenced prior to that date, and consequently in accordance with Part 7, Clause 29 of the Biodiversity Conservation (Savings and Transitional) Regulation 2017, Eurobodalla Shire Council elects to continue to apply the former planning provisions.

The proponent is seeking State Significant Development (SSD) Consent under Division 4.1 of Part 4 of the EP&A Act. An SSD can be declared under the *State Environmental Planning Policy (State and Regional Development) 2011* or by the Minister for Planning. The Development Application submitted for the SSD must be accompanied by an EIS, which is to be prepared in accordance with the SEARs.

The SEARs for the Project were issued by the NSW Department of Planning and Environment (DP&E) on 12th September 2017. The provisions that are relevant to this BAR are reproduced below.

The EIS must address the following specific matters that relate to the proposal:

- Demonstrate a design philosophy of impact avoidance on ecological values and, in particular, ecological values of high significance; and include a management framework consistent with the 'avoid, minimise or offset' principle during construction and operation, including but not necessarily limited to progressive rehabilitation works
- Be undertaken in accordance with the Framework for Biodiversity Assessment (Office of Environment and Heritage (OEH, 2014) and the NSW Biodiversity Offsets Policy for Major Projects (OEH, 2014), and by a person accredited in accordance with section 142B(1)(c) of the Threatened Species Conservation Act 1995
- Consider impacts on the species, populations and ecological communities listed as requiring further consideration in Attachment B of the letter from Office of Environment and Heritage dated 1 September 2017, and provide information specified in Section 9.2 of the Framework for Biodiversity Assessment.

2.2.2. Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) provides for the conservation and protection of threatened species, populations and ecological communities of animals and plants through specific objectives relating to the conservation of biodiversity and promoting ecologically sustainable development. The Schedules of the TSC Act identify endangered or vulnerable species, populations, ecological communities, critically endangered species or ecological communities and key threatening processes affecting the listed species, populations and ecological communities. Provision is made for the preparation of recovery plans for listed threatened species, populations and ecological communities and threat abatement plans to manage key threatening processes.

The TSC Act provides for the declaration and mapping of habitats that are critical to the survival of those identified threatened species, populations and ecological communities that are classified as endangered (critical habitats). Further, the TSC Act also sets out the methods of assessment, management and regulation of actions that may damage critical or other habitat or otherwise significantly affect threatened species, populations and ecological communities.

2.2.3. Fisheries Management Act 1994

The NSW *Fisheries Management Act 1994* (FM Act) provides for the protection, conservation and recovery of marine and aquatic fish species. It also makes provision for the management of threats to threatened species, populations and ecological communities, as well as the protection of fish and fish habitat in general.

2.2.4. Biosecurity Act 2015

The *Biosecurity Act 2015* replaced the *Noxious Weeds Act 1993* on 1st July 2017. The *Biosecurity Act* is a wide-ranging legislation that outlines the requirements of government, councils, private landholders and public authorities in the management of biosecurity matters. Priority weeds are regulated under the Biosecurity Act with a general biosecurity duty to prevent, eliminate or minimize any biosecurity risk they may pose. Some priority weeds have additional management obligations which may apply generally, or under specific circumstances. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised as is reasonably practicable.

2.2.5. State Environmental Planning Policy 44 - Koala Habitat Protection

State Environmental Planning Policy No.44 – Koala Habitat Protection (SEPP 44) aims to protect the koala and its habitat by incorporating prescriptions for consent authorities to consider during the assessment of development applications. SEPP 44 contains prescriptions for the consideration of "potential koala habitat" and "core koala habitat" for developments within Local Government Areas (LGAs) listed on Schedule 1 of the Policy. Eurobodalla LGA is listed on Schedule 1 as an area to which SEPP 44 applies and so requires further consideration.

"Potential koala habitat" is defined by SEPP 44 as "areas of native vegetation where the trees of types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component". None of the *Eucalyptus* species recorded within the development site are listed under Schedule 2 of the Policy as a Koala "feed tree species", as such the development site is not considered to be 'potential koala habitat' under the definition of SEPP 44.

"Core koala habitat" is defined under SEPP 44 as areas of land that contain "a resident population of koalas, evidenced by attributes such as breeding females and recent sightings of and historical records of a population". There is no available direct evidence (such as sightings, calls, scats and fur) to indicate that the development site supports a resident population of koalas and there is no evidence in general (historic records) of koala activity within the development site. Hence, the subject site does not constitute "core koala habitat", within the meaning of SEPP 44.

On this basis, the provisions of SEPP 44 do not apply to the proposed activity. A koala Plan of Management is not required to be prepared as part of the proposal.

2.2.6. NSW Biodiversity Offsets Policy for Major Projects

The NSW Biodiversity Offsets Policy for Major Projects was adopted in September 2014 and applies to SSD and State Significant Infrastructure designated under the EP&A Act. The policy provides a standard method for assessing impacts of major projects on biodiversity and determining offsetting requirements (OEH, 2014). The policy is underpinned by six principles, which must be considered when assessing offsets for major projects.

The Framework for Biodiversity Assessment (FBA) has been developed in conjunction with the policy to provide a method for determining the quantum of impacts. The FBA provides rules and software for calculating the number and type of credits that a development site will require in order to offset its impacts and thus improve or maintain biodiversity values. "Credits" are the currency used within FBA and they are not specifically area measurements. Rather, they are a measure of the current quality

of habitat. Where a proponent is proposing to establish an offset site as part of the Biodiversity Offset Strategy (BOS), the BioBanking Assessment Methodology 2014 (BBAM) must be used to assess the biodiversity values of the offset site and to identify the number and type of credits that may be created on the offset site (OEH, 2014).

The FBA requires the preparation of the following documents:

- Biodiversity Assessment Report: To describe the biodiversity values present within the development site and the impact of the project on these values; and
- Biodiversity Offset Strategy: To outline how the proponent intends to offset the impacts of the project.

These reports are required to be submitted as part of the EIS.

As the FBA applies predominantly to terrestrial biodiversity, the NSW Offsets Policy for Major Projects and FBA refers to the NSW Department of Primary Industries Policy and Guidelines for Fish Habitat Conservation and Management Update 2013 (DPI 2013) for guidance on assessing and offsetting aquatic impacts. Offsets for identified key fish habitats are required once avoidance and mitigation measures have been implemented. Under the NSW Fisheries waterways classification scheme (2003) the Tuross River is classified as Class 1 waterway and major key fish habitat.

3. Landscape Features

3.1. Landscape Features

3.1.1. IBRA Bioregions and IBRA Subregions

Bioregion

Development site: South East Corner (SEC) Bioregion

Outer assessment circle: South East Corner (SEC) Bioregion

The development site and outer assessment circle are wholly located within the South East Corner (SEC) Bioregion (Interim Biogeographical Regionalisation of Australia (IBRA) v.7, 2012). Bioregions are large, geographically distinct areas of land with common characteristics such as geology, landform patterns, climate, ecological features and plant and animal communities.

Environment Australia (2000) provides the following information on SEC Bioregion. This Bioregion consists of a series of deeply dissected near coastal ranges composed of Devonian granites and Palaeozoic sediments, inland of a series of gently undulating terraces (piedmont downs) composed of Tertiary sediments and flanked by Quaternary coastal plains, dunefields and inlets. The regional climate is strongly influenced by the Tasman Sea and the close proximity of the coast to the Great Dividing Range. The vegetation consists of high elevation woodlands, wet and damp sclerophyll forests interspersed with rain-shadow woodlands in the Snowy River Valley. Lowland and coastal sclerophyll forests, woodlands, warm temperate rainforest and coastal communities occur in the lower areas.

The proposal site lies over Ordovician sediments and metamorphic rocks, resulting in a steep hilly to mountainous terrain. Under natural conditions, soils over Ordovician rock types in the region are generally stable, with a gravelly surface lag inhibiting ongoing sheet erosion on slopes (Tulau 2002).

Subregion

Development site: Bateman Subregion (237.89 hectares)

Outer assessment circle: Bateman Subregion (476.6 hectares); South East Coastal Ranges Subregion (25.75 hectares)

The development site is located within the Bateman subregion, while the outer assessment circle falls within both the Bateman and South East Coastal Ranges subregion of the South East Corner (SEC) Bioregion (Interim Biogeographical Regionalisation of Australia (IBRA) v.7, 2012). The Bateman Subregion is described by Morgan (2001) in Table 3-1.

Table 3-1 Description of the subregions within SEC Bioregion

Subregion	Geology	Characteristic landforms	Typical Soils	Vegetation
Bateman	Tightly folded fine grained Ordovician metamorphic rocks with several intrusions of granite. Western margin is a tight synclinal fold in Devonian sandstone and siltstone. Small areas of Tertiary basalt and quartz sands behind the coastal headlands. Quaternary alluvium on main valley floors and in the estuaries.	Steep hills below the Great escarpment oriented north-south and controlled by rock structure. Lines of hills become lower toward the coast with a slight upturn along the coastal margin. Coastal barrier systems are small and estuarine fills limited.	Mostly texture contrast soils. Red clay subsoils with thin topsoil on metamorphic rocks, deeper coarser grained profiles on granite. Red brown structured loams on basalt and deep siliceous sands with some podsol development on Tertiary sands and coastal dunes.	Hakea, melaleuca, coast rosemary and dwarfed red bloodwood heath on headlands. Red bloodwood and spotted gum forests to 300 m. Yellow stringybark, grey ironbark and woollybutt to 550 m. Brown barrel, black ash, Sydney peppermint, large-fruited red mahogany, Sydney blue gum and monkey gum to 900 m, then snow gum.
South East Coastal Ranges	Extensive areas of granite amongst Ordovician and Silurian metamorphosed sedimentary and volcanic rocks; slates, chert, quartzites. Gently folded red and purple Devonian sandstones and shales, limited areas of Tertiary basalt and sand deposits. Quaternary coastal sediments and small areas of alluvium.	Very abrupt margin on the Great Escarpment. Deep gorges with rapids and waterfalls in the main streams including the lower Snowy River. Extensive subdued basin with rolling hills on the Bega granite with steep hillslopes at the contact aureole. Streams carry large volumes of sand to valley floors and estuaries. Small beach, dune, lagoon barrier systems.	Coarse texture contrast soils on granite, thinner profiles on metamorphics with red and yellow clay subsoils. Deep coarse sands in granite derived alluvium often deposited in swampy valley flats. Deep fine sands in dunes. Peaty sands in lagoons and swamps.	Red bloodwood and spotted gum forests to 300 m. Spotted gum less common in the south. Yellow stringybark, grey ironbark, black ash, yertchuk and woollybutt to 550 m. Brown barrel, black ash, large-fruited red mahogany, and monkey gum to 900 m, then snow gum.

3.1.2. NSW Landscape Regions (Mitchell Landscapes)

Development site: Bega Coastal Foothills (237.88 hectares); and Tuross Channel and Floodplain (0.01 hectares).

Outer assessment circle: Bega Coastal Foothills (3,911.61 hectares); and Tuross Channel and Floodplain (585.44 hectares).

The extent of the Mitchell Landscapes within the development site is shown in Figure 1-1. The extent of the Mitchell Landscapes within the outer assessment circle is shown in Figure 1-2.

Bega Coastal Foothills occurs over the majority of the development site with the Tuross Channel and Floodplain occurring along the Tuross River, close to the proposed water intake and associated ancillaries.

The Mitchell Landscape descriptions are provided in Table 3-2.

Table 3-2 Description of the Mitchell Landscape (DECC 2002)

Mitchell Landscape	Description
Bega Coastal Foothills (8737)	Low hills with general slope toward the coast on Ordovician quartzite, slate, chert, phyllite. General elevation 0 to 520m, local relief 250m. Thin stony red and red-yellow texture contrast soils. Open forest of tall *Corymbia maculata*, *Eucalyptus paniculata*, *Corymbia gummifera*, *Eucalyptus globoidea*, *Eucalyptus pilularis* with *Imperata cylindrica*, *Pteridium esculentum* and *Macrozamia sp.* in the understory, shrubs limited. On headlands heaths of *Hakea sericea*, *Melaleuca armillaris*, and *Westringia friticosa* occur in shallow soils subject to high salt spray input and frequent fire.
Tuross Channel and Floodplain (8789)	Channel, floodplain and terraces of the deep, narrow valley of Quaternary alluvium of the Tuross River from the coast to the base of the Great Escarpment. Elevation 0 to 200m. Brown uniform and gradational loam with *Casuarina cunninghamiana* along the banks. Patches of temperate rainforest with *Doryphora sassafras* and *Acmena smithii* in gully heads and as a gallery forest along major streams in sheltered locations.

3.1.3. Rivers and Streams

The development site falls within the Tuross River catchment. The main ephemeral tributary that flows from the development site into the Tuross River is an unnamed stream.

The proposed storage site location consists of a network of tributaries consisting of three primary ephemeral branches (1st and 2nd order streams in accordance with the Strahler system). These originate in steep sandstone valleys, linking up and draining via a single main north aspect ephemeral channel (3rd order steam) onto cleared agricultural land. The valley was dry during the time SMEC undertook site surveys for the project however NGH (2007) reported a number of deep pools located in the creek beds of the tributaries. The absence of fine stones or particles on the creek beds suggest that the discharge rate and stream velocity is high during periods of flow (The Ecology Lab 2006). Peak inflow of the catchment is 179 m^3/sec and the peak flood volume is 834 megalitres (NGH 2007).

The unnamed stream flows into the Tuross River approximately two kilometres north east of the development site. At this point along its extent, the Tuross River is classified as a 6th order stream.

The proposal would impact upon all of the riparian buffers within the development site.

The extent of the streams and their associated buffers within the inner and outer assessment circle is shown in Figure 1-2.

3.1.4. Wetlands

A NSW wetland has been mapped within the development site, however ground-truthing of the area has confirmed that there is no wetland present. As such, no important or local wetlands occur within the development site or outer assessment circle. A number of coastal wetlands occur to the west of the development site, including Tuross River Estuary, Nargal Lake and Wallaga Lake, which are listed as Nationally Important Wetlands within the Directory of Important Wetlands. The Tuross River

Estuary is the closest to the development site, approximately 10 kilometres to the north east. There are no Ramsar wetlands located within 10 kilometres of the development site.

3.1.5. Native Vegetation Extent

To map the extent of native vegetation within the development site, the Shoalhaven_Biometric_v2_E_3900 shapefile was overlain on a 2016 aerial available through the Department of Lands SIXmaps application. The extent of native vegetation cover was confirmed and revised where necessary through surveys of the site by SMEC in November 2016 and February 2017. Amendments to the extent of native vegetation were made using a Geographic Information System (GIS), ArcGIS 10.4. The boundaries of native vegetation were reduced in areas that have been cleared since the previous vegetation mapping was prepared. Conversely, the boundaries of native vegetation were extended in areas where the previous vegetation mapping indicated the land was cleared, but has subsequently been mapped or can be predicted to contain native vegetation using aerial imagery.

The Shoalhaven_Biometric_v2_E_3900 shapefile was merged with the SMEC vegetation mapping, with the merged shapefile used to calculate the native vegetation cover within the inner and outer assessment circles.

Native vegetation occurring in the inner and outer assessment circle is shown in Figure 1-3. Native vegetation occupies approximately 87.8 percent of the inner assessment circle, and 77.10 percent of the outer assessment circle. Native vegetation within the landscape buffer is predominately large, intact patches of native forest of various vegetation formations. The remaining land within the inner and outer assessment circles is comprised of farmland and waterways, with a small amount of rural development and infrastructure. It is considered that there are no differences between the mapped vegetation extent and aerial imagery utilised by this assessment.

3.1.6. State or Regionally Significant Biodiversity Links

State significant biodiversity links, regionally significance biodiversity links, very large area biodiversity links, large area biodiversity links or local area biodiversity links are defined in the FBA. To date, no biodiversity corridor plans have been approved by the Chief Executive of the OEH.

Appendix 2 of the FBA outlines the riparian buffer widths required for each order of stream classified in accordance with the Strahler system ordered. The proposal will be impacting upon the 50 metre riparian buffer outlined for 6th order stream (Tuross River). Under the FBA, riparian buffers for 6th order streams are considered to be a state significant biodiversity link. Consequently, the proposal will be impacting upon a state significant biodiversity link.

While it is noted that the riparian buffer of the Tuross River has been previously disturbed, the current condition of the buffer has no bearing on the scoring given to the connectivity value score given within the BioBanking Credit Calculator (BBCC).

3.1.7. Other Landscape Features

No other landscape features within the development site or landscape buffer were identified in the SEARs.

3.2. Landscape Value Score Components

A BioBanking credit assessment was completed for this project. The proposal ID for the assessment is 174/2016/3946MP and the assessment type was selected as 'Major Project'. This section summarises the values entered into the Landscape values section of the BBCC.

3.2.1. Method Applied

The Project is a site based impact development, as such the 'site based development' module was selected in the BioBanking Credit Calculator version 4.0. A 500 hectare inner assessment circle and 5000 hectare outer assessment circle was used for the BioBanking calculations. As the development footprint covers a large spatial extent, it crosses several boundaries of various spatial datasets. In the case where a selection was required, the option covering the majority area was selected. This included Major Catchment Area, Local Government Area and Interim Biogeographic Regionalisation for Australia (IBRA) Sub-region.

3.2.2. Percent native vegetation cover in the landscape

The current and future percentage of native vegetation cover in the inner and outer assessment circles were determined in increments of 5 percent using GIS. These calculations utilised the native vegetation extent identified in Section 3.1.5 and considered the condition of the vegetation. The Project will result in the loss of 65.57 hectares of native vegetation within the development site. A summary of the current and future percentage of native vegetation cover in the landscape buffer area is provided in Table 3-3. Based on these values, the Project has a native vegetation cover score of 1.3.

3.2.3. Connectivity Value

A 'Riparian buffer of a 6th order stream of higher' has been identified as being impacted by the development. In accordance with Appendix 4 of the FBA, this is considered a 'State significant biodiversity link' with a connectivity value score of 12.

3.2.4. Patch size

As the Project is a site based development, patch size has been determined in accordance with Appendix 4 of the FBA. The Bega Coastal Foothills in the Mitchell Landscapes within which most of the major project occurs. The native vegetation within the inner and outer assessment circle has been identified in Section 3.1.5. Of this vegetation, the largest patch of native vegetation of which a large portion occurs within the development site, is greater than 1000 hectares in size. Based on this, the patch size class is categorised as 'Extra Large' which has a corresponding patch size score of 12.

3.2.5. Landscape value score

Using the results from the assessment of landscape attributes in Section 3.2.1 – 3.2.4 and Equation 4 in Appendix 1 of the FBA, the landscape value score for the development site is 25.30.

3.2.6. Summary of Landscape Value Score Components

A summary of the landscape value score components is provided in Table 3-3.

Table 3-3 Summary of Landscape Value Score Components

Components	Inner Assessment Circle	Outer Assessment Circle
Current native vegetation cover extent	87.8%	77.1%
Future native vegetation cover extent	74.7%	75.7%
Connectivity value	Riparian buffer of a 6th order stream of higher	
Patch size	>1001	
Landscape value score	25.30	

4. Native Vegetation

4.1. Review of Existing Data

Prior to field surveys a review of existing vegetation data was undertaken. The review included the following primary sources:

- VIS 2.1 Vegetation Classification Database (OEH, 2017). Last accessed 7 August 2017
- Native vegetation of southeast NSW: a revised classification map for the coast and eastern tablelands. Version 1.0. (Tozer et al., 2010)
- Compilation Map: Biometric vegetation types and endangered ecological communities of the Shoalhaven, Eurobodalla & Bega Valley local government areas. A living map. Version 2.0 (OEH, 2013)
- BOM Atlas of Groundwater Dependent Ecosystems.

The following secondary sources were reviewed:

- Preliminary Flora and Fauna Overview – Eurobodalla Shire Water Supply Southern Storages Sites (NGH Environmental, 2005)
- Draft Flora and Fauna Impact Assessment – Off-stream Storage, Stony Creek Site 2 (NGH Environmental, 2006)
- Off-Stream Storage Stony Creek Site 2, Eurobodalla Shire Regional Water Supply Scheme: Flora and Fauna Impact Assessment (NGH Environmental, 2007a)
- Off-Stream Storage Stony Creek Site 2, Eurobodalla Shire Regional Water Supply Scheme: Species Impact Statement (NGH Environmental, 2007b)
- Eurobodalla Southern Storage Geotechnical Investigations – Biodiversity Technical Report (SMEC, 2017a).

The aforementioned resources were checked against the most recent aerial photography in order to determine whether aby changes in vegetation extent and patters had occurred since publication.

4.2. Surveys

4.2.1. Overview

Surveys of the vegetation within the development site and adjoining land were conducted between October 2016 and April 2017. The first round of survey was conducted to obtain an overview of the nature and extent of vegetation not just within the development site but also within adjacent lands, as well as map the extent of vegetation communities and establish the number of floristic plots required for the assessment. Once the likely Plant Community Types (PCTs) were identified, full floristic plots and plot and transect surveys were conducted to verify the PCTs and collect site value data from the identified vegetation zones.

These surveys were undertaken following the 'Major Project' determination and was designed to meet the requirements of the FBA. Areas of native vegetation were delineated using a handheld Global Positioning System (GPS) unit, aerial photograph interpretation and site notes.

For the purposes of assigning PCTs to native vegetation communities, plot based full floristic survey was undertaken in accordance with Table 1 of the FBA at 21 sites across the development site. These same sites were also used for plot and transect surveys of each vegetation zones.

The PCTs occurring within the development site were initially stratified into areas represented by the locally-defined vegetation communities. These were subsequently divided into different condition states as represented by each of the map units in Table 4-1, which resulted in the creation of six vegetation zones.

4.2.2. Plot-based Full Floristic Survey

Twenty-one full floristic plots were surveyed within the development site and have been utilised in this assessment. The following information was collected at each of the 20 x 20 metre full floristic plots in accordance with Table 1 of the FBA:

- Stratum (and layer): stratum and layer in which each species occurs
- Growth form: growth form for each recorded species
- Species name: scientific name and common name
- Cover: a measure or estimate of the appropriate cover measure for each recorded species; recorded from 1–5% and then to the nearest 5%. If the cover of a species is less than 1% and the species is considered important, then the estimated cover should be entered (e.g. 0.4)
- Abundance rating: a relative measure of the number of individuals or shoots of a species within the plot. Use the following intervals; numbers above about 20 are estimates only: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, or 1,000, or specify a number greater than 1,000 if required.

The locations of these plots are shown in Figure 4-1. The locations of the full floristic plots were determined by pacing a random distance into the vegetation zone that would enable an appropriate assessment of expected environmental variation. Areas considered not suitable for assessment include ecotones, vehicle tracks and their edges, and disturbed areas which are readily distinguishable from the broad condition state of the vegetation zone.

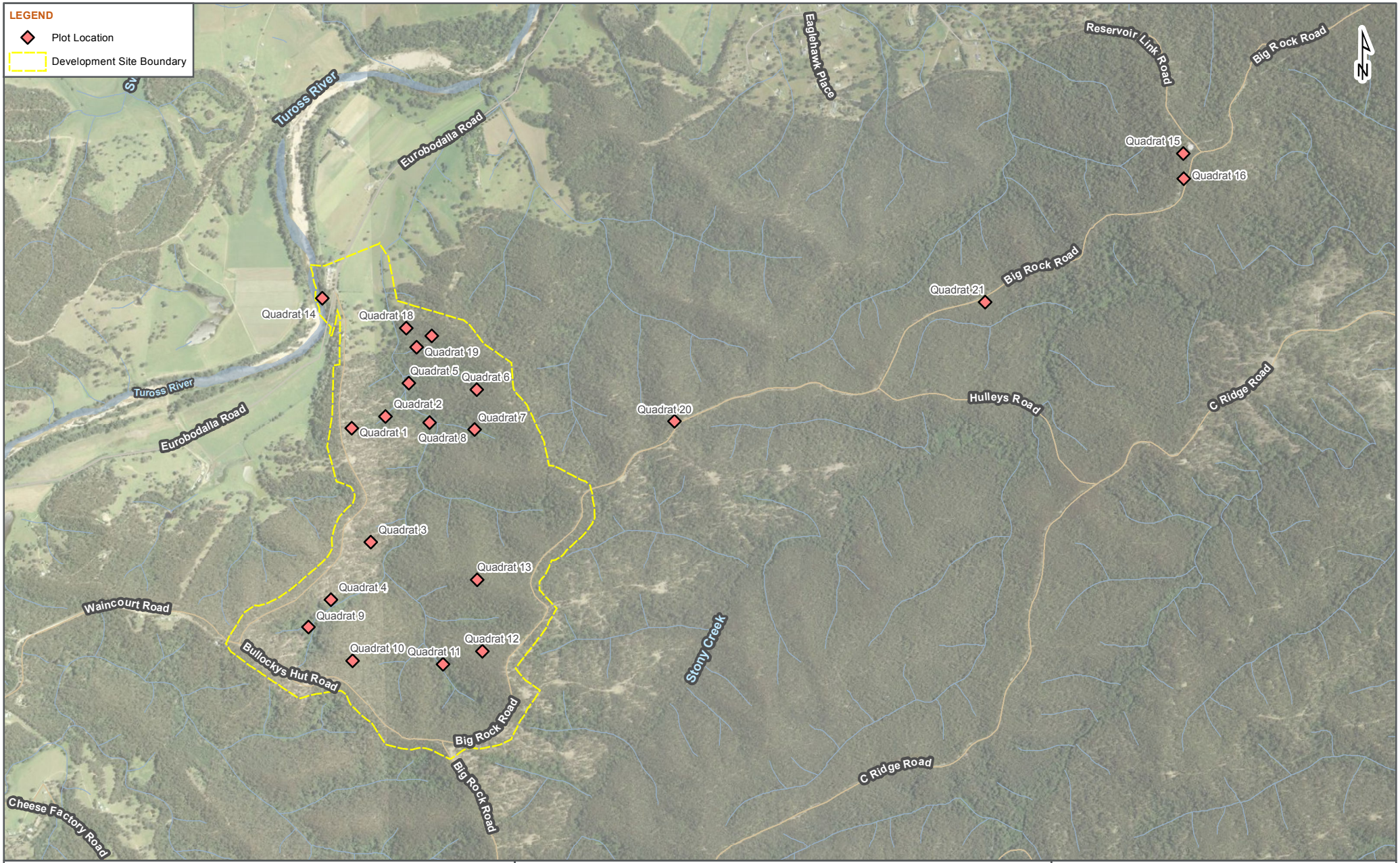

FIG NO. 4-1

FIGURE TITLE Plot-based full floristic survey and plot and transect survey sites

DATE 16/08/2018

0 100 200 400 600
1:25,000 Metres

PAGE SIZE A4

COORDINATE SYSTEM GDA 1994 MGA Zone 56

PROJECT NO. 30012127

PROJECT TITLE Eurobodalla Southern Storage Water Supply Project - BAR

CREATED BY FN12672

SOURCES Roadnet MDS 2017, public NSW
Imagery: © Department of Finance, Services & Innovation 2018

Location: \\AUMBFPV002\projects\Projects\30012127 - Eurobodalla Storage\09 GIS, Photos & Graphics\01 GIS\Maps\BAR\30012127_Fig_4_1_BAR_Flor_Survey.mxd

Last updated by: FN12672 on 16/08/2018 at 11:00

4.2.3. Plot and Transect Surveys

Twenty-one plot and transect sites surveyed within the development site have been utilised in this assessment. The following information was collected at each of the 20 x 50 metre plot and transect sites in accordance with Section 5.3.2 of the FBA:

- Native species richness recorded within each stratum of a 20 x 20 metre sub-plot
- Native overstory cover recorded at 10 points along a 50 metre transect
- Native midstory cover recorded at 10 points along a 50 metre transect
- Native ground cover recorded at 50 points along a 50 metre transect for three life forms (shrubs, grasses and other)
- Exotic plant cover expressed as a total percent cover across all strata (each stratum measured using the same method for native overstory, midstory and ground cover)
- Number of trees with hollows visible from the ground within the 20 x 50 metre plot
- The total length of fallen logs >10 centimetre in diameter within the 20 x 50 metre plot
- The proportion of regenerating overstory species within the vegetation zone.

The locations of the plot and transect sites are shown in Figure 4-1. The locations of the plots were determined by pacing a random distance into the vegetation zone that would enable an appropriate assessment of expected environmental variation.

Due to broader initial investigations, areas of Zone 2 mapped along Big Rock Road are no longer included within the current proposal. As a result, four plots located within vegetation along Big Rock Road are no longer located within Vegetation Zone 2 but still represent the same vegetation type. Given that these plots were originally included within Zone 2, they have the used in the current assessment to ensure that the minimum plot/transect requirements for Zone 2 are met.

Table 4-1 summarises the plot and transect survey effort undertaken for the Project With the exception of Vegetation Zone 1, the minimum number of plot and transect surveys required under the FBA have been conducted. One surrogate plot has been used in order for the assessment to meet minimum plot requirements for Vegetation Zone 1. Values for this surrogate plot were calculated by averaging the results of each attribute for the three plots completed during the assessment. Data collected from all plot and transect sites was utilised to determine the site value score for each vegetation zone.

Table 4-1 Plot and transect survey effort

Vegetation Zone	PCT Code / BVT Code	Condition*	Area within Development site (Ha)	Min. Plot and Transects Required	No. Plot and Transects Sampled
1	1220 / SR643	Moderate/Good_medium	47.19	4	3**
2	1220 / SR643	Moderate/Good_high	142.42	6	8+
3	875 / SR551	Moderate/Good	19.37	3	3
4	1109 / SR609	Moderate/Good	10.49	3	3

Vegetation Zone	PCT Code / BVT Code	Condition*	Area within Development site (Ha)	Min. Plot and Transects Required	No. Plot and Transects Sampled
5	1108 / SR608	Moderate/Good	0.84	1	1
6	777 / SR533	Moderate/Good	1.03	1	3

** Condition names reflect options available within the BioBanking Credit Calculator rather than on-ground condition.*

*** One additional surrogate plot utilised in BioBanking Calculations.*

+ 4 Plots located along Big Rock Road outside of Zone 2.

4.3. Native Vegetation Extent

The development site is 226.83 hectares in size, which includes 220.34 hectares of native vegetation. The extent of native vegetation extent within the development site is shown in Figure 4-2. This extent has been determined through aerial photograph interpretation and field surveys. It is considered that there are no differences between the mapped vegetation extent and aerial imagery utilised by this assessment.

The majority of the development site supports wet sclerophyll forest, of two different vegetation classes, as well as a medium sized area of dry rainforest and a small area of forested wetland. The slopes of the gully contain wet sclerophyll forest dominated by *Corymbia maculata*, and *Eucalyptus globoidea*, with *Eucalyptus longifolia, Eucalyptus agglomerata, Eucalyptus muelleriana, Eucalyptus tricarpa*, and *Eucalyptus pilularis* also present at densities of approximately less than 5 per hectare. Moist open forest occurs on the valley floor of the development site. The canopy is dominated by *Eucalyptus elata*, *Eucalyptus botryoides - saligna* intergrade, *Eucalyptus baueriana*, and *Angophora floribunda*, with occasional *Eucalyptus cypellocarpa*. This vegetation conforms to River Flat Eucalypt Forest on Coastal Floodplains EEC. Another form of wet sclerophyll forest dominated by *Eucalyptus cypellocarpa* occurs within the north-east corner of the development site.

River Flat Eucalypt Forest on Coastal Floodplains EEC also occurs as a forested wetland vegetation along the Tuross River. The canopy within this community is dominated by a mixture of eucalypts including *Eucalyptus muelleriana, Eucalyptus botryoides - saligna* intergrade and *Angophora floribunda*, as well as *Casuarina cunninghamiana* growing immediately along the banks of the Tuross River.

Dry rainforest dominated by *Backhousia myrtifolia* and *Acmena smithii* with the occasional emergent occurs in the bottom of the deep gullies located within the southern portions of the development site between the spurs dividing the wider valley.

4.4. Identification of Plant Community Types

Identification of the PCTs occurring within the development site was guided by the results of the review of existing data (see Section 4.1) and surveys of the development site (see Section 4.2). The data collected during surveys of the development site was analysed in conjunction with a review of the PCTs held within the VIS Classification Database, and previous published vegetation mapping, namely Tozer (2010). Consideration was given to the following:

- Occurrence within the SEC IBRA subregion
- Vegetation formation

- Landscape position
- Soil type and edaphics
- Dominant upper, mid and ground strata species.

The analysis determined that the vegetation within the development site aligned with three PCTs held within the VIS Classification Database. Table 4-2 lists the PCTs that have been identified within the development site and the justification for their selection

Table 4-2 Justification for selection of PCTs within the development site

PCT Code / BVT Code	PCT Name	Evidence Used for Identification	Species Relied upon for Identification
1220 / SR643	Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion	**IBRA Subregion**: Occurs within the Bateman IBRA subregion **Vegetation formation**: Wet Sclerophyll Forests (Grassy sub-formation) **Landscape position**: Widespread on coastal lowlands and hills between Milton and Narooma.	**Upper stratum species**: *Corymbia maculata, Eucalyptus globoidea, Eucalyptus pilularis, Eucalyptus muelleriana, Eucalyptus longifolia, Exocarpos cupressiformis, Acacia falciformis, Allocasuarina littoralis* **Mid stratum species**: *Macrozamia communis, Platysace lanceolata, Hibbertia aspera, Leucopogon lanceolata, Podolobium ilicifolium* **Ground stratum species**: *Entolasia stricta, Lepidosperma laterale, Dianella caerulea, Lomandra multiflora.*
875 / SR551	Grey Myrtle - Lilly Pilly dry rainforest in dry gullies of the Sydney Basin Bioregion and South East Corner Bioregion	**IBRA Subregion**: Occurs within the Bateman IBRA subregion **Vegetation formation**: Rainforests **Landscape position**: Occurs in dry shale gullies below 400m, mainly south of Nowra.	**Upper stratum species**: *Backhousia myrifolia, Acmena smithii* **Mid stratum species**: *Marsdenia rostrata, Smilax australis, Morinda jasminoides, Ficus coronata, Pittosporum undulatum, Notelaea venosa, Pittosporum revolutum* **Ground stratum species**: *Doodia aspera, Pseuderanthemum variable, Lastriopsis acuminata, Blechnum cartilagineum, Pyrrosia rupestris, Asplenium flabellifolium, Schoenus melanostachys, Lepidosperma gunnii.*

PCT Code / BVT Code	PCT Name	Evidence Used for Identification	Species Relied upon for Identification
1109 / SR609	River Peppermint - Rough-barked Apple moist open forest on sheltered sites, southern South East Corner Bioregion	**IBRA Subregion**: Occurs within the Bateman IBRA subregion **Vegetation formation**: Wet Sclerophyll Forests (Shrubby sub-formation) **Landscape position**: Occurs in dry lowland valleys between Yowrie-Wandella and Towamba, including the lower gorges of the Tuross and Wadbilliga Rivers, on sheltered slopes and in gullies up to 300 m elevation.	**Upper stratum species**: *Eucalyptus elata, Eucalyptus botryoides - saligna* intergrade, *Eucalyptus baueriana*, *Angophora floribunda.* **Mid stratum species**: *Clematis glycinoides var. glycinoides*, *Tylophora barbarta, Ficus coronata, Claoxylon australe, Psychotria loniceroides, Myrsine howittiana, Melicytus dentatus, Polyscias murrayi, Cassinia trinerva, Acmena smithii*, *Backhousia myrtifolia* **Ground stratum species**: *Carex longebrachiata, Microlaena stipoides var. stipoides, Entolasia marginata, Stellaria flaccida, Desmodium varians, Oplismenus imbecillis, Pteridium esculentum, Blechnum cartilagineum*, *Pellaea falcata*.
1108 / SR608	River Peppermint - Rough-barked Apple - River Oak herb/grass forest of coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion	**IBRA Subregion**: Occurs within the Bateman IBRA subregion **Vegetation formation**: Forested Wetland **Landscape position**: Occurs from Wandandian south to the Bega River on sandy alluvial flats, on floodplain margins and in riverine corridors.	**Upper stratum species**: *Angophora floribunda, Casuarina cunninghamiana subsp. cunninghamiana* **Mid stratum species**: *Melicytus dentatus, Acacia mearnsii, Breynia oblongifolia, Morinda jasminoides, Eustrephus latifolius* **Ground stratum species**: *Pseuderanthemum variable, Adiantum aethiopicum, Microlaena stipoides var. stipoides, Entolasia marginata.*

PCT Code / BVT Code	PCT Name	Evidence Used for Identification	Species Relied upon for Identification
777 / SR533	Coast Grey Box - Mountain Grey Gum - stringybark moist shrubby open forest in coastal gullies, southern South East Corner Bioregion	**IBRA Subregion**: Occurs within the Bateman IBRA subregion **Vegetation formation**: Wet Sclerophyll Forest (Grassy sub-formation) **Landscape position**: It occurs in steep gullies on the coastal range mainly between Merimbula and Narooma.	**Upper stratum species**: *Eucalyptus cypellocarpa, Eucalyptus muelleriana, Eucalyptus globoidea, Eucalyptus pilularis, and Eucalyptus longifolia* **Mid stratum species**: *Acacia falciformis, Allocasuarina littoralis, Notelaea venosa, and Pittosporum revolutum* **Ground stratum species**: *Gonocarpus teucrioides, Platysace lanceolata, Leucopogon lanceolatus, Pteridium esculentum, Blechnum cartilagineum, Lomandra longifolia, Lepidosperma laterale, Microlaena stipoides var. stipoides*, and *Entolasia stricta*.

4.5. Description of Plant Community Types

4.5.1. Overview

Table 4-3 provides a summary of the PCTs occurring within the development site, including vegetation formation, percent cleared within the Southern Rivers catchment and extent within the development site. The distribution of these PCTs within the development site is shown in Figure 4-2.

Table 4-3 Summary of PCTs occurring within the development site

PCT Code / BVT Code	PCT Name	Vegetation Formation	Vegetation Class	% Cleared within Catchment	Area within Development Site (Ha)
1220 / SR643	Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion	Wet Sclerophyll Forest (Grassy sub-formation)	Southern Lowland Wet Sclerophyll Forests	15	188.61
875 / SR551	Grey Myrtle - Lilly Pilly dry rainforest in dry gullies of the Sydney Basin Bioregion and South East Corner Bioregion	Rainforests	Dry Rainforests	10	19.37
1109 / SR609	River Peppermint - Rough-barked Apple moist open forest on sheltered sites, southern South East Corner Bioregion	Wet Sclerophyll Forest (Shrubby sub-formation)	South Coast Wet Sclerophyll Forests	65	10.49
1108 / SR608	River Peppermint - Rough-barked Apple - River Oak herb/grass forest of coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion	Forested Wetlands	Eastern Riverine Forests	50	0.84
777 / SR533	Coast Grey Box - Mountain Grey Gum - stringybark moist shrubby open forest in coastal gullies, southern South East Corner Bioregion	Wet Sclerophyll Forest (Grassy sub-formation)	Southern Lowland Wet Sclerophyll forests	15	1.03

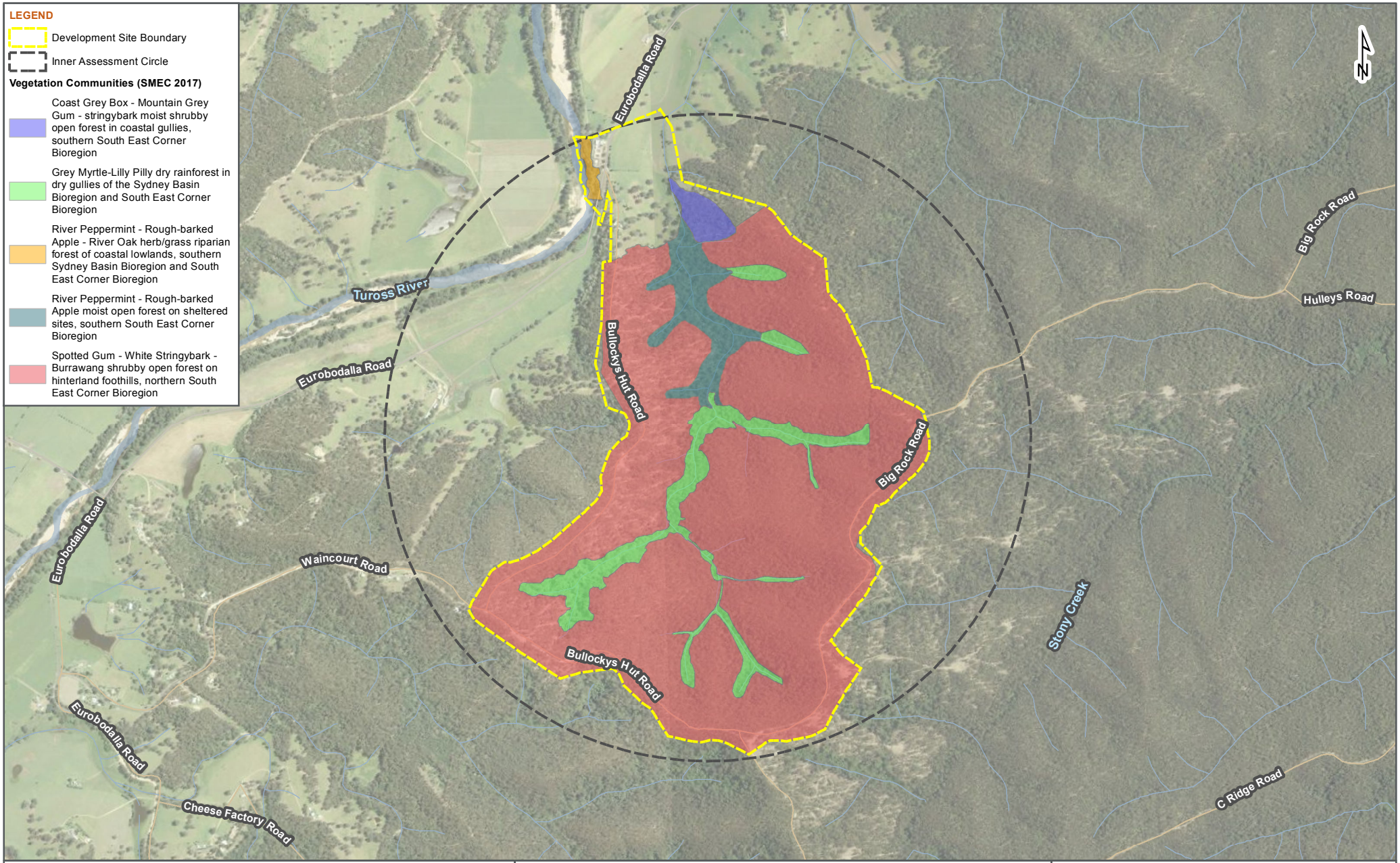

FIG NO. 4-2 **FIGURE TITLE** Plant Community Types Within The Development Site

DATE 16/08/2018

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COORDINATE SYSTEM GDA 1994 MGA Zone 56

PROJECT NO. 30012127 **PROJECT TITLE** Eurobodalla Southern Storage Water Supply Project - BAR

CREATED BY FN12672

SOURCES Roadnet MDS 2017, public NSW
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4.5.2. Threatened Ecological Communities

Two PCTs identified within the development site are components of a Threatened Ecological Community (TEC) according to the VIS Classification Database. As shown in Table 4-4; SR608 and SR609 are components of *River Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions.* This community is listed as an Endangered Ecological Community under Schedule 1 of the TSC Act. No EPBC listed TECs were found to occur within the development site.

The distribution of TECs within the development site is shown in Figure 4-3.

Table 4-4 TEC's associated within PCTs occurring within the development site

PCT Code	PCT Name	TEC Name	TEC Status	Assessed as Associated TEC
1109 / SR609	River Peppermint - Rough-barked Apple moist open forest on sheltered sites, southern South East Corner Bioregion	River Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	Endangered	Yes
1108 / SR608	River Peppermint - Rough-barked Apple - River Oak herb/grass forest of coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion	River Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	Endangered	Yes

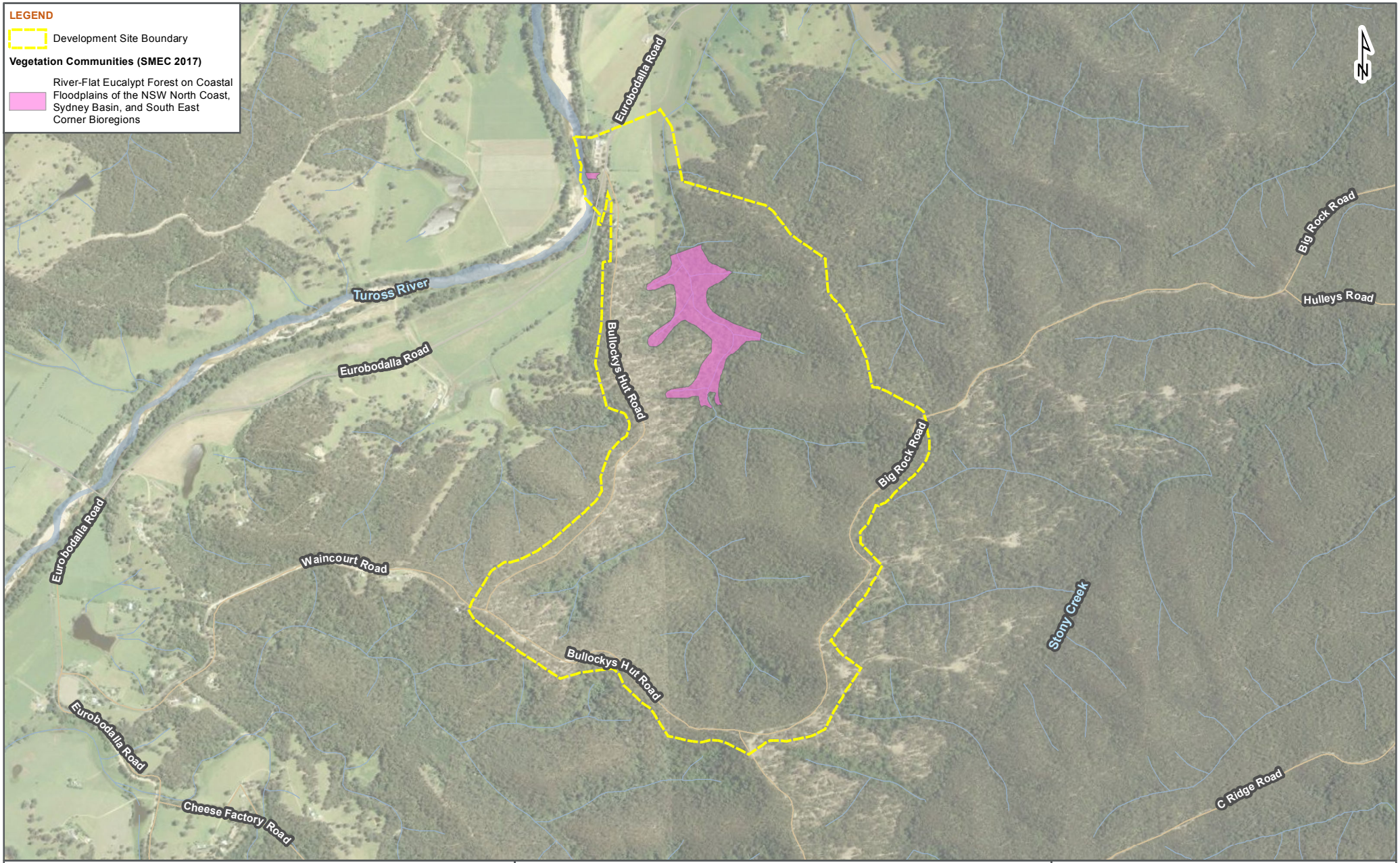

FIG NO. 4-3

FIGURE TITLE TSC Act Threatened Ecological Communities Within The Development Site

DATE 16/08/2018

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COORDINATE SYSTEM GDA 1994 MGA Zone 56

PROJECT NO. 30012127

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4.5.3. Description of Plant Community Types within the Development Site

SR643: Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion

Spotted Gum – White Stringybark – Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion has been mapped as occurring along the ridges and slopes of the valley, as well as along Big Rock Road immediately surrounding Big Rock Reservoir. Structurally, this community occurs as an open forest with and open midstory and grassy understory. Spotted Gum – White Stringybark – Burrawang shrubby open forest is dominated by *Corymbia maculata*, and *Eucalyptus globoidea*, with *Eucalyptus longifolia*, *Eucalyptus agglomerata*, *Eucalyptus muelleriana*, *Eucalyptus tricarpa*, and *Eucalyptus pilularis* also present at lower densities.

The midstory is dominated by *Exocarpos cupressiformis*, *Acacia falciformis*, and *Allocasuarina littoralis*. The understory is generally dominated by *Macrozamia communis*, *Platysace lanceolata*, *Hibbertia aspera*, *Entolasia stricta*, *Lepidosperma laterale*, and *Dianella caerulea*, although, highly localised variation in dominants occur given the extent of the community and differences to disturbance patterns within the development site. While the majority of this community shows evidence of past timber harvesting, the western ridge and slopes of the valley appears to have been more heavily and/or recently harvested which has resulted structurally in more open strata and poorer species richness.

SR551: Grey Myrtle - Lilly Pilly dry rainforest in dry gullies of the Sydney Basin Bioregion and South East Corner Bioregion

Grey Myrtle - Lilly Pilly dry rainforest was mapped in the current study as occurring at the bottom of the deep gullies located within the southern portions of the development site between the spurs dividing the wider valley. Structurally, the community consists of a closed canopy of *Backhousia myrtifolia* with emergent eucalypts, namely *Corymbia maculata*, and an open midstory, understory, and ground layer. The canopy is dominated by *Backhousia myrtifolia*, with occasional *Acmena smithii* present. Numerous climbers also occur in the canopy at high densities including *Marsdenia rostrata*, *Rubus nebulosus*, *Smilax australis*, *Stephania japonica* var. *discolour*, and *Morinda jasminoides*.

The midstory contains *Doryphora sassafras*, *Ficus coronata*, and *Pittosporum undulatum* at low densities, which the understory contains a variety of species including *Notelaea venosa*, *Psychotria loniceroides*, *Eupomatia laurina*, and *Pittosporum revolutum* also at low densities.

The ground stratum is the most species rich, and occurs as a mosaic of dense patches of vegetation and sole occurrences of plants. This layer consists of an assortment of graminoid, ferns, and herbaceous flowering species including *Lastriopsis acuminata*, *Doodia aspera*, *Blechnum cartilagineum*, *Pyrrosia rupestris*, *Asplenium flabellifolium*, *Schoenus melanostachys*, *Lepidosperma gunnii*, *Pseuderanthemum variable*, and *Sarcochilus hillii*.

Grey Myrtle - Lilly Pilly dry rainforest within the development site is structurally and floristically intact. Where disturbance has occurred, it appears been the result of stochastic events, namely falling trees and tree limbs.

SR609: River Peppermint - Rough-barked Apple moist open forest on sheltered sites, southern South East Corner Bioregion

River Peppermint - Rough-barked Apple moist open forest on sheltered sites, southern South East Corner Bioregion is considered a component of River Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions which is listed as an EEC on Part 3 of Schedule 1 of the TSC Act.

River Peppermint - Rough-barked Apple moist open forest occurs on the valley floor of the development site. The canopy is dominated by *Eucalyptus elata*, *Eucalyptus botryoides x saligna* intergrade, *Eucalyptus baueriana*, and *Angophora floribunda*, with occasional *Eucalyptus cypellocarpa*.

The lower strata are densely vegetated with high a high level of species richness, containing species often associated with rainforest communities.

The midstory consists of *Ficus coronata*, *Claoxylon australe*, *Psychotria loniceroides*, *Myrsine howittiana*, *Melicytus dentatus*, *Polyscias murrayi*, *Cassinia trinerva*, *Acmena smithii*, and *Backhousia myrtifolia*.

The lower stratum consists of a variety of graminoids, ferns, and herbaceous flowering plants including *Carex longebrachiata*, *Microlaena stipoides* var. *stipoides*, *Entolasia marginata*, *Stellaria flaccida*, *Hydrocotyle sibthorpioides*, *Desmodium varians*, *Oplismenus imbecillis*, *Pteridium esculentum*, *Blechnum cartilagineum*, and *Pellaea falcata*. Numerous species of climbers and scramblers are also present within the community including *Marsdenia rostrata*, *Cissus hypoglauca*, *Morinda jasminoides*, *Aphanopetalum resinosum*, *Clematis glycinoides* var. *glycinoides*, and *Tylophora barbarta*.

River Peppermint - Rough-barked Apple moist open forest within the development site is both structurally and floristically intact, relatively undisturbed, with little to no weed invasion. The community possesses an abundance of full sized remnant trees, with large hollows and pipes that suggests that the community has been subject to limited or selective logging in the past, if at all.

SR608: River Peppermint - Rough-barked Apple - River Oak herb/grass forest of coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion

River Peppermint - Rough-barked Apple - River Oak herb/grass forest of coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion is considered a component of River Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions, which is listed as an EEC on Part 3 of Schedule 1 of the TSC Act.

River Peppermint - Rough-barked Apple - River Oak herb/grass forest is found along the banks of the Tuross River, within the grounds of the Southern Water Treatment Plant. The canopy within this community is dominated by a mixture of eucalypts including *Eucalyptus muelleriana*, *Eucalyptus botryoides* - *saligna* intergrade and *Angophora floribunda*, as well as *Casuarina cunninghamiana* growing immediately along the banks of the Tuross River.

The midstory consists of *Melicytus dentatus*, *Pittosporum undulatum*, *Exocarpos cupressiformis*, *Trema tomentosa*, and *Acacia mearnsii*. There has been a loss of structural and floristic integrity within the lower strata of the community as a result of weed invasion and edge effects stemming from vegetation clearing up slope of the river. As such, the lower strata consist of a mixture of locally indigenous and exotic species including *Pseuderanthemum variable*, *Adiantum aethiopicum*, *Doodia aspera*, *Microlaena stipoides* var. *stipoides*, *Entolasia marginata*, *Dianella caerulea*, *Morinda jasminoides*, *Pandorea pandorana*, *Eustrephus latifolius*, *Tradescantia fluminensis*, *Acetosa sagittata*, *Ehrharta erecta*, *Paspalum dilatatum*, and *Lonicera japonica*.

SR533: Coast Grey Box - Mountain Grey Gum - stringybark moist shrubby open forest in coastal gullies, southern South East Corner Bioregion

Coast Grey Box - Mountain Grey Gum - stringybark moist shrubby open forest has been mapped in the north east corner of the subject site, extending northwards to cleared paddocks in residential land. Structurally, this community occurs as an open forest with and shrubby understory.

The canopy is dominated by *Eucalyptus cypellocarpa*, *Eucalyptus muelleriana*, *Eucalyptus globoidea*, *Eucalyptus pilularis*, and *Eucalyptus longifolia*. The midstory contains *Acacia falciformis*, *Exocarpos cupressiformis*, *Allocasuarina littoralis*, *Notelaea venosa*, *Persoonia linearis*, and *Pittosporum revolutum*.

The lower stratum is relatively open, with locally indigenous species occurring at low abundance including *Gonocarpus teucrioides*, *Platysace lanceolata*, *Leucopogon lanceolatus*, *Pteridium esculentum*, *Blechnum cartilagineum*, *Lomandra longifolia*, *Lepidosperma laterale*, *Microlaena stipoides* var. *stipoides*, and *Entolasia stricta*.

This community is relatively intact both structurally and floristically, although there is evidence of past logging within the area as evidenced by sawn stumps and, with the exception of retained hollow bearing trees, the canopy species appearing to be of a similar age class consistent with a disturbance event in the past.

4.6. Vegetation Zones

All PCTs identified within the development site were assessed as being in moderate-good condition. Four of the five PCTs were assessed as being within one broad condition state and largely homogenous tracts of vegetation, and thus included within their own distinct vegetation zone (one vegetation zone per PCT). The other PCT consisted of two varying condition classes, and thus split into two vegetation zones. Hence, in total six vegetation zones were identified within the development site. A summary of the vegetation zones within the development site is provided in Table 4-7 and their distribution is shown in Figure 4-4.

Each vegetation zone was assessed using plot and transect surveys to determine the site value score. Plot and transect data collected from the vegetation zones are provided in Appendix A. The calculated site value score for each of the vegetation zones identified within the development site is shown in Table 4-5. All of the vegetation zones within the development site have a site value score of ≥17 and therefore required to be further assessed.

It should be noted that the site value score Vegetation Zone 1 (70.83) is slightly higher than that for Vegetation Zone 2 (69.62) despite being assigned to a lower condition class due to more recent disturbance event, namely logging. This difference in value can be attributed to higher species richness and length of fallen logs within Vegetation Zone 1. It is likely that the high species richness in Vegetation Zone 1 is a result of post-disturbance activation of the soil seed bank and decreased canopy cover, whereas the vegetation in Vegetation Zone 2 is at a later seral stage where post-disturbance recruiters have died back. Furthermore, the higher length of fallen logs within Vegetation Zone 1 can be directly attributed to logging.

Table 4-5 Vegetation zones within the development site

Vegetation Zone	PCT Name	Condition*	Vegetation Zone Area in Development Site (Ha)	Vegetation Zone Area in construction and operational areas (Ha)	Site Value Score	Patch Size (Ha)
1	SR643: Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion	Moderate/Good_medium	47.19	21.08	70.83	1001+
2	SR643: Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion	Moderate/Good_high	141.42	25.5	69.62	1001+
3	SR551: Grey Myrtle - Lilly Pilly dry rainforest in dry gullies of the Sydney Basin Bioregion and South East Corner Bioregion	Moderate/Good	19.37	9.97	71.35	1001+
4	SR609: River Peppermint - Rough-barked Apple moist open forest on sheltered sites, southern South East Corner Bioregion	Moderate/Good	10.49	8.18	71.88	1001+
5	SR608: River Peppermint - Rough-barked Apple - River Oak herb/grass forest of coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion	Moderate/Good	0.84	0.36	76.00	1001+
6	SR533: Coast Grey Box - Mountain Grey Gum - stringybark moist shrubby open forest in coastal gullies, southern South East Corner	Moderate/Good	1.03	1.02	73.44	1001+

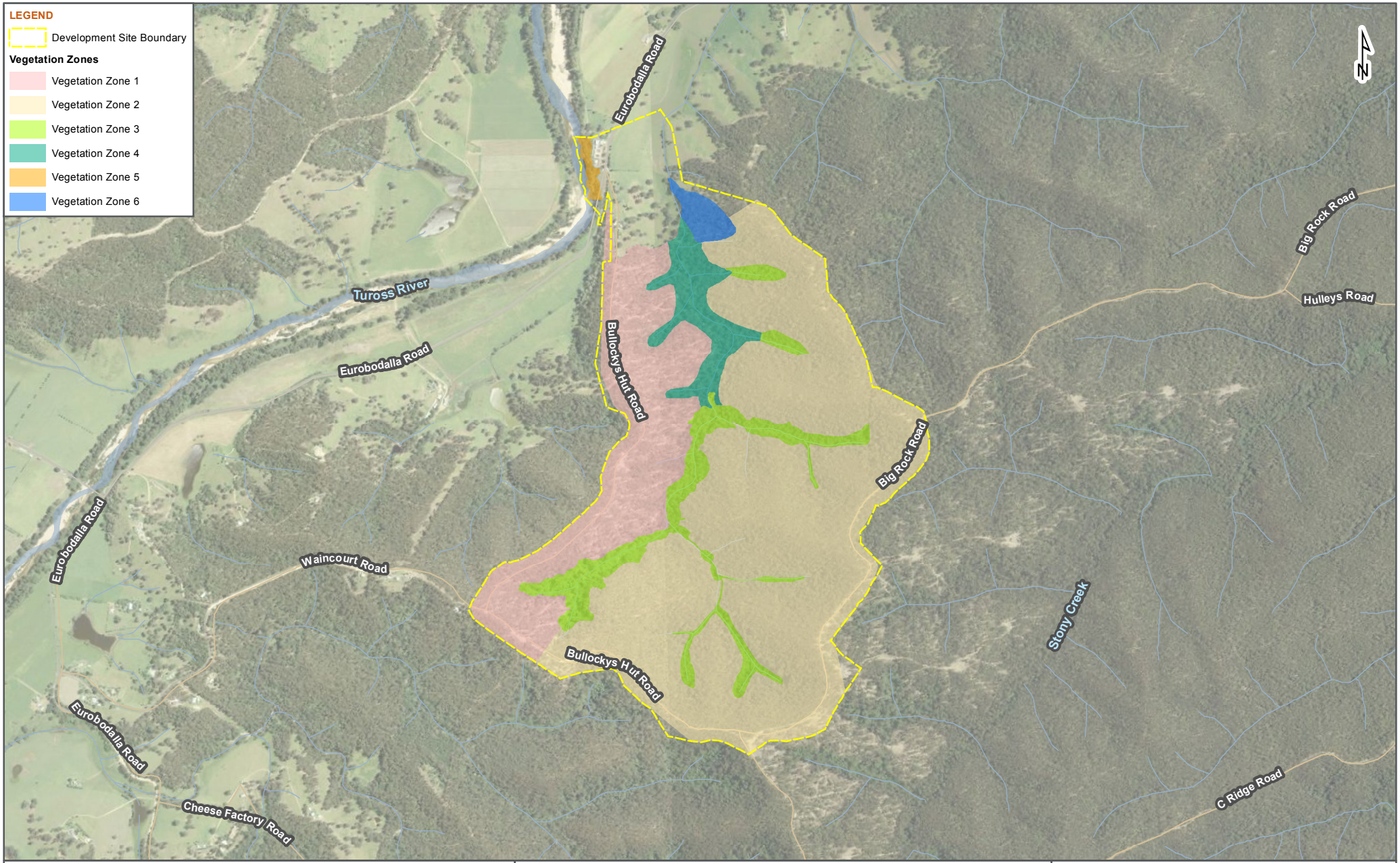

FIG NO. 4-4 **FIGURE TITLE** Vegetation Zones Within the Development Site

DATE 16/08/2018

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COORDINATE SYSTEM GDA 1994 MGA Zone 56

PROJECT NO. 30012127 **PROJECT TITLE** Eurobodalla Southern Storage Water Supply Project - BAR

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4.7. Groundwater Dependent Ecosystems

Groundwater dependent ecosystems (GDEs) for the development site were initially assessed by reviewing the Groundwater Dependent Ecosystem Atlas (BOM, 2017).

Six GDEs were identified within the development site as follows:

- Coastal Gully Shrub Forest
- Batemans Bay Cycad Forest
- Temperate Dry Rainforest
- Escarpment Foothills Wet Forest
- Coastal Lowlands Riparian Herb/Grass Forest
- South Coast River Flat Forest.

With exception of Escarpment Foothills Wet Forest, the GDEs identified on the GDE Atlas are broadly commensurate with the PCTs found to occur within the development site. The impacts to these PCTs that are identified as GDEs within the development site will be assessed in Chapter 7. A figure showing the location of all GDEs identified within the development site is shown in Figure 4-5.

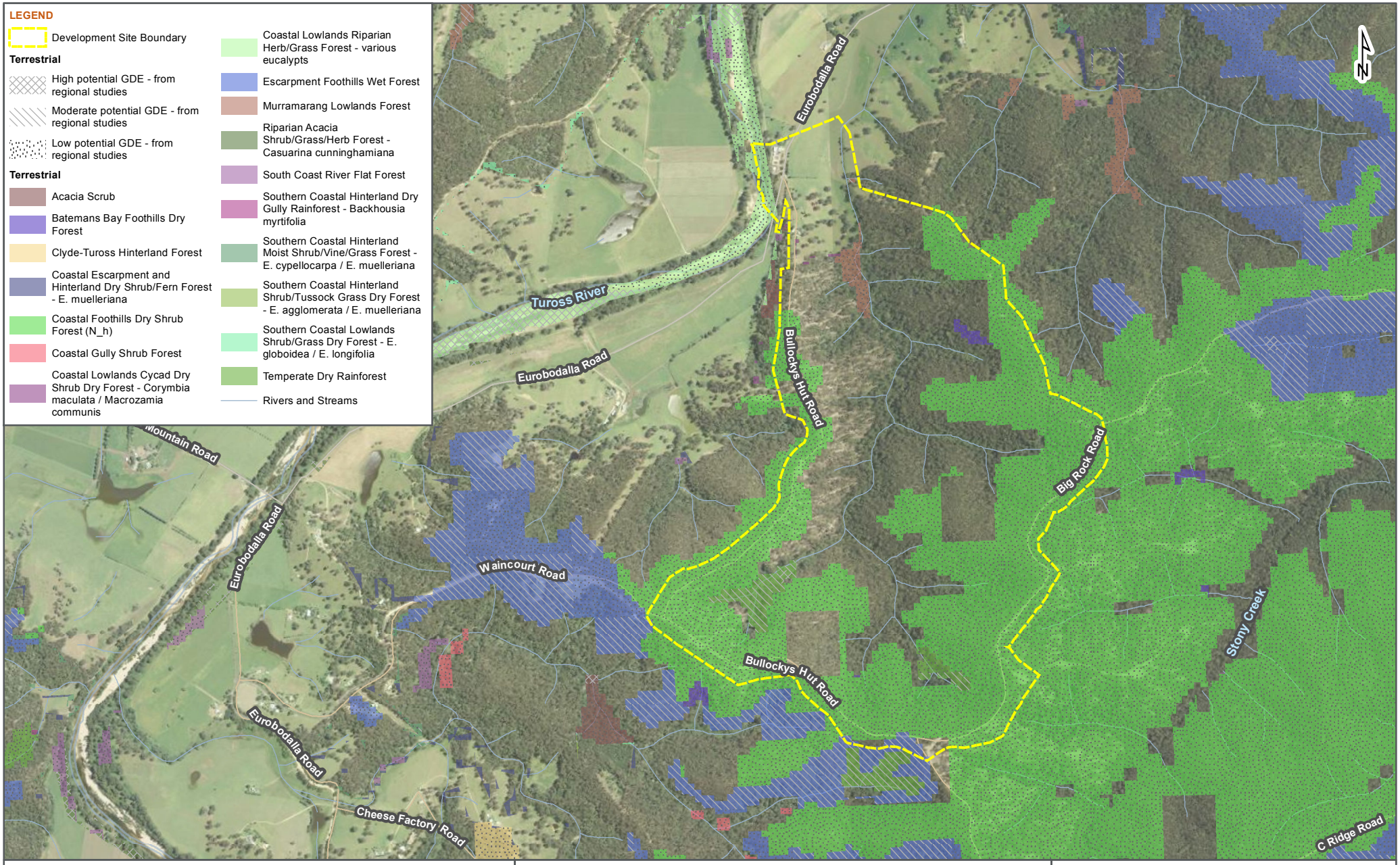

FIG NO. 4-5 **FIGURE TITLE** Groundwater Dependent Ecosystems Within The Development Site

DATE 16/08/2018

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PAGE SIZE A4

COORDINATE SYSTEM GDA 1994 MGA Zone 56

PROJECT NO. 30012127 **PROJECT TITLE** Eurobodalla Southern Storage Water Supply Project - BAR

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5. Threatened Species and Populations

5.1. Review of Existing Data

The following primary sources of information were consulted as part of a desktop assessment of potentially occurring threatened species and populations within the development site:

- NSW Office of Environment and Heritage (OEH) BioBanking Credit Calculator (http://www.environment.nsw.gov.au/bbccapp/ui/mynews.aspx). Last accessed 15th November 2017.
- NSW OEH Atlas of NSW Wildlife Database http://www.threatenedspecies.environment.nsw.gov.au/index.aspx. Last accessed 15th September 2017
- Department of the Environment and Energy Protected Matters Search Tool (DotEE, 2017). Last accessed 15th September 2017.
- DotEE Species Profiles and Threats database (SPRAT) http://www.environment.gov.au/cgi-bin/sprat/public/sprat.plDepartment of Sustainability, Environment, Water, Population and Communities (DSEWPC) EPBC Act Species Profiles and Threats Database (SPRAT).

Information obtained during the review of existing data was utilised in determining candidate ecosystem credit species and species credit species.

5.2. Ecosystem Credit Species

5.2.1. Predicted Ecosystem Credit Species

The BioBanking Credit Calculator (BBCC) generates a list of predicted ecosystem credit species from numerous inputs. Table 5-1 shows the ecosystem credit species have the highest Tg value in each vegetation zone. The Tg values is defined within the FBA as the ability of a species to respond to improvement in site value or other habitat improvement at a biobanking site with management actions, and it based on an assessment of effectiveness of management actions, life history characteristics, naturally rare species, and poorly known species.

Table 5-1 Ecosystem credit species with the highest Tg value in each vegetation zone

Vegetation Zone	Scientific Name	Common Name	Tg Value
1	*Tyto novaehollandiae*	Masked Owl	3.0
2	*Tyto novaehollandiae*	Masked Owl	3.0
3	*Tyto novaehollandiae*	Masked Owl	3.0
4	*Tyto novaehollandiae*	Masked Owl	3.0
5	*Tyto novaehollandiae*	Masked Owl	3.0
6	*Tyto novaehollandiae*	Masked Owl	3.0

Table 5-2 lists the predicted ecosystem credit species for the development site, which has been based on the following:

- IBRA subregion: Bateman subregion

- Associated PCTs: SR533, SR643, SR551, SR642, SR608, SR609
- Percent native vegetation in outer assessment circle: 75.7%
- Condition of vegetation: moderate to good (all vegetation zones)
- Patch size: 1001+ hectares
- Credit type: Ecosystem.

No additional assessment of habitat components for the predicted ecosystem credit species has been undertaken for this assessment.

Table 5-2 Predicted Ecosystem Credit Species

Scientific Name	Common Name	Tg Value	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6
Ninox connivens	Barking Owl	3.0	✓	✓	✓	✓	✓	✓
Stagonopleura guttata	Diamond Firetail	1.3	-	-	-	-	✓	-
Falsistrellus tasmaniensis	Eastern False Pipistrelle	2.2	✓	✓	✓	✓	✓	✓
Mormopterus norfolkensis	Eastern Freetail-bat	2.2	✓	✓	✓	✓	✓	✓
Callocephalon fimbriatum	Gang-gang Cockatoo	2.0	✓	✓	✓	✓	✓	✓
Calyptorhynchus lathami	Glossy Black-cockatoo	1.8	✓	✓	✓	✓	-	✓
Kerivoula papuensis	Golden-tipped bat	1.3	✓	✓	✓	-	-	✓
Scoteanax rueppellii	Greater Broad-nosed Bat	2.2	✓	✓	✓	✓	✓	✓
Hieraaetus morphnoides	Little Eagle	1.4	✓	✓	✓	✓	✓	✓
Glossopsitta pusilla	Little Lorikeet	1.8	✓	✓	✓	✓	✓	✓
Potorous tridactylus	Long-nosed Potoroo	1.3	✓	✓	✓	-	-	✓

Scientific Name	Common Name	Tg Value	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6
Tyto novaehollandiae	Masked Owl	3.0	✓	✓	✓	✓	✓	✓
Pachycephala olivacea	Olive Whistler	1.3	✓	✓	-	-	-	✓
Ninox strenua	Powerful Owl	3.0	✓	✓	✓	✓	✓	✓
Petroica boodang	Scarlet Robin	1.3	-	-	-	-	✓	-
Tyto tenebricosa	Sooty Owl	3.0	✓	✓	✓	✓	-	✓
Dasyurus maculatus	Spotted-tailed Quoll	2.6	✓	✓	✓	✓	✓	✓
Lophoictinia isura	Square-tailed Kite	1.4	✓	✓	-	✓	✓	✓
Lathamus discolor	Swift Parrot	1.3	✓	✓	-	-	-	✓
Neophema pulchella	Turquoise Parrot	1.8	-	-	✓	✓	✓	-
Daphoenositta chrysoptera	Varied Sittella	1.3	✓	✓	✓	✓	✓	✓
Petaurus australis	Yellow-bellied Glider	2.3	✓	✓	-	✓	-	✓
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	2.2	✓	✓	✓	-	✓	-

5.3. Species Credit Species

5.3.1. Candidate Species Credit Species

The BBCC generates a list of candidate species credit species from numerous inputs including classification of the species as a species credit species, the distribution of the species within the same IBRA subregion as the development site and the presence of habitat features or components associated with the species. The habitat features that have been assessed as present within the development site are as follows:

- Land within 40 metres of heath, woodland or forest with sandy or friable soils
- Land within 250 metres of termite mounds or rock outcrops
- Rainforest or tall open wet forest with understory and/or leaf litter and within 100 metres of streams
- Swamps, swamp margins or creek edges
- Land within 100 metres of emergent aquatic or riparian vegetation
- Land containing bark or leaf litter accumulation.

Species credit species that have been generated within the BBCC as candidate species for this assessment are listed in Table 5.5. This includes four flora species or populations and eight fauna species. No species credit species have been confirmed as occurring within the development site through previous surveys and therefore no additions to the list of candidate species have been made.

Table 5-3 Assessment of potential presence of Species Credit Species

Scientific Name	Common Name	Associated PCTs within development site	Required Habitat Components	Assessment of Habitat within the Development Site	Requires Further Assessment
FLORA					
Correa baeuerlenii	Chef's-hat Correa	SR533	N/A	Suitable habitat occurring within the riparian area which contains associated species.	Yes
Genoplesium vernale	East Lynne Midge-orchid	SR643	N/A	Species currently only a narrow belt, approximately 12 km wide, consisting predominantly of dry sclerophyll forest from 17 km south of Batemans Bay to 24 km north of Ulladulla. It is unlikely to occur within the development site.	No
Persicaria elatior	Tall Knotweed	SR533	N/A	Suitable habitat occurs within the open paddock areas of the development site within the dam creekline.	Yes
Galium australe	Tangled Bedstraw	SR608	N/A	Suitable habitat occurs along the Tuross River and along the unnamed creek.	Yes
FAUNA					
Phascogale tapoatafa	Brush-tailed Phascogale	SR533, SR609, SR643	Hollow bearing trees	Development site contains numerous large hollow bearing trees.	Yes

Scientific Name	Common Name	Associated PCTs within development site	Required Habitat Components	Assessment of Habitat within the Development Site	Requires Further Assessment
Cercartetus nanus	Eastern Pygmy-possum	SR643, SR551, SR609, SR533	N/A	Development site contain floriferous species, as well as abundant hollows, rotten stumps, and thickets of vegetation.	Yes
Heleioporus australiacus	Giant Burrowing Frog	SR643, SR551, SR609, SR533	N/A	Development site contains deeply dissected gullies with friable soils.	Yes
Phascolarctos cinereus	Koala	SR643, SR551, SR609, SR608, SR533	N/A	Development site consists of forest consisting of at least 17 species of eucalypt.	Yes
Anthochaera phrygia	Regent Honeyeater	SR643, SR551, SR609, SR608, SR533	N/A	Development site contains abundant associated foraging species including *Corymbia maculata*, stringybark species, ironbark species, and mistletoe.	Yes
Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)	SR643, SR609, SR533	Requires dense ground cover	Development site contains vegetation with dense ground cover.	Yes
Petaurus norfolcensis	Squirrel Glider	SR643, SR533	N/A	Development site contains large old trees with hollows which the species relies on for breeding and nesting.	Yes
Mixophyes balbus	Stuttering Frog	SR551, SR533	N/A	Development site does not contain flowing streams with	No

Scientific Name	Common Name	Associated PCTs within development site	Required Habitat Components	Assessment of Habitat within the Development Site	Requires Further Assessment
				permanent water, thus is unlikely to occur.	

5.4. Impacts on Biodiversity Requiring Further Consideration

5.4.1. Impacts on Threatened Species

The following threatened species outlined in Table 5-4 were listed as requiring further consideration beyond the FBA Assessment based on Attachment B of OEH's submission as part of the reissued SEARs.

Table 5-4 Threatened species requiring further consideration

Scientific Name	Common Name	Assessment of Habitat within the Development Site	Requires Further Assessment
FLORA			
Eucalyptus imlayensis	Imlay Mallee	The species has a highly restricted distribution at a single location within Mount Imlay National Park. It occurs within sclerophyll forest on skeletal soils on a steep slope. Development site does not contain preferred soil associations. Unlikely to occur within the development site.	No
Pomaderris bodalla	Bodalla Pomaderris	Suitable habitat occurs within the moist gullies along the unnamed creek and its tributaries.	Yes
Zieria adenophora	Araluen Zieria	Currently known from a single population near Araluen. Development site is about 55km South-South East of the Araluen area that the species is currently known from. Geology, landform and floristic associations in the development site do not generally conform to this community.	No
Zieria buxijugum	Box Range Zieria	Currently known from a single population approximately 15 km west of Pambula. Development site is about 95 km north of the Pambula area that the species is restricted to. Geology, landform and floristic associations in the development site do not generally conform to this community.	No
Zieria parrisiae	Parris' Zieria	Currently known from a single population approximately 15 km west of Pambula. Development site is about 95 km north of the Pambula area that the species is restricted to. Geology, landform and floristic associations in the development site do not generally conform to this community.	No
Zieria tuberculata	Warty Zieria	Known from the Mount Dromedary and Tilba area. Development site is about 25 km north of the Tilba Tilba/ Mt Dromedary area that the species is restricted to. Geology, landform and floristic associations in the development site do not generally conform to this community.	No
FAUNA			

Scientific Name	Common Name	Assessment of Habitat within the Development Site	Requires Further Assessment
Anthochaera phrygia	Regent Honeyeater	Development site contains abundant associated foraging species including *Corymbia maculata*, stringybark species, ironbark species, and mistletoe.	Yes
Callocephalon fimbriatum	Gang-gang Cockatoo	Development site contains well-timbered wet sclerophyll forest, and old growth attributes favoured for nesting and roosting.	Yes
Falsistrellus tasmaniensis	Eastern False Pipistrelle	Development site contains tall, mature, wet forest with trees taller than 20 m containing hollows.	Yes
Litoria aurea	Green and Golden Bell Frog	Development site does not contain bodies of standing water, such as dams, with fringing vegetation.	No
Mixophyes iteratus	Regent Honeyeater	Development site does not contain flowing streams required for breeding.	No
Ninox strenua	Powerful Owl	Development site contains suitable foraging, roosting, and breeding habitat.	Yes
Pseudomys fumeus	Smokey Mouse	Species is thought to have limited in distribution, however the persistence of colonies appears to be ephemeral. Suitable habitat may occur within the development site.	Yes
Scoteanax rueppellii	Greater Broad-nosed Bat	Development site contains suitable foraging, roosting, and breeding habitat.	Yes
Tyto novaehollandiae	Masked Owl	Development site contains gullies with wet sclerophyll forest, and large hollows for roosting and breeding.	Yes

5.4.2. Impacts on Endangered Populations

The following endangered populations outlined in Table 5-5 were listed within Attachment B of OEH's submission (as part of the reissued SEARs) as requiring further consideration beyond the FBA Assessment.

Table 5-5 Endangered populations requiring further consideration

Scientific Name	Common Name	Assessment of Habitat within the Development Site	Requires Further Assessment
Endangered Population			

Scientific Name	Common Name	Assessment of Habitat within the Development Site	Requires Further Assessment
Greater Glider Population of the Eurobodalla Local Government Area	Greater Glider Population of the Eurobodalla Local Government Area	Development site contains moist eucalypt forests and woodlands with old trees and abundant hollows, however it is located outside the boundaries specified by the Scientific Determination for the population.	No

5.4.3. Impacts on Endangered Ecological Communities

The following EECs outlined in were listed within Attachment B of OEH's submission as part of the reissued SEARs as requiring further consideration beyond the FBA Assessment.

Table 5-6 EECs requiring further consideration

Scientific Name	Assessment of Habitat within the Development Site	Requires Further Assessment
Endangered Ecological Community		
Araluen Scarp Grassy Forest in the South East Corner Bioregion	This community typically comprises eucalypt tree canopy with an open shrub layer and a grassy groundcover. The community is largely restricted to the escarpment and associated ridges on the northern and western sides of the Araluen valley. It occurs typically on sandy loams derived from granite, usually on steep slopes between approximately 200-700 m a.s.l. This distribution falls within a rain shadow zone, where mean annual rainfall is approximately 890-1000 mm. The structure of the community varies depending on past and current disturbances, particularly clearing and grazing. The development site is about 55 km South-South East of the Araluen Valley area that the community is largely restricted to. Floristic associations in the development site do not generally conform to this community.	No
Brogo Wet Vine Forest in the South East Corner Bioregion	The upper story of the forest is dominated by *Eucalyptus tereticornis* with occasional *Eucalyptus bosistoana* and *Eucalyptus baueriana*, with rainforest elements such as *Alectryon subcinereus* and *Ficus rubiginosa*. The open shrubby understory includes *Acacia implexa, Cassinia trinerva, Deeringia amaranthoides, Melicytus dentatus* and *Breynia oblongifolia*. There is a species-rich ground cover of forbs and graminoids. A variety of vines and twiners occur between the shrub and ground layer including *Marsdenia rostrata, Clematis glycinoides, Geitonoplesium cymosum, Glycine clandestina* and *Stephania japonica.* Brogo Wet Vine Forest is distinguished from other communities in the south	No

Scientific Name	Assessment of Habitat within the Development Site	Requires Further Assessment
	east forests of New South Wales by the dominance of *Eucalyptus tereticornis* and the abundance of mesophyll shrubs and vines. Floristic associations in the development site do not generally conform to this community.	
Dry Rainforest of the South East Forests in the South East Corner Bioregion	The community is a rainforest with a dense canopy to 10 m tall with occasional emergent eucalypts. The upperstory is dominated by *Ficus rubiginosa* with occasional *Pittosporum undulatum* and *Brachychiton populneus* and scattered emergent eucalypts. The sparse understory shrub layer includes *Alectryon subcinereus*, *Notelaea venosa* and *Melicytus dentatus* (syn. *Hymenanthera dentata)*, *Dendrocnide excelsa* and *Deeringia amaranthoides* may be locally common in the northern part of the range. The ground cover is patchy with scattered patches of *Plectranthus graveolens* and *Sigesbeckia orientalis*, with the fern *Pellaea falcata* var. *falcata* and grass *Oplismenus imbecillis* among rocks. *Ficus rubiginosa* is at the southern limit of its geographical distribution within the community. Floristic associations in the development site do not generally conform to this community.	No
Lowland Grassy Woodland in the South East Corner Bioregion	Lowland Grassy Woodland communities in the South East Corner bioregion are located in rain-shadow areas receiving less rainfall than more elevated terrain that partially surrounds them, with mean annual rainfall typically in the range of 700-1100 mm. The community typically occurs in undulating terrain up to 500 m in elevation on granitic substrates (e.g. adamellites, granites, granodiorites, gabbros, etc.) but may also occur on locally steep sites and on acid volcanic, alluvial and fine-grained sedimentary substrates. Contemporary tree-dominated stands of the community are largely relics or regrowth of originally taller forests and woodlands, which are likely to have had scattered shrubs and a largely continuous grassy groundcover. At some sites, mature trees may exceed 40 m, although regrowth stands may be shorter than 10 m. Floristic associations in the development site do not generally conform to this community.	No
Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions	The Montane Peatlands community is associated with accumulated peaty or organic-mineral sediments on poorly drained flats in the headwaters of streams. It occurs on undulating tablelands and plateaux, above 400-500 m elevation, generally in catchments with basic volcanic or fine-grained sedimentary substrates or, occasionally, granite. It is the only type of wetland that may contain more than trace amounts of *Sphagnum* spp., the hummock peat-	No

Scientific Name	Assessment of Habitat within the Development Site	Requires Further Assessment
	forming mosses. Small trees may be present as scattered emergent, or be absent from the community. Typically has an open to very sparse layer of shrubs, 1-5 m tall, including species of *Baeckea*, *Callistemon* and *Leptospermum*. Floristic associations in the development site do not generally conform to this community.	
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	This community is found on the river flats of coastal floodplains. It has a tall open tree layer of eucalypts, which may exceed 40 m in height, but can be considerably shorter in regrowth stands or under conditions of lower site quality. While the composition of the tree stratum varies considerably, the most widespread and abundant dominant trees include *Eucalyptus tereticornis*, *E. amplifolia*, *Angophora floribunda* and *A. subvelutina, Eucalyptus baueriana*, *E. botryoides* and *E. elata* may be common south from Sydney. *E. ovata* occurs on the far south coast, *E. saligna* and *E. grandis* may occur north of Sydney, while *E. benthamii* is restricted to the Hawkesbury floodplain. The combination of features that distinguish River-Flat Eucalypt Forest on Coastal Floodplains from other endangered communities on the coastal floodplains include: its dominance by either a mixed eucalypt canopy or by a single species of eucalypt belonging to either the genus *Angophora* or the sections Exsertaria or Transversaria of the genus *Eucalyptus*; the relatively low abundance or sub-dominance of *Casuarina* and *Melaleuca* species; the relatively low abundance of *Eucalyptus robusta*; and the prominent groundcover of soft-leaved forbs and grasses. Floristic associations in the development site generally conform to this community.	Yes

5.5. Field Surveys

5.5.1. Habitat Assessment

A general fauna habitat assessment was undertaken within the development site and adjoining land in October 2016. Fauna habitat assessments included consideration of important indicators of habitat condition and complexity including the occurrence of microhabitats such as tree hollows, fallen logs, bush rock and wetland areas such as creeks and soaks, and the presence of mistletoe and flowering trees for nectivorous bird species. Hollows were used as a general indication of habitat quality for arboreal fauna and for hollow dependent birds and bats.

5.5.2. Targeted Threatened Species Surveys

Flora

Targeted threatened-plant surveys were conducted in adherence to the NSW Guide to Surveying Threatened Plants (2016) and were completed across the development site between 13 - 17 February 2017. Field traverses were undertaken by two specialist botanists, covered each patch of suitable

habitat for each threatened flora species, and focussed on cryptic species. Survey were completed over six hours, and approximately 5.19 kilometres were traversed. Surveys were undertaken at the time of year to coincide with flowering of the threatened plants to maximise the potential for their detection. The location of threatened flora surveys are shown in Figure 5-1.

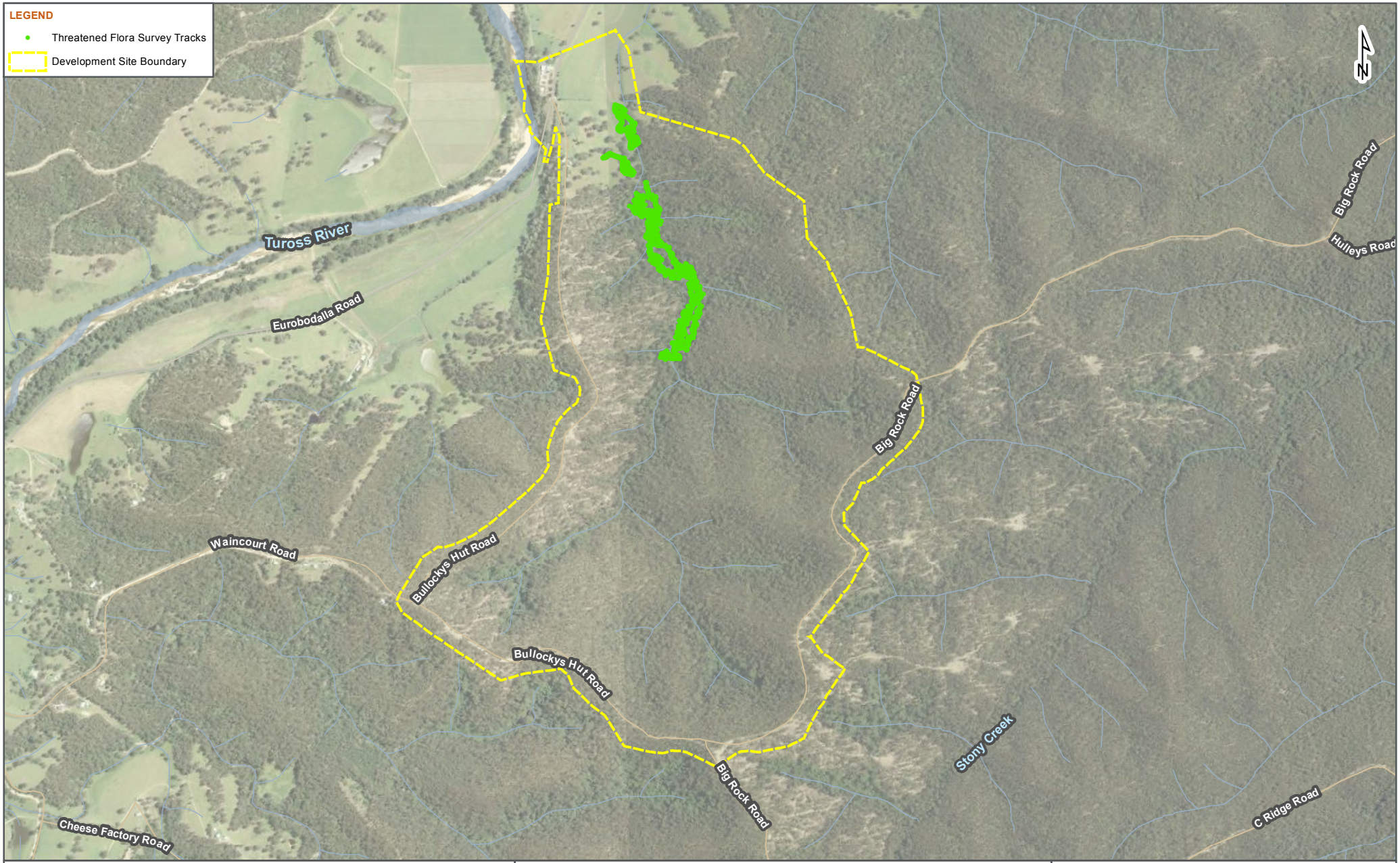

FIG NO. 5-1 **FIGURE TITLE** Threatened Flora Survey Locations

DATE 16/08/2018

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PAGE SIZE A4

COORDINATE SYSTEM GDA 1994 MGA Zone 56

PROJECT NO. 30012127 **PROJECT TITLE** Eurobodalla Southern Storage Water Supply Project - BAR

CREATED BY FN12672

SOURCES Roadnet MDS 2017, public NSW
Imagery: © Department of Finance, Services & Innovation 2018

Location: \\AUMBFPV002\projects\Projects\30012127 - Eurobodalla Storage\09 GIS, Photos & Graphics\01 GIS\Maps\BAR\30012127_Fig_5_1_BAR_ParaFT.mxd

Last updated by: FN12672 on 16/08/2018 at 11:16

Fauna

General fauna surveys, including nocturnal searches, were conducted within the development site over five days and four nights during October 2016, and over 15 days and 12 nights during February 2017. Fauna field surveys were consistent with the survey effort recommendations of Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft (DEC 2004) with particular reference to the size of the survey sites, broad scale vegetation communities and major sampling stratification units. The location of threatened fauna surveys are shown in *Figure 5-2*.

i. Amphibians

In accordance with the Commonwealth Survey guidelines for Australia's threatened frogs (DEWHA, 2010) surveys were conducted at the development site for a minimum of four nights.

Targeted surveys for Giant Burrowing Frog were carried out from the 27 February until 2 March 2017. Weather conditions on all four surveys were dry and warm. There had been little rain prior to surveys commencing, with a rainfall event of 7.2 millimetres occurring on the last night of February – March surveys. As such, weather conditions for surveys were considered to be suboptimal.

ii. Large Forest Owls

Nocturnal call playback and spotlighting was conducted for Large Forest Owls over nine nights using a megaphone and hand-held spotlight while walking around suitable habitat for Large Forest Owls. During surveys, call playback of taped Large Forest Owls calls were broadcast to elicit a response any resident owls. Calls were played for two minute periods at five minute intervals. This was followed by a period of quiet listening and spotlighting.

iii. Microchiropteran Bats

Two ultrasonic call detectors (Songmeter SM4BAT FS, Wildlife Acoustics) were placed in areas of potentially high bat activity across the development site to sample suitable vegetation types. The devices were left for two entire nights at four different locations. Calls were downloaded and converted to Anabat call sequence files with sorting and identification was carried out by Rebecca Carman. All calls were analysed using AnaLookW (Version 4.2g Corben 2016) with a generic filter applied to exclude poor quality calls unsuitable for identification and noise. Calls with fewer than four clearly defined non-fragmented pulses were also excluded from analysis. Identification of species was carried out by comparing to regional reference calls and published descriptions (Pennay *et al*. 2004). Call verification was undertaken by recognised bat call experts (Brad Law).

iv. Arboreal Mammals

Threatened arboreal mammals were surveyed using a variety of different survey techniques as follows:

- Spotlighting and call back: nocturnal spotlighting was conducted for arboreal mammals over 12 nights using a hand-held spotlight while traversing areas of identified suitable habitat for the target arboreal mammals. During spotlighting surveys, call playback of taped koala calls were broadcast using a megaphone to elicit a response from targeted threatened nocturnal species. Calls were played for two minute periods at five minute intervals. This was followed by a period of quiet listening and spotlighting.
- Arboreal cage traps: Elliot A traps were installed in suitable hollow bearing trees across the development site, sampling suitable vegetation types for a total of 162 trap nights. Traps were installed approximately 3 metres from the ground and baited with oats and peanut butter. Traps were set at dusk and checked at dawn.
- Arboreal hair tubes: Hair tubes were installed within suitable hollow bearing trees across the development site, sampling suitable vegetation types for a total of 450 "trap" nights. Tubes were installed approximately 3 metres from the ground and baited with oats and peanut butter. Each hair tube had wafers of sticking paper to collect and hair from visiting mammals left in situ for two

weeks. After two weeks the hair tubes were collected and any samples of hair left on the wafers were sent to Barbara Triggs for identification.

- Nestboxes: 30 Eastern Pygmy-possum style nestboxes were installed across the development site, targeting suitable vegetation types, and left in situ for approximately two months. The nestboxes were constructed from hollow logs with an internal diameter of approximately 10 centimetres, a metal lid and an approximately 2.5 centimetre entry hole on the side. After two months the nestboxes were checked for signs of being inhabited (presence of possum, scats or hair, or nest) and removed.
- Scat and scratch searches: Area search for ridged, ovals scats and scratches consisting of two angles lines consistent with koalas were undertaken across the development site within suitable vegetation types. Surveys searched 180 trees over a six-hour period.

v. Ground dwelling mammals

Threatened ground dwelling mammals were surveyed using a variety of different techniques as follows:

- Infrared camera traps: Twenty-eight baited infrared camera traps were placed in various habitats across the development site to target nocturnal and diurnal ground-dwelling mammalian fauna. Reconyx Hyperfire Cameras were placed a 1 meter from bait stations which consisted of a tea-ball on a stake, and containing oats and peanut butter. The cameras were removed after 676 trap nights.
- Ground Elliot traps: Elliot A traps were installed across the development site for a total of 238 trap nights. Traps were installed within areas of suitable habitat for the target species, being placed on the ground in sheltered locations and baited with oats and peanut butter. Traps were set at dusk and checked at dawn.
- Hair tubes: Hair tubes were installed across the development site, sampling suitable vegetation types for a total of 3255 trap nights. Traps were installed within areas of suitable habitat on the ground and baited with oats and peanut butter. Each hair tube had wafers of sticking paper to collect and hair from visiting mammals left in situ for 4 months. The hair tubes were collected and any samples of hair left on the wafers were sent to Barbara Triggs for identification.

vi. Rosenberg's Goanna

Although not required, infrared camera traps were placed around termite mounds across the development site to target Rosenberg's Goanna, which use termite mounds as breeding sites. The cameras were removed after 451 trap nights.

vii. Diurnal bird surveys

Visual observation and call identification of diurnal birds was carried out during spring, summer and autumn within the development site. Six 30-minute diurnal bird census points were surveyed between two ecologists equating to a total of 60 minutes survey effort at each diurnal bird census survey point each season. Diurnal birds were also opportunistically identified and recorded as they were encountered throughout the development site during all other surveys.

viii. Incidental observations

Any incidental vertebrate fauna species that was observed, heard calling, or otherwise detected on the basis of tracks or signs were recorded and listed in the total species list for the development site.

ix. Survey effort

Fauna survey methods and survey effort are summarised in Table 5-7.

Table 5-7 Summary of fauna survey effort

Method	Target species	Dates	Survey effort
Spotlighting	Koala, Greater Glider, Brush-tailed Phascogale	14-16, 27 Feb 2017	8 hours
	Giant Burrowing Frog	3 Mar 2017	3 hours
Call playback	Powerful Owl, Masked Owl, Sooty Owl, Barking Owl	15, 27, 28 Feb 2017 1 March 2017	4 nights
Infrared cameras (baited)	Southern Brown Bandicoot, Smoky Mouse	26 Oct 2016 – 14 Feb 2017	676 trap nights
Infrared cameras (termite mounds)	Rosenberg's Goanna	13 Feb – 2 Mar 2017	451 trap nights
Ground hair tubes	Smoky Mouse	27 Oct 2016 – 13 Feb 2017	3255 trap nights
Arboreal hair tubes	Brush-tailed Phascogale, Squirrel Glider	15-21 Feb 2017 21 Feb – 2 Mar 2017	450 trap nights
Ground Elliott traps	Smoky Mouse	24-28 Oct 2016 27 Feb – 2 Mar 2017	238 trap nights
Arboreal cage traps	Brush-tailed Phascogale, Squirrel Glider	25-28 Oct 2016 14-17 Feb 2017	162 trap nights
Nest boxes	Eastern Pygmy-possum	16 Feb – 21 Apr 2017	30 nest boxes
Ultrasonic recording	Eastern Bentwing Bat,	20-24 Feb 2017	8 nights
Scat searches	Koala	17 and 24 Feb 2017	6 hours (180 trees)
Diurnal bird surveys	Regent Honeyeater	13 Feb - 2 Mar 2017 18-21 Apr 2017	22 hours

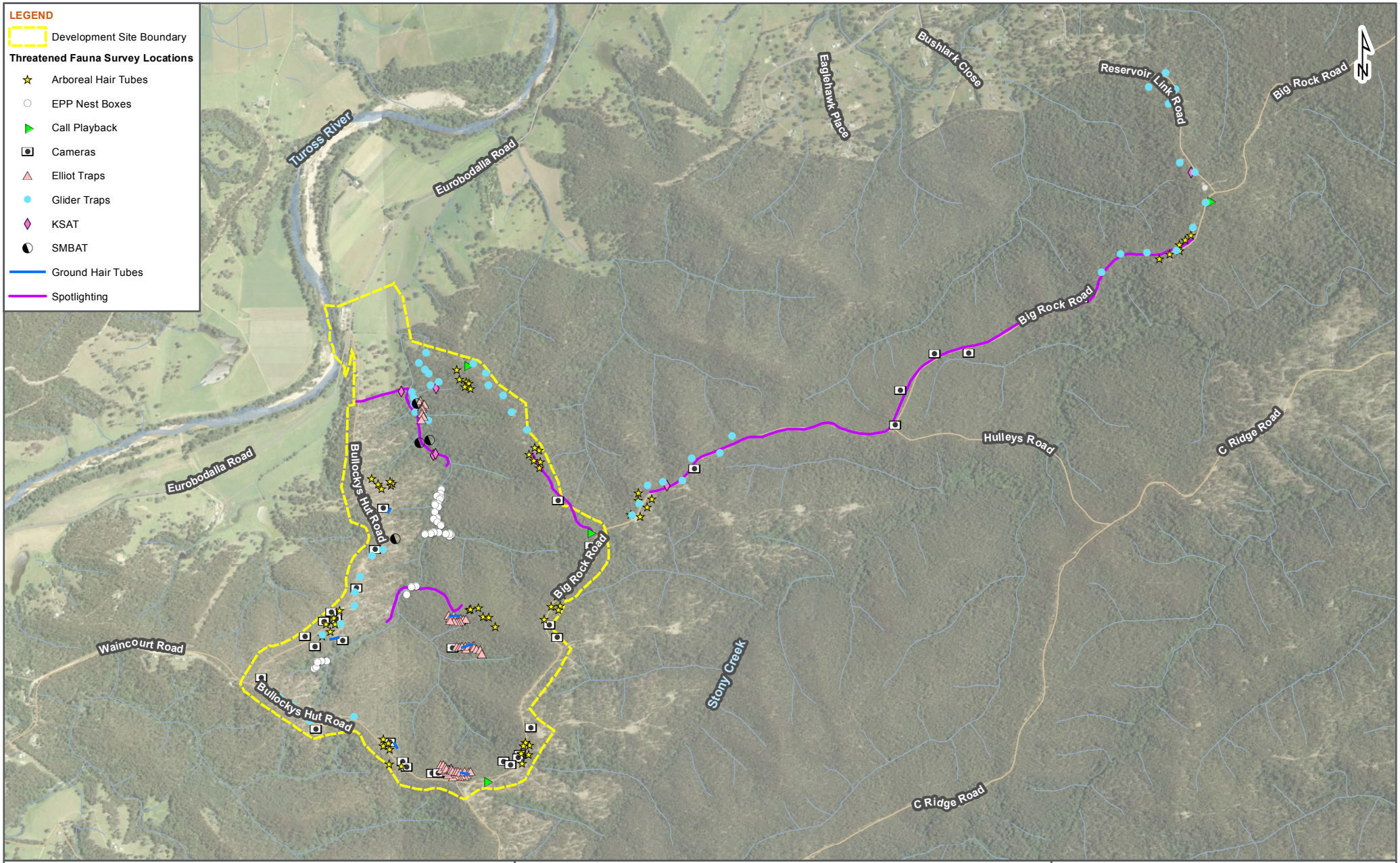

FIG NO. 5-2 **FIGURE TITLE** Threatened Fauna Survey Locations

DATE 16/08/2018

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PAGE SIZE A4

COORDINATE SYSTEM GDA 1994 MGA Zone 56

PROJECT NO. 30012127 **PROJECT TITLE** Eurobodalla Southern Storage Water Supply Project - BAR

CREATED BY FN12672

SOURCES Roadnet MDS 2017, public NSW
Imagery: © Department of Finance, Services & Innovation 2018

Location: \\AUMBFPV002\projects\Projects\30012127 - Eurobodalla Storage\09 GIS, Photos & Graphics\01 GIS\Maps\BAR\30012127_Fig_5_2_BAR_TFSL.mxd

Last updated by: FN12672 on 16/08/2018 at 14:12

5.5.3. Weather Conditions

Weather conditions throughout the survey period were generally warm and dry. Significant rainfall fell on the final night of the 2017 survey period (Table 5-8).

Table 5-8 Weather conditions during survey period

Temperature, humidity, pressure, cloud and rainfall observations are from Moruya Heads Pilot Station {station 069018}. Wind observations are from Moruya Airport AWS {station 069148}

Date	Temp. (°C)		Rain (mm)	Max. wind gust		
	Max.	Min.		Direction	Speed (km/hr)	Time
24 October 2016	4.9	19.0	2.0	SE	35	11:18
25 October 2016	8.2	20.9	0	ENE	30	11:37
26 October 2016	13.1	22.7	0	NNE	56	14:39
27 October 2016	13.6	16.8	0	SSE	35	20:48
28 October 2016	11.7	17.6	0	SSW	24	23:01
14 November 2016	21.5	12.4	0	SE	57	12:37
15 November 2016	20.9	10.6	0	ENE	26	10:43
16 November 2016	10.7	22.2	0	SE	31	10:43
17 November 2016	12.0	20.9	0	NE	48	13:57
13 February 2017	11.6	22.0	5.1	E	24	12:16
14 February 2017	14.9	23.5	0	SSE	39	12:35
15 February 2017	14.0	23.4	0	NE	44	14:01
16 February 2017	16.5	26.2	0	SSE	30	13:15
17 February 2017	17.1	25.4	0	S	41	19:43
18 February 2017	18.6	21.0	0	S	41	18:35
19 February 2017	14.5	22.4	4.2	SSW	28	23:20
20 February 2017	13.1	22.5	0	ENE	33	12:59
21 February 2017	11.8	23.3	0	E	31	13:11
22 February 2017	16.2	24.8	0	NNE	59	16:52
23 February 2017	13.1	25.0	0	NE	46	12:35
24 February 2017	19.9	24.2	0	SSE	39	18:19
25 February 2017	16.6	24.1	0	SSE	35	14:07

Date	Temp. (°C)		Rain (mm)	Max. wind gust		
	Max.	Min.		Direction	Speed (km/hr)	Time
26 February 2017	16.7	23.9	0	SSE	31	11:38
27 February 2017	15.0	24.7	1.4	WSW	20	01:51
28 February 2017	16.7	25.9	0.2	ESE	20	10:29
1 March 2017	16.7	25.1	0	SW	17	07:07
2 March 2017	19.2	26.2	7.2	E	20	11:34
18 April 2017	14.0	22.5	0	ENE	30	13:43
19 April 2017	14.5	22.7	0	NE	30	14:36
20 April 2017	14.1	22.2	0	NNE	43	17:02
21 April 2017	13.7	22.0	0	NNE	26	14:12

5.5.4. Survey Limitations

Field surveys were conducted over 25 days and 16 nights during Spring 2016 and Summer 2017. In addition to the surveys undertaken, the full spectrum of flora and fauna species and ecological processes likely to occur on the site were considered by identifying potential habitats for such species and assessing the potential for these species to occur on the site based on previous records, the type and condition of habitats present, the land use of the site and its landscape context.

As stated by the DEC (2004a) '*The absence of a species from survey data does not necessarily mean it does not inhabit the survey area. It may simply mean that the species was not detected at that time with the survey method adopted and the prevailing seasonal or climatic conditions*.' Accordingly, the relative brevity of the survey and its timing mean that the full spectrum of flora and fauna species, as well as ecological processes, likely to occur on the subject site cannot be fully quantified or described in this report.

The following limitations specifically relate to the current assessment:

- While surveys were conducted for Eastern Pygmy-possum utilising nest boxes, the boxes themselves were unlikely to have been installed for sufficient length of time to confidently rule out their presence onsite
- Targeted surveys for Giant Burrowing Frog were undertaken during 6-month period of very low rainfall. A rainfall event of 7.2 millimetres occurred on the final night of February – March surveys, but this volume and timeframe is unlike to have been sufficient amount to detect the species. However, habitat availability for the species was considered to be insufficient to support a viable breeding population, as such, it is unlikely that the species utilises the development site.

5.6. Fauna Habitats within the Development Site

Fauna habitats of the development and development site are assessed in two main categories for the current survey. Fauna habitat features and resources at a locality scale form part of the broader landscape of the development site to a 5 kilometre radius. Site specific fauna habitat features and

resources provide the key elements required by native fauna for the maintenance of life cycles. Fauna habitats identified in the current survey are summarised in Table 5-9.

Table 5-9 Fauna habitat types and resources

Area	Habitat Feature	Habitat Resources and Fauna
Development site	Broad area of remnant vegetation	Foraging, nesting, roosting and sheltering for birds, reptiles, amphibians, arboreal and terrestrial mammals and bat species. High quality habitat available for species with large home ranges including, but not limited to, *Dasyurus maculatus* (Spotted-tail Quoll), *Tyto tenebricosa* (Sooty Owl), *Tyto novaehollandiae* (Masked Owl), *Ninox strenua* (Powerful Owl), *Ninox connivens* (Barking Owl).
	Hollow bearing trees	Nesting, roosting, and sheltering habitat for numerous threatened and non-threatened birds, arboreal mammals, and microbats. Target species likely using this resource on site include *Petaurus australis* (Yellow-bellied Glider), *Calyptorhynchus lathami* (Glossy Black-cockatoo), *Callocephalon fimbriatum* (Gang gang Cockatoo), *Tyto tenebricosa* (Sooty Owl), *Tyto novaehollandiae* (Masked Owl), and various microbat species.
	Shrubby midstory and/or dense understory within the valley	Foraging, nesting, roosting and sheltering for small and medium birds, reptiles, arboreal and terrestrial mammals and arboreal frogs.
	Creek and tributaries	Roosting habitat for large forest owls (*Ninox strenua* and *Tyto novaehollandiae*). Foraging habitat for small and medium birds, reptiles, and amphibians. Amphibian breeding habitat when standing water is present.
	Fallen tree trunks, woody debris, and deep leaf litter	Sheltering habitat for small terrestrial mammals, amphibians, and reptiles.
	Access roads and pathways	Foraging and flyways for microbat species.
	Termite mounds	Termite mounds provide suitable breeding habitat for *Varanus rosenbergi* (Rosenberg's Goanna), as well as foraging habitat for *Tachyglossus aculeatus* (Echidna).
	Allocasuarina littoralis	Foraging habitat for *Calyptorhynchus lathami* (Glossy Black-cockatoo). Two Glossy Black-cockatoo feeding locations were recorded within the development site
	Stags	Nesting, roosting, and sheltering habitat for numerous threatened and non-threatened birds, arboreal mammals and microbats when hollow. Perch for predatory birds while foraging.

Area	Habitat Feature	Habitat Resources and Fauna
	Tuross River	Riparian vegetation contains foraging, nesting, roosting and sheltering for small, medium and large birds, and arboreal mammals, as well as providing connectivity through cleared agricultural land. River provides foraging habitat for threatened and non-threatened microbat species, including *Myotis macropus*. Also provides foraging habitat for water birds, namely Anseriformes, Ciconiiformes, and Coraciiformes.
	Cleared agricultural land with paddock trees	Foraging, nesting, roosting and sheltering for birds, arboreal and terrestrial mammals and bat species. Would tend to suit generalist species as opposed to species with high specialised habitat requirements.

The development site supports a variety of habitat resources that may be utilised by protected or threatened fauna occurring in the locality. The development site is within a very large tract of remnant bushland, as defined by BBAM 2014, which extends along the coast northwards to Nowra and south to Victoria, and through East Gippsland towards Melbourne. As such, it is part of a vegetated area which provides optimal habitat for species which require large home ranges such as *Dasyurus maculatus* (Spotted-tail Quoll), *Tyto tenebricosa* (Sooty Owl), *Tyto novaehollandiae* (Masked Owl), *Ninox strenua* (Powerful Owl), and *Ninox connivens* (Barking Owl).

Hollow bearing trees are abundant within the development site. The hollows themselves vary in size with many of the large hollows and pipes occurring within remnant vegetation on the valley floor. These large hollows are likely to be utilised by the threatened species recorded on site, including Sooty Owl, Masked Owl, Yellow-bellied Glider, Gang-gang Cockatoo, and Glossy Black-cockatoos. Small to medium sized hollows are likely to be utilised by *Petaurus breviceps* (Sugar Glider), *Trichosurus vulpecula* (Bush-tail Possum), *Platycercus elegans* (Crimson Rosella), and various species of microbats.

The valley of the development site contains vegetation with a dense midstory and lower strata. The shrubby and dense nature of the vegetation provides suitable habitat for species which are dependent on this type of vegetation structure. This includes *Cercartetus nanus* (Eastern Pygmy Possum), *Isoodon obesulus* (Southern Brown Bandicoot), *Perameles nasuta* (Long-nosed Bandicoot), as well as other small terrestrial mammal species, and small passerine birds. Suitable breeding habitat for amphibians is also present during and immediately after high rainfall events. The vegetation type surrounded the creekline and its tributaries provides foraging habitat for small and medium birds, reptiles, and amphibians. Taller and denser vegetation surrounding the creekline provides suitable roosting habitat for large forest owls, including *Ninox strenua* (Powerful Owl) and *Tyto tenebricosa* (Sooty Owl). A Sooty Owl was recorded roosting along the creekline during surveys conducted for this assessment.

5.7. Presence of Threatened Species

5.7.1. Predicted Ecosystem Credit Species

The following ecosystem credit species outlined in Table 5-10 were recorded within the development site during the field surveys. The locations of ecosystem credit species recorded during the field surveys are shown in Figure 5-3.

Table 5-10 Ecosystem credit species recorded within the development site

Genus species	Common Name	TSC Act Status[1]	EPBC Act Status[2]
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-
Daphoenositta chrysoptera	Varied Sittella	V	-
Mormopterus norfolkensis	Eastern Freetail-bat	V	-
Petaurus australis	Yellow-bellied Glider	V	-
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-
Tyto novaehollandiae	Masked Owl	V	-
Tyto tenebricosa	Sooty Owl	V	-

One threatened species, *Miniopterus schrebersii oceanensis* (Eastern Bentwing-bat) listed as Vulnerable under the TSC Act, was recorded within the development site. This species was not included within the list of predicted ecosystem credit species generated by the BBCC.

5.7.2. Candidate Species Credit Species

No candidate species credit species were recorded within the development site in the current investigation.

[1] TSC Act Status: CE Critically Endangered (Schedule 1A); E1 – Endangered (Schedule 1); V – Vulnerable (Schedule 2).

[2] EPBC Act Status: CE – Critically Endangered; E – Endangered; V – Vulnerable.

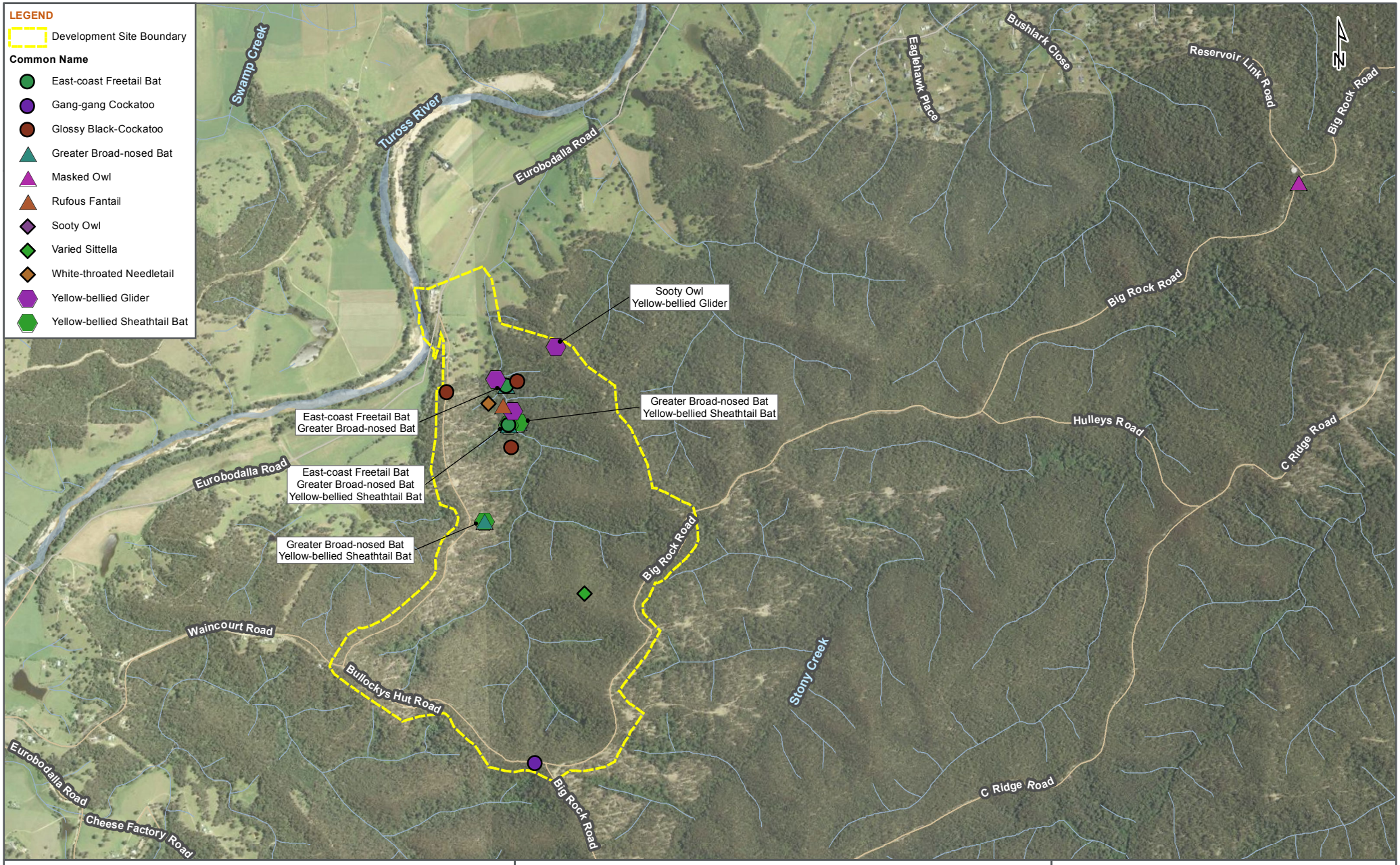

FIG NO. 5-3 **FIGURE TITLE** Threatened Species Records

DATE 16/08/2018

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PAGE SIZE A4

COORDINATE SYSTEM GDA 1994 MGA Zone 56

PROJECT NO. 30012127

PROJECT TITLE Eurobodalla Southern Storage Water Supply Project - BAR

CREATED BY FN12672

SOURCES Roadnet MDS 2017, public NSW
Imagery: © Department of Finance, Services & Innovation 2018

Location: \\AUMBFPV002\projects\Projects\30012127 - Eurobodalla Storage\09 GIS, Photos & Graphics\01 GIS\Maps\BAR\30012127_Fig_5_3_BAR_TSR.mxd

Last updated by: FN12672 on 16/08/2018 at 11:18

5.7.3. Biodiversity Requiring Further Consideration

The following biodiversity requiring further consideration as outlined within Appendix B of OEH's input into the SEARs were recorded within the development site during the field surveys.

Table 5-11 Biodiversity requiring further consideration recorded within the development site

Genus species	Common Name	Species/Population/EEC	TSC Act Status[3]	EPBC Act Status[4]
Callocephalon fimbriatum	Gang-gang Cockatoo	Species	V	-
Scoteanax rueppellii	Greater Broad-nosed Bat	Species	V	-
Tyto novaehollandiae	Masked Owl	Species	V	-
River Flat Eucalypt Forest on Coastal Floodplains	River Flat Eucalypt Forest on Coastal Floodplains	EEC	E	-

[3] TSC Act Status: CE Critically Endangered (Schedule 1A); E1 – Endangered (Schedule 1); V – Vulnerable (Schedule 2).

[4] EPBC Act Status: CE – Critically Endangered; E – Endangered; V – Vulnerable.

6. Avoid and Minimise Impacts

This chapter outlines the actions that have been undertaken to demonstrate that reasonable measures have been taken to avoid and minimise the potential direct and indirect impacts of a development proposal on biodiversity values.

6.1. Measures to Avoid

6.1.1. Avoidance of Direct Impacts

Under the FBA, a proponent must seek to avoid the direct impacts of the Major Project on all biodiversity values at the development site including impacts on:

- Endangered ecological communities (EECs) and critically endangered ecological communities (CEECs)
- PCTs that contain threatened species habitat
- Areas that contain habitat for vulnerable, endangered or critically endangered threatened species or populations
- An area of land that the Minister for Environment has declared as critical habitat in accordance with section 47 of the TSC Act
- The riparian areas of 4th order or higher streams and rivers, important wetlands and estuaries
- State significant biodiversity links.

Demonstration of these is summarised in Table 6-1.

Table 6-1 Avoidance of direct impacts on biodiversity values at the development site

Direct impact to be avoided	Avoidance mechanism proposed
Impacts to endangered ecological communities (EECs) and critically endangered ecological communities (CEECs)	The scale and nature of the development type means that options to avoid impacts to EECs within the development site are very limited; however, the proponent has designed the ESS so that 2.79 ha of EEC have been retained within the development site.
Impacts to PCTs that contain threatened species habitat	The scale and nature of the development type means that options to avoid impacts to PCTs containing threatened species habitat within the development site are limited; however, the proponent has designed the ESS so that 154.77 ha of native vegetation have been retained within the development site.
Impacts to areas that contain habitat for vulnerable, endangered or critically endangered threatened species or populations	The scale and nature of the development type means that options to avoid areas containing habitat for threatened species listed under the TSC Act within the development site are limited; however, the proponent has designed the ESS so that 157.44 ha of native vegetation that contains habitat for threatened species have been retained within the development site.

Direct impact to be avoided	Avoidance mechanism proposed
Impacts to an area of land that the Minister for Environment has declared as critical habitat in accordance with section 47 of the TSC Act	There are no areas of critical habitat within the development site.
Impacts to the riparian areas of 4th order or higher streams and rivers, important wetlands and estuaries	As water would be pumped from the Tuross River, impacts to the riparian buffers of a 4th order stream or higher cannot be avoided.
Impacts to state significant biodiversity links	There is no record available of any state significant biodiversity link within or adjacent to the development area. No information regarding such links has been provided in the SEARS. It should be noted that in accordance with Appendix 4 of the FBA, the connectivity value class 'State significant biodiversity link' includes impacts to riparian buffers of 6th order stream or higher. The project will impact upon the riparian buffer of the Tuross River, which is a 6th order stream at that point along its extent.

6.1.2. Site Selection

The selection of a suitable development site for this Project was informed though the consideration of various factors including social and environmental impacts, economic considerations, and the engineering feasibility and suitability of the site for a water storage facility. These factors have been considered through the preparation of numerous assessments of the development site, as well as alternative sites. A summary of considerations during site selection in accordance with Section 8.3.2.2 – 8.3.2.6 of the FBA is shown in Table 6-2.

Table 6-2 Consideration of the proposed development during site selection

FBA Section	FBA Criteria	Considerations of the FBA guidelines at Eurobodalla Storage Site
8.3.2.2	Selecting a suitable development site for a Major Project or a route for linear projects, should be informed by knowledge of biodiversity values. An initial desktop assessment of biodiversity values would assist in identifying areas of native vegetation cover, EECs or CEECs, and potential habitat for threatened species.	Biodiversity values within various potential storage sites have been considered within numerous reports including: • Eurobodalla Water Supply Augmentation Dam Site Feasibility Studies (DPWS, 2002) • Preliminary Flora and Fauna Overview – Eurobodalla Shire Water Supply Southern Storages Sites (NGH Environmental, 2005) • Draft Flora and Fauna Impact Assessment – Off-stream Storage, Stony Creek Site 2 (NGH Environmental, 2006) • Off-Stream Storage Stony Creek Site 2, Eurobodalla Shire Regional Water Supply Scheme: Flora and Fauna Impact Assessment (NGH Environmental, 2007a) • Off-Stream Storage Stony Creek Site 2, Eurobodalla Shire Regional Water Supply Scheme: Species Impact Statement (NGH Environmental, 2007b) • Eurobodalla Southern Storage Geotechnical Investigations – Biodiversity Technical Report (SMEC, 2017a). Impacts to biodiversity values have been considered alongside social impacts, economic considerations, and construction feasibility.
8.3.2.3	Stage 1 of the FBA will provide the preliminary information necessary to inform project planning. Early consideration of biodiversity values is recommended in site selection, or route selection for linear projects, and the planning phase.	Biodiversity values were given early consideration during the site selection plan, along with social impacts, economic considerations, and construction feasibility. Where feasible, storage ancillaries have been designed to minimise impacts on biodiversity.
8.3.2.4	The site/route selection process should include consideration and analysis of the biodiversity constraints of the proposed development site and consider the suitability of the Major Project based on the types of biodiversity values present on the development site.	Specific biodiversity constraints identified within the development site include: • The presence of River Flat Eucalypt Forest on Coastal Floodplains EEC

FBA Section	FBA Criteria	Considerations of the FBA guidelines at Eurobodalla Storage Site
		• The presence of nine threatened fauna species • The presence of suitable breeding, roosting, nesting, and foraging habitat for numerous threatened species.
8.3.2.5	When considering and analysing the biodiversity constraints for the purpose of selecting a development site, the following matters should be addressed: (a) whether there are alternative sites within the property on which the proposed development is located where siting the proposed Major Project would avoid and minimise impacts on biodiversity values (b) how the development site can be selected to avoid and minimise impacts on biodiversity values as far as practicable (c) whether an alternative development site to the proposed development site, which would avoid adversely impacting on biodiversity values, might be feasible.	Eurobodalla Shire Council (2005) provides an overview of the biodiversity values at four potential sites, including the current development site. Preliminary investigations had found a similar level of biodiversity value at all potential sites. As such, the impacts of a storage site at all potential sites were found to be equally significant. The scale and nature of the development type means that options to avoid and minimise impacts on biodiversity values are limited.
8.3.2.6	For linear projects, the route selection process must include consideration and an analysis of the biodiversity constraints of the various route options. In selecting a preferred option, loss of biodiversity values must be weighed up and justified against social and economic costs and benefits.	The proposed development is not a linear project.

6.1.3. Incorporation Principles of Avoidance and Minimising Impacts to Biodiversity During Planning Phase

Once a suitable development site was selected, further analysis of the biodiversity constraints of the proposed development site were used to inform concept planning, project siting and design. This includes the proposed location of temporary construction infrastructure such as roads, camps, stockpile sites. All temporary construction works will be located within the development site, so will not have any impacts above and beyond those assessed within this report.

A summary of considerations during site planning in accordance with Section 8.3.2.7 and 8.3.2.8 of the FBA is shown in Table 6-3.

Table 6-3 Consideration of the proposed development during site planning

FBA Section	FBA Criteria	Considerations of the FBA guidelines at Eurobodalla Southern Storage Site
8.3.2.8 (a)	The Major Project should be located in areas where the native vegetation or threatened species habitat is in the poorest condition, or which avoid an EEC or CEEC	All PCTs occurring within the development site have a similar site value score, indicating that all vegetation is of a comparable condition. Due to the scale and nature of the development, impacts to River Flat Eucalypt Forest on Coastal Floodplain EEC cannot be avoided.
8.3.2.8 (b)	The Major Project and associated construction infrastructure should be located in areas that do not have native vegetation, or in areas that require the least amount of vegetation to be cleared, and/or in areas where other impacts to biodiversity will be lowest.	As the development site is heavily vegetated, most of the impacts associated with the ESS cannot be avoided. The location of ancillaries and construction infrastructure have minimised vegetation removal where feasible. Due to the scale and nature of the development, impacts to cannot be contained to areas where biodiversity value is lowest. However, the proponent has designed the ESS so that 154.77 ha of intact native vegetation have been retained within the development site.
8.3.2.8 (c)	Major Projects can impact on the connectivity and movement of species through areas of adjacent habitat. Minimisation measures may include providing structures that allow movement of species across barriers or hostile gaps.	The proposed ESS will impact connectivity along the Tuross River. These impacts will be minimised through mitigation measures as outlined below.
8.3.2.8 (d)	Any other constraints that the assessor has considered in determining the siting and layout of the Major Project.	The siting and layout of the ESS was designed with geotechnical and ground stability considerations in mind. The 2006 concept design positioned the river intake pump station within a vegetated area adjacent to the Tuross River. During the 2016 concept design process the pump station was moved further away from the river bank into a previously cleared area. This was partially due to riverbank erosion concerns, and to minimise impacts on biodiversity.

6.2. Measures to Minimise Impacts

The proponent will implement reasonable measures to avoid and minimise any impacts that may occur during the construction and operational phases of the proposed development, that are additional to the impacts which occurred during the site selection and planning phases.

As part of the proposed development a Flora and Fauna Management Plan will be created as part of the Construction Environmental Management Plan (CEMP) to provide a framework for all biodiversity management and mitigation for the proposed development and will detail the management requirements for the following:

- Vegetation pre-clearance and clearance supervision
- Rehabilitation and habitat restoration
- Sediment and erosion control
- Weed and feral animal management
- Ecological Monitoring, if required.

6.2.1. Minimising Impacts During Construction Phase

Considerations have been given to minimising impacts during the construction phase. Considerations to minimise impacts to biodiversity at the development site during construction include:

- Method of clearing
- Clearing operations protocols
- Timing of construction
- Other measures that minimise inadvertent impacts of the proposed development on the biodiversity value's during the construction phase

Methods to minimise impacts during the construction phase are detailed below in Table 6-4.

Table 6-4 Considerations to minimise direct impacts of the proposed development during construction

FBA Section	FBA Criteria	Considerations of the FBA guidelines at Eurobodalla Southern Storage Site
8.3.2.10 (a)	Method of clearing – using a method of clearing during the construction phase that avoids damage to retained native vegetation and reduces soil disturbance. For example, removal of native vegetation by chain-saw, rather than heavy machinery, is preferable in situations where partial clearing is proposed	The majority of clearing will be completed by heavy machinery. Chainsaws will be used within 10 meters of clearing boundaries to ensure that damage to retained vegetation and soil disturbance is minimised. The method of clearing should be outlined within the Flora and Fauna Management Plan.
8.3.2.10 (b)	Clearing operations – minimising direct harm to native fauna during actual construction operations through onsite measures such as undertaking pre-clearing surveys, daily fauna surveys and the presence of a trained ecologist during clearing events	The clearing will take place in two stages. During the first stage, all habitat trees will be marked and left standing, while the vegetation surrounding them will be cleared. During stage 2, the habitat trees will be felled. A licensed wildlife carer and/or ecologist will capture and/or remove fauna that have the potential to be disturbed as a result of clearing activities. Disturbed fauna will be relocated into pre-determined habitat identified by relevant experts as suitable for fauna release. All fauna handling will be carried out by licensed wildlife carers and/or ecologists. The two-stage clearing process allows for minimised disturbance whilst clearing occurs around habitat trees, and allows fauna a chance to self-relocate upon nightfall, prior to the habitat tree being removed. The ecologist will be present during all clearing activities to rescue animals injured during the operation. Any unharmed fauna found will be captured and relocated to nearby remnant vegetation and released after nightfall to minimise the risk of predation by diurnal predators. Any animals that are inadvertently injured will be taken to the nearest prequalified veterinary clinic for treatment where, if assessed by a vet as unlikely to survive, it will be humanely euthanized. All persons working on the vegetation clearing will be briefed about the possible fauna present at the time of construction, and what procedures should be undertaken in the event of an animal being injured or disturbed. Results and outcomes of pre-clearing and clearing fauna surveys shall be documented by the ecologist and submitted to the proponent. The clearing protocol should be outlined in a Flora and Fauna Management Plan included within the CEMP.

FBA Section	FBA Criteria	Considerations of the FBA guidelines at Eurobodalla Southern Storage Site
8.3.2.10 (c)	Timing of construction – identifying reasonable measures that minimise the impacts on biodiversity. For example, timing construction activities for when migratory species are absent from the site, or when particular species known to or likely to use the habitat on the site are not breeding or nesting, can minimise the impacts of construction activities on biodiversity	Where feasible, clearing should be timed to minimise disturbance when fauna are at their most sensitive to disturbance (i.e. breeding). The breeding seasons of fauna species are outlined below: • *Callocephalon fimbriatum*: October to January • *Calyptorhynchus lathami*: March to August • *Daphoenositta chrysoptera*: June to April • *Mormopterus norfolkensis*: Winter breeding, young in a crèche until autumn • *Petaurus australis*: May to September • *Saccolaimus flaviventris*: Winter breeding, young at foot until autumn • *Scoteanax rueppellii*: Winter breeding, young at crèche until autumn • *Tyto novaehollandiae*: Any time of year but generally winter • *Tyto tenebricosa*: March to September Given that it is not feasible to avoid breeding seasons for all threatened species recorded within the development site, clearing should be undertaken in February and the first two weeks of March, to minimise impacts on the majority of threatened species. The timing of the vegetation clearing should be outlined within the Flora and Fauna Management Plan.
8.3.2.10 (d)	Other measures that minimise inadvertent impacts of the Major Project on the biodiversity values – measures such as installing temporary fencing to protect significant environmental features such as riparian zones, promoting the hygiene of construction vehicles to minimise spread of weeds or pathogens, appropriately training and inducting project staff and contractors so that they can implement all measures that minimise inadvertent adverse impacts of the Major Project on biodiversity values.	Temporary fencing should be installed prior to clearing works to delineate impact from protected areas. All mobile plant should be brought to site in clean condition to prevent the spread of weeds or pathogens into areas outside the development site. Stormwater run-off will be managed during the construction phase of the project by the construction contractor. The location of temporary fencing should be outlined within the Flora and Fauna Management Plan.

In addition to measures proposed above to minimise direct impacts to biodiversity, the following measures are proposed to minimise indirect impacts during the construction phase as shown in Table 6-5.

Table 6-5 Considerations to minimise indirect impacts of the proposed development during construction

Indirect Impact	Proposed measure to minimise impact
Sedimentation and run-off	Sediment barriers, sedimentation ponds, and detention basins have been incorporated into the project design to protect adjacent waterways from sediment and run-off. This measure will protect surrounding vegetation and Tuross River.
Noise, dust or light spill	Construction should be limited to daylight hours to mitigate for noise and light spill impacts to fauna in adjacent vegetation. Construction should be limited to daylight hours to mitigate for noise and light spill impacts to fauna in adjacent vegetation.
Inadvertent impacts on adjacent habitat or vegetation	Fencing should be erected to delineate the extent of the development site and protect adjacent vegetation from impacts such as vehicular traffic All set down areas and lay down areas should be located outside of areas of native vegetation, within the development site.
Feral pest, weed and/or pathogen encroachment into vegetation on land adjoining the development site	Light vehicles and mobile plant should all be clean when entering the site to prevent the introduction of pathogens that may impact vegetation outside the development site.

6.2.2. Minimising Impacts During Operational Phase

The following matters should be considered to avoid and minimise direct impacts on biodiversity values at the operational phase as described in Table 6-6.

Table 6-6 Considerations to minimise direct impacts of the proposed development during operation

FBA Section	FBA Criteria	Considerations of the FBA guidelines at Eurobodalla Southern Storage Site
8.3.2.12a	Seasonal impacts – whether there are likely to be any impacts that occur during specific seasons. Minimisation measures may include amending operational times to minimise impacts on biodiversity during periods when seasonal events such as breeding or species migration occur	There are no seasonal impacts expected from the proposed ESS during operation.
8.3.2.12b	Artificial habitats – using 'artificial habitats' for fauna where they may be effective in minimising impacts on such fauna. These include nest boxes, glider-crossings or habitat bridges.	Nest boxes are useful in reducing the impact to fauna habitat within the development site. Equivalent nest boxes should be erected for each natural hollow that is removed during the construction phase. Replacement nestboxes should be suitable for the all the threatened and non-threatened fauna inhabiting the development site. Nest boxes are to be erected before removal of hollow bearing trees. Prior to vegetation clearing, a Nest box Plan should be prepared. The Nest box Plan should sit as a subplan within the Flora and Fauna Management Plan. The Nest box plan should provide the following details: • Number and size of the hollow bearing trees to be removed as part of the clearing works • The number and types (target species) of boxes required to compensate for the loss of both threatened and protected fauna habitat • Specifications of nest box size and material • Details for nest box monitoring, maintenance, and replacement.
8.4.2.4f	Impacts during the operational phase – measures to avoid or minimise the indirect impacts on threatened species and threatened species habitat on land adjoining the development site, migratory species	There are no threatened flora species known within the development site. The proposed development will also have suitable security measures in place to prevent illegal dumping.

FBA Section	FBA Criteria	Considerations of the FBA guidelines at Eurobodalla Southern Storage Site
	or flight pathways as a result of the operation of the development. Such measures may include those adopted to avoid and minimise: (i) trampling of threatened flora species (ii) rubbish dumping (iii) noise (iv) light spill (v) weed encroachment (vi) nutrient run-off (vii) increased risk of fire, and (viii) Pest animals.	Noise from the water intake will be contained within the project boundary. Noise will be managed onsite to relevant standards. No light spill is anticipated to result from this project. There will not be an increased risk of fire as a result of the development. The occurrence of feral cats and foxes might increase as a result of the proposed development. A feral animal management plan will be incorporated into the Flora and Fauna Management Plan for the development site which may include fencing, baiting or trapping options for control of feral animals.

6.3. Summary of Measures

Although the proposed ESS has sought to avoid and minimise impacts, not all biodiversity impacts can be avoided for many aspects of the development as detailed above. The measure described in Table 6-7 should be implemented to mitigate impacts during construction and operation.

Table 6-7 Summary of measures to minimise direct impacts of the proposed development during all phases

Impact	Mitigation measure	Outcome	Timing	Responsibility
General flora and fauna impacts	A Flora and Fauna Management Plan would be prepared as part of the CEMP. Native vegetation clearing would not occur until the Flora and Fauna Management Plan is approved.	Flora and fauna would be managed in accordance with the requirements of the Flora and Fauna Management Plan.	Pre-construction and construction	Proponent and Construction Contractor
	The Flora and Fauna Management Plan would be prepared to manage the vegetation retained within the development site and catchment. The plan would include details on weed and pest management,	The vegetation within the development site surrounding the storage area would be managed in accordance with the Flora and Fauna Management Plan.	Construction and Operational Phase	Proponent and Construction Contractor

Impact	Mitigation measure	Outcome	Timing	Responsibility
	nest box and fauna habitat maintenance, and monitoring procedures.			
Degradation of freshwater wetland habitats	Install appropriate drainage infrastructure (e.g. sediment basins, diversion drains), sediment and erosion controls prior to the commencement of construction.	Prevention of sedimentation and erosion leading to a reduction in water quality and degradation of aquatic habitats.	Pre-construction/Construction	Construction Contractor
	Clearing of vegetation would be timed to avoid periods when rain is forecast	Prevention of sedimentation and erosion leading to a reduction in water quality and degradation of aquatic habitats.	Construction	Construction Contractor
	Locate soil or mulch stockpiles away from watercourses and key stormwater flow paths to limit potential transport of these substances into the watercourses via runoff.	Prevents soil and mulch reaching wetland habitats	Construction	Construction Contractor
	Dust suppression activities to be undertaken where appropriate.	Prevents sedimentation and erosion leading to a reduction in water quality and degradation of aquatic habitats.	Construction	Construction Contractor
	Stabilisation of disturbed areas, including revegetation in accordance with the Flora and Fauna Management Plan, is to be undertaken as soon as practicable after disturbance.	Prevents sedimentation and erosion leading to a reduction in water quality and degradation of aquatic habitats.	Construction	Construction Contractor

Impact	Mitigation measure	Outcome	Timing	Responsibility
	Emergency response protocols and procedures for implementation in the event of a contaminant spill or leak to be clearly articulated in the Construction and Operational Environmental Management Plans.	Prevents pollution of waterways.	Proponent and Construction Contractor	Pre-construction and construction
	Spill kits to be located to allow for timely response to uncontained spills. Site inductions are to include a briefing on the use of spill kits.	Prevents pollution of waterways.	Pre-construction and construction	Contractor
Vegetation removal or disturbance	Clearly identifying sensitive areas ('no-go areas') which cannot be impacted by construction and managing clearing such that clearing activities are constrained to these approved areas only.	Prevention of over clearing of vegetation.	Pre-construction and construction	Construction Contractor
	Site inductions are to include a briefing regarding the local threatened of the site and protocols to be undertaken if they are encountered.	Prevention of impacts to threatened species.	Construction and operation	Proponent and Construction Contractor
Weed invasion and spread	Management of weeds in and adjacent to cleared areas will occur in accordance with the Flora and Fauna Management Plan CEMP and OEMP. This plan would include details relating to the monitoring, management and	Prevention of weed establishment and invasion.	Pre-construction, construction and operation	Proponent and Construction Contractor

Impact	Mitigation measure	Outcome	Timing	Responsibility
	where necessary eradication of weeds, disposal of green waste, and vehicle/plant weed wash down protocols, if required.			
	Management of noxious weeds is to be undertaken in accordance with the Biosecurity Act 2017.	Prevention of weed establishment and invasion.	Pre-construction and construction	Proponent and Construction Contractor
	Equipment used for treating weed infestation will be cleaned prior to moving to a new area within the development site to minimise the likelihood of transferring any plant material and soil.	Prevention of weed spread.	Pre-construction and construction	Proponent and Construction Contractor
	Soil stripped and stockpiled from areas containing known weed infestations are to be stored on cleared land at least 40 m from native vegetation.	Prevention of weed establishment and invasion.	Construction	Construction Contractor
Impacts to fauna and fauna habitat	Fauna microhabitat such as hollow logs and dead trees should be removed from areas to be cleared and relocated to adjacent woodland habitat.	Retaining fauna habitat resources.	Pre-construction and construction	Construction Contractor
	A nest box and connectivity management strategy would be prepared prior to clearing of hollow	Replaces lost hollow resources in the landscape.	Pre-construction, construction and operation	Construction Contractor

Impact	Mitigation measure	Outcome	Timing	Responsibility
	bearing trees and connecting links. The strategy would inform the installation of nest boxes and fauna crossings in and between retained native vegetation adjacent to the site, and the on-going monitoring and maintenance of nest boxes and crossings through the construction and operational phases.			
	High visibility plastic fencing is to be installed to clearly define the limits of the works area.	Prevents disturbance or over clearing of fauna habitat and native vegetation outside the construction area.	Construction	Construction Contractor
	Undertake a pre-start-up check for sheltering native fauna of all infrastructure, plant and equipment and/or during relocation of stored construction materials.	Prevents fauna injury/mortality.	Construction	Construction Contractor
	Undertake a two-stage approach to clearing: • Remove non-hollow bearing trees at least 48 hours before habitat trees are removed. • Hollow bearing trees are to be knocked with an excavator bucket or other machinery to encourage	Prevents fauna injury/mortality.	Construction	Construction Contractor and appointed ecologist

Impact	Mitigation measure	Outcome	Timing	Responsibility
	fauna to evacuate the tree immediately prior to felling. • Felled trees must be left for a short period of time on the ground to give any fauna trapped in the trees an opportunity to escape before further processing of the trees. • Felled hollow bearing trees must be inspected by an ecologist as soon as possible (not longer than 2 hours after felling).			
	Site inductions are to include a briefing regarding the local fauna of the site and protocols to be undertaken if fauna are encountered.	Prevents fauna injury/mortality.	Construction	Construction Contractor
	If any animal is injured, contact the relevant local wildlife rescue agency (e.g. WIRES) and/or prequalified veterinary surgery as soon as practical. Until the animal can be cared for by a suitably qualified animal handler, if possible minimise stress to the animal and reduce the risk of further injury by:	Prevents fauna injury/mortality.	Pre-construction, construction and operation	Proponent and Construction Contractor

Impact	Mitigation measure	Outcome	Timing	Responsibility
	• Handling fauna with care and as little as possible. • Covering larger animals with a towel or blanket and placing in a large cardboard box. • Placing small animals in a cotton bag, tied at the top. • Keeping the animal in a quiet, warm, ventilated and dark location.			
	If any pits/trenches are to remain open overnight, they are to be securely covered, where reasonable and feasible. Alternatively, fauna ramps (logs or wooden planks) are to be installed to provide an escape for trapped fauna.	Prevents fauna injury/mortality.	Construction	Construction Contractor
	The extent of vegetation clearing is to be clearly identified on construction plans.	Prevents impacts to fauna habitat and native vegetation outside the development footprint.	Pre-construction	Proponent and Construction Contractor
	In circumstances where native vegetation or mature tree clearing is required outside of the biodiversity development site, an ecologist will inspect the proposed area and provide advice on the impact to flora	Prevents impacts to fauna habitat and native vegetation outside the development footprint.	Construction	Proponent, Construction Contractor and appointed ecologist

Impact	Mitigation measure	Outcome	Timing	Responsibility
	and fauna and appropriate management.			
	Directional lighting will be used where lighting is required in construction areas.	Minimises disruption to fauna foraging, nesting or roosting behaviours.	Construction	Construction Contractor
	Frequent maintenance of construction machinery and plant will be undertaken to minimise unnecessary noise.	Prevents fauna injury/ mortality.	Construction	Construction Contractor
	Speed limits will be developed so as to minimise the potential for fauna to be struck by a vehicle within the construction areas. All vehicles and plant in operation during construction are to adhere to site rules relating to speed limits.	Prevents fauna injury/ mortality.	Construction	Construction Contractor
Bushfire risk connectivity	Bushfire awareness included in staff induction and in toolbox talks pre-commencement.	Reduces risk of possible bushfire events impacting on biodiversity values.	Pre-construction and construction	Construction Contractor

6.4. Assessment of Impacts

6.4.1. Direct Impacts

Direct impacts relating to the development site include:

- Vegetation clearance
- Habitat removal.

The direct impacts associated the proposed ESS are discussed further within Chapter 7.

6.4.2. Indirect Impacts

Indirect impacts of the Project during construction and operation phase includes the following impacts described as described in Table 6-8.

Table 6-8 Assessment of indirect impacts

Indirect Impact	Assessment of Impact
Sedimentation and run-off	Potential impacts to water quality could occur from erosion and sedimentation, accidental spillage of chemicals, fuels, lubricating and hydraulic oils from mobile construction equipment, and runoff from equipment and vehicle wash-down. Introduction of pollutants into surrounding waterways may cause: ▪ Changes to pH, electrical conductivity, dissolved oxygen and temperature ▪ Reduction of light penetration due to increased sediments ▪ Increased sediment load, organic matter and turbidity ▪ Introduction of toxic pollutants such as construction fuels, oil, grease and chemicals.
Noise, dust or light spill	The proposed ESS will increase the level of noise and vibration within the development site during the timeframe within which construction is completed. Some of the threatened species recorded within the development site are sensitive to noise and vibrational disturbance, and may temporarily evacuate from sheltering or nesting habitat when disturbed. Given, that the development site occurs well away from large urban areas, it is likely that the fauna species inhabiting the development site will not be acclimatised to noise related disturbance. Large Forest Owls are particularly sensitive to disturbance during their breeding season, and will readily abandon nests if disturbed. Breeding within both Sooty and Masked Owls species can potentially occur in all months of the year, but most typically peaks during autumn – early spring. As construction will be taking place all year, including during the most likely breeding season, it has the potential to impact upon the breeding success of Sooty Owls and Masked Owls utilising the site. As construction will take place during standard working hours, no lighting will be required thus the proposal will not increase light pollution within the development site.
Inadvertent impacts on adjacent habitat or vegetation	The proposed ESS will increase the risk that the surrounding vegetation and fauna habitat will inadvertently impacted by continual foot traffic, or movement of light vehicles or heavy machinery outside of the designated clearing boundary. Impacts include loss of structural and floristic complexity, weed invasion, and loss of fauna microhabitats.
Feral pest, weed and/or pathogen encroachment into vegetation on land adjoining the development site	Vegetation in the development site does not appear to be affected by dieback and hence may be potentially be contaminated with *Phytophthora cinnamomi*. Infection of native plants by *P. cinnamomi* is listed as a key threatening process both in NSW and nationally. Evidence of *P. cinnamomi* induced die-back has been identified in several vegetation classes including coastal heaths and woodlands (DECC 2008). Ongoing loss of understory species infested with Phytophthora can indirectly affect threatened fauna

Indirect Impact	Assessment of Impact
	species through the loss of cover, food resources and nesting habitat (DECC 2008). Activities associated with this proposal (ground disturbance) have the potential risk of introducing or spreading *P. cinnamomi* to the development site so a precautionary approach to managing this disease should be taken. The vegetation within the development site did not appear to be affected by Myrtle rust. Myrtle rusts are serious pathogens which affect plants belonging to the family Myrtaceae including Australian natives like bottle brush (*Callistemon* spp.), tea tree (*Melaleuca* spp.) and eucalypts (*Eucalyptus* spp.). These occur throughout the development site. Infection of native plants by Myrtle rust can indirectly affect threatened fauna species through the loss of cover, food resources and nesting habitat. Appropriate mitigation measures should be taken to minimise the risk of Myrtle Rust being spread into the development site. Four introduced species were observed during field investigations: *Vulpes vulpes* (European Fox), *Felis catus* (Cat), *Canis lupus familiaris* (Dog) and *Rattus rattus* (Black Rat). The development site may also to provide habitat for other introduced fauna. While the proposal is unlikely to increase the presence of introduced fauna in the development site, it will reduce available habitat for species within the critical weight range of 450 g to 5000 g which are particularly susceptible to predation by foxes and cats. Two frog species were recorded within the development site, while several frog species, including the Green and Golden Bell Frog, have been recorded within the locality. Amphibians are susceptible to the amphibian chytrid fungus. Activities associated with this proposal have the potential risk of introducing or spreading chytrid to the study site so a precautionary approach to managing this disease should be taken. Earthworks, vehicle movements and increased human activity during the proposed works have the potential to facilitate the spread of weeds. The overall risk of such spread is considered to be medium due to the disturbance of topsoil during the course of works.

6.5. Identification of Final Project Footprint

The layout for the Project has been refined through the consideration of a number of alternatives which have reduced the potential for adverse impacts to the environment, including specific impacts on threatened ecological communities. The final footprint is referred to as the development site and is shown in Figure 1-4.

7. Impact Summary

7.1. Introduction

The Project will involve direct impacts on native vegetation and fauna habitat, primarily within the construction phase. As the operation of the development will be relatively contained within the storage facility, impacts of the operation phase will be minimal and confined to indirect impacts. The direct impacts of the construction phase are summarised below.

7.2. Summary of Impacts

A summary of the impacts of the proposed ESS is shown in Table 7-1.

Table 7-1 Summary of Impacts

Likely Impact	Details	Extent/Scale
Loss and fragmentation of native vegetation	Wet sclerophyll forest, forested wetlands, and dry rainforest vegetation communities.	65.57 hectares of native vegetation will be cleared.
Loss of threatened ecological communities	River Flat Eucalypt Forest on Coastal Floodplains.	8.54 hectares of EEC will be cleared.
Loss of threatened fauna species and fragmentation of habitat	No threatened flora species present.	None.
Loss of fauna habitat	Remnant vegetation with an abundance of hollow bearing trees provides habitat for 10 threatened species occurring within the development site.	65.57 hectares of fauna habitat will be cleared.
Fauna fragmentation	Removal of commuting habitat of fauna species.	May reduce the capacity of some less mobile fauna to move within and between patches of remaining habitat adjacent to the development site.
Fauna mortality	May result from clearance works, earthworks or collisions with vehicles or machinery.	Most likely during clearance activities.
Degradation of aquatic habitats	Caused by changes in run-off, infiltration, pollution and erosion. May influence downstream habitats.	Impacts to aquatic habitat are described in detail in the Aquatic Ecological Assessment (ecologique, 2017) for the ESS.

Likely Impact	Details	Extent/Scale
Impacts on fish passage	No important fish passage habitat is present within the development site.	None.
Edge effects and weed invasion	Vehicles and plant may transport weed propagules into the development site. New edges will be created as a result of the development creating the potential for edge effects.	Most likely during clearance activities.
Pests and pathogens	Vehicles and plant may transport pathogens into the development site. Clearing of native vegetation and increased human activity increase the risk of pest animal species increasing.	May occur during construction and operational phases.
Alteration to air quality and noise environments	May impact upon the roosting, breeding and foraging activities of locally occurring fauna.	Temporary and localised scale of impacts during construction.

7.2.1. Direct Loss of Native Vegetation

The proposed ESS will remove 65.57 hectares of native vegetation. Native vegetation to be removed includes five vegetation communities, one of which is listed under the TSC Act as TECs. A summary of the areas directly impacted and areas to be retained within the development site is shown in Table 7-2.

Table 7-2 Summary of areas directly impacted by the Project

Vegetation	TSC Act Status	EPBC Act Status	Area to be Removed (Ha)	Area to be Retained (Ha)
SR643: Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion	-	-	46.58	142.03
SR551: Grey Myrtle - Lilly Pilly dry rainforest in dry gullies of the Sydney Basin Bioregion and South East Corner Bioregion	-	-	9.97	9.4
SR609: River Peppermint - Rough-barked Apple moist open forest on sheltered sites, southern South East Corner Bioregion	EEC	-	8.18	2.31
SR608: River Peppermint - Rough-barked Apple - River Oak herb/grass forest of coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion	EEC	-	0.36	0.48

Vegetation	TSC Act Status	EPBC Act Status	Area to be Removed (Ha)	Area to be Retained (Ha)
SR533: Coast Grey Box - Mountain Grey Gum - stringybark moist shrubby open forest in coastal gullies, southern South East Corner	-	-	0.48	0.55

7.2.2. Direct Loss of Fauna Habitat

The development site supports a variety of habitat resources that may be utilised by common protected or threatened fauna occurring in the development site. Important fauna habitat features that will most likely be removed by the Project include:

- Understory vegetation – loss of shelter and foraging habitat for amphibians, reptiles, small birds and terrestrial mammals.
- Fallen logs, woody debris and leaf litter – although limited within the development site, loss of shelter habitat for amphibians, reptiles and terrestrial mammals, and forage habitat for woodland bird species.
- Hollow-bearing living trees and stags – loss of habitat for a range of fauna species which may rely on them for shelter, breeding or roosting. Loss of mature hollow-bearing trees will have important implications for threatened species such as birds, arboreal mammals and microbats.
- Nectar-producing trees and shrubs – loss of food resources for blossom-dependant birds, arboreal mammals and mega chiropteran bats (flying-foxes).
- Shrubs and grasses – loss of food for a range of passerine birds and herbivorous mammals.
- Ephemeral drainage lines – loss of foraging, shelter and breeding habitat for amphibians, and some reptiles.

All of the proposed ESS impacts (65.57 hectares) occur within woody native vegetation communities which is likely to provide useable habitat to a large variety of native fauna.

7.3. Thresholds for Assessing Unavoidable Impacts

Unavoidable impacts of the Project have been considered and a determination made of the assessment and offsetting requirements of such impacts. Table 7-3 summarises these requirements which include:

- Impacts that require further consideration by consent authority
- Impacts for which the assessor is required to determine an offset
- Impacts for which the assessor is not required to determine an offset
- Impacts that do not require further assessment by the assessor.

Table 7-1 shows the location of these areas within the development site. A discussion of each of these components is provided below. The Biodiversity Credit Report generated by the Project is provided in Appendix D.

Table 7-3 Thresholds for the assessment and offsetting of unavoidable impacts of the Project

Threshold	Biodiversity Value	Criteria	Applicable to the Project?
I. Impacts that require further consideration by consent authority	Landscape Features	Impacts that will substantially reduce the width of vegetation in the riparian buffer zone bordering rivers and streams 4th order or greater	**Yes** – the proposed ESS will impact and remove vegetation within the riparian buffer zone of a 6th order stream.
		Impacts in state biodiversity links	No
		Impacts on important wetlands and their buffers	No
		Impacts in the buffer zone along estuaries	No
	Native Vegetation	Any impact on a CEEC (unless specifically excluded in the SEARs) because it is likely to: • cause the extinction of the CEEC from the IBRA subregion, or • significantly reduce the viability of the CEEC	No
		Any impact on an EEC nominated in the SEARs because it is likely to: • cause the extinction of the EEC from the IBRA subregion, or • significantly reduce the viability of the EEC	**Yes** – the proposed ESS will impact upon SR608 and SR609 which component PCTs of River Flat Eucalypt Forest nominated within the SEARs.
	Species and Populations	Impacts on areas of land that the Minister for Environment has declared as critical habitat in accordance with section 46 of the TSC Act and which is listed on the Register of Critical Habitat in NSW	No
		Any impact on a critically endangered species (unless specifically excluded in the SEARs)	No
		Any impact on a threatened species or population nominated in the SEARs because it is likely to: • cause the extinction of a species or population from an IBRA subregion, or • significantly reduce the viability of a species or population	**Yes** – the proposed ESS will impact upon nine threatened fauna species nominated within the SEARs

Threshold	Biodiversity Value	Criteria	Applicable to the Project?
		Any impact on a threatened species or population that has not previously been recorded in the IBRA subregion according to records in the NSW Wildlife Atlas	No
II. Impacts for which the assessor is required to determine an offset	Landscape Features	Not applicable to the FBA	N/A
	Native Vegetation	Impacts on CEECs that are specifically excluded from requiring further consideration in the SEARS	No
		Impacts on PCTs that are EECs not specifically nominated as requiring further consideration in the SEARs	No
		Impacts on PCTs associated with threatened species habitat and which have a site value score ≥17	No
	Species and populations	Impacts on a critically endangered species that is specifically excluded from requiring further consideration in the SEARS	No
		Impacts on threatened species, populations and threatened species habitat not specifically nominated as requiring further consideration in the SEARs	No
		Impacts on threatened species habitat associated with a PCT and which has a site value score of ≥17	No
III. Impacts for which the assessor is not required to determine an offset	Landscape Features	Not applicable to the FBA	N/A
	Native Vegetation	Impacts on PCTs that: • have a site value score <17, or • are not identified as CEECs / EECs	No
		Impacts on PCTs that are not associated with threatened species habitat and are not identified as CEECs / EECs	No

Threshold	Biodiversity Value	Criteria	Applicable to the Project?
	Species and Populations	Impacts on non-threatened species and populations that do not form part of a CEEC or EEC	No
		Impacts on threatened species habitat associated with a PCT within a vegetation zone with a site value score of <17	No
V. Impacts that do not require further assessment by the assessor	Landscape Features	Areas of land without native vegetation, unless the area of land requires assessment under the SEARs issued for the Major Project	No
	Native Vegetation	Areas of land without native vegetation, unless the area of land requires assessment under the SEARs issued for the Major Project	No
	Species and populations	Not applicable since all areas of land must be assessed for threatened species, even if they do not contain native vegetation	N/A

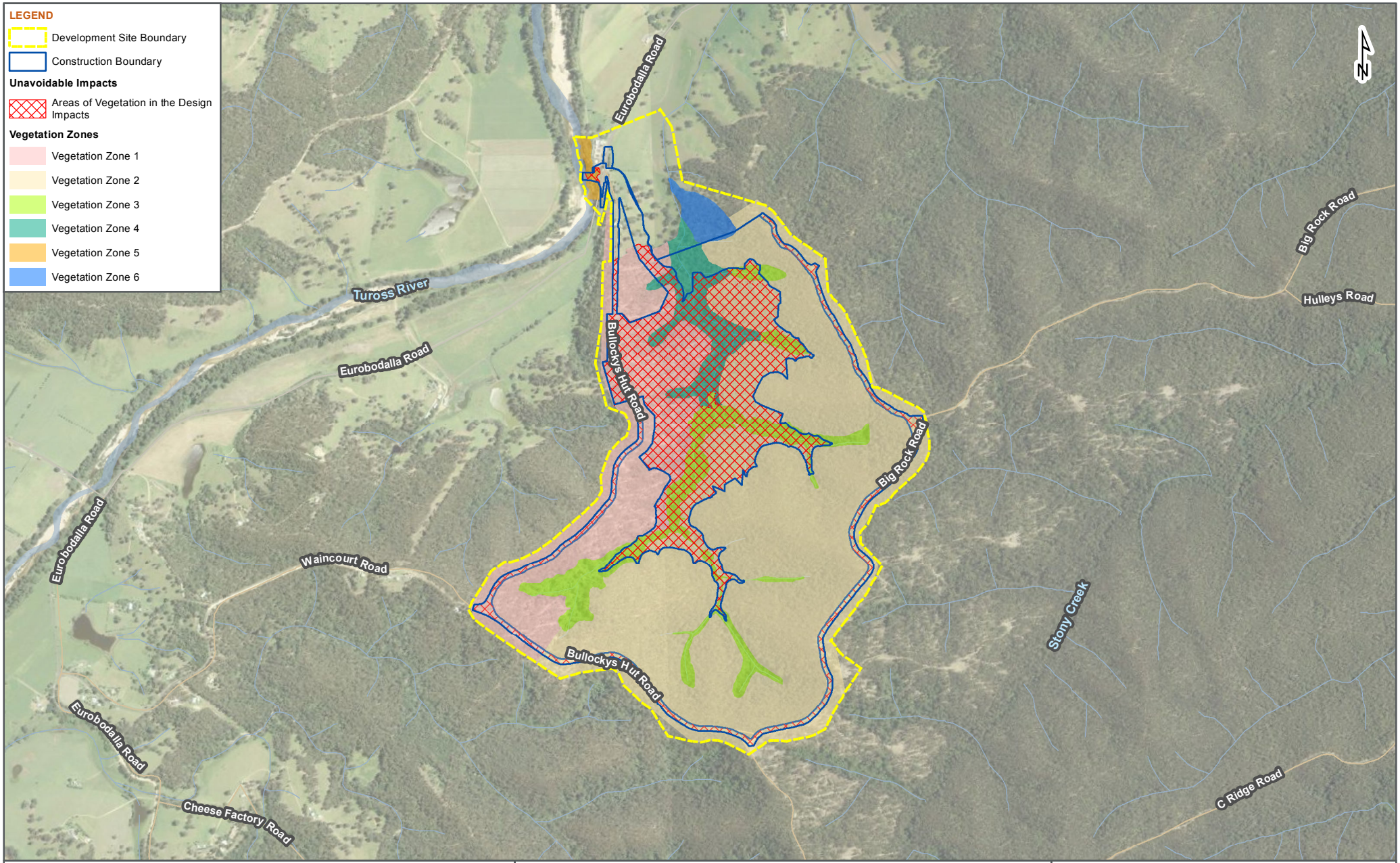

FIG NO. 7-1 **FIGURE TITLE** Unavoidable Impacts

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COORDINATE SYSTEM GDA 1994 MGA Zone 56

PROJECT NO. 30012127 **PROJECT TITLE** Eurobodalla Southern Storage Water Supply Project - BAR

CREATED BY FN12672

SOURCES Roadnet MDS 2017, public NSW
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Last updated by: FN12672 on 16/08/2018 at 11:20

7.4. Impacts that Require Further Consideration

7.4.1. Landscape Features

Impacts reducing the width of riparian buffer of important rivers, streams, and estuaries

This consideration applies to impacts of development on areas within native vegetation within

a) 20 metres either side of 4th or 5th order stream

b) 50 metres either side of a 6th order stream or higher

c) 50 metres around an estuarine area

As the proposed ESS will impact upon native vegetation within the 50 metre riparian buffer of a 6th order stream or higher, the following matters outlined within Table 7-4 are to be considered.

Table 7-4 Further consideration of impacts to riparian buffers

FBA Section	Criteria	Consideration
9.2.3.3	(a) the name and stream order of the riparian buffer being impacted.	The Tuross River is an 6th order stream at the point of its extent at which the impact will occur.
	(b) the total area of the riparian buffer that is impacted by the Major Project, the extent to which the width of the link will be reduced and over what length, and the size of the gaps being created or expanded.	The proposed ESS will remove 0.36 ha of the riparian buffer creating a 30 metre gap in the riparian buffer with a width of 0 metres in that area.
	(c) the PCT and condition of the vegetation in the riparian buffer being impacted.	The proposed ESS will remove 0.36 ha of SR608 which is in moderate to good condition.
	(d) any direct impacts on wetlands or watercourses downstream of the development site.	It is unlikely that any wetlands or watercourses downstream of the development site will be impacted by the removal of the riparian vegetation
	(e) mitigation measures proposed to minimise the impact on the biodiversity values of the riparian or downstream area.	The following mitigation measures to reduce impacts are proposed: • Erosion and sediment control during construction phase. • Bank stabilisation measures during operation phase.

7.4.2. Native Vegetation

Impacts on native vegetation that require further consideration include impacts on:

a) any CEEC, unless the CEEC is specifically excluded by the SEARs

b) an EEC specifically nominated in the SEARs as an EEC that is likely to become extinct or have its viability significantly reduced in the IBRA subregion if it is impacted on by the development.

The proposed ESS will impact upon two PCTs, SR608 and SR609, considered components of River Flat Eucalypt Forest on Coastal Floodplains EEC. This EEC was listed in the SEARs as matter for further consideration, as such the following matters outlined in **Error! Reference source not found.** are to be considered.

Table 7-5 Further consideration of impacts to River Flat Eucalypt Forest on Coastal Floodplains

FBA Section	Criteria	Consideration
9.2.4.2	(a) the area and condition of the River Flat Eucalypt Forest on Coastal Floodplains to be impacted directly and indirectly by the proposed development	River Flat Eucalypt Floodplains is present within the development area as two PCTs of moderate to good condition: • SR609: River Peppermint - Rough-barked Apple moist open forest on sheltered sites, southern South East Corner Bioregion • SR608: River Peppermint - Rough-barked Apple - River Oak herb/grass forest of coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion. The proposal will remove: • 8.18 hectares of SR609 • 0.36 hectares of SR608
	(b) the extent and overall condition of the River Flat Eucalypt Forest within an area of 1000 hectares and 10,000 hectares surrounding the proposed development site.	The Shoalhaven_Biometric_v2_E_3900 vegetation mapping was used to calculate the area of River Flat Eucalypt Forest within 1000 ha and 10,000 ha of the development site. This mapping methodology as mapped: • 4.85 ha of the EEC within 1000 ha of the development site • 86.19 ha of the EEC within 10,000 ha of the development site. It should be noted that the River Flat Eucalypt Forest occurring within the development site was not mapped within Shoalhaven_Biometric_v2_E_3900. As such, it is possible that additional extents of the EEC occur within these buffer areas. The condition of the EEC within the buffer areas is likely to be variable and be dependent upon the level of disturbance within and surrounding the EEC. For example, vegetation along the Tuross River adjacent to agricultural land is likely to be more disturbed than

FBA Section	Criteria	Consideration
		extents of the EEC occurring in gullies similar to the gully in the development site.
	(c) an estimate of the extant area and overall condition of River Flat Eucalypt Forest remaining in the IBRA subregion after the impact of the proposed development has been taken into consideration.	It is estimated that 1,367 hectares of River Flat Eucalypt Forest occur within the Bega Coastal Foothills IBRA subregion. The condition of the EEC within the IBRA subregion is likely to be variable and be dependent upon the level of disturbance within and surrounding the EEC. For example, vegetation along the Tuross River adjacent to agricultural land is likely to be more disturbed than extents of the EEC occurring in gullies similar to the gully in the development site.
	(d) the development proposal impact on: • abiotic factors critical to the long-term survival of River Flat Eucalypt Forest • characteristic and functionally important species through impacts such as, but not limited to, inappropriate fire regimes, removal of understory species, or harvesting of plants • the quality and integrity of River Flat Eucalypt Forest through threats and indirect impacts	Approximately 11.33 hectares of River Flat Eucalypt Forest, consisting of two PCTs, has been mapped within the development site. Of this, approximately 8.89 hectares of the EEC occurs within the development site, and will be impacted as a result of proposed ESS. As a result of the proposal, all characteristic and functionally important species to the EEC will be removed from within the development site. In addition to vegetation removal, the proposed ESS will remove the abiotic factors critical for the long-term survival of the EEC. 2.79 hectares of River Flat Eucalypt Forest within the development site will be retained. These areas of EEC have the potential to suffer indirect impacts including but not limited to, edge effects, weed invasion, and loss of structural and floristic complexity though inappropriate fire regimes over the long term. This may further reduce the extent of the EEC within the development site and across the IBRA subregion.
	(e) direct or indirect fragmentation and isolation of an important area of the EEC.	The proposed ESS will result in increased fragmentation of River Flat Eucalypt Forest across its extent in the IBRA subregion. It is not expected that that proposal will isolate any important areas of the EEC.
	(f) the measures proposed to contribute to the recovery of the ECC in the IBRA subregion	The proponent of the Project proposes to acquire offsets in the form of BioBanking Credits commensurate to the exact credit requirement prescribed by the BBCC. A summary of the credit requirements for this EEC are outlined in Table 7-9

7.4.3. Species and Populations

Impacts on threatened species that require further consideration include impacts on:

a) on any critically endangered species, unless the critically endangered species is specifically excluded in the SEARs

b) on a threatened species or population that is specifically nominated in the SEARs as a species or population that is likely to become extinct or have its viability significantly reduced in the IBRA subregion if it is impacted on by the development, or

c) where the survey or expert report undertaken in Section 6.6 confirms that a threatened species is present on the proposed development site, and the threatened species has not previously been recorded in the IBRA subregion according to records in the NSW Wildlife Atlas.

The proposed ESS will impact upon three threatened species listed within Attachment B on OEH's input into the SEARs; the Sooty Owl, Gang-gang Cockatoo and Greater Broad-nosed Bat. The Sooty Owl was recorded in the development site on two occasions; roosting in the gully and responding to call playback in the north-west of the development site. The Gang-gang Cockatoo was observed in the development site.

The proposed ESS will impact upon suitable breeding, roosting, and foraging habitat for Sooty Owls. This species was listed in the SEARs as matter for further consideration, as such the following matters outlined in Table 7-6 are to be considered.

Table 7-6 Further consideration of impacts on the Sooty Owl

FBA Section	Criteria	Consideration
9.2.5.2	(a) the size of the local population directly and indirectly impacted by the development	Sooty Owls live in social units that include an adult pair and 1-2 dependent young (DEC 2006). The vegetation to be removed is likely provide suitable habitat for one social unit. This unit is likely to interact with other units occupying nearby suitable habitat, although the extent and number of individuals comprising the local population is unknown.
	(b) the likely impact (including direct and indirect impacts) that the development will have on the habitat of the local population	The proposal would result in the removal of 65.57 ha of native vegetation including suitable hunting, roosting and breeding habitat for the Sooty Owl. This vegetation is likely to form part of the home range for one social unit that comprises part of a larger local population of an unknown number of individuals.
	(c) the likely impact on the ecology of the local population	The valley of the development site provides the majority of the foraging habitat for the Sooty Owls recorded, however, it is likely that the ridgetops are also utilised. The proposal would require the removal of forging habitat and suitable habitat for prey species of the Sooty Owl. Tree hollows are used for roosting and nesting. These occur at a

FBA Section	Criteria	Consideration
		relatively high density in the unlogged gullies and a low density in regrowth forest on ridgelines.
	(d) a description of the extent to which the local population will become fragmented and isolated as a result of the proposed development	The vegetation to be removed is within the Bodalla State Forest. Removal of this vegetation is unlikely to result in the fragmentation or isolated of any Sooty Owl habitat given they occupy home ranges of 200-800 hectares in continuous habitat similar to the habitat that occurs in the development site. Juvenile owls are also known to be capable of dispersing 10-20 kilometres (DEC 2006).
	(e) the relationship of the local population to other populations of the species	Sooty Owls occupy home ranges of 200-800 hectares, dependant on the quality of the habitat (DEC 2006). The extent of the local population is unknown but is likely to include social units occupying areas of suitable habitat over thousands of hectares throughout Bodalla State Forest, Kooraban National Park and other adjoining areas of forested habitat.
	(f) the extent to which the proposed development will lead to an increase in threats and indirect impacts, including impacts from invasive flora and fauna, that may in turn lead to a decrease in the viability of the local population	The proposal is unlikely to result in the increase of any threats or indirect impacts to the extent that it decreases the viability of a local population of Sooty Owls.
	(g) the measure/s proposed to contribute to the recovery of the species in the IBRA subregion	The proponent of the Project proposes to acquire offsets in the form of BioBanking Credits commensurate to the exact credit requirement prescribed by the BBCC. A summary of the credit requirements is outlined in Table 7-9.

The proposed ESS will impact upon suitable breeding, roosting, and foraging habitat for Gang-gang Cockatoos. This species was listed in the SEARs as matter for further consideration, as such the following matters outlined in Table 7-7 are to be considered.

Table 7-7 Further consideration of impacts to Gang-gang Cockatoo

FBA Section	Criteria	Consideration
9.2.5.2	(a) the size of the local population directly and indirectly impacted by the development	Gang-gang Cockatoos occur in pairs, family groups, and small flocks. They appear to breed semi-colonially where densities are high and show a high fidelity to a selected nest hollow (NSW Scientific Committee 2008). Densities of Gang-gang 'territories' are thought to be in the order of 7-22 km^2 (NSW Scientific Committee 2008). The vegetation to be removed is likely provide suitable habitat for one social unit. This unit is likely to interact with other units occupying adjoining suitable habitat, although the extent and number of individuals comprising the local population is unknown.
	(b) the likely impact (including direct and indirect impacts) that the development will have on the habitat of the local population	The proposal would result in the removal of 65.57 ha of native vegetation including suitable foraging, roosting and breeding habitat for Gang-gang Cockatoos. This vegetation is likely to form part of the home range for one social unit that comprises part of a larger local population of an unknown number of individuals.
	(c) the likely impact on the ecology of the local population	The ecology of Gang-gang Cockatoos is poorly understood with little detailed studies on the species (NSW Scientific Committee 2008). The valley of the development site provides the majority of the foraging habitat for the Gang-gang cockatoos recorded, however, it is likely that the ridgetops are also utilised. The proposal would require the removal of forging habitat for the species. Tree hollows are used for breeding and occasionally roosting. These occur at a relatively high density in the unlogged gullies and a low density in regrowth forest on ridgelines.
	(d) a description of the extent to which the local population will become fragmented and isolated as a result of the proposed development	The Gang-gang Cockatoo is a highly mobile species, moving seasonally between mountain forests and lower open habitat to forage on available food resources. It is through that habitat fragmentation inhibits dispersal and foraging efficiency (NSW Scientific Committee 2008). Suitable foraging and breeding habitat occurs within with Bodalla State Forest, adjacent to other State Forests and National Parks. As such the proposal is unlikely to isolate the local population but will contribute to the overall level of fragmentation within Gang-gang habitat across the landscape.

FBA Section	Criteria	Consideration
	(e) the relationship of the local population to other populations of the species	Gang-gang Cockatoos are thought to have territories of 7-22 km^2 centred around nest sites. The extent of the local population is unknown but is likely to include social units occupying areas of suitable habitat over thousands of hectares throughout Bodalla State Forest, Kooraban National Park and other adjoining areas of forested habitat.
	(f) the extent to which the proposed development will lead to an increase in threats and indirect impacts, including impacts from invasive flora and fauna, that may in turn lead to a decrease in the viability of the local population	The proposal is unlikely to result in the increase of any threats or indirect impacts to the extent that it decreases the viability of a local population of Gang-gang Cockatoos.
	(g) the measure/s proposed to contribute to the recovery of the species in the IBRA subregion	The proponent of the Project proposes to acquire offsets in the form of BioBanking Credits commensurate to the exact credit requirement prescribed by the BBCC. A summary of the credit requirements is outlined in Table 7-9.

The proposed ESS will impact upon suitable breeding, roosting, and foraging habitat for Greater Broad-nosed Bats. This species was listed in the SEARs as matter for further consideration, as such the following matters outlined in Table 7-8 are to be considered.

Table 7-8 Further consideration of impacts on Greater Broad-nosed Bat

FBA Section	Criteria	Consideration
9.2.5.2	(a) the size of the local population directly and indirectly impacted by the development	The extent of the local population is unknown. However, given the mobility of the species, it is likely that the bats recorded within the development site interact with other units occupying adjoining suitable habitat.
	(b) the likely impact (including direct and indirect impacts) that the development will have on the habitat of the local population	The proposal would result in the removal of 65.57 hectares of native vegetation including suitable foraging, roosting and breeding habitat for Greater Broad-nosed Bats. This vegetation is likely to form part of the home range for animals comprising part of a larger local population of an unknown number of individuals.
	(c) the likely impact on the ecology of the local population	The unnamed tributary within valley of the development site provides the majority of the foraging habitat for Greater Broad-nosed Bats, however, it is likely that the ridgetops are also utilised. The proposal would require the removal of forging habitat for the species.

FBA Section	Criteria	Consideration
		Tree hollows are used for breeding and roosting. These occur at a relatively high density in the unlogged gullies and a lower density in regrowth forest on ridgelines.
	(d) a description of the extent to which the local population will become fragmented and isolated as a result of the proposed development	Greater Broad-nosed Bats are highly mobile species that are found within a variety of landscapes. The proposal would result in the removal of up to 65.57 ha of potential forging habitat within the Bodalla State Forest, which covers an area of approximately 17,000 ha. As such, it is highly unlikely the local population of Greater Broad-nosed Bat will become fragmented or isolated as a result of the proposed ESS given the high mobility of these species.
	(e) the relationship of the local population to other populations of the species	The extent of the local population is unknown but is likely to include social units occupying areas of suitable habitat over thousands of hectares throughout Bodalla State Forest, Kooraban National Park and other adjoining areas of forested habitat.
	(f) the extent to which the proposed development will lead to an increase in threats and indirect impacts, including impacts from invasive flora and fauna, that may in turn lead to a decrease in the viability of the local population	The proposal is unlikely to result in the increase of any threats or indirect impacts to the extent that it decreases the viability of a local population of Greater Broad-nosed Bats.
	(g) the measure/s proposed to contribute to the recovery of the species in the IBRA subregion	The proponent of the Project proposes to acquire offsets in the form of BioBanking Credits commensurate to the exact credit requirement prescribed by the BBCC. A summary of the credit requirements is outlined in Table 7-9.

7.5. Impacts Require Offsetting

7.5.1. Native Vegetation

Impacts of the Project that fall into the threshold of impacts that require offsetting include:

- The removal of 46.58 hectares of SR643: Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion
- The removal of 9.97 hectares of SR551: Grey Myrtle - Lilly Pilly dry rainforest in dry gullies of the Sydney Basin Bioregion and South East Corner Bioregion
- The removal of 8.18 hectares of SR609: River Peppermint - Rough-barked Apple moist open forest on sheltered sites, southern South East Corner Bioregion

- The removal of 0.36 hectares of SR608: River Peppermint - Rough-barked Apple - River Oak herb/grass forest of coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion
- The removal of 0.48 hectares of SR533: Coast Grey Box - Mountain Grey Gum - stringybark moist shrubby open forest in coastal gullies, southern South East Corner

The offset requirement for the above PCTs were calculated using the BBCC. A summary of the vegetation zone impacted, threatened species associated with that vegetation zone, loss landscape value, loss in site value, and the number of ecosystem credits required for the impacts is detailed in Table 7-9.

Table 7-9 Credit requirement of the project

Vegetation Zone	PCT	Condition	Area Impacted (Ha)	Current Site Value	Future Site Value	Credit Requirement
1	SR643	Moderate/Good_medium	21.08	70.83	0.00	1,253
2	SR643	Moderate/Good_high	25.5	69.62	0.00	1,493
3	SR551	Moderate/Good	9.97	71.35	0.00	597
4	SR609	Moderate/Good	8.18	71.88	0.00	493
5	SR608	Moderate/Good	0.36	76.00	0.00	23
6	SR533	Moderate/Good	0.48	73.44	0.00	29

7.5.2. Species and Populations

No species credit species or populations have been assessed as impacted by the Project.

7.6. Impacts not Requiring Offsetting

7.6.1. Native Vegetation

All native vegetation relevant to the Project is required to be further assessed (see Section 7.4) or requires an offset (see Section 7.5).

7.6.2. Species and Populations

A number of non-threatened species and populations have been recorded within the development. In accordance with Section 9.4.2 of the FBA these species do not require offsetting.

7.7. Impacts that do not Require Further Assessment

The development site includes areas of paddocks and existing roads/tracks that are not considered to comprise native vegetation or habitat for threatened species and populations. In accordance with Section 9.5.1.1 of the FBA this area of land does not require further assessment.

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Appendix A Plot and transect data

Zone	Plot	Date	Recorder	BVT	No. Native species	Native overstorey cover %	Native midstorey cover %	Native ground cover (grasses) %	Native ground cover (shrubs) %	Native ground cover (other) %	Exotic plant cover %	Number of trees with hollows	Regeneration	Total length of fallen logs (m)	Site Value Score	Bearing°	Eastings	Northings	Zone
Zone 1	Q1	15/11/2016	AB & RM	SR643_Moderate/Good_medium	34	24	6	14	12	24	0.6666667	0	0.5	300	70.83	55°	230383.313	5997025.672	56
	Q3	15/11/2016	AB & RM	SR643_Moderate/Good_medium	25	31	7.7	18	8	20	0.6666667	0	0.5	140	70.83	115°	230475.832	5996470.553	56
	Q4	15/11/2016	AB & RM	SR643_Moderate/Good_medium	24	29.5	0	12	12	14	0	2	0.5	105	70.83	95°	230281.054	5996188.125	56

Zone	Plot	Date	Recorder	BVT	No. Native species	Native overstorey cover %	Native midstorey cover %	Native ground cover (grasses) %	Native ground cover (shrubs) %	Native ground cover (other) %	Exotic plant cover %	Number of trees with hollows	Regeneration	Total length of fallen logs (m)	Site Value Score	Bearing°	Eastings	Northings	Zone
Zone 2	Q6	16/11/2016	RM & AB	SR643_Moderate/Good_high	22	17	4	6	4	4	0	0	1	120	69.62	245°	230994.535	5997215.385	56
	Q10	17/11/2016	RM & AB	SR643_Moderate/Good_high	18	16	0.7	8	0	18	0	2	1	19	69.62	15°	230386.484	5995890.366	56
	Q12	17/11/2016	RM & AB	SR643_Moderate/Good_high	9	22.5	0	10	14	4	0	1	1	95	69.62	300°	231023.080	5995936.527	56
	Q13	17/11/2016	RM & AB	SR643_Moderate/Good_high	19	18	3	14	0	12	0	1	1	29	69.62	210°	230996.833	5996286.225	56
	Q15	16/02/2017	DM & RM	SR643_Moderate/Good_high	28	15	3	46	12	24	0	2	1	175	69.62	197°	234451.099	5998369.837	56
	Q16	16/02/2017	DM & RM	SR643_Moderate/Good_high	29	28.5	2	50	10	48	0	2	1	56	69.62	261°	234454.845	5998246.545	56
	Q20	17/02/2017	DM & RM	SR643_Moderate/Good_high	19	47	0	24	10	8	0	0	1	95	69.62	275°	231963.238	5997059.804	56
	Q21	17/02/2017	DM & RM	SR643_Moderate/Good_high	30	77.5	2.5	52	14	10	0	2	1	207	69.62	88°	233482.155	5997642.800	56

Zone	Plot	Date	Recorder	BVT	No. Native species	Native overstorey cover %	Native midstorey cover %	Native ground cover (grasses) %	Native ground cover (shrubs) %	Native ground cover (other) %	Exotic plant cover %	Number of trees with hollows	Regeneration	Total length of fallen logs (m)	Site Value Score	Bearing°	Eastings	Northings	Zone
Zone 3	Q7	16/11/2106	RM & AB	SR551_Moderate-good	17	7	41.5	0	0	12	0	3	0	70	71.35	5°	230984.977	5997020.072	56
	Q11	17/11/2016	AB&RM	SR551_Moderate-good	19	10.5	56.5	0	0	30	0	3	0	22	71.35	133°	230828.853	5995873.283	56
	Q9	17/11/2016	AB&RM	SR551_Moderate-good	19	5	50.5	0	2	58	0	0	0	17	71.35	135°	230171.282	5996055.988	56

Zone	Plot	Date	Recorder	BVT	No. Native species	Native overstorey cover %	Native midstorey cover %	Native ground cover (grasses) %	Native ground cover (shrubs) %	Native ground cover (other) %	Exotic plant cover %	Number of trees with hollows	Regeneration	Total length of fallen logs (m)	Site Value Score	Bearing°	Eastings	Northings	Zone
Zone 4	Q2	15/11/2016	AB&RM	SR609_Moderate-good	29	9.5	31	8	6	52	0	0	0.75	120	71.88	80°	230548.874	5997084.105	56
	Q5	16/11/2016	AB&RM	SR609_Moderate-good	40	16	17	0	0	70	0	1	0.75	60	71.88	175°	230663.236	5997246.039	56
	Q8	16/11/2016	AB&RM	SR609_Moderate-good	44	6	27	2	0	56	0	5	0.75	50	71.88	87°	230765.048	5996188.125	56

Zone	Plot	Date	Recorder	BVT	No. Native species	Native overstorey cover %	Native midstorey cover %	Native ground cover (grasses) %	Native ground cover (shrubs) %	Native ground cover (other) %	Exotic plant cover %	Number of trees with hollows	Regeneration	Total length of fallen logs (m)	Site Value Score	Bearing°	Eastings	Northings	Zone
Zone 5	Q14	14/02/2017	DM & RM	SR608_Moderate-good	42	22.5	24	64	16	22	14	1	0.5	89	76	5°	230238.862	5997662.778	56

Zone	Plot	Date	Recorder	BVT	No. Native species	Native overstorey cover %	Native midstorey cover %	Native ground cover (grasses) %	Native ground cover (shrubs) %	Native ground cover (other) %	Exotic plant cover %	Number of trees with hollows	Regeneration	Total length of fallen logs (m)	Site Value Score	Bearing°	Eastings	Northings	Zone
Zone 6	Q17	16/02/2017	DM & RM	SR533_Moderate-good	30	15.5	9.5	16	32	22	0	1	0.66	227	73.44	41°	230775.745	5997478.167	56
	Q18	16/02/2017	DM & RM	SR533_Moderate-good	32	22.5	8.5	30	16	20	0	3	0.66	157	73.44	245°	230650.462	5997516.269	56
	Q19	16/02/2017	DM & RM	SR533_Moderate-good	37	13	18.5	12	24	16	0	0	0.66	229	73.44	5°	230700.583	5997423.629	56

Appendix B Flora species list

Status	Family	Genus species	Common Name	Q1	Q1	Q2	Q2	Q3	Q3	Q4	Q4	Q5	Q5	Q6	Q6	Q7	Q7	Q8	Q8	Q9	Q9	Q10	Q10	Q11	Q11	Q12	Q12	Q13	Q13	Q14	Q14	Q15	Q15	Q16	Q16	Q17	Q17	Q18	Q18	Q19	Q19	Q20	Q20	Q21	Q21
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
li	Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower			<5	50					5	1000					<1	100	2	40									10	500														
li	Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair									<1	500					<5	100											<5	50												
li	Adiantaceae	*Adiantum hispidulum*	Rough Maidenhair Fern																					<1	10																		
li	Adiantaceae	*Cheilanthes sieberi ssp sieberi*	Mulga Fern							<1	10																																
li	Adiantaceae	*Pellaea falcata*	Sickle Fern			40	500+											<5	1000											<1	50												
li	Anthericaceae	*Thysanotus tuberosus ssp*	Common Fringe-lily							<1	4																																
li	Aphanotetalaceae	*Aphanopetalum resinosum*	Gum Vine									20	100					20	100					5	5																		
li	Apiaceae	*Centella asiatica*	Indian Pennywort							<1	100	10	1000																														
li	Apiaceae	*Hydrocotyle sibthorpioides*										1	50																														
li	Apiaceae	*Platysace lanceolata*	Shrubby Platysace	4	10			10	100	5	100			20	50							<1	30			<5	20	10	50			10	50	5	50	<5	10	<5	50			1	25	<5	30
li	Apocynaceae	*Marsdenia rostrata*	Milk Vine			20	500+					30	500					20	100	10	3																	1	1				
li	Apocynaceae	*Marsdenia suaveolens*	Scented Marsdenia																																					<1	4			
li	Apocynaceae	*Parsonsia straminea*	Common Silkpod																																	<1	5						
li	Apocynaceae	*Tylophora barbata*	Bearded Tylophora	<1	1																																						
li	Araliaceae	*Polyscias murrayi*																		<1	1																						
li	Aspleniaceae	*Asplenium flabellifolium*	Necklace Fern													<1	2																										
li	Asteraceae	*Cassinia aculeata*	Dolly Bush																											<1	2												
li	Asteraceae	*Cassinia trinerva*				10	5					<1	2					<5	2											5	20					5	20	15	10				
*	Asteraceae	*Conyza bonariensis*	Flaxleaf Fleabane	<1	100																																						
*	Asteraceae	*Gnaphalium sp*		<1	1																																						
li	Asteraceae	*Ozothamnus argophyllus*	Spicy Everlasting																																	3	10	2	5	70	100	<1	2		
li	Asteraceae	*Ozothamnus diosmifolius*	Rice Flower	<1	1			<5	20	<1	1			2	5			<5	2									<1	1							5	20			<1	3				
li	Asteraceae	*Ozothamnus ferrugineus*	Tree Everlasting	20	200	10	5							5	20													<1	1														
li	Asteraceae	*Ozothamnus sp*																																								2	3
li	Asteraceae	*Senecio vagus*																<1	1																								
li	Asteraceae	*Sigesbeckia orientalis ssp orientalis*		<1	10							<1	25					<2	10																								
*	Bignoniaceae	*Macfadyena unguis-cati*	Cat's Claw Creeper																											<1	6												
li	Bignoniaceae	*Pandorea pandorana*	Wonga Wonga Vine											<1	10	<1	10													<1	5							<1	5				
li	Blechnaceae	*Blechnum cartilagineum*	Gristle fern			70	100+											30	2000	10	50			15	100													1	20			<1	5
li	Blechnaceae	*Doodia aspera*	Prickly Rasp Fern									10	5000			<1	500	5	1000	<1	10			<1	20					<5	50												
li	Campanulaceae	*Wahlenbergia gracilis*	Sprawling Bluebell							<1	30							<1	20																								
li	Campanulaceae	*Wahlenbergia stricta ssp*	Australian Bluebell	<1	20																																						
*	Caprifoliaceae	*Lonicera japonica*	Japanese Honeysuckle																											<1	5												
li	Caryophyllaceae	*Stellaria flaccida*		<1	30	30	100					60	5000					20	100																								
li	Casuarinaceae	*Allocasuarina littoralis*	Black She-oak	<1	1			<1	1					15	10																			10	5	5	20	5	4				5	4
li	Casuarinaceae	*Casuarina cunninghamiana ssp*	River Oak																											30	50												
li	Chenopodiaceae	*Einadia hastata*	Berry Saltbush	<1	1																																						
li	Colchicaceae	*Burchardia umbellata*	Milkmaids																													1	30										
li	Commelinaceae	*Tradescantia fluminensis*	Wandering Jew																											40	1000												
li	Convolvulaceae	*Calystegia marginata*										<1	50							<1	1																						
li	Convolvulaceae	*Dichondra repens*	Kidney Weed	<5	100					<1	1000							<5	100											5	500			10	500								
li	Cyatheaceae	*Cyathea australis*	Black Tree-fern			<5	1					10	6																														

Status	Family	Genus species	Common Name	Q1	Q1	Q2	Q2	Q3	Q3	Q4	Q4	Q5	Q5	Q6	Q6	Q7	Q7	Q8	Q8	Q9	Q9	Q10	Q10	Q11	Q11	Q12	Q12	Q13	Q13	Q14	Q14	Q15	Q15	Q16	Q16	Q17	Q17	Q18	Q18	Q19	Q19	Q20	Q20	Q21	Q21
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
li	Cyperaceae	*Carex longebrachiata*				5	100					20	1000																																
li	Cyperaceae	*Cyathochaeta diandra*																														20	200	50	350										
li	Cyperaceae	*Gahnia melanocarpa*	Black Fruit Saw-sedge											1	5	3	20	10	30																										
li	Cyperaceae	*Lepidosperma concavum*																10	100																				2	100						
li	Cyperaceae	*Lepidosperma gunnii*																						<1	5																				
li	Cyperaceae	*Lepidosperma laterale*		<1	50			5	20	2	200			<1	50							<5	50			<1	30	10	50	5	20					5	500			2	100	2	25	2	25
li	Cyperaceae	*Lepidosperma sp*																												5	20														
li	Cyperaceae	*Schoenus melanostachys*														5	50																												
li	Dennstaedtiaceae	*Pteridium esculentum*	Common Bracken	<1	20	20	100+					20	500					20	100																	<1	4	5	100	<1	50			<1	10
li	Dicksoniaceae	*Calochlaena dubia*	Soft Bracken			20	100+					30	1000					<5	100																										
li	Dilleniaceae	*Hibbertia ?monogyna*																														1	5												
li	Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower																													5	20	5	50					5	50			<5	30
li	Dilleniaceae	*Hibbertia dentata*	Trailing Guinea Flower			10	100+	<5	30									20	100																										
li	Dilleniaceae	*Hibbertia empetrifolia ssp empetrifolia*		<1	10																																								
li	Dilleniaceae	*Hibbertia sp*																														<1	5												
li	Dryopteridaceae	*Lastreopsis acuminata*	Creeping Shield Fern																	20	50			2	20																				
li	Elaeocarpaceae	*Elaeocarpus reticulatus*	Blueberry Ash			<1	1											<5	10													<1	1					<1	1			<1	1
li	Ericaceae	*Leucopogon juniperinus*	Prickly Beard-heath	<1	10																							<1	1			<1	2	5	5					<1	2				
li	Ericaceae	*Leucopogon lanceolatus*																																		<1	1			<1	1			<1	2
li	Ericaceae - Styphelioideae	*Lissanthe strigosa ssp strigosa*	Peach Heath											2	10																											<1	2		
li	Euphorbiaceae	*Breynia oblongifolia*	Coffee Bush																															<1	1									
li	Euphorbiaceae	*Claoxylon australe*	Brittlewood																	<1	1			<1	1																			
li	Euphorbiaceae	*Phyllanthus gunnii*	Scrubby Spurge																											<1	5													
li	Euphorbiaceae	*Phyllanthus hirtellus*								<1	1																																	
li	Euphorbiaceae	*Poranthera microphylla*		<1	20																																							
li	Eupomatiaceae	*Eupomatia laurina*	Bolwarra																	<1	2																							
*	Fabaceae - Caesalpinioideae	*Senna septemtrionalis*	Arsenic Bush															<1	1																										
li	Fabaceae - Faboideae	*Bossiaea buxifolia*																																<1	5									
li	Fabaceae - Faboideae	*Daviesia corymbosa*								5	100											60	100																						
li	Fabaceae - Faboideae	*Desmodium rhytidophyllum*																																<1	1			<1	5	<1	1				
li	Fabaceae - Faboideae	*Desmodium varians*	Slender Tick-trefoil									1	50																																
li	Fabaceae - Faboideae	*Glycine microphylla*	Small-leaf glycine	<1	20																									<1	5			<1	20					<1	10				
li	Fabaceae - Faboideae	*Hardenbergia violacea*	Purple Coral Pea											<1	10							<1	10					<1	1					<1	1			<1	5			<1	30	<1	5
li	Fabaceae - Faboideae	*Indigofera australis*	Australian Indigo	10	100																																							
*	Fabaceae - Faboideae	*Platylobium formosum*																																				5	20						
*	Fabaceae - Faboideae	*Podolobium ilicifolium*	Prickly Shaggy Pea											10	20							<1	1																			2	30		
*	Fabaceae - Faboideae	*Pultenaea scabra*																																									<5	20
li	Fabaceae - Mimosoideae	*Acacia decurrens*	Black Wattle											10	5																									1	1				
li	Fabaceae - Mimosoideae	*Acacia falcata*																																										
li	Fabaceae - Mimosoideae	*Acacia falciformis*	Broad-leaved Hickory					20	8													<1	1			5	5	5	2							10	5	5	2	5	5				
li	Fabaceae - Mimosoideae	*Acacia implexa*	Hickory Wattle																									<1	1															

Status	Family	Genus species	Common Name	Q1	Q1	Q2	Q2	Q3	Q3	Q4	Q4	Q5	Q5	Q6	Q6	Q7	Q7	Q8	Q8	Q9	Q9	Q10	Q10	Q11	Q11	Q12	Q12	Q13	Q13	Q14	Q14	Q15	Q15	Q16	Q16	Q17	Q17	Q18	Q18	Q19	Q19	Q20	Q20	Q21	Q21
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
li	Fabaceae - Mimosoideae	*Acacia irrorata*	Green Wattle					15	20																																				
li	Fabaceae - Mimosoideae	*Acacia longifolia ssp longifolia*	Sydney Golden Wattle																															2	1										
li	Fabaceae - Mimosoideae	*Acacia mearnsii*	Black Wattle																											5	10			<5	5										
li	Fabaceae - Mimosoideae	*Acacia sp*		<1	1																									<5	5							1	1	5	10				
li	Fabaceae - Mimosoideae	*Acacia terminalis*	Sunshine Wattle																							11	4																	5	30
li	Fabaceae - Mimosoideae	*Acacia ulicifolia*	Prickly Moses																													<5	4			<1	2								
li	Geraniaceae	*Geranium potentilloides*				20	50					<1	500																																
li	Goodeniaceae	*Dampiera stricta*																																<1	20										
li	Goodeniaceae	*Goodenia ovata*	Hop Goodenia					15	20									10	100																												
li	Goodeniaceae	*Scaevola ramosissima*	Purple Fan-flower	<1	20																											<1	1												
li	Haloragaceae	*Gonocarpus teucrioides*	Raspwort							<1	30																											1	100	5	50			<1	5
li	Iridaceae	*Patersonia sericea*	Silky Purple-Flag																													1	50												
li	Lamiaceae	*Plectranthus parviflorus*	Cockspur Flower									1	<1																	<1	2														
li	Lamiaceae	*Prostanthera incisa*	Cut-leaved Mint-bush															10	100																												
li	Lamiaceae	*Prostanthera lasianthos ssp*	Victorian Christmas Bush									2	1																																		
li	Lindsaeaceae	*Lindsaea linearis*	Screw Fern													<1	1																												
li	Lindsaeaceae	*Lindsaea microphylla*	Lacy Wedge Fern																																			1	10					<1	5
li	Lobeliaceae	*Pratia purpurascens*	Whiteroot	<1	1000			15	100	<1	100	<1	1000																									<1	10						
li	Lomandraceae	*Lomandra confertifolia*	Mat-rush							5	1000											10	200			7	50	10	50													3	100		
li	Lomandraceae	*Lomandra filiformis*						5	30					5	70																			10	100										
li	Lomandraceae	*Lomandra glauca*	Pale Mat-rush																															<5	10										
li	Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush					<5	3	<1	50					<1	10													5	20							<1	1	<1	5			<1	1
li	Lomandraceae	*Lomandra multiflora*	Many-flowered Mat-rush							<1	50											<1	25			3	20					20	100	30	150	<5	100	<1	5	<1	5	<1	2	1	10
li	Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry			<5	50					<1	50					<5	30											<1	5			<1	1	<1	1						
li	Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily									<1	50			<1	10	<5	50											<1	5					<1	1			<1	1				
li	Menispermaceae	*Sarcopetalum harveyanum*	Pearl Vine																							5	5																		
li	Menispermaceae	*Stephania japonica var discolor*	Snake Vine																	10	3																								
li	Monimiaceae	*Doryphora sassafras*	Sassafras																							<1	1																		
li	Moraceae	*Ficus coronata*	Sandpaper Fig			20	5					15	5					5	2	5	15																								
li	Myrsinaceae	*Myrsine howittiana*	Brush muttonwood			10	1											10	5																	<1	1								
li	Myrtaceae	*Acmena smithii*	Lilly Pilly																	15	30																								
li	Myrtaceae	*Angophora floribunda*	Apple																											40	20							5	1	10	3				
li	Myrtaceae	*Backhousia myrtifolia*	Grey Myrtle											<1	1	95	600			80	100			90	50					5	20							<1	1	10	10				
li	Myrtaceae	*Corymbia maculata*	Spotted Gum	40	6			10	5	40	8			40	4	30	7					40?	11	20	3	30	10	20	6			20	4	20	4							15	20	15	11
li	Myrtaceae	*Eucalyptus agglomerata*	Blue-leaved Stringybark											10	5											10	1															<1	1		
li	Myrtaceae	*Eucalyptus baueriana*	Blue Box			10	1	10	2			15	2			20	10	10	1																										
li	Myrtaceae	*Eucalyptus bosistoana*	Coast Grey Box																									5	7																
li	Myrtaceae	*Eucalyptus botryoides*	Bangalay																											10	1														
li	Myrtaceae	*Eucalyptus botryoides-saligna intergrade*				20	4					15	3																																
li	Myrtaceae	*Eucalyptus cypellocarpa*	Monkey Gum															10	1																			20	2	20	4				

Status	Family	Genus species	Common Name	Q1	Q1	Q2	Q2	Q3	Q3	Q4	Q4	Q5	Q5	Q6	Q6	Q7	Q7	Q8	Q8	Q9	Q9	Q10	Q10	Q11	Q11	Q12	Q12	Q13	Q13	Q14	Q14	Q15	Q15	Q16	Q16	Q17	Q17	Q18	Q18	Q19	Q19	Q20	Q20	Q21	Q21
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
li	Myrtaceae	*Eucalyptus elata*	River Peppermint															5	1																												
li	Myrtaceae	*Eucalyptus eugenioides*	Thin-leaved Stringybark																																							15	20		
li	Myrtaceae	*Eucalyptus fibrosa*	Red Ironbark																																									5	1
li	Myrtaceae	*Eucalyptus globoidea*	White Stringybark					5	2		20	5		10	5							40	2			40	30	22	25					5	1	20	3			10	25	5	10		
li	Myrtaceae	*Eucalyptus longifolia*	Woollybutt											12	2													<5	1							20	3	10	1			<5	5	5	5
li	Myrtaceae	*Eucalyptus muelleriana*	Yellow Stringybark	10	2	10	1																							5	5					20	3	30	6	10	25				
li	Myrtaceae	*Eucalyptus pilularis*	Blackbutt																													15	1	60	4	10	1			10	2			20	5
li	Myrtaceae	*Eucalyptus sieberi*	Silvertop Ash																									20	2			10	7												
li	Myrtaceae	*Eucalyptus sp.*	Stringybark																																									5	3
li	Myrtaceae	*Eucalyptus sp.*	Box					15	6																																				
li	Myrtaceae	*Eucalyptus tricarpa*	Mugga Ironbark																									5	2																
li	Myrtaceae	*Leptospermum trinervium*	Slender Tea-tree																											<5	5														
li	Myrtaceae	*Tristaniopsis collina*	Mountain Water Gum																	<1	1																								
li	Oleaceae	*Notelaea longifolia*	Large Mock-olive																											5	1														
li	Oleaceae	*Notelaea venosa*	Veined Mock-olive									<1	5	<1	1	<1	3	<5	20					<1	5																	15	10				
li	Orchidaceae	*Cryptostylis ?erecta*																																									<1	30
li	Orchidaceae	*Sarcochilus hillii*																						<1	1																				
li	Oxalidaceae	*Oxalis sp*										<1	1000																																
li	Passifloraceae	*Passiflora cinnabarina*	Red Passionflower									<1	25																																
li	Passifloraceae	*Passiflora suberosa*	Cork Passionflower																																										
li	Phormiaceae	*Dianella caerulea*	Blue Flax-lily																			<1	1					<1	1	<1	2	<1	10	<1	50			1	10						
li	Phormiaceae	*Dianella revoluta*	Paroo Lily																													<1	10			<1	5			<1	4	<1	3	<1	5
li	Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry	<1	10			<5	50	<1	20											<1	1													<1	10	<1	2	<1	2			<1	1
li	Pittosporaceae	*Bursaria spinosa*	Blackthorn																											<1	2					<5	6	<5	20	<5	20				
li	Pittosporaceae	*Pittosporum revolutum*	Wild Yellow Jasmine	<1	1	1	1	<5	10			2	25	<1	1	<5	10	5	20	<1	1			<1	1											<1	2			5	10				
li	Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum											<1	1	<1	1							<1	1					10	4														
li	Poaceae	*Dichelachne sp.*																																5	100										
li	Poaceae	*Echinopogon caespitosus var caespitosus*	Tufted Hedgehog-grass	<1	100																																								
li	Poaceae	*Ehrharta erecta*	Panic Veldtgrass																											<1	50														
li	Poaceae	*Entolasia marginata*	Bordered Panic									<1	500					<5	100											1	100														
li	Poaceae	*Entolasia stricta*	Wiry Panic	15	200	15	100	10	100	<1	1000			10	100							<5	70									10	1000			1	100	1	500	<1	100	<1	40	5	40
li	Poaceae	*Eragrostis sp*																												<1	10														
li	Poaceae	*Imperata cylindrica*	Blady Grass																													20	1000	20	1000			1	500						
li	Poaceae	*Joycea pallida*	Silvertop Wallaby Grass																			<5	70																			15	180			
li	Poaceae	*Microlaena stipoides var stipoides*	Weeping Grass	<1	50					<1	1000	<1	500																	30	1000							5	100	<1	100				
li	Poaceae	*Oplismenus aemulus*	Oplismenus																											5	1000														
li	Poaceae	*Oplismenus imbecillis*	Oplismenus									20	1000					20	1000																										
li	Poaceae	*Paspalum dilatatum*	Paspalum																											<1	50														
li	Poaceae	*Poa meionectes*	Snowgrass							10	100			15	200																							1	50	10	1000	5	100			5	40
li	Poaceae	*Poa sp*																												10	50														
li	Poaceae	*Rytidosperma sp*						20	500																									5	100	1	100								
li	Poaceae	*Rytidosperma tenuius*		<1	20																																								
li	Poaceae	*Tetrarrhena juncea*	Wiry Ricegrass																															5	100										
li	Poaceae	*Themeda triandra*	Kangaroo Grass																													20	1000	20	1000					5	100	1	20		

Status	Family	Genus species	Common Name	Q1	Q1	Q2	Q2	Q3	Q3	Q4	Q4	Q5	Q5	Q6	Q6	Q7	Q7	Q8	Q8	Q9	Q9	Q10	Q10	Q11	Q11	Q12	Q12	Q13	Q13	Q14	Q14	Q15	Q15	Q16	Q16	Q17	Q17	Q18	Q18	Q19	Q19	Q20	Q20	Q21	Q21
				C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
li	Polygonaceae	*Acetosa sagittata*	Rambling Dock																											<1	1																
li	Polypodiaceae	*Pyrrosia rupestris*	Rock Felt Fern													<1	1																												
li	Proteaceae	*Banksia spinulosa*	Hairpin Banksia																																									2	5
li	Proteaceae	*Hakea eriantha*																																2	1									
li	Proteaceae	*Lomatia ilicifolia*	Holly Lomatia																											<1	5	<1	1												
li	Proteaceae	*Persoonia linearis*	Narrow-leaved Geebung					<5	1	2	1											<1	3			<5	20	<1	1			15	2	<1	20	5	4					1	6	<1	5
li	Ranunculaceae	*Clematis aristata*	Old Man's Beard	<1	10																																								
li	Ranunculaceae	*Clematis glycinoides var glycinoides*	Headache Vine															1	1											<1	5															
li	Ranunculaceae	*Ranunculus plebeius*																														1	50												
li	Ranunculaceae	*Ranunculus sp*																																									<1	5
li	Rhamnaceae	*Pomaderris aspera*	Hazel Pomaderris			<1	1					5	5																														
li	Rhamnaceae	*Pomaderris aspera x cinerea*																<5	20																										
li	Rhamnaceae	*Pomaderris sp*																																		<5	4	1	1	5	5				
li	Rhamnaceae	*Pomaderris sp 2*																																		<5	6			<1	1				
li	Rosaceae	*Rubus nebulosus*	Green-leaved Bramble									5	1					5	100	10	3																								
li	Rosaceae	*Rubus rosifolius ssp*	Rose-leaf Bramble	<1	5	<5	100+					<5	50																																
li	Rubiaceae	*Morinda jasminoides*	Sweet Morinda									10	50							2	1			5	5					<1	5														
li	Rubiaceae	*Pomax umbellata*	Pomax							<1	100											<1	30																						
li	Rubiaceae	*Psychotria loniceroides*	Hairy Psychotria									<1	1					<1	4	2	5			<1	5																				
li	Rutaceae	*Zieria smithii*	Sandfly Zieria					<5	1									<1	1																								2	5
li	Santalaceae	*Exocarpos cupressiformis*	Cherry Ballart					10	2	5	1			10	2	2	10	2	1							<1	2			<1	1					10	3								
li	Santalaceae	*Exocarpos strictus*	Pale-fruit Ballart																																					<1	1				
li	Scrophulariaceae	*Veronica plebeia*	Trailing Speedwell									<1	100																																
li	Smilacaceae	*Smilax australis*																<5	30	10	3			15	10																				
li	Smilacaceae	*Smilax glyciphylla*	Sweet Sarsaparilla					<5	10			5	50																																
li	Solanaceae	*Solanum mauritianum*				10	5					<1	1																																
li	Solanaceae	*Solanum prinophyllum*	Forest Nightshade	<1	30			21	1			<1	1					<5	10																										
li	Sterculiaceae	*Commersonia fraseri*	Blackfellow's Hemp			<1	1																																						
li	Ulmaceae	*Trema tomentosa ssp viridis*	Native Peach																											5	5														
li	Uvulariaceae	*Schelhammera undulata*		<1	1000	5	1000					30	1000			<1	100																							5	100	<1	100				
li	Violaceae	*Melicytus dentatus*	Tree Violet			2	10					<1	1																	30	20														
li	Violaceae	*Viola eminens*										<1	1000																																
li	Violaceae	*Viola sp*																																						1	100				
li	Vitaceae	*Cissus hypoglauca*	Water Vine			40	500+											10	100					15	10																				
li	Xanthorrhoeaceae	*Xanthorrhoea minor ssp minor*																																								<1	4				
li	Xanthorrhoeaceae	*Xanthorrhoea sp*	Blackboy																					<1	1					<1	1														
li	Zamiaceae	*Macrozamia communis*	Burrawang	11	1			15	50	<1	10			10	5							20	20			20	10	<1	5			5	10	5	10							<1	2		

Appendix C Fauna species list

Common Name	Species Name	Exotic	TSC Act	EPBC Act
Amphibians				
Limnodynastes peronii	Striped Marsh Frog			
Litoria peronii	Peron's Tree Frog			
Birds				
Acanthiza lineata	Striated Thornbill			
Acanthiza pusilla	Brown Thornbill			
Acanthorhynchus tenuirostris	Eastern Spinebill			
Aegotheles cristatus	Australian Owlet-nightjar			
Alisterus scapularis	Australian King Parrot			
Aquila audax	Wedge-tailed Eagle			
Cacomantis variolosus	Brush Cuckoo			
Callocephalon fimbriatum	Gang-gang Cockatoo		V	
Calyptorhynchus lathami	Glossy Black-Cockatoo		V	
Chrysococcyx basalis	Horsefield's Bronze-cuckoo			
Colluricincla harmonica	Grey Shrike-thrush			
Cormobates leucophaea	White-throated Treecreeper			
Corvus coronoides	Australian Raven			
Cracticus tibicen	Australian Magpie			
Cracticus torquatus	Grey Butcherbird			
Dacelo novaeguineae	Laughing Kookaburra			
Daphoenositta chrysoptera	Varied Sittella		V	
Eopsaltria australis	Eastern Yellow Robin			
Eurostopodus mystacalis	White-throated Nightjar			
Eurystomus orientalis	Dollarbird			
Gerygone mouki	Brown Gerygone			
Grallina cyanoleuca	Magpie-lark			
Hirundapus caudacutus	White-throated Needletail			M
Leucosarcia melanoleuca	Wonga Pigeon			
Lichenostomus chrysops	Yellow-faced Honeyeater			
Lichenostomus fuscus	Fuscous Honeyeater			
Lichenostomus leucotis	White-eared Honeyeater			
Macropygia amboinensis	Brown Cuckoo-Dove			
Malurus cyaneus	Superb Fairy-wren			
Manorina melanophrys	Bell Miner			
Meliphaga lewinii	Lewin's Honeyeater			
Menura novaehollandiae	Superb Lyrebird			
Microeca fascinans	Jacky Winter			
Monarcha melanopsis	Black-faced Monarch			M
Myiagra rubecula	Leaden Flycatcher			
Neochmia temporalis	Red-browed Finch			
Ninox boobook	Southern Boobook			

Common Name	Species Name	Exotic	TSC Act	EPBC Act
Oriolus sagittatus	Olive-backed Oriole			
Pachycephala pectoralis	Golden Whistler			
Philemon corniculatus	Noisy Friarbird			
Platycercus elegans	Crimson Rosella			
Podargus strigoides	Tawny Frogmouth			
Psophodes olivaceus	Eastern Whipbird			
Ptilonorhynchus violaceus	Satin Bowerbird			
Rhipidura albiscapa	Grey Fantail			
Rhipidura rufifrons	Rufous Fantail			M
Sericornis frontalis	White-browed Scrubwren			
Strepera graculina	Pied Currawong			
Todiramphus sanctus	Sacred Kingfisher			
Tyto novaehollandiae	Masked Owl		V	
Tyto tenebricosa	Sooty Owl		V	
Mammals				
Acrobates pygmaeus	Feathertail Glider			
Antechinus agilis	Agile Antechinus			
Antechinus sp.	Unidentified antechinus			
Austronomus australis	White-striped Freetail-bat			
Canis lupus familiaris	Dog	*		
Chalinolobus gouldii	Gould's Wattled Bat			
Chalinolobus morio	Chocolate Wattled Bat			
Felis catus	Cat	*		
Macropus giganteus	Eastern Grey Kangaroo			
Macropus rufogriseus	Red-necked Wallaby			
Miniopterus schreibersii oceanensis	Eastern Bentwing Bat			
Mormopterus norfolkensis	East-coast Freetail Bat		V	
Mormopterus ridei	Eastern Freetail Bat			
Mormopterus sp.	Unidentified microbat			
Nyctophilus sp.	Unidentified long-eared bat			
Perameles nasuta	Long-nosed Bandicoot			
Petaurus australis	Yellow-bellied Glider		V	
Petaurus breviceps	Sugar Glider			
Rattus fuscipes	Bush Rat			
Rhinolophus megaphyllus	Eastern Horseshoe Bat			
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat		V	
Scoteanax rueppellii	Greater Broad-nosed Bat		V	
Scotorepens orion	Eastern Broad-nosed Bat			
Tachyglossus aculeatus	Short-beaked Echidna			
Trichosurus vulpecula	Common Brushtail Possum			
Vespadelus darlingtoni	Large Forest Bat			
Vespadelus regulus	Southern Forest Bat			
Vespadelus vulturnus	Little Forest Bat			
Vombatus ursinus	Common Wombat			

Common Name	Species Name	Exotic	TSC Act	EPBC Act
Vulpes vulpes	European Red Fox	*		
Wallabia bicolor	Swamp Wallaby			
Reptiles				
Amphibolurus muricatus	Jacky Dragon			
Lampropholis guichenoti	Pale-flecked Garden Sunskink			
Varanus varius	Lace Monitor			

Appendix D Biodiversity credit report

BioBanking Credit Calculator

Ecosystem credits

Proposal ID :	174/2016/3946MP
Proposal name :	Eurobodalla Dam Construction
Assessor name :	Rachel Musgrave
Assessor accreditation number :	174
Tool version :	v4.0
Report created :	09/02/2018 16:07

Assessment circle name	Landscape score	Vegetation zone name	Vegetation type name	Condition	Red flag status	Management zone name	Management zone area	Current site value	Future site value	Loss in site value	Credit required for bio diversity	Credit required for TS	TS with highest credit requirement	Average species loss	Species TG Value	Final credit requirement for management zone
AC_1	25.30	SR643_Moderate/Good_Medium	Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion	Moderate/Good_Medium	No	MZ1	26.64	70.83	0.00	70.83	0	1,584	Masked Owl	75.00	3.00	1,584
AC_1	25.30	SR643_Moderate/Good_High	Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion	Moderate/Good_High	No	MZ2	24.14	69.62	0.00	69.62	0	1,413	Masked Owl	75.00	3.00	1,413
AC_1	25.30	SR551_Moderate/Good	Grey Myrtle - Lilly Pilly dry rainforest in dry gullies of the Sydney Basin Bioregion and South East Corner Bioregion	Moderate/Good	Yes	MZ3	9.97	71.35	0.00	71.35	0	597	Masked Owl	75.00	3.00	597
AC_1	25.30	SR609_Moderate/Good	River Peppermint - Rough-barked Apple moist open forest on sheltered sites, southern South East Corner Bioregion	Moderate/Good	Yes	MZ4	8.30	71.88	0.00	71.88	500	500	Masked Owl	77.78	3.00	500
AC_1	25.30	SR608_Moderate/Good	River Peppermint - Rough-barked Apple - River Oak herb/grass riparian forest of coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion	Moderate/Good	Yes	MZ5	0.20	76.00	0.00	76.00	13	13	Masked Owl	50.00	3.00	13
AC_1	25.30	SR533_Moderate/Good	Coast Grey Box - Mountain Grey Gum - stringybark moist shrubby open forest in coastal gullies, southern South East Corner Bioregion	Moderate/Good	No	MZ6	0.41	73.44	0.00	73.44	0	25	Masked Owl	55.56	3.00	25

BioBanking Credit Calculator

Species credits

Proposal ID :

Proposal name :

Assessor name :

Assessor accreditation number :

Tool version : v4.0

Report created : 09/02/2018 16:07

Scientific name	Common name	Species TG value	Identified population?	Can Id. popn. be offset?	Area / number of loss	Negligible loss	Red flag status	Number of credits
			No					

Biodiversity credit report

This report identifies the number and type of biodiversity credits required for a major project.

Date of report: 9/02/2018 Time: 4:08:24PM Calculator version: v4.0

Major Project details

Proposal ID:	174/2016/3946MP
Proposal name:	Eurobodalla Dam Construction
Proposal address:	1 Smith Street Eurobodalla NSW 2545
Proponent name:	Eurobodalla Shire Council
Proponent address:	PO Box 99 Moruya NSW 2537
Proponent phone:	
Assessor name:	Rachel Musgrave
Assessor address:	Level 5, 20 Berry Street North Sydney NSW 2010
Assessor phone:	02 9900 7115
Assessor accreditation:	174

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Coast Grey Box - Mountain Grey Gum - stringybark moist shrubby open forest in coastal gullies, southern South East Corner Bioregion	0.41	25.00
Grey Myrtle - Lilly Pilly dry rainforest in dry gullies of the Sydney Basin Bioregion and South East Corner Bioregion	9.97	597.00
River Peppermint - Rough-barked Apple - River Oak herb/grass riparian forest of coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion	0.20	13.00
River Peppermint - Rough-barked Apple moist open forest on sheltered sites, southern South East Corner Bioregion	8.30	500.00
Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion	50.78	2,997.00
Total	69.66	4,132

Credit profiles

1. Grey Myrtle - Lilly Pilly dry rainforest in dry gullies of the Sydney Basin Bioregion and South East Corner Bioregion, (SR551)

Number of ecosystem credits created	597
IBRA sub-region	Bateman

Offset options - Plant Community types	Offset options - IBRA sub-regions
Grey Myrtle - Lilly Pilly dry rainforest in dry gullies of the Sydney Basin Bioregion and South East Corner Bioregion, (SR551) Grey Myrtle dry rainforest of the Sydney Basin Bioregion and South East Corner Bioregion, (SR552) Rusty Fig - Sweet Pittosporum dry rainforest on rocky slopes, southern South East Corner Bioregion, (SR613) Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion, (SR662)	Bateman and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. Coast Grey Box - Mountain Grey Gum - stringybark moist shrubby open forest in coastal gullies, southern South East Corner Bioregion, (SR533)

Number of ecosystem credits created	25
IBRA sub-region	Bateman

Offset options - Plant Community types	Offset options - IBRA sub-regions
Coast Grey Box - Mountain Grey Gum - stringybark moist shrubby open forest in coastal gullies, southern South East Corner Bioregion, (SR533) Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion, (SR592) Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion, (SR641) Spotted Gum - Grey Ironbark - Woollybutt grassy open forest on coastal flats, southern Sydney Basin Bioregion and South East Corner Bioregion, (SR642) Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion, (SR643) Turpentine - Red Bloodwood - Sydney Peppermint shrubby open forest on the foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion, (SR658)	Bateman and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

3. Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion, (SR643)

Number of ecosystem credits created	2,997
IBRA sub-region	Bateman

Offset options - Plant Community types	Offset options - IBRA sub-regions
Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion, (SR643) Coast Grey Box - Mountain Grey Gum - stringybark moist shrubby open forest in coastal gullies, southern South East Corner Bioregion, (SR533) Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion, (SR592) Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion, (SR641) Spotted Gum - Grey Ironbark - Woollybutt grassy open forest on coastal flats, southern Sydney Basin Bioregion and South East Corner Bioregion, (SR642) Turpentine - Red Bloodwood - Sydney Peppermint shrubby open forest on the foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion, (SR658)	Bateman and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

4. River Peppermint - Rough-barked Apple moist open forest on sheltered sites, southern South East Corner Bioregion, (SR609)

Number of ecosystem credits created	500
IBRA sub-region	Bateman

Offset options - Plant Community types	Offset options - IBRA sub-regions
River Peppermint - Rough-barked Apple moist open forest on sheltered sites, southern South East Corner Bioregion, (SR609)	Bateman and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

5. River Peppermint - Rough-barked Apple - River Oak herb/grass riparian forest of coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion, (SR608)

Number of ecosystem credits created	13
IBRA sub-region	Bateman

Offset options - Plant Community types	Offset options - IBRA sub-regions
River Peppermint - Rough-barked Apple - River Oak herb/grass riparian forest of coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion, (SR608) River Oak open forest of major streams, Sydney Basin Bioregion and South East Corner Bioregion, (SR606) White Sally Wattle - Leptospermum emarginatum riparian scrub of the Bega and Towamba valleys, southern South East Corner Bioregion, (SR665)	Bateman and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Summary of species credits required

Member of the Surbana Jurong Group

SMEC Australia Pty Ltd

Level 5, 20 Berry Street
North Sydney, NSW, 2060

T +61 2 9925 5555
F +61 2 9925 5566

www.smec.com