

South Batemans Bay Link Road

Biodiversity Assessment Report

Transport for NSW | March 2020



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Approval and authorisation

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Signed:	
Dated:	

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Executive summary

The study area was found to support predominantly native vegetation comprising five Plant Community Types (PCT):

- PCT1206 Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion
- PCT1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion
- 877 Grey Myrtle dry rainforest of the Sydney Basin Bioregion and South East Corner Bioregion
- 1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion
- 1326 Woollybutt - White Stringybark - Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion.

Vegetation meeting diagnostic criteria for the following BC Act and EPBC Act listed threatened ecological communities (TECs) is present in the study area but absent from within the construction boundary:

- Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Swamp Oak Floodplain Forest) BC Act listed EEC
- Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community (Coastal Swamp Oak Forest) EPBC Act listed EEC
- River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (River-Flat Eucalypt Forest) BC Act listed EEC
- Illawarra and south coast lowland forest and woodland EPBC Act listed CEEC.

Prior to the 2019/20 bushfire, the study area supported significant habitat features including numerous hollow bearing trees with a range of hollow sizes suitable for hollow dependent fauna and foraging resources for range of threatened fauna species. On a precautionary basis, it has been assumed that a large proportion of habitat features such as hollow bearing trees, will have survived the fire and that other habitat will recover at the site. Twenty BC Act listed threatened fauna species, six EPBC Act listed threatened fauna species and three EPBC Act listed migratory species were recorded or presumed present in the construction boundary following targeted surveys. No BC Act or EPBC Act listed threatened flora or populations were recorded or presumed present in the study area following targeted surveys.

The proposal would remove up to 22.68 hectares (ha) of native vegetation belonging to two PCTs within the construction boundary:

- PCT1206 Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion
- PCT1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion.

An additional 1.34 ha of non-native vegetation and 7.15 ha of bare ground, sealed and gravel road surfaces is present in the construction boundary. Depending on survival post fire, up to 72 hollow bearing trees, which are potential habitat for a range of threatened hollow dependent fauna, would be removed. The exact location and quantity of vegetation removal would be further refined through the detailed design phase. No threatened ecological communities listed under the BC Act or the EPBC Act are present in the construction boundary or would be impacted by the proposal.

Assessments of significance under Part 7.3 of the BC Act were conducted for all BC Act listed threatened species, populations and ecological communities likely to be affected by the proposal (Appendix E). Through these assessments, it was considered that the proposal is unlikely to have a significant impact on any threatened species, population or ecological community. Given that the proposal is not likely to lead to a significant impact on threatened species, populations, ecological communities or their habitats, a Species Impact Statement is not required to support this proposal.

Under the Roads and Maritime Activities Strategic Assessment, potential impacts must be considered in the REF and tests of significance under the EPBC Act have been included in Appendix F. Separate tests of significance under the EPBC Act were prepared for each EPBC Act listed threatened species likely to be present within the construction boundary. A single combined test of significance under the EPBC Act was prepared for listed migratory bird species likely to occur in the construction boundary. No significant impacts on EPBC Act listed species is likely to occur and the EPBC Act Strategic Assessment is not triggered by the proposal.

While unlikely due to fire intensity, if the yellow-bellied glider population in Hanging Rock Creek catchment has survived the 2019 – 2020 bushfire, there is potential for the proposal to partly or completely isolate these family groups from the population in the surrounding landscape. Further assessment of whether individuals persist within the Hanging Rock Creek catchment may be warranted to confirm the significance tests and determine whether additional connectivity measures may require implementation.

The proposal exceeds habitat clearing thresholds for offsetting identified in the Guideline for Biodiversity Offsets (Roads and Maritime, 2016) for two species credit species and fifteen ecosystem credit species as defined in the OEH Threatened Species Profile Database (TSPD). Preparation of an offsets strategy is required in accordance with the Guideline for Biodiversity Offsets (Roads and Maritime, 2016) to meet the following offset requirements for potential clearing in the construction boundary is:

- 15.95 ha of glossy black cockatoo breeding habitat
- 7.69 ha of sooty owl breeding habitat
- 0.37 ha of PCT1206 for ecosystem credit species
- 21.42 ha of PCT1220 for ecosystem credit species.

Based on Transport for NSW standard practice, mitigation measures to avoid and minimise clearing of native vegetation and threatened fauna habitat would be implemented during detailed design and construction and proposed works would be undertaken in the manner specified in and in accordance with the Biodiversity Guidelines (Roads and Traffic Authority, 2011). Additional safeguards and mitigation measures have been included in this report as recommendation for implementation.

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Appendix A	Flora Species Recorded
Appendix B	Fauna Species Recorded
Appendix C	Habitat Assessment Table
Appendix D	Assessment of candidate vegetation zones against criteria for BC Act listed EECs
Appendix E	Assessment of candidate vegetation zones against criteria for EPBC Act listed CEECs and EECs
Appendix F	Five-part Tests of Significance under the NSW Biodiversity Conservation Act 2016
Appendix G	Assessment of Significance under the Commonwealth EPBC Act 1999

Glossary of terms

Definitions	
Biodiversity offsets	Management actions that are undertaken to achieve a gain in biodiversity values on areas of land in order to compensate for losses to biodiversity values from the impacts of proposal (OEH, 2017).
Construction footprint	The area to be directly impacted by the proposal during construction activities. Analogous with subject land (see definition for subject land).
Cumulative impact	The impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Refer to Clause 228(2) of the EP&A Regulation 2000 for cumulative impact assessment requirements.
Direct impact	Direct impacts on biodiversity values include those related to clearing native vegetation and threatened species habitat and impacts on biodiversity values prescribed by the Biodiversity Conservation Regulation 2017 (the BC Regulation) (BAM, 2017)
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component.
Indirect impact	Indirect impacts include but not limited to: (a) indirect impacts on adjacent vegetation and habitat during construction (b) indirect impacts on adjacent vegetation and habitat during operation (c) impacts on adjacent vegetation and habitat arising from a change in land-use patterns (BAM, 2017)
Local population	The population that occurs in the study area. In cases where multiple populations occur in the study area or a population occupies part of the study area, impacts on each subpopulation must be assessed separately (OEH, 2017).
MNES	A matter of national environmental significance (MNES) protected by a provision of Part 3 of the EPBC Act
Mitchell landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000 (OEH, 2014).
Mitigation	Action to reduce the severity of an impact (OEH, 2014).
Mitigation measure	Any measure that facilitates the safe movement of wildlife and/or prevents wildlife mortality or injury.
Native vegetation	(a) trees (including any sapling or shrub or any scrub), (b) understorey plants, (c) groundcover (being any type of herbaceous vegetation), (d) plants occurring in a wetland. A plant is native to New South Wales if it was established in New South Wales before European settlement (BC Act).

Definitions	
OEH BAM Credit Calculator (BCC)	An online application of the Biodiversity Assessment Method (BAM). The calculator uses the rules and calculations outlined in the BAM and allows the user to apply the BAM at a site and observe the results of the assessment.
Operational footprint	The area that would be subject to ongoing operational impacts from the proposal. This includes the road, surrounding safety verges and infrastructure, fauna connectivity structures and maintenance access tracks and compounds.
Phreatophytic	Plant that primarily or partly uses water held in the phreatic (saturated) zone that occurs below the water table
Population	A group of organisms all of the same species, occupying a particular area (BAM, 2017).
Proposal area/site/ footprint	The area of land that is directly impacted on by the proposal that is being assessed under the EP&A Act, including access roads and areas used to store construction materials (OEH, 2014). It includes the construction and operational areas for the proposal.
Study area	The area directly affected by the proposal and any additional areas likely to be affected by the proposal, either directly or indirectly (OEH, 2014).
Target species	A species has been identified within the study area or is considered to have a moderate to high likelihood of occurrence and may be impacted by the proposal.
Vadophytic	Plant that primarily uses water held in the vadose (unsaturated) zone that occurs above the water table

Abbreviations	
BAM	Biodiversity Assessment Method (OEH, 2018)
BC Act	Biodiversity Conservation Act 2017
BCC	Biodiversity Credit Calculator
BOS	Biodiversity Offset Scheme under the BC Act
BVT	Biometric Vegetation Type
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
DBH	Diameter at Breast Height
DoEE	Department of Environment and Energy
DP&E	Department of Planning and Environment (now DPIE)
DPI	Department of Primary Industries
DPIE	Department of Planning, Industry and Environment
EEC	Endangered Ecological Community
EPBC Act	Environmental Protection and Biodiversity Conservation Act 1999 (Commonwealth).
FM Act	Fisheries Management Act 1994 (NSW)
GDE	Groundwater Dependent Ecosystems
IBRA	Interim Biogeographically Regionalisation of Australia
MNES	Matters of National Environmental Significance
OEH	Office of Environment and Heritage (now Biodiversity and Conservation Division, DPIE)
PCT	Plant Community Type
PMST	Protected Matters Search Tool
REF	Review of Environmental Factors
SEPP	State Environmental Planning Policy
TECs	Threatened Ecological Communities
TBDC	Threatened Biodiversity Data Collection
TSC Act	Threatened Species Act 1997 (NSW, repealed)
VEC	Vulnerable Ecological Community
VIS	Vegetation Information System
WONS	Weeds of National Significance

1 Introduction

1.1 Proposal identification

Transport for NSW, formerly Roads and Maritime Services (Roads and Maritime), is proposing to connect the Princes Highway with the existing South Batemans Bay Link Road at Glenella Road (the proposal). The proposal would include a new roundabout at the intersection of Princes Highway and Glenella and a new two-lane road (one lane in each direction) between the roundabout and Heron Road. The proposal would generally follow the current alignment of Glenella Road (formerly known as The Ridge Road) between the existing Heron Road and the Princes Highway to complete the South Batemans Bay Link Road project.

This report supports the environmental assessment for the proposal. The proposal is subject to assessment by a review of environmental factors (REF) under Division 5.1 of *Environmental Planning and Assessment Act 1979* (EP&A Act).

1.1.1 Proposal location

The proposal is located within the Eurobodalla Local Government Area (LGA) about 2.5 kilometres (km) south of Batemans Bay, adjacent to the Princes Highway, about 300 km south of Sydney and 150 km east of Canberra (Figure 1-1). Batemans Bay is the main commercial centre of the Eurobodalla Shire. The town centre has a mix of commercial, tourist, recreational and residential land uses. There are further urban residential and future employment lands located along the coastal villages south of Batemans Bay. The area is a popular tourist destination, particularly for Australian Capital Territory (ACT) residents and the Batemans Bay population increases substantially during holiday periods.

During late 2019 and early 2020, Australia experienced a severe bushfire season with fires across several states. New South Wales was one of the largest areas impacted with over 5.13 million hectares (ha) of land burnt across the state (DPIE, 2020).

The construction boundary area was among those affected and formed part of the Clyde Mountain fire which burnt approximately 84,000 ha of land in the Eurobodalla Shire Council area. This was linked to the Currowan and Badja Forest Road fire complexes in which more than 950,000 ha of land was burnt primarily in the Shoalhaven City Council and Eurobodalla Shire Council areas. The fire resulted in the temporary loss of dense bushland within the construction boundary as well as loss of a number of residences and industrial complexes in the surrounding greater Batemans Bay area. Existing roads relating to the proposal have been reopened to through traffic and bushland vegetation is expected to regenerate over the following years. The timing of this regeneration would be dependent on the interaction of a range of environmental factors such as fire intensity and particularly the extent of canopy fire, the presence of unburnt vegetation, canopy fire response category, existing seedbank, seasonal rainfall and suitable climate.

This biodiversity assessment considers the impacts of the bushfire events in relation to fauna habitat and the potential for significant impacts on fauna and has assessed the potential environmental impacts of the proposed works based on the assumption that there is potential for long-term regeneration to pre-bushfire conditions.

1.1.2 Key features of the proposal

Key features of the proposal include:

- A new roundabout on the Princes Highway, including:
 - two southbound lanes through the roundabout
 - a single northbound right turn lane through the roundabout to Glenella Road
 - a northbound bypass lane on the Princes Highway
 - single lane entry and exit to and from the Glenella Road
- A new two-lane road (one lane in each direction), about one kilometre in length, between the new roundabout on the Princes Highway and Heron Road
- A new T-intersection at the junction of The Ridge Road and Glenella Road
- Utility adjustments including for telecommunication, electrical and water infrastructure
- Earthworks including cuttings, embankments and retaining walls
- Establishment and use of temporary ancillary facilities during construction, including site offices, access tracks, plant laydown areas, stockpile sites, water quality controls and vehicle turning bays
- Lighting at the Princes Highway and Glenella Road roundabout, and approaches, and at the Glenella Road and the Ridge Road intersection
- Drainage and stormwater management infrastructure along the road corridor
- Site rehabilitation and landscaping work.

The construction boundary includes ancillary sites, construction access tracks and the operational footprint for the proposal (Figure 1-2). The following definitions are applied:

- Construction boundary (Figure 1-2): the whole impact boundary including the area contained within the operational boundary and areas impacted by the establishment and use of temporary ancillary facilities during construction (temporary impacts) such as access tracks, site offices, plant laydown areas, stockpile sites, water quality controls and vehicle turning bays
- Operational boundary: includes the proposed road alignment only (permanent impacts) comprising, new roundabout, two-lane road, T-intersection, minor adjustments, utility adjustments, earthworks and rehabilitation/landscaping areas.

The total area within the construction boundary is 31.17 ha, of which 15.65 ha are within the operational boundary.

1.1.3 Proposal background

The Princes Highway is an important connection for regional motorists and is a key route for heavy vehicle, commuter and tourist traffic movements. The traffic volume on the Princes Highway just south of Batemans Bay is around 8,800 vehicles per day with 8.3 per cent heavy vehicles and a growth rate of around 1.2 per cent per year. Beach Road is a regional road and a major sub-arterial road through the Batemans Bay CBD linking the Princes Highway, just south of the Batemans Bay Bridge, to the various residential areas and beaches south of the CBD, from Catalina to Surf Beach and further south along George Bass Drive.

In June 2014, the NSW Government announced \$10 million for the South Batemans Bay Link Road project to improve traffic flow through Batemans Bay and support future growth in the region. In early 2019, Eurobodalla Shire Council completed construction of the first stage of the South Batemans Bay Link Road between George Bass Drive and Heron Road, east of the Princes Highway. The completed section of the South Batemans Bay Link Road is known as Glenella Road. As part of these works, the section of The Ridge Road from the Princes Highway to Glenella Road was renamed to Glenella Road. This was undertaken by Council to define the connection of the sub arterial road (Glenella Road) through to the Princes Highway. In January 2019, the NSW Government announced funding of \$30 million for Transport for NSW to finalise planning and build the connection of the South Batemans Bay Link Road to the Princes Highway.

Transport for NSW proposes to build a link road connection between the Princes Highway and the South Batemans Bay Link Road along the existing alignment of Glenella Road. The proposal would reduce pressure on the existing Beach Road/Princes Highway, ease congestion in the Batemans Bay CBD and accommodate for future traffic growth.

The main objective of the proposal is to provide a safe and efficient connection between the Princes Highway and the South Batemans Bay Link Road.

Other objectives of the proposal are to:

- Facilitate land use development in the Batemans Bay CBD and southern coastal villages to support residential property and employment growth
- Increase freight productivity for heavy vehicles accessing the southern coastal villages and the proposed Surf Beach employment lands
- Improve traffic and pedestrian amenity in the Batemans Bay CBD by relieving congestion in the town centre and providing an alternative route to South Batemans Bay.

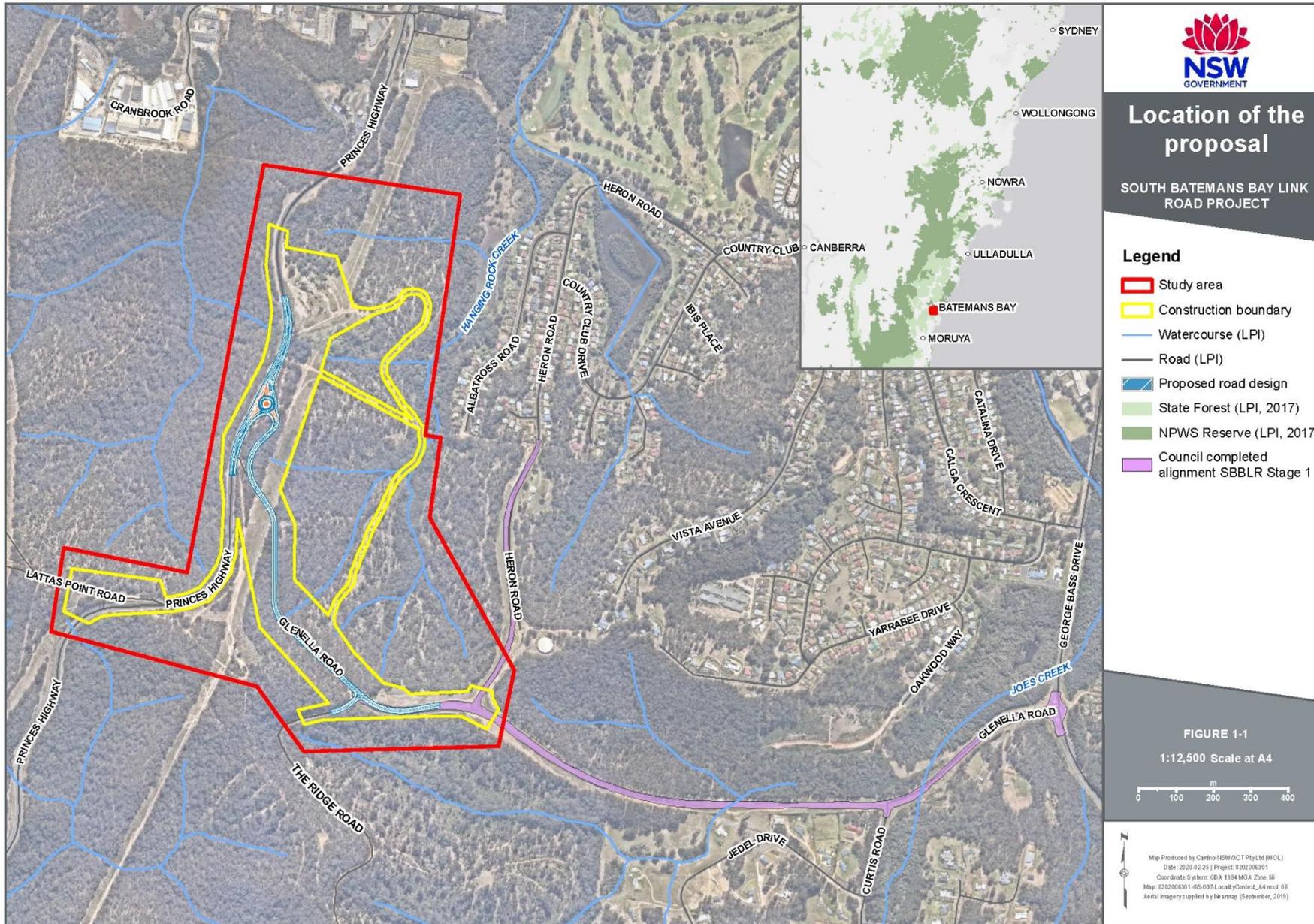


Figure 1-1: Location of the proposal

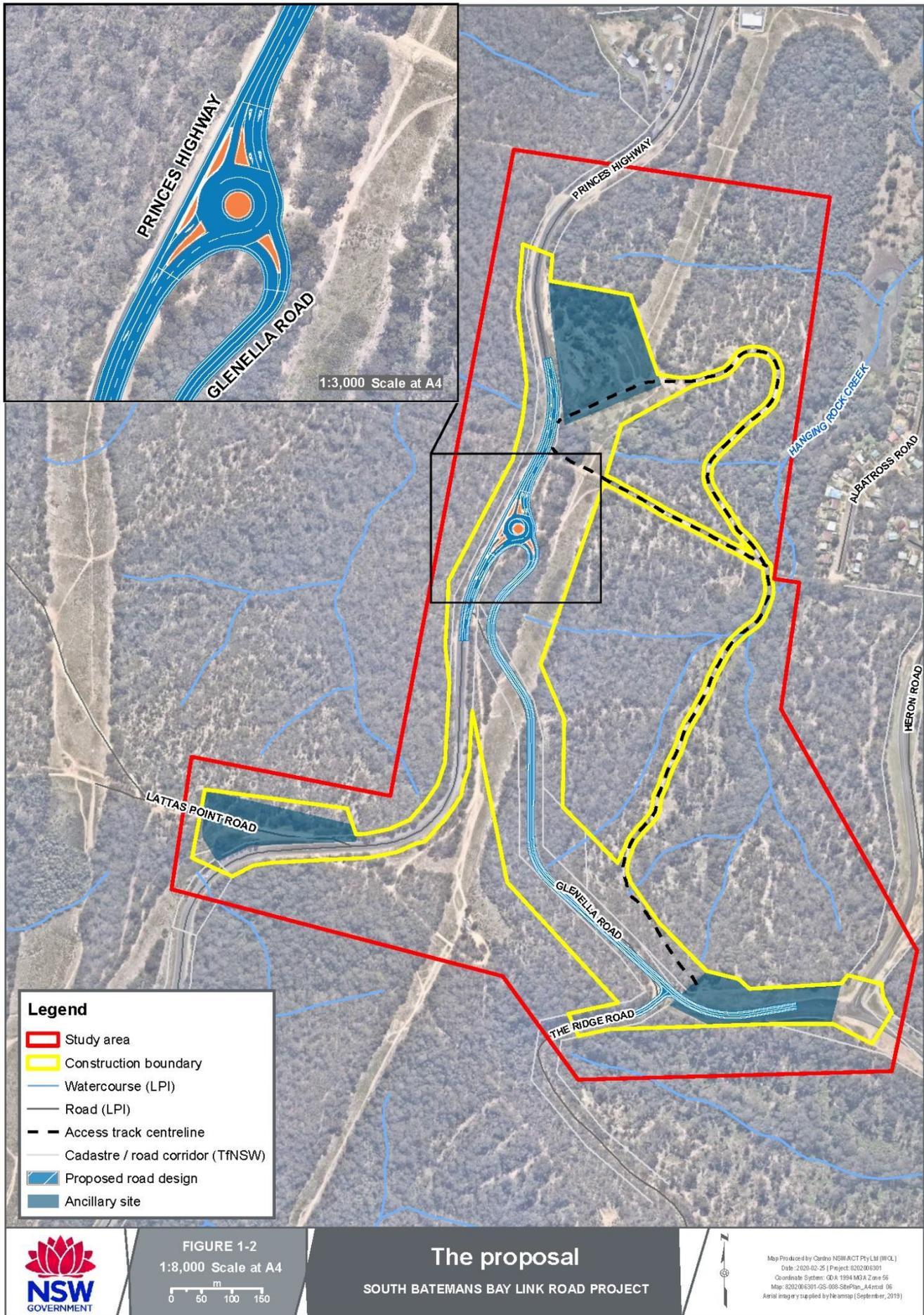


Figure 1-2: The proposal

1.2 Purpose of the report

This Biodiversity Assessment Report has been prepared by Umwelt (Australia) Pty Ltd on behalf of Transport for NSW. For the purposes of these works, Transport for NSW is the proponent and the determining authority under Division 5.1 of the EP&A Act.

The purpose of the Biodiversity Assessment Report is to describe the existing ecological context, to document the likely impacts of the proposal on native vegetation, flora and fauna present or assessed as likely to occur within the construction boundary and to recommend mitigation and management measures to be implemented to manage potential impacts on biodiversity.

The description of the proposed work and assessment of associated environmental impacts has been undertaken in the context of clause 228 of the Environmental Planning and Assessment Regulation 2000, the factors in Is an EIS Required? Best Practice Guidelines for Part 5 of the Environmental Planning and Assessment Act 1979 (Is an EIS required? guidelines) (DUAP, 1995/1996), Roads and Related Facilities EIS Guideline (DUAP, 1996), the *Biodiversity Conservation Act 2016* (BC Act), the *Fisheries Management Act 1994* (FM Act) and the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

1.3 Legislative context

A Review of Environmental Factors (REF) is prepared to satisfy Transport for NSW duties under s.5.5 of the EP&A Act to “examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity” and s.5.5 in making decisions on the likely significance of any environmental impacts. This biodiversity impact assessment forms part of the REF being prepared for the proposal and assesses the biodiversity impacts of the proposal to meet the requirements of the EP&A Act.

Sections 7.2A of the BC Act and Part 7A of the FM Act require that the significance of the impact on threatened species and threatened ecological communities is assessed using a five-part test. Where a significant impact is likely to occur, a species impact statement (SIS) must be prepared in accordance with the Director-General's requirements or a Biodiversity Development Assessment Report (BDAR) must be prepared by an accredited assessor in accordance with the Biodiversity Assessment Method (BAM).

In September 2015, a “strategic assessment” approval was granted by the Federal Minister in accordance with the EPBC Act. The approval applies to Transport for NSW activities being assessed under Division 5.1 (formerly Part 5) of the EP&A Act with respect to potential impacts on nationally listed threatened species, ecological communities and migratory species. As a result, Transport for NSW proposals assessed via a REF:

- Must address and consider potential impacts on nationally listed threatened species, populations, ecological communities and migratory species, including application of the “avoid, minimise, mitigate and offset” hierarchy.
- Do not require referral to the DoEE for these matters, even if the activity is likely to have a significant impact.

To assist with this, assessments are required in accordance with the Matters of National Environmental Significance: Significant impact guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999 (DoE, 2013).

2 Methods

2.1 Personnel

Table 2.1 provides a list of personnel involved in the assessments and an overview of the qualifications and experience.

Table 2.1 Qualifications of participating personnel

Personnel Name / Years Experience	Job Title	Qualification
Travis Peake 25 years	National Ecology Leader	<ul style="list-style-type: none"> • Bachelor of Natural Resources (Hons) • NSW Framework for Biodiversity Assessment (FBA), Biobanking and BioCertification Accredited Assessor (Assessor No. 0020) • NSW BAM Accredited Assessor (Assessor No. 17081) • Environmental Expert Professional Development Course – EIANZ • Associate Professional Certificate in Expert Evidence for Land and Environment Court
David Moore 11 years	Principal Ecologist	<ul style="list-style-type: none"> • Master of Environmental Management and Development • Bachelor of Science (Hons) • NSW BAM Accredited Assessor (Assessor No. 18066) • Certified Environmental Practitioner (CEnvP)
Jonathan Carr 8 years	Senior Ecologist	<ul style="list-style-type: none"> • Bachelor of Environmental Science and Management • NSW BAM Accredited Assessor (Assessor No. BAAS18009)
Philippa Fagan 6 years	Ecologist	<ul style="list-style-type: none"> • Bachelor of Biodiversity and Conservation • Master of Environmental and Business Management • Cert 3 in Conservation and Land Management • NSW BAM Accredited Assessor (Assessor No. BAAS18117).

Personnel Name / Years Experience	Job Title	Qualification
Natasha Crook 8 years	Ecologist	<ul style="list-style-type: none"> • Master of Environmental Management and Development • Bachelor of Science (Hons) • NSW BAM Accredited Assessor (Assessor No. 18043)
Mark Allen 3 years	Ecologist	<ul style="list-style-type: none"> • Bachelor of Science (Resource and Environmental Management) with Honours
Luke Richmond 1 year	Graduate Ecologist	<ul style="list-style-type: none"> • Bachelor of Applied Ecology (Honours)

2.2 Background research

2.2.1 Desktop review

A desktop assessment was performed prior to conducting the field assessment to inform the methodology and gain an understanding of the presence or likelihood of occurrence in the study area (shown in Figure 1-2) of:

- Threatened and protected terrestrial and aquatic flora and fauna species and their habitat
- Threatened populations
- Threatened ecological communities
- Important habitat for migratory species
- Areas of outstanding biodiversity value.

Database and spatial searches were conducted with a minimum search area of 10 square km around the study area. Databases searched and access dates and search areas where applicable, are listed in Table 3.1.

Aerial imagery of the study area and surrounding locality were reviewed to gain an appreciation of the extent of vegetation communities within and adjacent to it. In addition, a literature review was conducted, with the following available relevant documentation and mapping resources studied:

- Proposed A1 Princes Highway – South Batemans Bay Link Road Junction: Preliminary Environmental Investigation: Biodiversity Assessment (Jacobs, 2015)
- Batemans Bay Bypass – Stage 2: Threatened Species Assessment (NGH Environmental, 2005)
- Native Vegetation of Southeast NSW: A Revised Classification and Map for the Coast and Eastern Tablelands (Tozer et al., 2010)

- South Batemans Bay Link Road Minor Works Preliminary Biodiversity Investigation (Roads and Maritime, 2019)
- Compilation Map: Biometric Vegetation Types of the Shoalhaven, Eurobodalla and Bega Valley Local Government Areas. Version 2.1. VIS_ID 3900 (OEH, 2013)
- Southern Integrated Forestry Operations Approval (IFOA) – Compartment 137, 138, 139, Mogo State Forest, Batemans Bay Management Area Harvesting Plan (Forestry Corporation, 2016)
- Southern Region – Compartment 151, Mogo State Forest, South Coast Management Area Harvesting Plan (Forestry Corporation, 2012).

Table 3.1 Database searches

Database	Date Accessed	Search Area	Comment
NSW Office of Environment and Heritage (OEH) Datasets			
BioNet- the website for the Atlas of NSW Wildlife and Threatened Biodiversity Data Collection (TBDC) http://www.bionet.nsw.gov.au/	8 November 2019	10 km x 10 km	Threatened species records formed the basis of the habitat assessment. Threatened species habitat requirements, spatial constraints and associated vegetation types recorded in the TBDC were used to inform habitat assessment in the study area. A total of 25 threatened species listed under the BC Act were identified in the OEH BioNet search as potentially occurring within this search area.
OEH vegetation information system (VIS) database http://www.environment.nsw.gov.au/NSWVCA20PRapp/LoginPR.aspx	8 November 2019	N/A	VIS system data, including PCT profiles and the PCT identification tool, reviewed to assist in identification PCTs and threatened ecological communities (TECs).
NSW Office of Environment and Heritage (OEH) Vegetation Types Database: http://www.environment.nsw.gov.au/projects/BiometricTool.htm	8 November 2019	N/A	Archived datasets. Current data available in the Biodiversity Conservation Division (BCD) vegetation information system (VIS) database was used in preference.

Database	Date Accessed	Search Area	Comment
NSW Department of Primary Industries (DPI) Datasets			
NSW DPI Fisheries Fish Records Viewer https://www.dpi.nsw.gov.au/about-us/science-and-research/spatial-data-portal	11 November 2019	10 km x 10 km	Consideration of fish distribution data. NSW Estuarine Macrophytes and NSW Marine Protected Areas Downstream.
DPI's database for threatened aquatic species and communities https://www.dpi.nsw.gov.au/fishing/threatened-species/what-current	11 November 2019	10 km x 10 km	Consideration of fish distribution and habitat requirements. No threatened aquatic species or communities listed under the FM Act were identified within the study area.
Commonwealth Datasets			
The DoEE's Protected Matters Search Tool (PMST): http://environment.gov.au/erin/ert/epbc/index.html	12 November 2019	10 km x 10 km	A total of six threatened ecological communities, 67 threatened species and 57 migratory species listed under the EPBC Act were identified in the PMST search as having the potential to occur within 10 km of the study area.
The federal Bureau of Meteorology's Atlas of Groundwater Dependent Ecosystems (GDE): http://www.bom.gov.au/water/groundwater/gde/map.shtml	11 November 2019	10 km x 10 km	Potential aquatic and terrestrial GDEs were identified in the search area. The study area is located in the Clyde River Unregulated and Alluvial Water Sources groundwater management areas. No subterranean GDEs were identified. The study area includes Hanging Rock Creek, identified as a potential aquatic GDE and has moderate to high likelihood of supporting terrestrial GDEs.
DoEEs directory of important wetlands: http://www.environment.gov.au/cgi-bin/wetlands/search.pl?smode=DOIW	11 November 2019	10 km x 10 km	The Clyde River Estuary, a Nationally Important Wetland is located 2.3 km north-west and north-east of the study area.

Database	Date Accessed	Search Area	Comment
Other NSW Datasets			
SEED datasets https://datasets.seed.nsw.gov.au	11 November 2019	10 km x 10 km	Publicly available vegetation mapping was obtained from the SEED datasets including Biometric vegetation types of the Shoalhaven, Eurobodalla and Bega Valley local government areas. Version 2.1. VIS_ID 3900 and Southeast NSW Native Vegetation Classification and Mapping - SCIVI. VIS_ID 2230.
Coastal management areas identified by the Coastal Management SEPP http://webmap.environment.nsw.gov.au/PlanningHtml5Viewer/?viewer=SEPP_CoastalManagement	11 November 2019	10 km x 10 km	A small portion of north-west corner of the study area is mapped as a “Coastal Environment Area” under the Coastal Management State Environmental Planning policy (SEPP). Consideration of relevant clauses within the SEPP is required for works within the Coastal Environment Area. The proposal does not include any works within this mapped area.
Areas of outstanding biodiversity value (critical habitat): https://www.environment.nsw.gov.au/criticalhabitat/CriticalHabitatProtectionByDoctype.htm	11 November 2019	10 km x 10 km	No mapped areas of outstanding biodiversity value (critical habitat) are present in or near study area.
Department of Planning and Environment’s Biodiversity Values Map https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BOSETMap	11 November 2019	10 km x 10 km	The Hanging Rock Creek drainage line is identified on the Biodiversity Values Map within the study area. There is a small overlap between the area identified in the Biodiversity Values Map and the study area.

2.2.2 Digital aerial photograph interpretation

Digital imagery (aerial photographs) of the study area was viewed prior to and after vegetation surveys to identify spatial patterns in vegetation, land use and landscape features. These informed field survey design, ecological assessment and vegetation community mapping of the study area.

Vegetation communities in the study area were mapped on-screen overlaying the April 2010 aerial imagery sourced from SixMaps NSW. Mapping was undertaken using QGIS 3.8. Use of GIS allowed zooming in to a relatively large scale. Generally, the minimum mapping unit for a vegetation zone was 0.1 hectare.

2.3 Habitat assessment

A habitat assessment table was completed to assess the likelihood of each threatened species, population or ecological community (threatened biodiversity) identified with the potential to occur in the study area. This habitat assessment considered the results of the database records, spatial searches and literature review. Threatened species meeting the following criteria in the study area were included in the habitat assessment:

- The species is known or predicted to occur within the (IBRA) subregion
- The species is associated with a Plant Community Type (PCT) identified in the study area
- The study area meets the native vegetation cover criteria and minimum patch size for the species
- The study area contains any geographic constraints associated with the species
- The study area contains any habitat constraints associated with the occurrence of the threatened species
- Past records of the species occur in the study area.

Marine obligate species were excluded from the habitat assessment.

Threatened species, populations and ecological communities were assigned to a category to signify their likely occurrence based on the presence, condition and type of habitat in the study area and previous records in the locality, taking into consideration the habitat profile for the species and any other habitat information in the TBDC. The categories used in the habitat assessment follow those defined in the Transport for NSW Preliminary Biodiversity Investigation template and are described in Appendix C.

The habitat assessment was revisited after the surveys were completed and habitat components confirmed in the study area. Both initial and revised habitat assessment values are reported. The habitat assessments were based on information collected prior to the 2019 – 2020 fires and were retained on the basis that habitat has the potential to recover in the long term.

Table 2.2 Likelihood of occurrence criteria

Likelihood	Criteria
Recorded	The species was observed in the study area during the current survey.
High	It is highly likely that a species inhabits the study area and is dependent on identified suitable habitat (i.e. for breeding or important life cycle periods such as winter flowering resources), has been recorded recently in the locality (10km) and is known or likely to maintain resident populations in the study area. Also includes species known or likely to visit the study area during regular seasonal movements or migration.
Moderate	Potential habitat is present in the study area. Species unlikely to maintain sedentary populations, however may seasonally use resources within the study area opportunistically or during migration. The species is unlikely to be dependent (i.e. for breeding or important life cycle periods such as winter flowering resources) on habitat within the study area, or habitat is in a modified or degraded state. Includes cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded.
Low	It is unlikely that the species inhabits the study area and has not been recorded recently in the locality (10 km). It may be an occasional visitor but habitat similar to the study area is widely distributed in the local area, meaning that the species is not dependent (i.e. for breeding or important life cycle periods such as winter flowering resources) on available habitat. Specific habitat is not present in the study area or the species are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded.
None	<p>Suitable habitat is absent from the study area.</p> <p>Based on a field assessment of the habitat constraints or microhabitats on the study area, the habitat is identified as being substantially degraded such that the species is unlikely to utilise the study area (or specific vegetation zones), or an expert report that is prepared that states the species is unlikely to be present on the study area or specific vegetation zones.</p>

2.4 Field survey

Field surveys were undertaken in the study area, with a focus on areas within the construction boundary to ground-truth the results of the background research and habitat assessment. Field surveys comprised:

- Vegetation surveys (Section 2.4.1)
- Targeted flora surveys (Section 2.4.2)
- Targeted fauna surveys (Section 2.4.3)
- Aquatic habitat surveys (Section 2.4.4)
- Post-fire inspection (Section 2.4.6).

Dates and weather conditions for all surveys are summarised in Section 2.4.5. Survey limitations and departures from survey guidelines are provided in Section 2.4.7. All floristic and targeted threatened flora and fauna surveys were completed prior to wildfire, with the exception of the second camera trap survey for terrestrial mammals for which all cameras and associated data were lost in the fire. Associated limitations are discussed in Section 2.4.7.

All information in this report is provided based on the condition of vegetation communities and threatened flora and fauna habitat prior to bushfires burning the study area in late December 2019 and early January 2020. A brief post-fire inspection was completed to collect information on burn intensity to enable consideration of potential fire impacts in final tests of significance.

2.4.1 Vegetation surveys

Preliminary vegetation community mapping was completed 26 – 30 August 2019. Detailed vegetation mapping and detailed vegetation surveys were completed between 22 – 24 October 2019 and 18 – 20 November 2019.

Vegetation mapping and vegetation integrity surveys were completed in line with the Biodiversity Assessment Method (BAM) (OEH, 2017) (see Section 5 of the BAM).

Vegetation Community Mapping

Vegetation community mapping was undertaken using best-practice techniques to delineate vegetation communities across the study area. Vegetation mapping involved the following key steps:

- Review of existing regional vegetation mapping of the study area
- Review of digital airborne imagery to explore vegetation distribution patterns as dictated by change in canopy texture, tone and colour, as well as topography
- Preparation of a draft vegetation community map based on interpretation of digital airborne imagery
- Ground-truthing of the vegetation map as part of detailed flora surveys
- Revision of vegetation map based on vegetation integrity plots, rapid vegetation assessment points and meandering transects.

Vegetation communities were delineated through the identification of repeating patterns of plant species assemblages in each of the identified strata. Vegetation communities were stratified into vegetation zones based in the study area conditions and characteristics. Areas of non-native vegetation were identified and mapped.

Plant Community Type (PCT) Allocation

Each of the vegetation communities described within the study area were aligned with an equivalent PCT as detailed in the VIS Classification Database (OEH, 2019c). For each vegetation community described in the study area, the dominant and characteristic species were compared to the PCT descriptions. The profiles for each of the possible PCTs were then interrogated and the most appropriate PCT was assigned based on floristic, structure, soil, landform and distribution details.

Vegetation Integrity Surveys

Vegetation integrity plots were completed in accordance with the BAM (OEH, 2017) to assist in PCT identification and permit calculation of vegetation integrity scores.

Plot-based full floristic survey was completed, based on a nested 20 metre x 50 metre quadrat layout, in line with Section 5.0 of the BAM (OEH, 2017). Plots were completed over six days in October (22 – 24) and November (18 – 20) 2019. Plot data and locations were collected using ESRI Survey123 for Arc and location data was recorded with a general accuracy of \pm five metres.

A total of 15 vegetation integrity plots were conducted across the study area during the surveys undertaken for this assessment. The location of full floristic plots, including plot labels, in each vegetation zone is shown in Figure 2-1. The minimum floristic plot survey effort for each native vegetation zone required by the BAM was met (Table 2.3). Vegetation integrity plots were not completed for areas of exotic vegetation in the roadside batters due to safety considerations. For vegetation zones present in the study area but absent from the construction boundary, a single plot was completed to aid with PCT identification and assessment against TEC condition thresholds.

At each vegetation integrity plot, about 45 to 60 minutes was spent searching for all vascular flora species present within the 20 x 20 metre plot. Searches of each 20 x 20 metre plot were generally undertaken through parallel transects from one side of the plot to another. Most effort was spent on examining the groundcover, which usually supported well over half of the species present. The composition of any shrub, mid-storey, canopy and emergent layers were also recorded.

For each flora species recorded in the vegetation integrity plot, the following data was collected in accordance with Table 2 of the BAM (OEH, 2017):

- Stratum/layer in which the species occurs
- Growth form
- Scientific name and common name
- Cover
- Abundance.

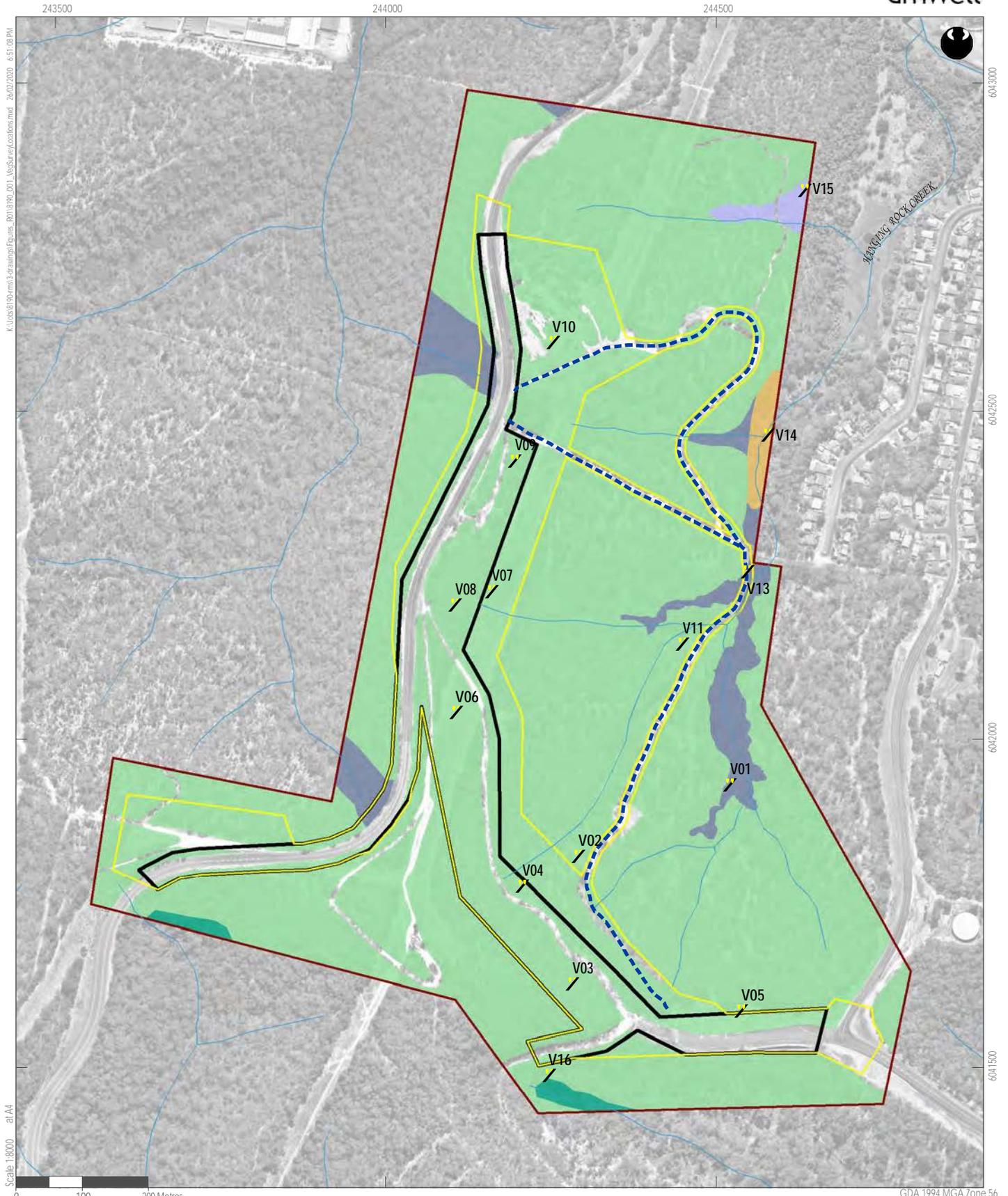
At each vegetation integrity plot the following attributes were also recorded in accordance with the BAM (OEH, 2017):

- **Composition** – native plant species richness by growth form (within the 20 x 20 metre plot)
- **Structure** – estimate foliage cover of native and exotic species by growth form (within the 20 x 20 metre plot)
- **Function** – (within the 20 x 50 metre plot) including number of large trees, presence or otherwise of tree stem size classes, presence or otherwise of canopy species regeneration, length of fallen logs, percentage cover for litter (recorded from five 1 x 1 metre plots), number of trees with hollows and high threat exotic plant cover.

Plant Identification and Nomenclature Standards

All vascular plants recorded or collected within vegetation integrity plots and rapid vegetation assessment points were identified using keys and nomenclature in Harden (1992, 1993, 2000 and 2002). Where known, changes to nomenclature and classification have been incorporated into the results. Updated taxonomy has been derived from PlantNET (Botanic Gardens Trust 2019).

Common names used follow Harden (1992, 1993, 2000 and 2002) where available and draw on other sources such as local names where these references do not provide a common name.



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Scale 1:8000 at A4

GDA 1994 MGA Zone 56

Legend

- Study Area
- Construction Boundary
- Operation Boundary
- Access Tracks
- Watercourses
- BAM Plot Locations

- Vegetation Communities**
- 1206: Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion
 - 1220: Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion
 - 1232: Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion
 - 1326: Woollybutt - White Stringybark - Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion
 - 877: Grey Myrtle dry rainforest of the Sydney Basin Bioregion and South East Corner Bioregion

FIGURE 2-1

Vegetation survey locations

Table 2.3 Full floristic plot survey effort by vegetation zone

Zone	PCT	Condition Class	Area in study area (ha)	Area in construction boundary (ha)	Number of Vegetation Integrity Plots Required	Number of Vegetation Integrity Plots Completed	Plot label
1	1206 Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion	High	4.22	0.37	1	2	V01, V13
2	1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion	High	50.19	13.25	3	4	V03, V04, V08, V09
3	1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion	Degraded grassland	1.96	1.95	1	1	V10

Zone	PCT	Condition Class	Area in study area (ha)	Area in construction boundary (ha)	Number of Vegetation Integrity Plots Required	Number of Vegetation Integrity Plots Completed	Plot label
4	1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion	Derived grassland	6.90	3.89	2	2	V06, V07
5	1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion	Degraded forest	26.17	2.33	2	2	V02, V11
6	1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion	Plantings	1.12	0.89	1	1	V05
7	877 Grey Myrtle dry rainforest of the Sydney Basin Bioregion and South East Corner Bioregion	High	0.58	0.00	0	1	P16

Zone	PCT	Condition Class	Area in study area (ha)	Area in construction boundary (ha)	Number of Vegetation Integrity Plots Required	Number of Vegetation Integrity Plots Completed	Plot label
8	1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion	High	0.50	0.00	0	1	V15
9	1326 Woollybutt - White Stringybark - Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion	High	0.61	0.00	0	1	V14
Road Batter	Exotic	N/A	2.36	1.34	1	0	N/A
Unvegetated	N/A	N/A	8.69	7.15	N/A	0	N/A

2.4.2 Targeted flora surveys

Threatened flora surveys were undertaken in accordance with the NSW *Guideline for surveying threatened plants* (OEH, 2016) and the *Draft survey guidelines for Australia's threatened orchids* (DOE, 2013) on 24 October 2019, between 18 and 20 November 2019 and on 16 and 17 December 2019.

Targeted surveys were completed for five threatened flora species identified as having a moderate to high likelihood of occurring and having potential habitat in the construction boundary. These included:

- Three threatened shrubs - surveys completed on 24 October 2019 and between 18 and 20 November 2019:
 - chefs cap correa (*Correa baeuerlenii*, *Vulnerable - BC Act and EPBC Act*)
 - Bodalla pomaderris (*Pomaderris bodalla*, *Vulnerable - BC Act*)
 - scrub turpentine (*Rhodamnia rubescens*, *Critically Endangered - BC Act*).
- Two cryptic orchid species:
 - leafless tongue-orchid (*Cryptostylis hunteriana*, *Vulnerable - BC Act and EPBC Act*) completed on 16 and 17 December 2019
 - east Lynne midge orchid (*Genoplesium vernale*, *Vulnerable - BC Act and EPBC Act*) completed between 18 and 20 November 2019.

Surveys were completed by applying a systematic transect approach. Surveys for cryptic orchids were conducted at a spacing of about 10 metres, whereas surveys for non-cryptic shrub species were completed at a spacing of about 20 metres. Survey timing was determined with reference to the TBDC and following confirmation of flowering at local reference sites prior to commencement of surveys.

Targeted surveys for chefs cap correa, East Lynne midge orchid and leafless tongue orchid were completed throughout the construction boundary (Figure 2-2). Potential habitat for Bodalla pomaderris and scrub turpentine was restricted to riparian areas. Targeted surveys for Bodalla pomaderris and scrub turpentine (Figure 2-2) were carried out in the study area based on a preliminary construction boundary (*not shown*) which included potential habitat along drainage lines in the headwaters of Hanging Rock Creek. Subsequent refinement of the Construction boundary meant that potential habitat for Bodalla pomaderris and scrub turpentine was excluded from the construction boundary (Figure 2-2). All surveys for threatened flora were completed within the required survey periods.

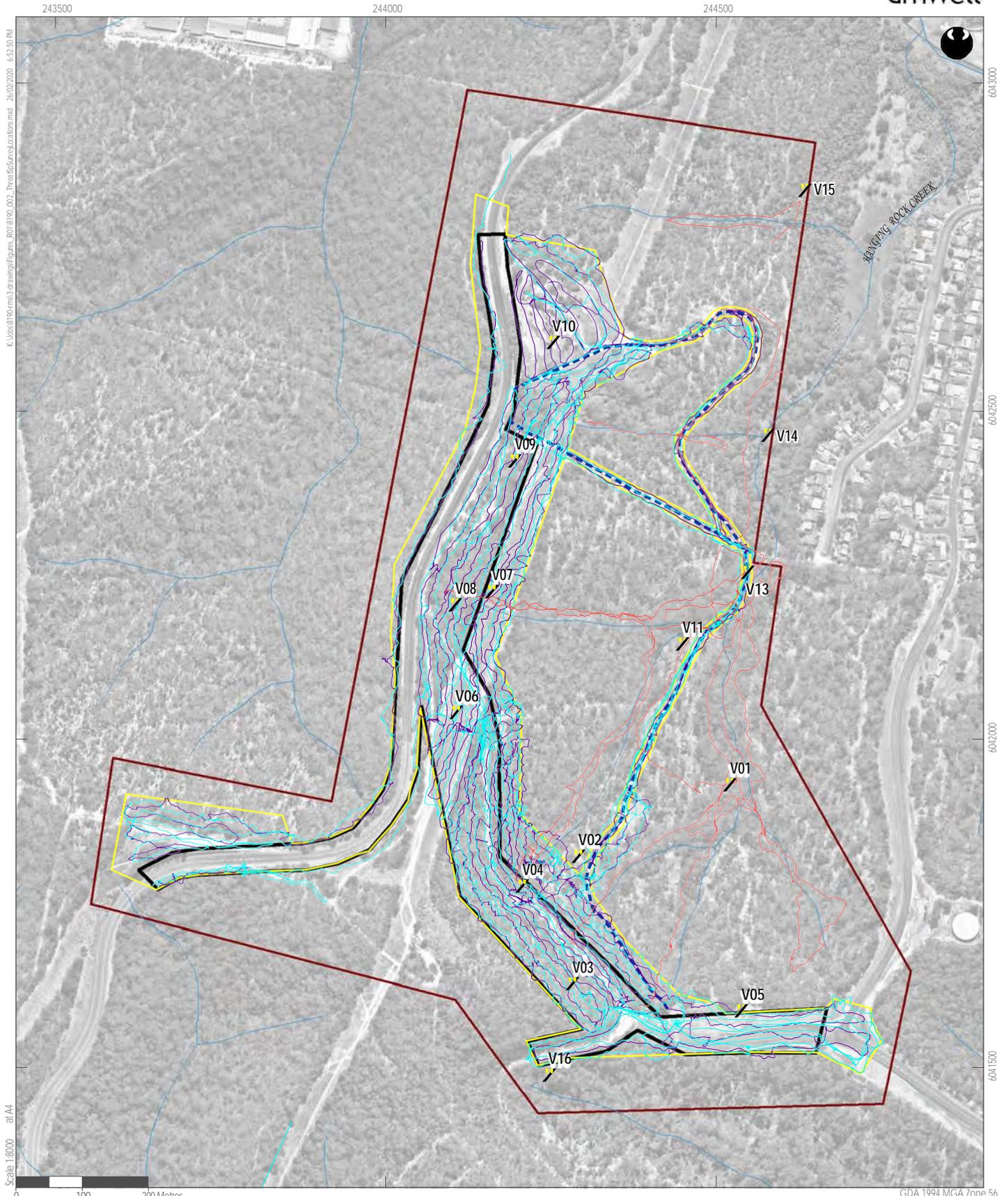
Surveys for East Lynne midge orchid were completed following confirmation of flowering by the survey team near Maidens Road in Murramarang National Park on 18 November 2019. Advice from John Briggs (DPIE) indicated poor flowering due to drought; however, plants flowering and in fruit were detectable at the time of survey.

Surveys for leafless tongue orchid were completed following confirmation of flowering by the survey team at the Erowal Bay Heritage Estate on 16 December 2019, with budding reported commencing in late November. The reference site at Meroo National Park had been impacted by fire at the time of survey and was not accessible.

The location of threatened flora transects completed for each survey period and demonstrating site coverage, are shown in Figure 2-2.

No threatened flora species were detected during detailed survey of floristic composition at the vegetation integrity plots completed in each vegetation zone (Figure 2-1). A summary of

threatened flora survey effort is provided in (Section 2.4.7). Surveys were completed in severe drought conditions, with unseasonably low winter rainfall.



Legend

- Study Area
 - Construction Boundary
 - Operation Boundary
 - ↗ BAM Plot Locations
 - Access Tracks
 - ~ Watercourses
-
- Threatened Flora Transects
 - Survey 1 (23 to 24 October 2019)
 - Survey 2 (18 to 20 November 2019)
 - Survey 3 (16 to 17 December 2019)

FIGURE 2-2

Threatened flora species survey locations

2.4.3 Targeted fauna surveys

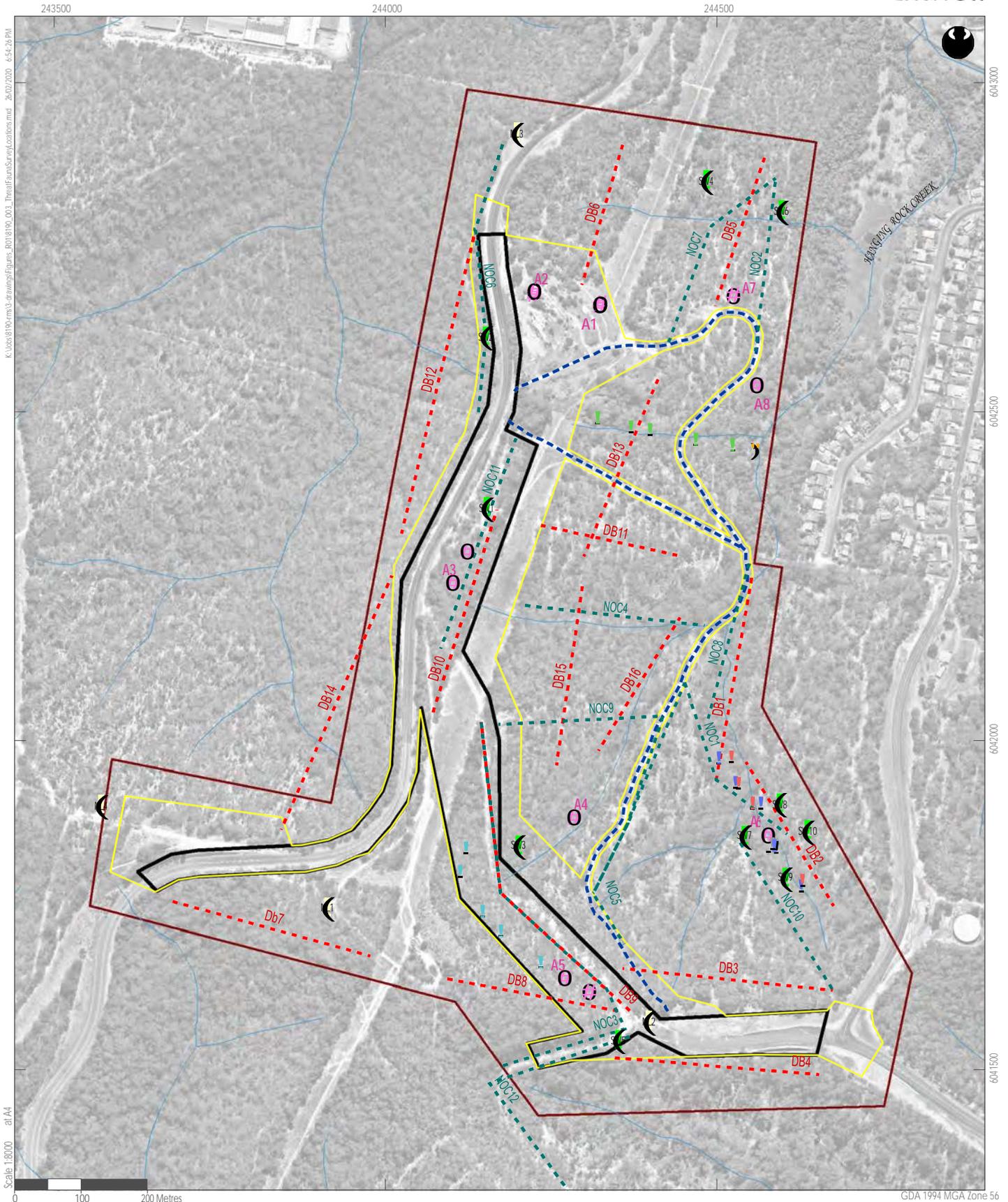
Threatened fauna surveys were completed during appropriate seasonal conditions between August 2019 and November 2019 as follows:

- Targeted habitat surveys to identify habitat constraints for target fauna as identified in the TBDC (DPIE, 2019), completed between 26 August and 30 August 2019
- Diurnal bird surveys targeting swift parrot (*Lathamus discolor*), completed between 26 August and 3 September 2019
- Roost and nest tree searches for forest owls and large parrots, completed between 26 August and 30 August 2019
- Stag-watch surveys for forest owls and arboreal mammals, completed between 26 August and 3 September 2019
- Nocturnal surveys for forest owls and both terrestrial and arboreal mammals, completed between 26 August and 3 September 2019
- Camera trapping for terrestrial and arboreal mammals completed over one survey period between 23 October and 7 November 2019. A second camera trap survey for terrestrial mammals was commenced on 16 December 2019. However, all cameras and associated data were lost in bushfires in early January. Associated limitations are discussed in Section 2.4.7.
- Ultrasonic micro-bat surveys completed on two occasions between 23 and 24 October 2019 and between 19 November and 16 December 2019
- Grey-headed flying-fox (*Pteropus poliocephalus*) roost surveys completed on two occasions between 23 October and 20 November 2019
- Koala (*Phascolarctos cinereus*) habitat assessment completed between 23 October and 16 December 2019.

A summary of survey dates and weather conditions is provided in 2.4.5. A summary of threatened fauna survey effort is provided in (Section 2.4.7). Survey locations are shown in Figure 2-3.

The above surveys were planned and conducted with reference to the relevant NSW and Commonwealth Survey guidelines, including the Survey Guidelines for Australia's Threatened Bats (Commonwealth of Australia, 2010a), Survey Guidelines for Australia's Threatened Birds (Commonwealth of Australia, 2010b), Survey Guidelines for Australia's Threatened Mammals (Commonwealth of Australia, 2011), 'Species credit' threatened bats and their habitats (OEH, 2018) and habitat constraint and survey data available on the TBDC (DPIE, 2019). No surveys were completed for threatened amphibians as no species were assessed as having a moderate to high likelihood of occurrence.

During all surveys, observers recorded any incidental records or evidence of threatened fauna activity observed. Additional detail regarding the methods completed, including weather conditions for each survey component is provided in the following sections. Weather condition data is derived from the Batemans Bay – Catalina weather station (069134) from the Bureau of Meteorology where available or alternatively from the Moruya Heads Pilot Station (069018) (BOM, 2019).



Legend

- | | | |
|-----------------------|-------------------------------|--------------------------------|
| Study Area | Anabat Survey Locations | Camera Trap Locations |
| Construction Boundary | Koala SAT/SPOT Survey | Arboreal Camera Transect T1 |
| Operation Boundary | Diurnal Bird Transects | Terrestrial Camera Transect T2 |
| Access Tracks | Dusk stag-watch Locations | Arboreal Camera Transect T3 |
| Watercourses | Nocturnal Listening Locations | Terrestrial Camera Transect T4 |
| | Spotlight Transects | |

FIGURE 2-3

Threatened fauna species survey locations

Habitat survey

A desktop review of aerial imagery and 1:25,000 topographic maps was carried out to identify wetlands, caves and escarpments in the landscape in and surrounding the study area, which may influence habitat polygons for threatened fauna. During site inspections all key habitat features observed in the study area were recorded, with surveyors recording standing water, caves, escarpments, termite mounds and artificial structures potentially providing threatened fauna habitat or influencing threatened species polygons. Habitat structure and habitat degradation potentially influencing threatened species habitat polygons were recorded.

All observed hollow bearing trees were mapped within the construction boundary, with systematic surveys completed throughout the construction boundary to assist in assessment of potential impacts on hollow dependent fauna. In addition, hollow bearing trees with diameter, at breast height (DBH), larger than 50 centimetres and hollows larger than 10 centimetres in diameter were systematically mapped throughout the study area to assist in assessing likelihood of roosting or breeding habitat for forest owls, glossy black cockatoo (*Calyptorhynchus lathami*) and gang gang cockatoo (*Callocephalon fimbriatum*). The hollow bearing tree assessment was completed in August 2019. The post-fire inspection did not include detailed review of hollow bearing trees. While several trees supporting large and very large hollows were observed to have fallen during or following the fires, others were still standing and it is unknown what proportion survived the fire. For the purposes of the habitat assessment, it has been assumed that the habitat characteristics in the study area would recover to their pre-fire status. However, it is likely that there would be a reduction in the number of hollows available and new hollows may take 80 to 200 years to form under normal circumstances (Koch et al 2008; Gibbons and Lindenmayer 2002). The approach for the post-fire inspection is documented in Section 2.4.6.

Diurnal bird surveys

Targeted diurnal bird surveys were completed between 26 August and 4 September 2019, achieving a total of 20 hours over eight days. Surveys consisted of 20 minute timed 2 hectare transect surveys, all birds observed or heard within 50 metres were recorded along a transect about 400 metres long. All observations of threatened species were recorded. Surveys were conducted between dawn and 4 hours after dawn and within the period three hours before dusk. Sixteen transects were surveyed between two and five times. Transect locations (DB1 – DB16) are shown in Figure 2-3. All incidental observations of threatened or uncommon bird species were recorded during other survey components. To improve potential for detection of nectivorous bird species and particularly swift parrot, surveys included targeted inspection of flowering eucalypts, where detected.

Searches to identify glossy black-cockatoo potential nest trees involved listening for and tracking of adults and begging young, during the roost and nest tree searches conducted between 26 and 30 August 2019. Searches to identify gang gang cockatoo activity during the breeding season were completed throughout the construction boundary between 22 and 24 October and 18 and 20 November 2019 in conjunction with vegetation mapping, vegetation plot surveys and targeted threatened flora surveys.

During all other surveys, incidental observations of threatened diurnal birds, including notes regarding potential breeding behavior, were recorded.

Roost and nest tree searches

Roost and nest tree searches were completed in August 2019 to identify large hollow-bearing trees throughout the study area, with a focus on areas within 100 metres of the construction boundary. The bases of identified potential nest and roost trees were searched for whitewash and castings to assist in identification of potential roost or nest trees.

Between 26 and 30 August 2019, roost and nest tree searches included targeted surveys for glossy black-cockatoo breeding behaviour and forest owl potential nest trees. Targeted surveys for glossy black cockatoo nesting trees included listening for and tracking of adults and begging young during the roost and nest tree searches. Targeted searches for forest owl roost and nest trees included focusing searches on areas identified, during nocturnal surveys, as supporting forest owl activity.

Raptor stick-nest surveys were completed throughout the study area between 22 to 24 October and 18 to 20 November 2019 in conjunction with vegetation mapping, vegetation plot surveys and targeted threatened flora surveys. All gullies and watercourses in the study area were inspected by a single surveyor on foot on both occasions to determine whether flying-fox roosts were present.

Stag-watch surveys

Dusk stag-watches were completed at a total of ten locations over six nights, targeting forest owls and arboreal fauna. On four evenings between 26 and 30 August 2019, two observers conducted eight stag-watches and on two evenings on 2 and 3 September, a single observer conducted two stag-watches. The location of stag-watch surveys (SW1 – SW10) are shown in Figure 2-3.

Stag-watches were conducted at potential roost or nest trees, focussing on trees with the greatest potential identified during the nesting tree habitat search. Stag-watch vantage points were established to allow visibility of at least one and up to three potential roost or nest hollows within a 30 degree field of view. The majority of stag-watch surveys were completed outside the construction boundary in parts of the study area with the highest density of hollows and greatest potential for detection of nocturnal hollow-dwelling fauna. Each stag watch location was surveyed once.

Nocturnal surveys

Nocturnal surveys comprised both listening periods and spotlight survey transects. All spotlight transects and associated listening periods were completed by two observers between 26 and 30 August. In addition, four half hour listening vantage points were conducted on 2 and 3 September 2019 to provide additional detail on landscape usage by sooty owl following detection in the headwaters of Hanging Rock Creek. The location of spotlighting transects (NOC1 – NOC12) and listening points (NL1 – 4) are shown in Figure 2-3. Spotlighting transects and listening points were conducted in vegetation zones occurring in the construction boundary (i.e. zones 1, 2 and 5).

Listening periods were conducted for periods of five to ten minutes at the commencement of each spotlight transect. Additional listening periods were conducted at the end of each survey transect in the event that potential forest owls were detected.

Spotlight survey transects were conducted on foot by two observers with high powered (i.e. at least 200 lumen) handheld torches. Spotlight surveys were completed for a minimum

of 20 minutes at each site and up to 40 minutes per site. Spotlight surveys were completed throughout the study area but focussed on areas with a high density of hollow bearing trees.

Camera trapping

Bushnell HD remote infra-red flash cameras were deployed targeting both terrestrial and arboreal mammals. All arboreal (Arboreal Camera Transect T1 and T3) and terrestrial (Terrestrial Camera Transect T2 and T4) camera trap locations are shown in Figure 2-3. An initial round of camera trapping for terrestrial mammals was conducted for 14-15 nights at 10 sites between 23 October and 8 November 2019. Terrestrial camera transects were located in areas of the study area with high shrub and groundcover density to maximise potential for detection of southern brown bandicoot (*Isoodon obesulus obesulus*), with cameras primarily located in vegetation zones 1 and 2 on this basis. Cameras were mounted at a 45 degree to 60 degree angle from the ground, with bait stations located between 1.25 and 1.75 metres from the camera. Where possible, cameras were set up facing the base of a tree trunk or log to minimise accidental triggering. Camera traps were baited using tuna bait and balls made from universal bait (i.e. rolled oats, peanut butter and honey). Tuna bait stations were made out of punctured tuna tins securely pegged to the ground and tuna oil was distributed around the local area. Universal bait stations comprised tea infusers containing the bait ball securely pegged at two points.

A second round of terrestrial camera traps were established at 20 sites on 16 December 2019 to take into account the reduced survey effort resulting from false triggers (see Section 2.4.7 for further details) and to better meet survey effort specified in Commonwealth survey guidelines (Commonwealth of Australia, 2011) for southern brown bandicoot. Camera traps were burnt in fires on 31 December and 1 January and data was not recovered.

Camera trapping for arboreal mammals was conducted for 14-15 nights between 23 and 24 October and 8 November at 10 sites. Arboreal camera transects were located in areas of the study area with the highest density of hollow bearing trees, with cameras primarily located in vegetation zones 1 and 2 on this basis. All arboreal cameras were positioned angled at 90 degrees (horizontal) and pointing at rough barked trees between 1.5 and 2 metres above ground level. Due to the automatic triggering sensitivity malfunctioning, data was collected by some cameras for only part of the survey period. Cameras were baited using universal bait (rolled oats, peanut butter and honey) supplemented with a honey water solution. Bait stations comprised tea infusers containing the bait ball securely tied to the tree with a rope in the centre of the focal area, with honey water solution sprayed onto the tree between 2 and 4 metres above ground level using a pump action spray bottle.

Micro-bat surveys

Anabat Swift ultrasonic recording units were set up at 1 – 2 metres above ground level and angled at 45 degrees. All devices were set to record between dusk and dawn in full spectrum format. Survey locations are shown in Figure 2-3.

Anabat Swifts were set up at:

- Locations A1 to A6 for two nights between 22 and 24 October 2019
- Locations A1, A2, A3 and A5 for two nights between 18 and 20 November 2019
- Locations A7 and A8 for 27 nights in potential southern myotis habitat between 20 November 2019 and 17 December 2019; however, only four nights of data (i.e. 29 November, 4 December, 8 December and 15 December) was analysed.

Surveys at points A4 and A6 were not repeated on the second survey, as these areas were outside the construction boundary and additional survey points (i.e. A7 and A8) were required within the potential southern myotis (*Myotis macropus*) species habitat polygon.

Two units were deployed at potential artificial roosting habitat identified in the former timber mill site (A1 and A2), while the remaining units were deployed in typical habitat types elsewhere in the construction boundary.

Flying-fox roost surveys

Flying-fox roost surveys were completed throughout the study area during two distinct survey periods, between 22 to 24 October and between 18 to 20 November 2019, in conjunction with vegetation mapping, vegetation plot surveys and targeted threatened flora surveys (Figure 2-2 and Figure 2-3). All gullies and watercourses in the study area were inspected by a single surveyor on foot on both occasions to determine whether flying-fox roosts were present.

Koala habitat survey

The occurrence of primary or secondary koala (*Phascolarctos cinereus*) feed tree species was recorded to assist in identification of potential koala habitat. State Environmental Planning Policy No. 44 Koala Habitat Protection (SEPP 44) was the current legislation at the time of the surveys (October to December 2019) but was repealed from 1 March 2020 and replaced by the State Environmental Planning Policy (Koala Habitat Protection) 2019. The koala habitat survey was carried out in accordance with SEPP 44; however, implications under the Koala Habitat Protection SEPP have also been addressed.

A single Spot Assessment Technique (SAT) survey was completed in vegetation in the study area identified as having the greatest density of preferred koala feed species as specified in SEPP 44 (i.e. PCT1232). Koala scat searches were conducted around the base of 30 potential feed trees. The location of the SAT survey location (Koala SAT/SPOT Survey 1) is shown in Figure 2-3.

2.4.4 Aquatic surveys

All waterways marked on the 1:25,000 topographic map series in the study area were walked to assess key fish habitat value on 24 October 2019. The assessment route is shown in Figure 2-4. Streams were classified into assessment areas according to Strahler classification, physical hydrological and ecological characteristics (Figure 2-4).

The habitat value of each waterway (i.e. habitat sensitivity and classification of waterways for fish passage) was characterised according to criteria listed in Table 2.4 in accordance with NSW DPI (Fisheries) document Policy and Guidelines for fish habitat conservation and management (2013 update).

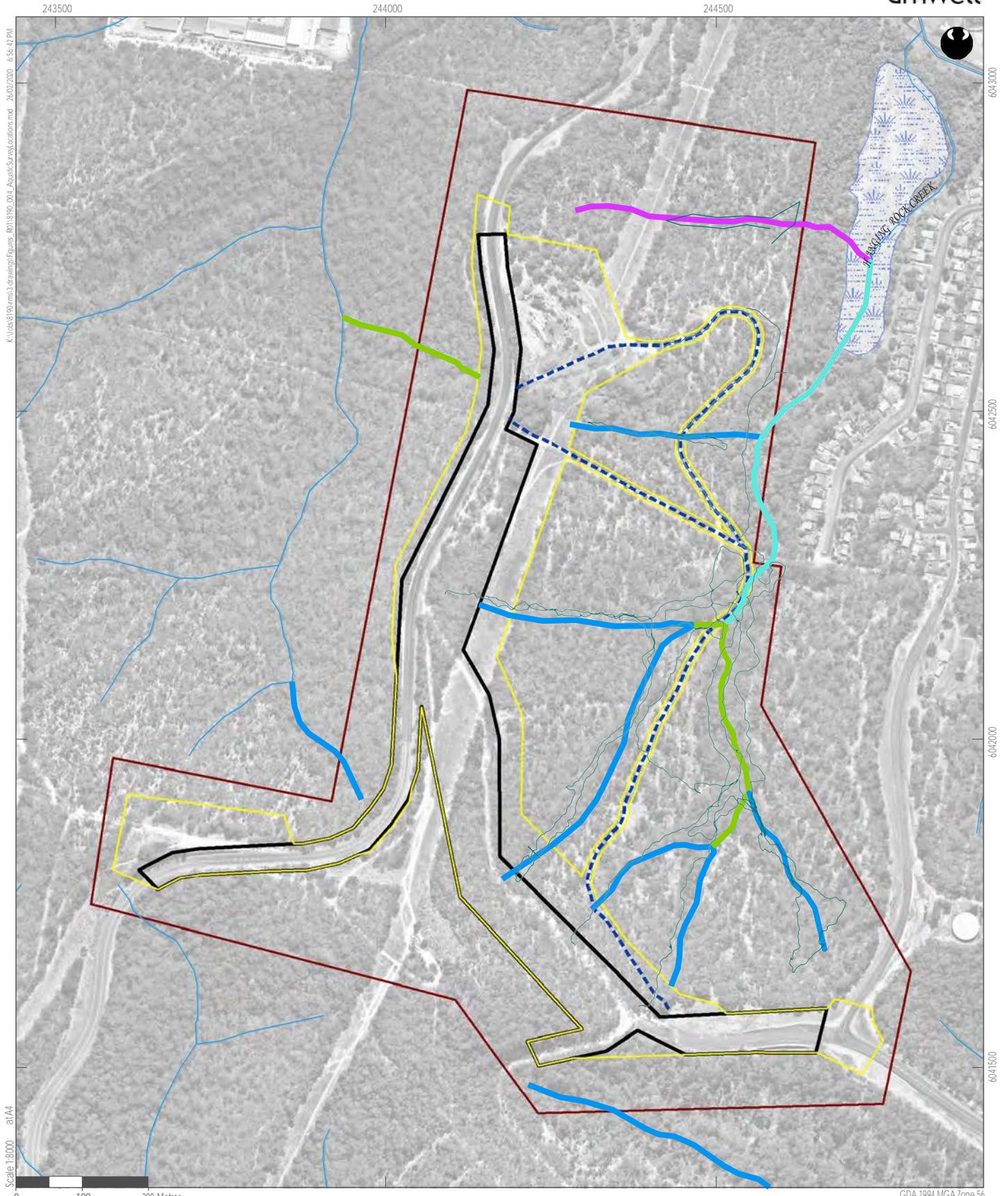
Detailed aquatic surveys are warranted if a project crosses any Class 1 watercourse (major key fish habitat) or Class 2 watercourse (moderate key fish habitat) that has been identified as having a moderate or high potential to be occupied by a threatened aquatic species or communities. The proposal does not cross any Class 1 or Class 2 watercourses (Figure 2-4). Hence, detailed aquatic surveys assessments were not completed.

Table 2.4 Classification of waterways for fish passage

Classification	Characteristics of waterway class
CLASS 1 Major key fish habitat	Marine or estuarine waterway or permanently flowing or flooded freshwater waterway (e.g. river or major creek), habitat of a threatened or protected fish species or 'critical habitat'.
CLASS 2 Moderate key fish habitat	Non-permanently flowing (intermittent) stream, creek or waterway (generally named) with clearly defined bed and banks with semi-permanent to permanent waters in pools or in connected wetland areas. Freshwater aquatic vegetation is present. TYPE 1 and 2 habitats present.
CLASS 3 Minimal key fish habitat	Named or unnamed waterway with intermittent flow and sporadic refuge, breeding or feeding areas for aquatic fauna (e.g. fish, yabbies). Semi-permanent pools form within the waterway or adjacent wetlands after a rain event. Otherwise, any minor waterway that interconnects with wetlands or other CLASS 1-3 fish habitats.
CLASS 4 Unlikely key fish habitat	Waterway (generally unnamed) with intermittent flow following rain events only, little or no defined drainage channel, little or no flow or free standing water or pools post rain events (e.g. dry gullies or shallow floodplain depressions with no aquatic flora present).

2.4.5 Weather conditions

Weather conditions for all components of the threatened species surveys are presented in Table 2.5. Weather conditions for all surveys were suitable for the detection of target species.



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Scale 1:8000 atA4

GDA 1994 MGA Zone 56

- Legend**
- Study Area
 - Construction Boundary
 - Operation Boundary
 - Access Tracks
 - Watercourses
 - Indicative Wetland Boundary
 - Aquatic Habitat Survey Route
 - Aquatic Assessment Areas
 - Area A (Habitat Class 3)
 - Zone B (Habitat Class 4)
 - Zone C (Habitat Class 4)
 - Area D (Habitat Class 3)

FIGURE 2-4
Aquatic habitat survey

Table 2.5 Weather conditions during threatened fauna surveys

Date	Survey component	Daily Data			Monthly Data		
		Min-Max Temp. (°C)	Rainfall (mm)	Relative Humidity (per cent)	Min-Max Temp (mean) (°C)	Rainfall (total) (mm)	Relative Humidity (mean) (per cent)
2019-08-26	Diurnal bird survey targeting swift parrot and glossy black cockatoo	9.5-19.8	0	70			
2019-08-27	Roost and nest tree	4.4-19.8	0	83			
2019-08-28	searches Stag-watch	4.4-19.8	0	74*			
2019-08-29	surveys Nocturnal surveys				3.7-17.8	9.0	75
	Preliminary vegetation mapping						
	Habitat surveys (including Koala habitat)	4.4-16.5	1.2	61			
2019-08-30	Diurnal bird survey	8.9-15.0	4.4	78			
2019-09-02	Diurnal bird survey	6.2-18.2	0	55			
2019-09-03	Stag-watch surveys						
	Nocturnal surveys	4.9-19.6	0	59	6.4-19.4*	44.2**	57*
2019-09-04	Diurnal bird survey	3.1-19.3	0	66			

Date	Survey component	Daily Data			Monthly Data		
		Min-Max Temp. (°C)	Rainfall (mm)	Relative Humidity (per cent)	Min-Max Temp (mean) (°C)	Rainfall (total) (mm)	Relative Humidity (mean) (per cent)
2019-10-22	Vegetation mapping	7.5-20.7	0	69			
2019-10-23	Vegetation integrity surveys	10.5-22.	0	68			
2019-10-24	Gang gang breeding habitat survey				0.0-20.0	20.0	00
	Camera setup (deployment 1)						
	Anabat surveys (deployment 1)	12.0-22.9	0	92			
	Grey-headed flying-fox roost surveys						
2019-11-07	Camera collection (deployment 1)	13.2-24.1	0	23			
2019-11-08	Habitat survey	12.6-26.6	3.2	75			
2019-11-18	Vegetation integrity surveys	9.6-27.5	0.4	70			
2019-11-19	Targeted flora surveys – <i>Genoplesium venale</i> / <i>Correa baueriana</i>	10.0-23.5	0	83	10.6-26.2	5.3	77
2019-11-20	Gang gang breeding habitat survey						
	Anabat surveys (deployment 2)	15.2-31.5	0	79			
	Grey-headed flying-fox roost surveys						

Date	Survey component	Daily Data			Monthly Data		
		Min-Max Temp. (°C)	Rainfall (mm)	Relative Humidity (per cent)	Min-Max Temp (mean) (°C)	Rainfall (total) (mm)	Relative Humidity (mean) (per cent)
2019-12-16	Targeted flora surveys – <i>Cryptostylis hunteriana</i> Camera setup (deployment 2) (<i>n.b. cameras destroyed in fire</i>)	16.7-23.9	0	70	15.4-23.4	8.4	71
2019-12-17	Targeted flora surveys – <i>Cryptostylis hunteriana</i> Koala SAT survey	14.2-20.9	0	71			

2.4.6 Post-fire inspection

A post fire inspection of the study area was completed by an ecologist on 22 January 2020. The site was inspected from along Princes Highway, Glenella Road (section formally known as part of The Ridge Road), The Ridge Road (to the south-west of the intersection with Glenella Road), Heron Road and on-site access tracks. Due to safety considerations, such as the potential for falling limbs and trees and the presence of hotspots in the landscape, the study area was not assessed outside these areas.

The following information was recorded for each stratum:

- Per cent scorch (i.e. leaf browned due to heat relative to green remaining)
- Per cent consumption (proportion of leaf matter consumed by fire)
- Scorch height (where relevant).

Due to the consistency of the burn, data was collected for the whole site, rather than divided for each vegetation zone. Comments were recorded with relation to potential impacts on fauna habitat in the construction boundary. Where accessible, photographs were taken of each vegetation zone at or near an original plot location.

On a precautionary basis, all habitat assessments are completed on the basis of the pre-fire assessment, as the study area has the potential to recover post fire. Fire impacts on habitat, along with burn intensity relative to the surrounding landscape was taken into consideration when considering the importance of habitat for significance assessments.

2.4.7 Summary of survey effort and limitations

Survey effort summary

The summarised survey effort for threatened flora survey is provided in Table 2.6 and the summarised survey effort for threatened fauna is provided in Table 2.7.

Table 2.6 Threatened flora survey effort.

Species	Common name	BC Act status	EPBC Act status	Minimum survey requirements ¹	Survey date	Reference population checked (if applicable)	Survey effort completed
<i>Correa baeuerlenii</i>	chef's cap correa	V	V	Transects 10 - 20 metres apart within suitable habitat in accordance with the NSW Guide to Surveying Threatened Plants during any month of the year.	24 October 18 – 20 November	Not applicable	Transects 10 - 20 metres apart completed throughout the construction boundary (Figure 2-2)
<i>Cryptostylis hunteriana</i>	leafless tongue-orchid	V	V	Transects 10 metres apart within suitable habitat in accordance with the NSW Guide to Surveying Threatened Plants during Nov-Feb.	16 and 17 December	Budding stems detected at Vincentia approx. 19 November 2019. Consistent flowering predicted by experts to be from mid-December onwards. Flowering and visibility confirmed by the survey team on 16 December at the Old Erowal Bay Heritage Estate reference site.	Transects ~10 metres apart completed throughout the construction boundary (Figure 2-2)

Species	Common name	BC Act status	EPBC Act status	Minimum survey requirements ¹	Survey date	Reference population checked (if applicable)	Survey effort completed
<i>Genoplesium vernale</i>	East Lynne midge-orchid	V	V	Transects 10 metres apart within suitable habitat in accordance with the NSW Guide to Surveying Threatened Plants during Nov-Dec.	18 – 20 November	Flowering and visibility confirmed by the survey team on 18 November 2019 at East Lynne reference site.	Transects 10 - 20 metres apart completed throughout the construction boundary (Figure 2-2)
<i>Pomaderris bodalla</i>	Bodalla pomaderris	V	-	Transects 10 - 20 metres apart within suitable habitat in accordance with the NSW Guide to Surveying Threatened Plants during any month of the year.	24 October 18 – 20 November	N/A	Transects 10 - 20 metres apart completed in suitable habitat in the construction boundary and along riparian zones in the study area (Figure 2-2)
<i>Rhodamnia rubescens</i>	scrub turpentine	CE	-	Transects 10 - 20 metres apart within suitable habitat in accordance with the NSW Guide to Surveying Threatened Plants during any month of the year.	24 October 18 – 20 November	N/A	Transects 10 - 20 metres apart completed in suitable habitat in the construction boundary and along riparian zones in the study area (Figure 2-2)

Species	Common name	BC Act status	EPBC Act status	Minimum survey requirements ¹	Survey date	Reference population checked (if applicable)	Survey effort completed
*V= Vulnerable, E=Endangered, CE = Critically Endangered							
¹ Minimum survey requirements based on the TBDC and/or relevant Commonwealth and NSW survey guidelines (Section 2.4.2)							

Table 2.7 Threatened fauna survey effort

Species	Common name	BC Act status	EPBC Act status	Minimum survey requirements ¹	Survey Date	Survey effort completed
Diurnal birds						
<i>Artamus cyanopterus cyanopterus</i>	dusky woodswallow	V	-	No specific survey requirements.	26 th August – 4 th September 2019.	A total of 20 hrs of bird surveys were conducted over 7 days.
<i>Daphoenositta chrysoptera</i>	varied sittella	V	-	No specific survey requirements.		Additional observations over 4 days in October and 3 days in November.
<i>Glossopsitta pusilla</i>	little lorikeet	V	-	No specific survey requirements.		
<i>Lathamus discolor</i>	swift parrot	E	CE	20 hrs over 8 days March – Jul (DoEE 2010) May – Aug (NSW Guidelines)		

Species	Common name	BC Act status	EPBC Act status	Minimum survey requirements ¹	Survey Date	Survey effort completed
Large hollow nesting parrots						
<i>Callocephalon fimbriatum</i>	gang gang cockatoo	V	-	Identification of pairs of breeding individuals, or confirmation of nesting. Conducted during Oct-Jan.	20 – 24 October 18 – 20 November	A total of 20 hrs of bird surveys were conducted over 7 days in August and September. Additional 40 hours of survey for breeding individuals over 4 days in October and 3 days in November in conjunction with vegetation mapping, vegetation plot surveys and targeted threatened flora surveys. Habitat assessment.

Species	Common name	BC Act status	EPBC Act status	Minimum survey requirements ¹	Survey Date	Survey effort completed
<i>Calyptorhynchus lathamii</i>	glossy black-cockatoo	V	-	No specific survey requirements.	26 August – 4 September 2019. 20 – 24 October 18 – 20 November	A total of 20 hrs of bird surveys were conducted over 7 days in August and September. Additional observations over 4 days in October and 3 days in November. Inspection of understorey for signs of foraging activity (chewed cones), August, September, October and November. Identification and mapping of potential nest trees (trees with hollows > 15 cm diameter). Inspection of potential nest trees for white-wash (August).
Raptors						
<i>Haliaeetus leucogaster</i>	white-bellied sea-eagle	V	-	Identify very large stick nests and evidence not wedge tailed eagle. Conducted during Jul – Dec.	26 August – 4 September 2019.	A total of 20 hrs of bird surveys were conducted over 7 days. Stick nest searches were conducted during bird surveys and

Species	Common name	BC Act status	EPBC Act status	Minimum survey requirements ¹	Survey Date	Survey effort completed
<i>Hieraaetus morphnoides</i>	little eagle	V	-	Identify stick nests with little eagle confirmed present. Conducted during Sep to Jan.	22 – 24 October	during vegetation surveys which comprised 28 hours of survey over 4 days in October in conjunction with vegetation mapping, vegetation plot surveys and targeted threatened flora surveys.
<i>Lophoictinia isura</i>	square-tailed kite	V	-	Identify stick nests with square tailed kites confirmed present. Conducted during Sep to Jan.		Incidental observation recorded during other surveys.
Nocturnal birds						
<i>Ninox strenua</i>	powerful owl	V	-	Surveys targeting breeding individuals must be conducted during May – December.	26 August – 30 August	Targeted surveys for threatened forest owls comprised three survey components: <ul style="list-style-type: none"> • Roost and nest tree searches • Dusk stag-watches of potential roost trees (10 hours) • Nocturnal surveys comprising spotlighting and active listening (8 hours)
<i>Tyto novaehollandiae</i>	masked owl	V	-	Surveys targeting breeding individuals must be conducted during May – Aug		
<i>Tyto tenebricosa</i>	sooty owl	V	-	Surveys targeting breeding individuals must be conducted during Apr – Aug		

Species	Common name	BC Act status	EPBC Act status	Minimum survey requirements ¹	Survey Date	Survey effort completed
Terrestrial mammals						
<i>Dasyurus maculatus</i>	spotted-tailed quoll	V	V	Camera trapping should be conducted for at least 14 nights at a density of at least 10 cameras per hectare during any months.	26 August – 4 September (nocturnal surveys) 23 October to 7 November (camera deployment)	A total of 6 hrs of nocturnal spotlighting over 4 nights. Camera trapping conducted for 14-15 nights at 10 sites in October and November using tuna bait and universal bait.
<i>Isodon obesulus obesulus</i>	southern brown bandicoot	E	V	Camera trapping should be conducted for at least 14 nights at a density of at least 10 cameras per hectare during all months Spotlighting Habitat assessment (note: Commonwealth requirements specify two deployments of 14 nights one month apart)		Both ground based trap lines located in the best habitat in study area, outside the construction boundary due to the very restricted area of suitable habitat in the construction boundary. Inspection of understorey for signs of foraging activity (bandicoot diggings), August, September, October and November 2019.
Arboreal mammals						

Species	Common name	BC Act status	EPBC Act status	Minimum survey requirements ¹	Survey Date	Survey effort completed
<i>Cercartetus nanus</i>	eastern pygmy-possum	V	-	October – March	26 August – 4 September (nocturnal surveys) 23 October to 7 November (camera traps)	A total of 18 hrs of dusk and nocturnal survey comprising stag-watching, spotlighting and active listening. Camera trapping conducted for 14-15 nights at 10 sites using universal bait and sugar water at rough barked trees up to 2 metres high.
<i>Petauroides volans</i>	greater glider	V	V	All months	26 August – 4 September	A total of 18 hrs of dusk and nocturnal survey comprising stag-watching and spotlighting
<i>Petaurus australis</i>	yellow-bellied glider	V	-	All months	26 August – 4 September	A total of 18 hrs of dusk and nocturnal survey comprising stag-watching, spotlighting and active listening.
<i>Petaurus norfolkensis</i>	squirrel glider	V	-	All months	26 August – 4 September (dusk and nocturnal surveys)	A total of 18 hrs of dusk and nocturnal survey comprising stag-watching, spotlighting and active listening. Camera trapping conducted for 14-15 nights at 10 sites using universal bait and sugar water at

Species	Common name	BC Act status	EPBC Act status	Minimum survey requirements ¹	Survey Date	Survey effort completed
					23 October to 7 November (camera traps)	rough barked trees up to 2 metres high.
<i>Phascogale tapoatafa</i>	brush-tailed phascogale	V	-	Camera trapping should be conducted for at least 14 nights at a density of at least 10 cameras per hectare during all months	26 August – 4 September (nocturnal surveys) 23 October to 7 November (camera traps)	A total of 18 hrs nocturnal survey comprising 10 hrs of stag-watching, 6 hrs of spotlighting. Camera trapping conducted for at least 14 nights at 10 sites using universal bait and sugar water at rough barked trees up to 2 metres high.
<i>Phascolarctos cinereus</i>	koala	V	V		26 August – 4 September (nocturnal surveys)	Spotlighting surveys completed August 2019. Habitat assessment to identify core Koala habitat in accordance with SEPP 44.
Micro-bats						
<i>Chalinolobus dwyeri</i>	large-eared pied bat	V	V	Bat detectors can be used to survey this species during any time of year.	22 October to 24 October (6 sites)	Six Anabat Swifts deployed for 4 survey nights each (i.e. 2 nights each at least two weeks apart at least six locations), including two Anabat units deployed for 4 nights

Species	Common name	BC Act status	EPBC Act status	Minimum survey requirements ¹	Survey Date	Survey effort completed
				Habitat polygons based on proximity to caves and escarpments	18 – 20 November (4 sites) 20 November - 26 November (2 sites)	each adjacent to artificial habitats in the old timber mill site.
<i>Falsistrellus tasmaniensis</i>	eastern false pipistrelle	V	-	Bat detectors can be used to survey this species during any time of year.	22 October to 24 October (6 sites)	Six Anabat Swifts deployed for 4 survey nights each (i.e. 2 nights each at least two weeks apart at least six locations), including two Anabat units deployed for 4 nights each adjacent to artificial habitats in the old timber mill site.
<i>Miniopterus orianae oceanensis</i>	large bent-winged bat	E	-	Bat detectors are to be deployed during Nov – Feb if targeting breeding individuals.	18 – 20 November (4 sites) 20 November -	
<i>Micronomus norfolkensis</i>	eastern coastal free-tail bat	V	-	Bat detectors can be used to survey this species during any time of year.	26 November (2 sites)	
<i>Saccolaimus flaviventris</i>	yellow-bellied sheath-tail-bat	V	-	Bat detectors can be used to survey this species during all months.		

Species	Common name	BC Act status	EPBC Act status	Minimum survey requirements ¹	Survey Date	Survey effort completed
<i>Scoteanax rueppellii</i>	greater broad-nosed bat	V	-	Bat detectors can be used to survey this species during all months.		
<i>Myotis macropus</i>	Southern myotis	V	-	At least four nights of ultrasonic acoustic detection survey at 4 locations. Due to the limited extent of habitat in the construction boundary, only 2 locations were surveyed within the potential species habitat.	22 October -26 October (2 sites)	4 survey nights at 2 locations within 200m of standing water. Habitat assessment (waterbodies within 200 metres of the study area and roosting areas within 200 metres of standing water).
Frugivorous/nectivorous bats						
<i>Pteropus poliocephalus</i>	grey-headed flying-fox	V	V	Oct - Dec	22 October to 24 October 18 – 22 November	Roost search throughout gullies and riparian areas on two separate occasions one month apart during the survey period.
*V= Vulnerable, E=Endangered, CE = Critically Endangered						
¹ Minimum survey requirements based on the TBDC and/or relevant Commonwealth and NSW survey guidelines (Section 2.4.3)						

Variations on survey timing and duration

The majority of surveys were conducted within the recommended survey periods for the targeted species and meeting minimum survey requirements. Exceptions are described below.

Due to the date of survey engagement, the timing of diurnal bird surveys extended a few days outside the NSW survey guidelines survey period for swift parrot (May - Aug). However, swift parrots were confirmed to be present in the Sydney Basin and Canberra during the first week of September 2019 based on regular reporting by birdwatching groups. Furthermore, the timing of the surveys is appropriate given that of the 332 swift parrot records in the South East Corner and the Sydney Basin from 2010 - 2019 in the NSW Atlas (BioNet), 77 occurred in June, 48 in July, 162 in August and 45 in September. Of the 11 records of 100 or more individuals documented between June and September in the South East Corner since 2010, none occurred in June or July, eight occurred in August and three occurred in September.

Camera trapping survey effort conducted for terrestrial and arboreal mammals does not comply with the recommended standard survey effort of 10 cameras deployed per hectare for the recommended survey periods (Commonwealth of Australia, 2011). Survey effort has been scaled to take into account the combined approach, where camera surveys is just one of several survey methods implemented for terrestrial and arboreal mammals (i.e. nocturnal surveys, camera surveys and searches for signs). While cameras were deployed for the recommended survey periods, in some cases where triggered frequently, cameras have stopped recording data part way through the survey period due to memory card space limitations. This reduced the camera trapping survey effort achieved by approximately 50 per cent.

Due to the combination of methods (i.e. spotlighting, nocturnal listening and stag-watching) for arboreal fauna, appropriate levels of survey effort were met despite reduced survey effort as a result of false triggered cameras.

Commonwealth guidelines for detection of southern brown bandicoot (Commonwealth of Australia, 2011) specify that camera trapping should be undertaken for 14 days on two occasions at least one month apart. To meet Commonwealth guidelines for detection of southern brown bandicoot and address limitations in the survey effort of the first survey resulting from false triggers, a second camera trap survey for terrestrial mammals was commenced on 16 December 2019. All cameras and associated data were lost in bushfires in early January. Consequently, habitat assessments were revised on the basis of camera trapping information collected during the first deployment only.

Survey limitations

Extremely dry conditions were experienced for the duration of the survey period between August and December 2019. BOM rainfall deficiency data for November 2019 indicates that the Batemans Bay region was subject to a severe four month deficiency, serious 11 month rainfall deficiency and severe 20 month rainfall deficiency. The extreme dry conditions experienced may have had the following impacts on surveys:

- Reduced detectability of nectarivorous birds, including swift parrot, due to the absence of typical winter / early spring eucalypt flowering events; no eucalypt flowering was observed during the targeted diurnal bird surveys, hence the negative survey result for

swift parrot is unlikely to provide sufficient evidence to argue that swift parrot have a low likelihood of occurrence

- Reduced native diversity detectable during vegetation integrity survey plots, hence underestimation of Vegetation Integrity Scores and reduced detection of characteristic species. Vegetation integrity scores collected are all above thresholds for classification of native vegetation as being 'low' condition and hence are unlikely to have a substantial impact on assessment outcomes
- Reduced flowering and detectability of cryptic orchid species. Due to the dry conditions, flowering may be occurring at substantially lower rates. Targeted surveys for cryptic orchid species were only completed after confirmation of flowering at reference sites. Hence, while lower rates may be expected, there remains confidence that flowering individuals would be detectable if present.

Vegetation integrity plots were not completed for areas of exotic vegetation in the roadside batters due to safety considerations. These areas could not be safely accessed due to the proximity of traffic along Princes Highway and the steepness of batter slopes. These areas are highly disturbed, located on artificial landscaped surfaces and, based on examination from adjacent areas, were dominated by exotic vegetation.

Camera trapping survey effort for terrestrial mammals constituted a single deployment for 14 days, with ten cameras in high quality habitat, less than the recommended guidelines for southern brown bandicoot (Commonwealth of Australia, 2011). Due to a high occurrence of false triggers, survey effort was reduced by at least half of the duration of this deployment. On a precautionary basis, the likelihood of southern brown bandicoot and spotted-tailed quoll occurring in identified potential habitat has been assessed as moderate and assumed present for the purposes of the impact assessment, despite the absence of detection.

3 Existing environment

The landscape context of the study area, including IBRA bioregions, IBRA subregions and Mitchell landscapes, catchment areas and any other relevant aspects of the landscape are described in Table 3.1.

Table 3.1. Landscape Value Features

Landscape Features	
IBRA Bioregion	South Eastern Corner
IBRA Subregion	Bateman
Mitchell Landscape	Clyde Valley Foothills
Land Tenureship, Parks and Reserves	<p>The study area is located on land owned and managed by Transport for NSW, Forestry Corporation of NSW and Eurobodalla Shire Council.</p> <p>Batemans Bay town, including urban industrial, suburban and recreational areas on private and council-owned land, is located to the north and east of the study area.</p> <p>The majority of the landscape to the south and west of the study area, including the study area, form part of Mogo State Forest and are managed for timber production.</p>
Rivers, Streams, Estuaries	<p>Hanging Rock Creek and associated minor drainage lines is present in the study area on the east side of the Princes Highway. Minor drainage lines in the study area west of the Princes Highway flow into the headwaters of McLeods Creek.</p> <p>These comprise incised ephemeral drainage lines on steep slopes and broad flowlines with no distinct channel in low-lying areas, typical of the headwaters of coastal ephemerals streams.</p>
Wetlands (within, adjacent to and downstream)	<p>No wetlands or coastal environment areas are within the construction boundary.</p> <p>The north-eastern corner of the study area is within a Coastal Environment Area protected under the State Environmental Planning Policy (Coastal Management).</p> <p>The Clyde River Estuary EPBC Act listed Nationally Important Wetland, comprisesf tidal waters and intertidal wetlands of the Clyde River and Cullendulla Creek, is located 2.3 km downstream from the study area in the Hanging Rock Creek catchment. The Clyde River Estuary forms part of Batemans Bay Marine Park, which incorporates tidal areas of McLeods Creek and is located</p>

Landscape Features	
	<p>1.5 km downstream from the study area, west of Princes Highway.</p> <p>One non-protected permanent wetland, possibly artificial, is present on Hanging Rock Creek, outside but immediately downstream of the study area).</p>
Total study area (ha)	103.30
Total construction boundary (ha)	31.17
Total operational boundary (ha)	15.65
Percentage of Native Vegetation within a 1.5 km buffer of the study area	76 per cent
Cover Class	>70 per cent
Areas of Geological Significance or Soil Hazard Features	<p>No areas of geological significance have been identified in the study area or within 1.5 km of the study area.</p> <p>No soil hazard features have been identified in the study area. Eurobodalla Shire Council mapping identifies Acid Sulphate Soils along Hanging Rock Creek immediately downstream of the study area and associated with mangrove wetlands on McLeods Creek.</p>

3.1 Plant community types

3.1.1 Past mapping and reports

The most recent comprehensive mapping for the local region is the Biometric vegetation types of the Shoalhaven, Eurobodalla and Bega Valley local government areas. Version 2.1. VIS_ID 3900 (OEH, 2013). This mapping was utilised and field verified by the Biodiversity Assessment conducted for the Proposed A1 Princes Highway – South Batemans Bay Link Road Junction: Preliminary Environmental Investigation (Jacobs, 2015) for a larger assessment area and reviewed for a subset of the study area in the SBBLR Minor Works Preliminary Biodiversity Investigation (Roads and Maritime, 2019).

Regional mapping (OEH, 2013) and previous reports (Jacobs, 2015; Roads and Maritime, 2019) identified seven biometric vegetation types (BVT) as potentially occurring in the study

area of which four were confirmed in the study area by a Biodiversity Assessment conducted for the Proposed A1 Princes Highway – South Batemans Bay Link Road Junction: Preliminary Environmental Investigation (Jacobs, 2015) (Table 3.2). This table includes only vegetation communities identified in low resolution regional mapping or previous assessments. The final list of vegetation communities identified during detailed assessment of the study area is presented in Section 3.1.2.

The Proposed A1 Princes Highway – South Batemans Bay Link Road Junction: Preliminary Environmental Investigation Biodiversity Assessment (Jacobs, 2015) identified one TSC Act listed endangered ecological community, Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions, in the study area. Two endangered ecological communities Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions and Lowland Grassy Woodland in the South East Corner Bioregion were identified in that report as potentially occurring adjacent to the study area to the north east.

Table 3.2 Biometric vegetation types identified in the study area by OEH (2013), Jacobs (2015) and Roads and Maritime (2019) and PCT equivalents

Biometric Vegetation Type (BVT) VIS_ID 3900 (OEH, 2013)	Equivalent Plant Community Type (PCT)	TEC Equivalent	Verified On Site (Jacobs, 2015)	Verified On Site (Roads and Maritime, 2019)
SR552 Grey Myrtle dry rainforest of the Sydney Basin and South East Corner	877 Grey Myrtle dry rainforest of the Sydney Basin Bioregion and South East Corner Bioregion	None	Yes	No (outside assessment area)
SR582 Mountain Grey Gum - Yellow Stringybark moist shrubby open forest in gullies of the coastal ranges, northern South East Corner	947 Mountain Grey Gum - Yellow Stringybark moist shrubby open forest in gullies of the coastal ranges, northern South East Corner Bioregion	None	No	No
SR621 Silvertop Ash - Blue-leaved Stringybark - Red Bloodwood dry shrubby open forest on ridges of the hinterland foothills, northern South East Corner	1147 Silvertop Ash - Blue-leaved Stringybark - Red Bloodwood dry shrubby open forest on ridges of the hinterland foothills, northern South East Corner Bioregion	None	No	No
SR622 Silvertop Ash - Blue-leaved Stringybark - Woollybutt shrubby open forest on coastal foothills central South East Corner	1148 Silvertop Ash - Blue-leaved Stringybark - Woollybutt shrubby open forest on coastal foothills central South East Corner Bioregion	None	No	No
SR641 Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin and northern South East Corner	1206 Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin	None	Yes	Yes

Biometric Vegetation Type (BVT) VIS_ID 3900 (OEH, 2013)	Equivalent Plant Community Type (PCT)	TEC Equivalent	Verified On Site (Jacobs, 2015)	Verified On Site (Roads and Maritime, 2019)
	Bioregion and northern South East Corner Bioregion			
SR643 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner	1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion	None	Yes	Yes
SR650 - Estuarine Swamp Oak Forest	1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act)	Yes	No (outside assessment area)
SR671 Yellow Stringybark - Coast Grey Box shrubby open forest on the coastal ranges, South East Corner	1336 Yellow Stringybark - Coast Grey Box shrubby open forest on the coastal ranges, South East Corner Bioregion	None	No	No

3.1.2 Vegetation survey results

Five PCTs categorised into nine vegetation zones were mapped in the study area (Table 3.3). In addition to the native vegetation communities mapped, two non-native or un-vegetated zones were identified: exotic vegetation on road batters; and bare-ground / un-vegetated areas comprising roads, tracks and bare road verges. The distribution of PCTs and condition classes is shown in Figure 3-1.

Details of each PCT and associated vegetation zones are described in the sections below. Vegetation composition, structure and function scores for each vegetation zone are presented in Table 3.4.

Table 3.3 Plant community types

Zone	PCT	Condition Class	Vegetation Integrity score	Patch size (ha)	BC Act Status	EPBC Act Status	Area in study area (ha)	Area in construction boundary (ha)	Area in operational boundary (ha)
1	1206 Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion	High	67.1	100	-	-	4.22	0.37	0.16
2	1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion	High	61.8	100	-	-	50.19	13.25	8.03

Zone	PCT	Condition Class	Vegetation Integrity score	Patch size (ha)	BC Act Status	EPBC Act Status	Area in study area (ha)	Area in construction boundary (ha)	Area in operational boundary (ha)
3	1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion	Degraded grassland	23.3	100	-	-	1.96	1.95	0.13
4	1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion	Derived grassland	21	100	-	-	6.90	3.89	1.32
5	1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion	Degraded forest	58.3	100	-	-	26.17	2.33	0.18

Zone	PCT	Condition Class	Vegetation Integrity score	Patch size (ha)	BC Act Status	EPBC Act Status	Area in study area (ha)	Area in construction boundary (ha)	Area in operational boundary (ha)
6	1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion	Plantings	8.8	100	-	-	1.12	0.89	0.66
7	877 Grey Myrtle dry rainforest of the Sydney Basin Bioregion and South East Corner Bioregion	High	48.5	100	-	-	0.58	0.00	0.00
8	1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion	High	44.2	100	Potential EEC	Potential EEC	0.50	0.00	0.00

Zone	PCT	Condition Class	Vegetation Integrity score	Patch size (ha)	BC Act Status	EPBC Act Status	Area in study area (ha)	Area in construction boundary (ha)	Area in operational boundary (ha)
9	1326 Woollybutt - White Stringybark - Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion	High	65.5	100	Potential EEC	Potential CEEC	0.61	0.00	0.00
Total area of TEC							1.11	0.00	0.00
Total native vegetation							92.25	22.68	10.48
11	Roads, tracks, bare ground	N/A	-				8.69	7.15	3.95
12	Exotic vegetation in road batter	N/A	-				2.36	1.34	1.22
Total							103.30	31.17	15.65

Table 3.4 Vegetation integrity plot survey results

Zone	PCT	Condition	Composition condition score	Structure condition score	Function condition score	Vegetation integrity score
1	1206	High	45.1	59.5	97.6	67.1
2	1220	High	60.9	59.5	63.5	61.8
3	1220	Degraded grassland	24.3	30.2	17.2	23.3
4	1220	Derived native grassland	76.1	59.9	2	21
5	1220	Degraded forest	69.7	44.2	64.5	58.3
6	1220	Plantings	17.4	2.3	17.3	8.8
7	877	High	25.1	70	65	48.5
8	1232	High	46.5	28.5	65	44.2
9	1326	High	60.2	87	53.5	65.5

PCT 1206 Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion

Vegetation formation: KF_CH2A Wet Sclerophyll Forest (Grassy sub-formation)

Vegetation class: Southern Lowland Wet Sclerophyll Forests

PCT: 1206: Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion

Other mapping sources:

- Proposed A1 Princes Highway – South Batemans Bay Link Road Junction: Preliminary Environmental Investigation: Biodiversity Assessment (Jacobs, 2015)
- Batemans Bay Bypass – Stage 2: Threatened Species Assessment (NGH Environmental, 2005)
- Native Vegetation of Southeast NSW: a revised classification and map for the coast and eastern tablelands (Tozer et al., 2010)
- South Batemans Bay Link Road Minor Works Preliminary Biodiversity Investigation (Roads and Maritime, 2019)
- Compilation map: Biometric Vegetation Types of the Shoalhaven, Eurobodalla and Bega Valley Local Government Areas. Version 2.1. VIS_ID 3900 (OEH, 2013).

Conservation status: PCT1206 does not conform to any NSW BC Act or Commonwealth EPBC Act listed threatened ecological communities.

Estimate of percent cleared: 15 per cent (DPIE 2019).

Condition and Extent in the study area: One vegetation zones identified as PCT 1206 occurs in the study area:

- Zone 1, High.

The total extent of PCT1206 present (Table 3.3) comprises:

- 4.22 ha in the study area
- 0.37 ha within the construction boundary
- 0.16 ha within the operational boundary.

Plots: Two plots, V01 and V13 have been completed in PCT1206, Zone 1.

PCT Allocation: Zone 1 is identified as PCT1206 as it supports many of the species and stratum specifics identified for the PCT as listed on the VIS Classification Database (OEH 2019a). Of the 23 flora species listed on the database as characteristic for PCT 1206, Zone 1 supports 12 (52.2 per cent) (Table 3.5). The co-dominance of blackbutt (*Eucalyptus pilularis*), relative scarcity of burrawang (*Macrozamia communis*), presence of a moist shrubby understorey and occurrence on deeper loamy soils distinguishes this community from adjacent areas of PCT 1220. Additional flora species characteristic of this community were observed during the study area walkovers.

Table 3.5 Zone 1, PCT1206: Characteristic species recorded during plot surveys

Growth form	Characteristic species	Cover
Trees	Spotted gum (<i>Corymbia maculata</i>), blackbutt (<i>Eucalyptus pilularis</i>)	25 – 41 per cent
Shrubs	Coffee bush (<i>Breynia oblongifolia</i>), lance beard-heath (<i>Leucopogon lanceolatus</i>)	11 – 27 per cent
Grass and grass like	Rapier sword-sedge (<i>Lepidosperma urophorum</i>), wiry panic (<i>Entolasia stricta</i>), spiny-headed mat-rush (<i>Lomandra longifolia</i>)	7 – 14 per cent
Forb	Blue flax-lily (<i>Dianella caerulea</i>)	2 – 3 per cent
Fern	Bracken (<i>Pteridium esculentum</i>)	11 – 20 per cent
Other	Wombat berry (<i>Eustrephus latifolius</i>), Burrawang (<i>Macrozamia communis</i>), bearded tylophora (<i>Tylophora barbata</i>)	57 – 65 per cent

Description: Zone 1 – High

A tall open forest with spotted gum (*Eucalyptus maculata*) and blackbutt typically occurring as co-dominant canopy species. It supports a scattered mid-stratum, typically dominated by sweet pittosporum (*Pittosporum undulatum*) with occasional vine thickets also present. The groundcover is dominated by grass-like species such as rapier sword-sedge (*Lepidosperma urophorum*) and spiny-headed matrush (*Lomandra longifolia*) with dense ferns such as bracken (*Pteridium esculentum*). Grasses are sparse. Large hollow-bearing trees are common within this zone, with the majority of areas excluded from logging operations due to the proximity to minor streams, although disturbance in the forms of tracks and adjacent logging operations is present. The zone supports a relatively dense but variable ground and shrub layer, ranging from fern dominated to small vine thickets.

The post fire inspection determined that all ground, mid and canopy stratum had a 100 per cent scorch, indicating high to very high fire intensity. 100 per cent of the ground stratum vegetative matter had been consumed, with approximately 50 per cent to 90 per cent of the mid stratum vegetative matter consumed. 5 to 10 per cent of canopy vegetative matter had been consumed. The soil structure was destroyed, such that regeneration of groundcovers and shrubs must be dependent on the seed bank. Some large trees, including hollow bearing trees, had been destabilised and fallen as a result of the fires.



Photograph 1A: Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion



Photograph 1B: Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion (post-fire)

PCT 1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner

Vegetation formation: KF_CH2A Wet Sclerophyll Forest (Grassy sub-formation)

Vegetation class: Southern Lowland Wet Sclerophyll Forests

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

Other mapping sources:

- Proposed A1 Princes Highway – South Batemans Bay Link Road Junction: Preliminary Environmental Investigation: Biodiversity Assessment (Jacobs, 2015)
- Batemans Bay Bypass – Stage 2: Threatened Species Assessment (NGH Environmental, 2005)
- Native Vegetation of Southeast NSW: a revised classification and map for the coast and eastern tablelands (Tozer et al., 2010)
- South Batemans Bay Link Road Minor Works Preliminary Biodiversity Investigation (Roads and Maritime, 2019)
- Compilation map: Biometric Vegetation Types of the Shoalhaven, Eurobodalla and Bega Valley Local Government Areas. Version 2.1. VIS_ID 3900 (OEH, 2013).

Conservation status: PCT1220 does not conform to any NSW BC Act or Commonwealth EPBC Act listed threatened ecological communities.

Estimate of percent cleared: 15 per cent (DPIE 2019)

Condition and Extent in the study area: Five vegetation zones conforming with PCT 1220 occur in the study area:

- Zone 2, High
- Zone 3, Degraded grassland
- Zone 4, Derived native grassland
- Zone 5, Degraded forest
- Zone 6, Plantings.

The total extent of PCT1220 in the study area is 86.34 ha (Table 3.3). The extent of each zone in the study area, the construction boundary and the operational boundary is shown in Table 3.6.

Plots: A total of ten vegetation integrity plots were completed within PCT1220. A summary of plots completed by vegetation zone is provided in Table 3.6.

Table 3.6 Vegetation integrity plots completed in PCT 1220

Zone	Condition	Plots Completed	Area in study area (ha)	Area in construction boundary (ha)	Area in operational boundary (ha)
2	High	V03, V04, V08, V09	50.19	13.25	8.03

Zone	Condition	Plots Completed	Area in study area (ha)	Area in construction boundary (ha)	Area in operational boundary (ha)
3	Degraded grassland	V10	1.96	1.95	0.13
4	Derived native grassland	V06, V07	6.90	3.89	1.32
5	Degraded forest	V02, V11	26.17	2.33	0.18
6	Plantings	V05	1.12	0.89	0.66

PCT Allocation: Zone 2 and Zone 5 are identified as PCT1206 as they support many of the species and stratum specifics identified for the PCT as listed on the VIS Classification Database (OEH 2019a). Of the 16 flora species listed on the database as characteristic for PCT 1206, Zone 2 supports 14 (87.5 per cent) and Zone 5 supports 13 (81.25 per cent) within the vegetation integrity plots (Table 3.7).

The dominance of spotted gum (*Corymbia maculata*), relative scarcity of blackbutt, presence of a sparse shrubby ground layer typically dominated by burrawang and occurrence on slopes and ridges with shallow rocky soils distinguishes this community from adjacent areas of PCT 1206.

Zone 3, Zone 4 and Zone 6 are aligned with PCT1220 on the basis that, due to the position of these zones in the landscape and in relation to areas retaining an intact canopy, that PCT1220 is most likely to have been the community present prior to clearing. Typical species composition has been highly modified as a result of clearing, past disturbance and regeneration, hence a comparison has not been made with characteristic species.

Table 3.7 PCT1220: Characteristic species recorded in plots

Growth form	Characteristic species (Zone 2 and Zone 5 only)	Cover
Trees	Spotted gum (<i>Corymbia maculata</i>), grey ironbark (<i>Eucalyptus paniculata</i>), white stringybark (<i>Eucalyptus globoidea</i>), yellow stringybark (<i>Eucalyptus muelleriana</i>)	Zone 2: 12 – 16 per cent Zone 3: 2 per cent (planted <i>Casuarina glauca</i>) Zone 4: 2 – 3 per cent (regenerating seedlings) Zone 5: 26 – 50 per cent Zone 6: 5 per cent
Shrubs	Rough guinea flower (<i>Hibbertia aspera</i>), lance beard-heath (<i>Leucopogon lanceolatus</i>), narrow-leafed geebung (<i>Persoonia linearis</i>), shrubby platysace (<i>Platysace lanceolata</i>), prickly shaggy pea (<i>Podolobium ilicifolium</i>)	Zone 2: 6 – 12 per cent Zone 3: 6 per cent (planted <i>Acacia</i> spp.) Zone 4: 14 – 58 per cent Zone 5: 7 – 14 per cent Zone 6: 5 per cent (planted <i>Acacia</i> spp.)
Grass and grass like	Variable sword-sedge (<i>Lepidosperma laterale</i>), wiry panic (<i>Entolasia stricta</i>), many-flowered Mat-rush (<i>Lomandra multiflora</i>), blady grass (<i>Imperata cylindrica</i>), couch grass (<i>Cynodon dactylon</i>)	Zone 2: 16 – 26 per cent Zone 3: 61 per cent Zone 4: 36 – 86 per cent Zone 5: 3 – 24 per cent Zone 6: 3 per cent
Forb	Blue flax-lily (<i>Dianella caerulea</i>)	Zone 2: 11 – 21 per cent Zone 3: 6 per cent Zone 4: 10 – 16 per cent Zone 5: 1 – 4 per cent Zone 6: 0 per cent
Fern	Giant maidenhair (<i>Adiantum formosum</i>)	Zone 2: 0 – 6 per cent Zone 3: 0 per cent Zone 4: 1 – 2 per cent Zone 5: 0 – 1 per cent Zone 6: 0 per cent

Growth form	Characteristic species (Zone 2 and Zone 5 only)	Cover
Other	Burrawang (<i>Macrozamia communis</i>)	Zone 2: 4 – 7 per cent Zone 3: 2 per cent Zone 4: 1 – 2 per cent Zone 5: 6 – 36 per cent Zone 6: 1 per cent

Description: Zone 2 – High

PCT 1220 in high condition comprises a tall open forest with an open shrub layer. The zone is dominated by spotted gum, with a minor component of other species including grey ironbark, white stringybark (*Eucalyptus globoidea*), yellow stringybark (*Eucalyptus muelleriana*) and blackbutt. Black she-oak (*Allocasuarina littoralis*) is widespread throughout the area. The mid-stratum is typically sparse, however, dominated by burrawang, small shrubs and wattle species (*Acacia* spp.). The groundcover is sparse and comprises grass species such as wiry panic (*Entolasia stricta*), long-leaved wallaby grass (*Rytidosperma longifolium*) and rushes such as variable sword sedge (*Lepidosperma laterale*). Forbs are sparse and were dominated by blue flax-lily (*Dianella caerulea*), false sarsaparilla (*Hardenbergia violacea*) and twining glycine (*Glycine tabacina*). Large hollow-bearing trees are scattered throughout the zone; however, there has been disturbance throughout the area with evidence of historical timber harvesting and clearing for access tracks. Dumping was observed along the main tracks. Weeds are present along the road edge or in degraded areas such as informal vehicle tracks.

This zone supports hollow bearing trees, fallen logs, foraging and potential breeding habitat for a range of species. Groundcover and shrub cover is typically sparse, with a high proportion of bare ground and litter cover.

The post fire inspection determined that all ground, mid and canopy stratum had a 100 per cent scorch, indicating high to very high fire intensity. 100 per cent of the ground stratum vegetative matter had been consumed, with approximately 60 per cent to 100 per cent of the mid stratum vegetative matter consumed. Burrawang stumps were showing signs of sprouting. The soil structure was destroyed, such that regeneration of groundcovers and shrubs must be dependent on the seed bank. 5 to 10 per cent of canopy vegetative matter had been consumed, with isolated areas with 50 to 90 per cent canopy vegetative matter consumed indicating areas of extreme fire intensity. Some large trees, including hollow bearing trees, had been destabilised and fallen as a result of the fires.



Photograph 2A: Zone 2 – High - PCT 1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner



Photograph 2B: Zone 2 – High - PCT 1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner (post-fire)

Description: Zone 3 – Degraded grassland

Degraded grassland is present in former timber mill site at the northern end of the study area. The former timber mill site has been highly disturbed and no longer supports any natural vegetation. The site supports a weedy disturbed groundcover with low native diversity. While the dominant groundcover species is native couch (*Cynodon dactylon*), exotic perennial grasses, forbs and shrubs including kikuyu (*Pennisetum clandestinum*), paspalum (*Paspalum dilatatum*), paddy's Lucerne (*Sida rhombifolia*), tobacco bush (*Solanum mauritianum*) and blackberry (*Rubus anglocandicans*) are common. There is low native forb diversity.

A natural canopy or mid-stratum is absent. The site has been subject to rehabilitation works and supports planted and self-sown (from adjacent plantings) swamp she-oak and black she-oak. The mid-stratum comprises planted wattle species (*Acacia* spp.) and paperbark (*Melaleuca* sp.), not typically associated with PCT1220. This zone has been allocated to PCT1220 on the basis of the position in the landscape and the presence of PCT1220 in adjacent areas. Habitat for threatened species is absent from this zone.

Zone 3 was not inspected during the post fire inspection, however based on driving past the study area, it had 100% scorch of all strata, 100% consumption of the ground stratum and 50 to 90 per cent consumption of all trees and shrubs. Some grasses were shooting. The building present in the old timber mill site had been burnt.



Photograph 3: Zone 3 – Degraded grassland - PCT 1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner

Description: Zone 4 – Derived native grassland

Derived native grassland occurs along the cleared powerline easement. While a canopy is absent as a result of clearing and regular powerline maintenance there are regenerating spotted gum scattered in the area, which are regularly trimmed. A low mid-stratum supports short and scattered shrubs such as shrubby platyscae (*Platysace lanceolata*) and rough guinea flower (*Hibbertia aspera*). The ground cover is dense with kangaroo grass (*Themeda australis*), purple wire grass (*Aristida ramosa*), blady grass (*Imperata cylindrica*) and variable sword sedge. There is a moderate to high forb diversity. This zone has been allocated to PCT1220 on the basis of the position in the landscape and the presence of PCT1220 in adjacent areas. Habitat for threatened species is absent from this zone.

The post fire inspection determined that all ground cover and shrub cover had 100 per cent scorch. 100 per cent of the ground stratum vegetative matter had been consumed, with approximately 50 to 60 per cent of the shrub layer consumed, indicating possibly lower fire intensity due to the absence of tree cover. The soil structure was intact relative to other parts of the study area. Some grasses were already shooting at the time of the inspection, despite the absence of rain.



Photograph 4A: Zone 4 – Derived native grassland - PCT 1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner



Photograph 4B: Zone 4 – Derived native grassland - PCT 1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner (post-fire)

Description: Zone 5 – Degraded forest

PCT 1220 degraded forest comprises an extensively disturbed tall open forest which has been subject to recent timber harvesting. The zone supports scattered trees which have been retained during harvesting. Tree species present include grey ironbark (*Eucalyptus paniculata*), white stringybark and yellow stringybark and regeneration is occurring. Black she-oak is widespread throughout the area, however, typically occurs in isolated clumps as a result of recent clearing. The mid-stratum is typically disturbed due to harvesting operations and regeneration has commenced. The groundcover is sparse, with extensive areas of disturbed bare ground and piles of timber debris. Forbs, grasses and low shrubs are sparse. Occasional large hollow-bearing trees are present, having been retained as habitat trees during timber harvesting operations. Dumping was observed along the main tracks. Weeds are present. Habitat for threatened species is highly degraded but largely consistent with adjacent areas of Zone 2 and shows signs of rapid regeneration.

The post fire inspection determined that all ground, mid and canopy stratum had a 100 per cent scorch, indicating high to very high fire intensity. 100 per cent of the ground stratum vegetative matter had been consumed, with approximately 80 per cent to 100 per cent of the mid stratum vegetative matter consumed indicating extreme fire intensity. The soil structure was destroyed, such that regeneration of groundcovers and shrubs must be dependent on the seed bank. 40 to 100 per cent of canopy vegetative matter had been consumed, also indicating extreme fire intensity.



Photograph 5A: Zone 5 – Degraded forest - PCT 1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner



Photograph 5B: Zone 5 – Degraded forest - PCT 1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner (post-fire)

Description: Zone 6 – Plantings

Recent revegetation plantings occur along the Glenella Road batter in the south of the study area. It has been previously cleared and landscaped with planted local native shrubs and rushes. The plants include local wattle species and rushes such as spiny-headed mat-rush. Exotic grasses and forbs occur throughout the regenerative area. Several spotted gum are present along the lower edge of the zone where they have not been removed by earthworks. Habitat for threatened species is largely absent.

The post fire inspection determined the majority of organic materials, including weed mattings and planted forbs and shrubs were burnt. The ground layer had a 50 per cent scorch, with one grasslike species, tall mat-rush, surviving the fire. All planted shrubs were 100 per cent scorched. Despite burning of weed matting, the soil structure was largely intact, likely due to indicating lower intensity burns than elsewhere. Where a canopy was present on the lower edge, a 100 per cent scorch had occurred consistent with adjacent areas of Zone 2.



Photograph 6A: Zone 6 – Plantings - PCT 1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner



Photograph 6B: Zone 6 – Plantings - PCT 1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner (post-fire)

PCT 877 Grey Myrtle dry rainforest of the Sydney Basin Bioregion and South East Corner Bioregion

Vegetation formation: KF_CH1 Rainforests

Vegetation class: Dry Rainforests

PCT: Grey Myrtle dry rainforest of the Sydney Basin Bioregion and South East Corner Bioregion

Other mapping sources:

- Proposed A1 Princes Highway – South Batemans Bay Link Road Junction: Preliminary Environmental Investigation: Biodiversity Assessment (Jacobs, 2015)
- Batemans Bay Bypass – Stage 2: Threatened Species Assessment (NGH Environmental, 2005)
- Native Vegetation of Southeast NSW: A Revised Classification and Map for the Coast and Eastern Tablelands (Tozer et al., 2010)
- Compilation map: Biometric Vegetation Types of the Shoalhaven, Eurobodalla and Bega Valley Local Government Areas. Version 2.1. VIS_ID 3900 (OEH, 2013).

Conservation status: PCT877 does not conform to any NSW BC Act or Commonwealth EPBC Act listed threatened ecological communities.

Estimate of percent cleared: 25 per cent (DPIE 2019)

Condition and Extent in the study area: One vegetation zones identified as PCT 877 occurs in the study area:

- Zone 7, High.

The total extent of PCT 877 in the study area is 0.58 ha (Table 3.3). This community does not occur within the construction boundary or the operational boundary.

Plots: One plot, V16, has been completed in PCT 877.

PCT Allocation: Zone 7 is identified as PCT877 as the dominance of a mid-storey canopy of grey myrtle (*Backhousia myrtifolia*) with a fern dominated groundcover and occurrence in sheltered gullies are diagnostic features of this community. While of the 14 flora species listed on the database as characteristic for PCT 877, Zone 7 supports two (14.3 per cent) (Table 3.8), PCT 877 remains the most likely PCT due to the dominance of grey myrtle and landscape position. Additional flora species characteristics of this community were observed during the study area walkovers.

Table 3.8 Zone 7, PCT 877: Characteristic species recorded in plots

Growth form	Characteristic species	Cover
Trees	No characteristic species recorded, however emergent Spotted gum (<i>Corymbia maculata</i>) are present consistent with wet sclerophyll forest / rainforest succession patterns.	22 per cent
Shrubs	Grey myrtle (<i>Backhousia myrtifolia</i>), large mock-olive (<i>Notelaea longifolia</i>).	52 per cent
Grass and grass like	No characteristic species recorded.	1 per cent
Forb	No characteristic species recorded.	1 per cent
Fern	No characteristic species recorded, however the understorey is dominated by other species such as gristle fern (<i>Blechnum cartilagineum</i>) and prickly rasp fern (<i>Doodia aspera</i>).	41 per cent
Other	No characteristic species recorded, however vines are present such as water vine (<i>Cissus hypoglauca</i>).	10 per cent

Description: Zone 7 – High

Zone 7 comprises mid-storey canopy of grey myrtle with a fern dominated groundcover and occurrence in sheltered gullies along the southern boundary of the study area. Areas are largely undisturbed by timber harvesting or other activities. Emergent spotted gum are present, consistent with succession patterns associated with colonisation of wet sclerophyll forest (e.g. PCT1220) with rainforest species over time in suitable microhabitats. The midstorey includes large mock-olive (*Notelaea longifolia*), sandpaper fig (*Ficus coronata*) and vines such as water vine (*Cissus hypoglauca*). The groundcover is dominated by ferns such as prickly rasp fern (*Doodia aspera*) and gristle fern (*Blechnum cartilagineum*). While ferns and vines are not identified as characteristic species in the PCT descriptions, these species are commonly dominant or co-dominant in dry rainforest communities. Due to the small patch size and the ecotonal nature of the plot, atypical species such as burrawang and variable sword-sedge were also present in the plot. The zone comprises habitat for threatened species, particularly potential roosting habitat for forest owls.

Zone 7 was inspected from The Ridge Road, south-west of the interserction with Glenella Road, to assess fire impacts. The post fire inspection determined that all ground, mid and canopy stratum had a 100 per cent scorch, indicating high fire intensity. 100 per cent of the ground stratum vegetative matter had been consumed, however only approximately 20 per cent of the mid stratum vegetative matter consumed. The reduced consumption of the canopy is likely a result of the fire resistant character of grey myrtle foliage. The soil structure was destroyed, such that regeneration of groundcovers must be dependent on the seed bank. 5 to 20 per cent of canopy vegetative matter had been consumed.



Photograph 7A: Zone 7 – High – PCT 877 Grey Myrtle dry rainforest of the Sydney Basin Bioregion and South East Corner Bioregion



Photograph 7B: Zone 7 – High – PCT 877 Grey Myrtle dry rainforest of the Sydney Basin Bioregion and South East Corner Bioregion (post-fire)

PCT 1232: Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion

Vegetation formation: KF_CH9 Forested Wetlands

Vegetation class: Coastal Swamp Forests

PCT: 1232: Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion

Other mapping sources:

- Proposed A1 Princes Highway – South Batemans Bay Link Road Junction: Preliminary Environmental Investigation: Biodiversity Assessment (Jacobs, 2015)
- Batemans Bay Bypass – Stage 2: Threatened Species Assessment (NGH Environmental, 2005)
- Native Vegetation of Southeast NSW: A Revised Classification and Map for the Coast and Eastern Tablelands (Tozer et al., 2010)
- Compilation map: Biometric Vegetation Types of the Shoalhaven, Eurobodalla and Bega Valley Local Government Areas. Version 2.1. VIS_ID 3900 (OEH, 2013).

Conservation status: PCT 1232 may constitute the following NSW BC Act listed Endangered Ecological Communities (EECs):

- River Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
- Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.

PCT 1232 may constitute the following EPBC Act listed threatened ecological communities:

- Illawarra and south coast lowland forest and woodland Critically Endangered ecological community (CEEC)
- Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland (EEC).

Estimate of percent cleared: 95 per cent (DPIE 2019)

Condition and Extent in the study area: One vegetation zone identified as PCT 1232 occurs in the study area:

- Zone 8, High.

The total extent of PCT 1232 in the study area is 0.50 ha (Table 3.3). This community does not occur within the construction boundary or the operational boundary.

Plots: One plot, V15, has been completed in PCT 1232.

PCT Allocation: Zone 8 is identified as PCT 1232 based on dominance of a canopy of swamp oak (*Casuarina glauca*) with flood tolerant groundcover and its occurrence on waterlogged soils adjacent to a wetland area. While of the 16 flora species listed on the database as characteristic for PCT 1232, Zone 8 supports two (12.5 per cent) (Table 3.9), PCT 1232 remains the most likely PCT due to the dominance of swamp oak, groundcover characteristics and landscape position. Additional flora species, including sedges and forbs, characteristic of this community were observed during the study area walkover.

Table 3.9 Zone 8, PCT 1232: Characteristic species recorded in plots

Growth form	Characteristic species	Cover
Trees	Swamp oak (<i>Casuarina glauca</i>).	60 per cent
Shrubs	-No characteristic species recorded.	5 per cent
Grass and grass like	common reed (<i>Phragmites australis</i>).	11 per cent
Forb	No characteristic species recorded.	12 per cent
Fern	No characteristic species recorded.	2 per cent
Other	No characteristic species recorded.	17 per cent

Description: Zone 8 – High

This zone fringes a wetland area located outside the study area to the east. The core area has a dense canopy of swamp oak, gradually intergrading with eucalypts typical of PCT 1220 up the drainage line to the west. While a midstorey is mostly absent, sweet pittosporum and regenerating swamp oak are present. The ground layer exhibits evidence of occasional flooding but supports a diversity of native grasses, sedges, forbs and creepers. Flooding tolerant or dependent species such as black-fruit sword-sedge (*Gahina melanocarpa*), *Lobelia anceps*, whiteroot (*Lobelia purpurascens*) and common reed (*Phragmites australis*) are common. Photograph 8 shows Zone 8 when assessed prior to fires.

Due to access safety constraints, Zone 8 was not visited during the post fire assessment. Viewed from adjacent area, Zone 8 appeared to be subject to 100 per cent canopy scorch at all stratum.



Photograph 8: Zone 8 – High – PCT 1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion

PCT 1326: Woollybutt – White Stringybark – Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion

Vegetation formation: KF_CH3 Grassy Woodlands

Vegetation class: Coastal Valley Grassy Woodlands

PCT: Woollybutt – White Stringybark – Forest Red Gum grassy woodland and coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion

Other mapping sources:

- Proposed A1 Princes Highway – South Batemans Bay Link Road Junction: Preliminary Environmental Investigation: Biodiversity Assessment (Jacobs, 2015)
- Batemans Bay Bypass – Stage 2: Threatened Species Assessment (NGH Environmental, 2005)
- Native Vegetation of Southeast NSW: A Revised Classification and Map for the Coast and Eastern Tablelands (Tozer et al., 2010)
- Compilation map: Biometric Vegetation Types of the Shoalhaven, Eurobodalla and Bega Valley Local Government Areas. Version 2.1. VIS_ID 3900 (OEH, 2013).

Conservation status: PCT 1326 may constitute the following threatened ecological communities:

- Lowland Grassy Woodland in the South East Corner Bioregion – EEC listed under BC Act
- Illawarra and south coast lowland grassy woodland – CEEC listed under EPBC Act.

Estimate of percent cleared: 95 per cent (DPIE 2019)

Condition and Extent in the study area: One vegetation zone identified as PCT 1326 occurs in the study area:

- Zone 9, High.

The total extent of PCT 1326 in the study area is 0.61 ha (Table 3.3). This community does not occur within the construction boundary or the operational boundary.

Plots: One plot, V14, has been completed in PCT 1326.

PCT Allocation: Zone 9 is identified as PCT 1326 due to the dominance of forest red gum (*Eucalyptus tereticornis*), grassy understorey and location of the community on flats at < 100 metre altitude gullies are diagnostic features of this community. While of the 24 flora species listed on the database as characteristic for PCT 1326, Zone 9 supports five (20.8 per cent) (Table 3.10), PCT 1326 remains the most likely PCT due to the dominance of forest red gum and landscape position. Additional flora species, including grasses and forbs, characteristic of this community were observed during the study area walkover.

Table 3.10 Zone 9, PCT 1326: Characteristic species recorded in plots

Growth form	Characteristic species	Cover
Trees	Forest red gum (<i>Eucalyptus tereticornis</i>).	30 per cent
Shrubs	Sweet pittosporum (<i>Pittosporum undulatum</i>), twining glycine (<i>Glycine tabacina</i>).	26 per cent
Grass and grass like	Variable sword-sedge (<i>Lepidosperma laterale</i>).	36 per cent
Forb	White root (<i>Pratia purpurascens</i>).	9 per cent
Fern	No characteristic species recorded.	2 per cent
Other	No characteristic species recorded.	17 per cent

Description: Zone 9 - High

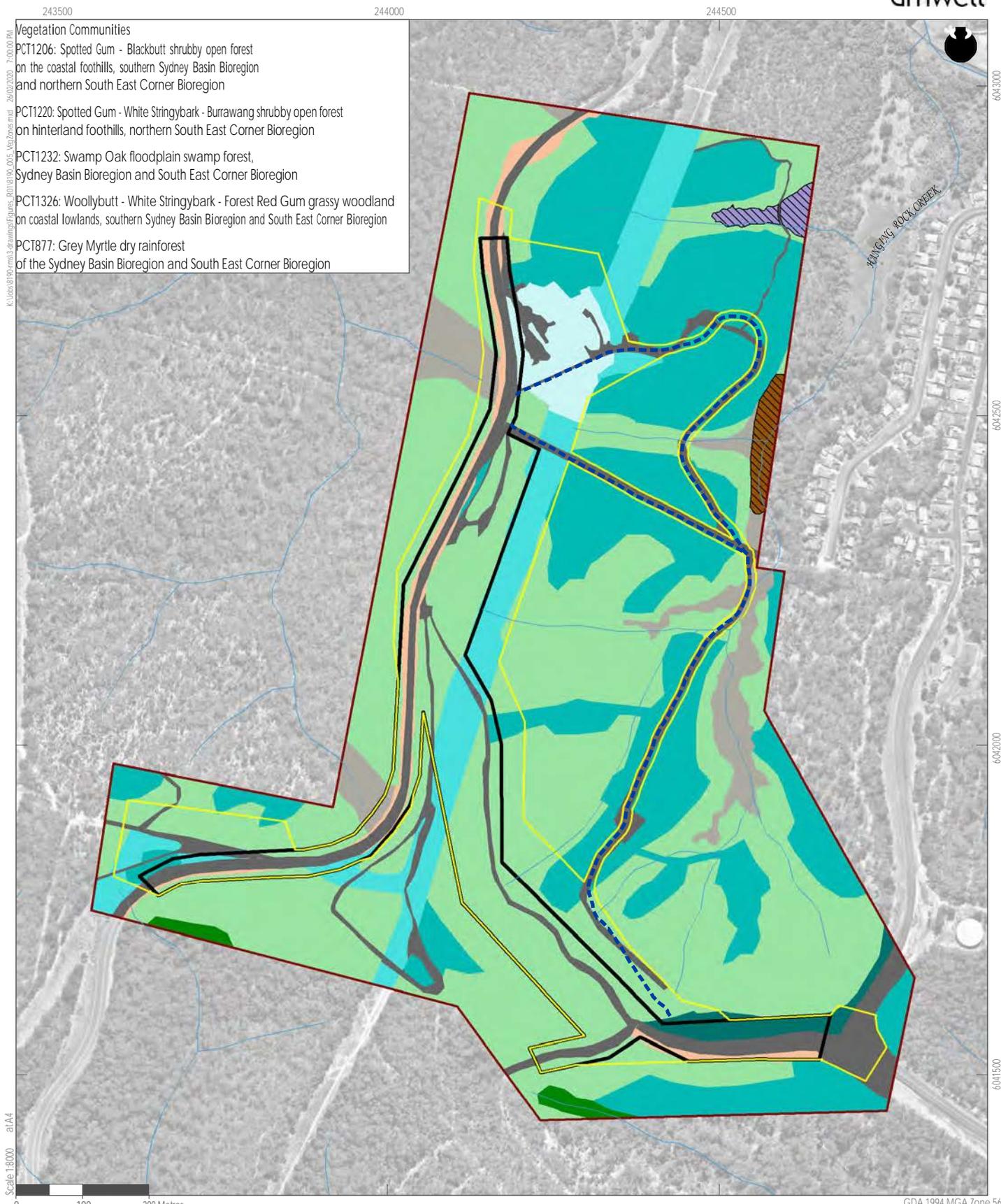
PCT 1326 occurs on the eastern boundary of the study area and is considered as in high condition. It is a tall open forest with an open shrub layer. Within the study area, the zone is ecotonal in nature with species from PCT1220 and PCT1206 integrating into PCT 1326. The community is dominated by forest red gum; however, it is co-dominated by spotted gum with scattered white stringybark. The shrub and the groundcover species composition varies with a dense shrublayer in the north and a grassy understorey in the south. Vines thickets are present in patches. The groundcover comprises ferns and grasses such as wiry panic, blady grass, snowgrass (*Poa meionectes*) and black-fruited saw-sedge. Forbs are widespread and include blue flax-lily, whiteroot and native violet (*Viola hederacea*). Large hollow-bearing trees are scattered throughout PCT1326. There has been disturbance through the area with past clearing for vehicle access and bike access. Due to the location of the zone within a drainage line, there has been no recent timber harvesting. The site supports diverse habitats for threatened species. Zone 9 was inspected from adjacent access tracks to assess fire impacts. The post fire inspection determined that all ground, mid and canopy stratum had a 100 per cent scorch, indicating high to very high fire intensity. 100 per cent of the ground stratum vegetative matter had been consumed, with approximately 50 per cent to 80 per cent of the mid stratum vegetative matter consumed. 5 to 10 per cent of canopy vegetative matter had been consumed. The soil structure was destroyed, such that regeneration of groundcovers and shrubs must be dependent on the seed bank although some fire resilient species may persist. Some large trees, including hollow bearing trees, had been destabilised and fallen as a result of the fires.



Photograph 9A: Zone 9 – High – PCT 1326 Woollybutt – White Stringybark – Forest Red Gum grassy woodland and coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion



Photograph 9B: Zone 9 – High – PCT 1326 Woollybutt – White Stringybark – Forest Red Gum grassy woodland and coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion (post-fire)



Vegetation Communities

PCT1206: Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion

PCT1220: Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion

PCT1232: Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion

PCT1326: Woollybutt - White Stringybark - Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion

PCT877: Grey Myrtle dry rainforest of the Sydney Basin Bioregion and South East Corner Bioregion

Legend

- | | | |
|-----------------------|--|--|
| Study Area | Vegetation Zone, PCT, Condition | 6, PCT1220, Plantings |
| Construction Boundary | 1, PCT1206, High | 7, PCT877, High |
| Operation Boundary | 2, PCT1220, High | 8, PCT1232, High |
| Access Tracks | 3, PCT1220, Degraded grassland | 9, PCT1326, High |
| Watercourses | 4, PCT1220, Derived native grassland | 11, Bare ground |
| | 5, PCT1220, Degraded forest | 12, Exotic |
| | | BC Act Endangered Ecological Community |

FIGURE 3-1
Vegetation zones

3.2 Bushfire impacts

3.2.1 Vegetation

During bushfires on 31 December 2019, the study area was burnt at very high intensity resulting in the understorey, midstorey and canopy of the study area being scorched throughout. There were no unburnt patches, or areas with only partial canopy scorch in any stratum. While the Google Earth Engine Burnt Area Map (DPIE, 2020B) maps most the area as having canopy partially affected or canopy unburnt, the site inspection confirmed complete scorch of the canopy.

All vegetative material in the groundcover and most low shrubs, with the exception of fire resistant burrawang stumps, was consumed by fire. Fire consumption of vegetative material of small trees was variable throughout the site, typically being between 50 to 100 per cent consumption but as low as 40 per cent consumption in patches of species with fire resistant foliage such as grey myrtle.

While there was no un-scorched living material in the canopy, most scorched leaf in the tree canopy was not consumed. Isolated areas, particularly in Zone 5 (Figure 3-1) had had severe canopy burn indicated by up to 100 per cent canopy consumption, indicating areas of extreme fire intensity. Fire intensity at the site is unlikely to have been sufficiently severe to prevent epicormics resprouting of most eucalypt species present.

3.2.2 Fauna Habitat

Due to the loss of combustible habitat features and exposure to extreme heat it is unlikely that the site provided any substantial safe refugia for fauna during the fire and it must be assumed that there was mortality of the majority of fauna on the site. Due to the urban edge along the eastern boundary of the study area and surrounding habitat patch, even mobile species are likely to have been trapped within the burnt area during the fire.

The majority of combustible habitat features on the ground, such as logs, were completely burnt away throughout the site. Some large hollow bearing trees had been burnt on the inside due to chimneys forming in hollow trunks. Some fauna may have survived sheltering in insulated blind hollows high in the canopy above the flame zone. However, it is uncertain whether species would have survived in hollows given complete canopy scorch indicates extreme heat even in the canopy.

A number of large hollow bearing trees identified during previous surveys had destabilised and fallen as a result of the fire and it is likely that this process will continue. However, the majority of hollow bearing trees were still standing at the time of the post-fire inspection. The loss of cover resulting from vegetative material scorch and consumption, particularly in the mid-stratum and ground layer is likely to substantially reduce the capacity of the area to provide shelter to small mammals, reptiles and birds in the short term.

Due to the high intensity of the burn, the soil structure and soil biota have been substantially degraded, decreasing foraging opportunities for species dependent on invertebrates, tubers and fungi that might have persisted in a lower intensity burn.

3.2.3 Regeneration potential

PCT1220, the wet sclerophyll forest type dominant throughout the majority of the study area (i.e. Zones 2 – 6, Figure 3-1), is dominated by species highly resilient to bushfire and typically supports shrubs with soil stored seed, or which release seed following fire. Most eucalypt species, such as spotted gum, white stringybark, yellow stringbark and forest red gum are epicormic resprouters. Consequently, regeneration of the canopy is likely to occur within 10 years. Depending on fire intensity, blackbutt is an obligate seeder and regeneration of areas dominated by this species may take 15 to 30 years. In general, regeneration of the majority of wet sclerophyll forest to a similar state based on structure and species composition is likely to occur within 15 to 20 years.

In one to three years following the fire, there is likely to be increased density of shrub cover as short-lived fire responding shrub species colonise the area after the fire. Longer lived obligate seeders, such as black sheoak, are also likely to regenerate rapidly from seed and are likely to dominate the mid-storey from 5 to 15 years. Due to the intensity of the fire, however, certain components of the soil stored seedbank are likely to be depleted and in the short term substantially different species composition is likely to occur. Epicormically resprouting canopy species are likely to resume flowering in approximately three to five years.

Vegetation types restricted to sheltered gullies, Zones 1, 7, 8 and 9 (Figure 3-1) support a greater proportion of fire sensitive species and species composition, particularly of small trees and vines is likely to be substantially modified. Due to the seeding strategies of dominant eucalypts, recovery of canopy cover is likely to occur within 10 years and while a dense mid-stratum is likely to form, this is likely to have modified species composition, dominated by fire respondent species in the short to medium term. Fire sensitive species found in sheltered gullies and typically associated with dry rainforest (e.g. in Zone 7) may not regenerate within 20 to 50 years.

3.2.4 Importance of habitat for threatened fauna recovery

Unburnt patches and areas burnt at a low fire intensity play an important role as fauna refugia during fire and through providing habitat and foraging resources necessary for the persistence of surviving fauna after a fire. Such areas provide essential habitat for source populations to recolonise adjacent burnt areas following fire.

Due to bushfire conditions on 31 December 2019, the landscape was intensely burned throughout a very large area, including the majority of Mogo State Forest to the south and west of the study area. Unburnt patches are rare or absent in the nearby landscape but are present in the fire ground distant from the study area. Adjacent areas of Mogo State Forest were burnt with high to extreme fire intensity resulting in complete canopy scorch and partial or complete consumption of vegetative material in the canopy. With complete canopy scorch and only small areas with consumption of canopy vegetative material, the fire in the study area burnt at very high intensity. There are no unburnt patches, or areas subject to low fire intensity, likely to provide refugia for threatened fauna during, or after, the fire. However, due to the absence of complete consumption of the canopy, the potential for fauna to have survived in blind hollows cannot be discounted.

The study area does not support any significant waterbodies that may have provided refuge, patches of vegetation that are unburnt or burnt at a low fire intensity and consequently does not provide any important fauna refugia in the post-fire landscape.

On a precautionary basis, for the purpose of the habitat assessment it has been assumed that, in the long term, the likelihood of the study area supporting threatened species has not changed. However, there is no evidence that habitat in the study area is likely to be important for the recovery of any fauna species in the landscape.

Species-specific impacts of fire are documented further in Section 3.5 and incorporated in significance assessments.

3.3 Exotic vegetation and weeds

3.3.1 Exotic vegetation

Areas of exotic vegetation in the study area are restricted primarily to the disturbed batters of the Princes Highway and Glenella Road (Figure 3-1).

These areas comprise cleared and disturbed land supporting predominantly exotic grasses and weeds located on roadside batters. No overstorey or midstratum is present and the ground stratum is dominated by a wide range of exotic grasses and common roadside weeds including kikuyu grass (*Pennisetum clandestinum*), paspalum (*Paspalum dilatatum*) clovers (*Trifolium* spp.), lambs tongue (*Plantago lanceolata*), wild iris (unidentified Iridaceae) and purpletop (*Verbena bonariensis*). Exotic shrubs include Paddys lucerne (*Sida rhombifolia*) and blackberry (*Rubus anglocandicans*). Couch (*Cynodon dactylon*) is present but not dominant.

No plots were completed in exotic vegetation in the study area. The majority of exotic vegetation is located along the steep road batters and is inaccessible due to safety considerations.

3.3.2 Significant weeds

Records of key weed species listed under the NSW *Biosecurity Act 2015* or identified as Weeds of National Environmental Significance (WONS) identified in the construction boundary are identified in Figure 3-2.

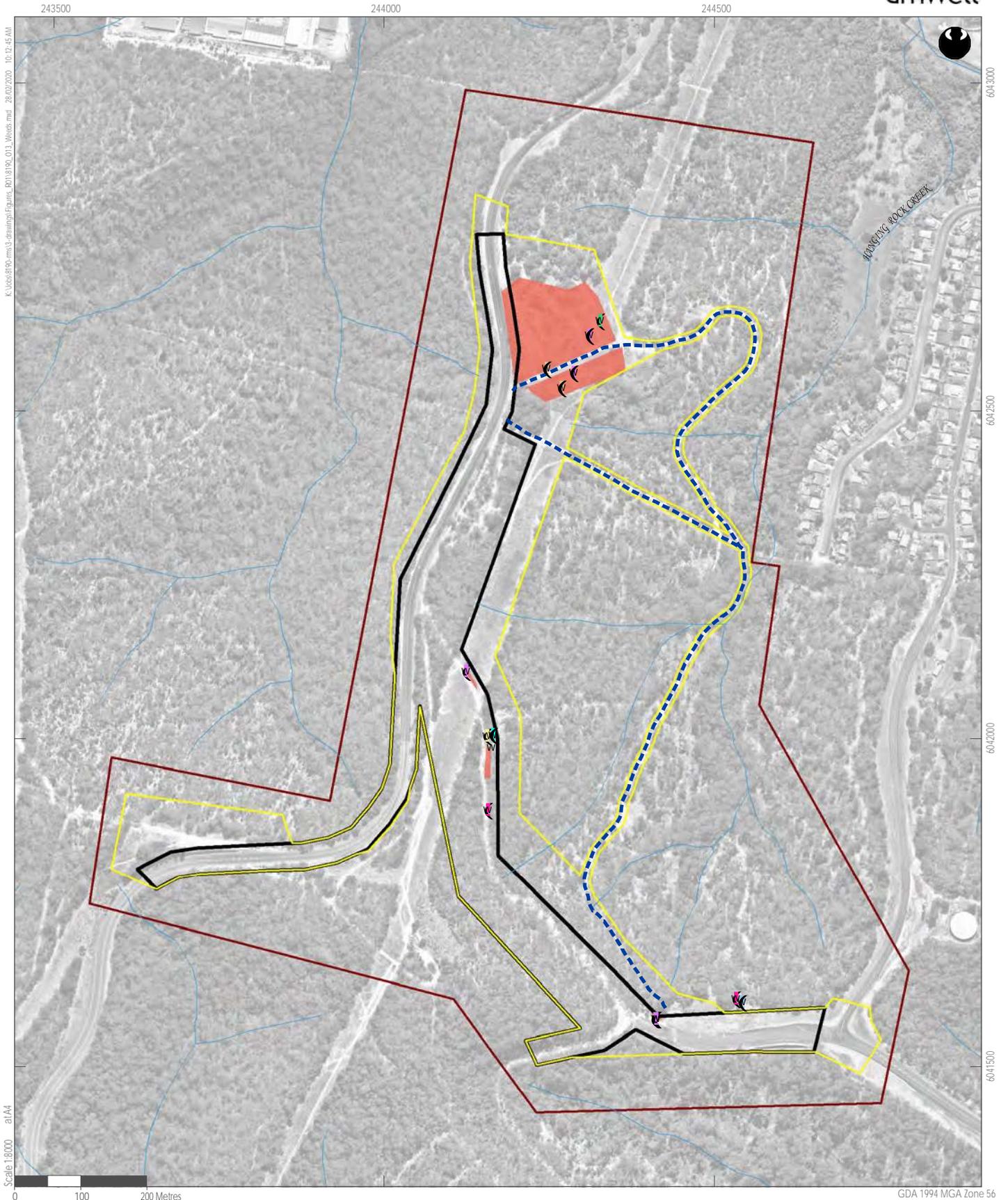
Boneseed (*Chrysanthemoides monilifera* subsp. *monilifera*), observed within the study area, has a control order duty under the *Biosecurity Act 2015*. It appears that recent control has been undertaken of boneseed. Weed zones supporting weed species listed under the *Biosecurity Act 2015* are identified in Figure 3-2. Due to the high level of disturbance and presence of a range of exotic species, the entire disturbed site of the former timber mill has been identified as a weed zone, despite listed weed species being present only within restricted locations in this area.

Table 3.11 Listed weed species observed within the study area

Species Name	Common Name	National Status	NSW <i>Biosecurity Act 2015</i> Status
<i>Rubus anglocandicans</i>	Blackberry	WONS	General Biosecurity Duty Prohibition on Dealings
<i>Senna septemtrionalis</i>	Arsenic bush		General Biosecurity Duty
<i>Chrysanthemoides monilifera</i> subsp. <i>monilifera</i>	Boneseed	WONS	General Biosecurity Duty Prohibition on Dealings Control Order
<i>Solanum mauritianum</i>	Wild tobacco bush		General Biosecurity Duty
<i>Asparagus aethiopicus</i>	Ground asparagus	WONS	General Biosecurity Duty Prohibition on Dealings

Other notable exotic species, not considered to be aggressive weeds in NSW but noted as occurring in the study area, were:

- Coral tree (*Erythrina x sykesii*)
- Common climbing-aloe (*Aloe ciliaris*)
- Paddy's lucerne (*Sida rhombifolia*)
- Kikuyu grass (*Pennisetum clandestinum*).



Legend

- | | | |
|-----------------------|----------------------|------------|
| Study Area | Weed Records | Weed Zones |
| Construction Boundary | Aspenic bush | |
| Operation Boundary | Asparagus fern | |
| Access Tracks | Blackberry | |
| Watercourses | Boneseed | |
| | Common climbing-aloe | |
| | Coral tree | |
| | Paddy's lucerne | |
| | Wild tobacco bush | |

FIGURE 3-2

Weeds and identified weed zones

3.4 Threatened ecological communities

Vegetation zones in the study area potentially conforming to BC Act listed EECs or EPBC Act listed threatened ecological communities (EECs and CEECs) are as follows:

- Zone 8 supporting PCT1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion in high condition has the potential to meet diagnostic criteria for:
 - the BC Act listed Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Swamp Oak Floodplain Forest) EEC
 - the BC Act listed River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (River-Flat Eucalypt Forest) EEC
 - the EPBC Act listed Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland (Coastal Swamp Oak Forest) EEC
 - the EPBC Act listed Illawarra and South Coast Lowland Forest and Woodland CEEC.
- Zone 9, supporting PCT1326: Woollybutt – White Stringybark – Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion in high condition, has the potential to meet diagnostic criteria for:
 - the BC Act listed River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (River-Flat Eucalypt Forest) EEC
 - the BC Act Lowland Grassy Woodland in the South East Corner Bioregion EEC
 - the EPBC Act listed Illawarra and South Coast Lowland Forest and Woodland CEEC.

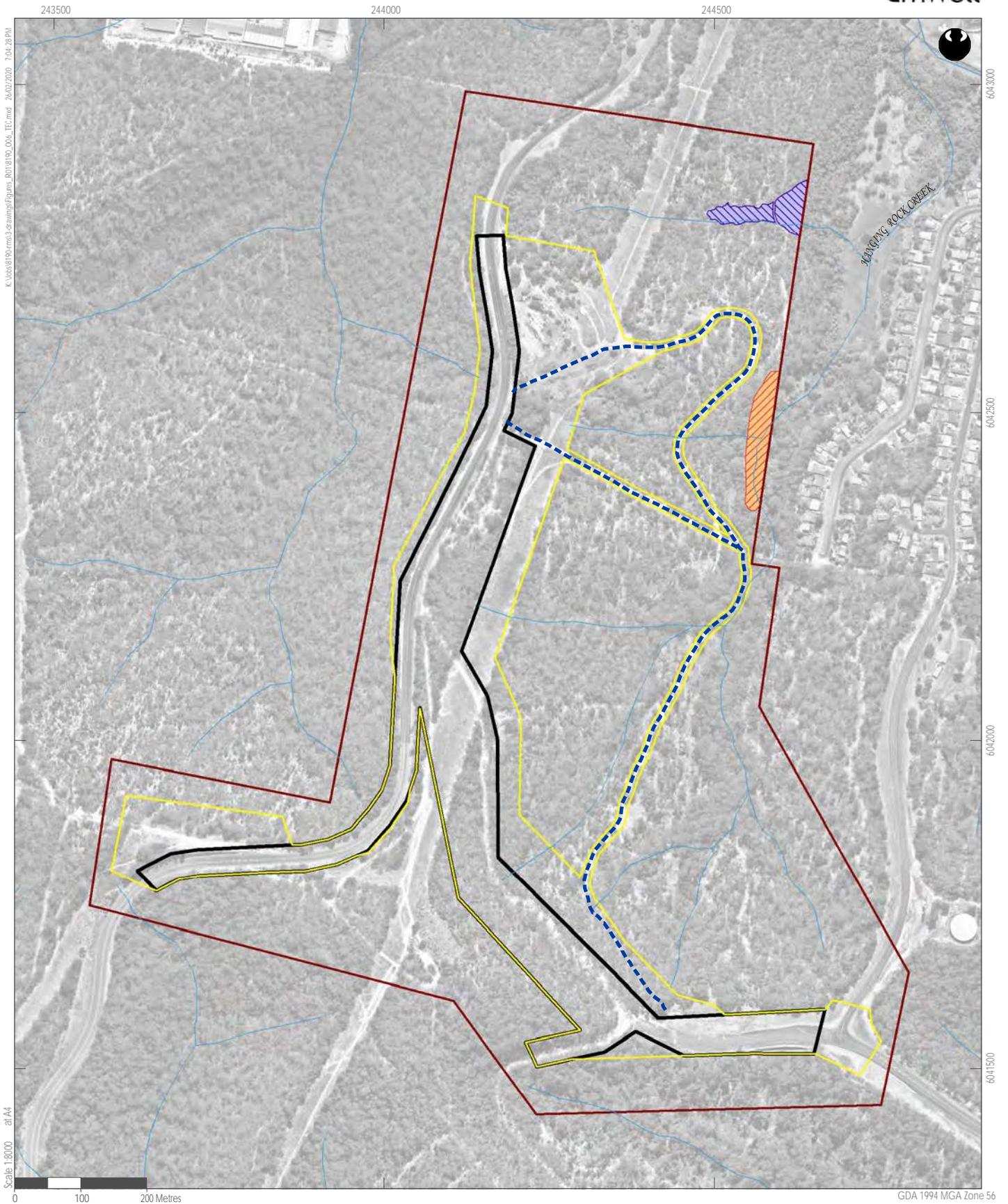
While associated with PCT1326, the BC Act listed Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion by definition occurs only in the Sydney Basin Bioregion and consequently has been discounted as a potential EEC candidate.

Appendix D documents assessments of Zones 8 and 9 against the diagnostic criteria for each of the identified potential BC Act listed EECs. Appendix E documents assessments of vegetation Zones 8 and 9 against the diagnostic criteria and condition thresholds for each of the identified potential EPBC Act listed ecological communities.

Zone 8, supporting PCT1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion, meets diagnostic criteria for the BC Act listed Swamp Oak Floodplain Forest EEC and is a high quality patch (Category B) of the EPBC Act listed Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community (Coastal Swamp Oak Forest) EEC.

Zone 9, supporting PCT1326: Woollybutt – White Stringybark – Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion, meets diagnostic criteria for the BC Act listed River-Flat Eucalypt Forest EEC and is a high quality patch (Category B) of the EPBC Act listed Illawarra and south coast lowland forest and woodland CEEC.

The location of threatened ecological communities identified in the study area is shown in Figure 3-3. Neither Zone 8 nor Zone 9 is located in the construction boundary. No vegetation zones within the construction boundary have the potential to meet the diagnostic criteria for any BC Act or EPBC Act listed ecological communities.



Legend

- Study Area
- Construction Boundary
- Operation Boundary
- Access Tracks
- Watercourses
- Threatened ecological communities (EPBC Act)**
- Illawarra and south coast lowland forest and woodland (CEEC)
- Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland (EEC)
- Threatened ecological communities (BC Act)**
- River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (EEC)
- Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions (EEC)

FIGURE 3-3

Threatened ecological communities

3.5 Groundwater dependent ecosystems

The level of groundwater dependence of vegetation communities in the study area has been identified using the Atlas of GDE (Bureau of Meteorology, 2017) and the *Risk Assessment Guidelines for Groundwater Dependent Ecosystems* released by the NSW DPI (Kuginis et al., 2012). Potential aquatic and terrestrial groundwater dependent ecosystems are shown in Figure 3-4. The level of groundwater dependence and potential for interaction is identified for terrestrial ecosystems in the study area in Table 3.12.

No aquatic or terrestrial GDEs are likely to be present in the operational boundary (Figure 3-4). Potential aquatic GDEs associated with Hanging Rock Creek were discounted based on the absent of permanent waterbodies in the study area. Two plant community types (PCT1232 and PCT1326) with potential to be high value GDEs on the basis of being listed threatened ecological communities are located in the study area but outside both the Construction and operational boundary (Figure 3-1, Table 3.12). One plant community type (PCT1206) with potential to be a high value GDE based on supporting listed threatened species crosses the access track in the construction boundary where superficial access track upgrades may occur.

Due to the absence of permanent waterbodies or potential high value terrestrial GDEs in the operational boundary and the small extent of PCT1206 in the construction boundary no ecological valuation risk assessment has been completed for potential GDEs in the study area.

3.5.1 Aquatic groundwater dependent ecosystems

One watercourse identified as a high potential aquatic GDE by the Atlas of GDE (Bureau of Meteorology, 2017), Hanging Rock Creek, is present inside and downstream of the study area (Figure 3-4). No potential aquatic GDEs are present within the operational boundary. At the eastern-most extent, access tracks within the construction boundary include a small area of overlap with the Hanging Rock Creek potential aquatic GDE. GDEs associated with the Hanging Rock Creek waterbody potentially consist of:

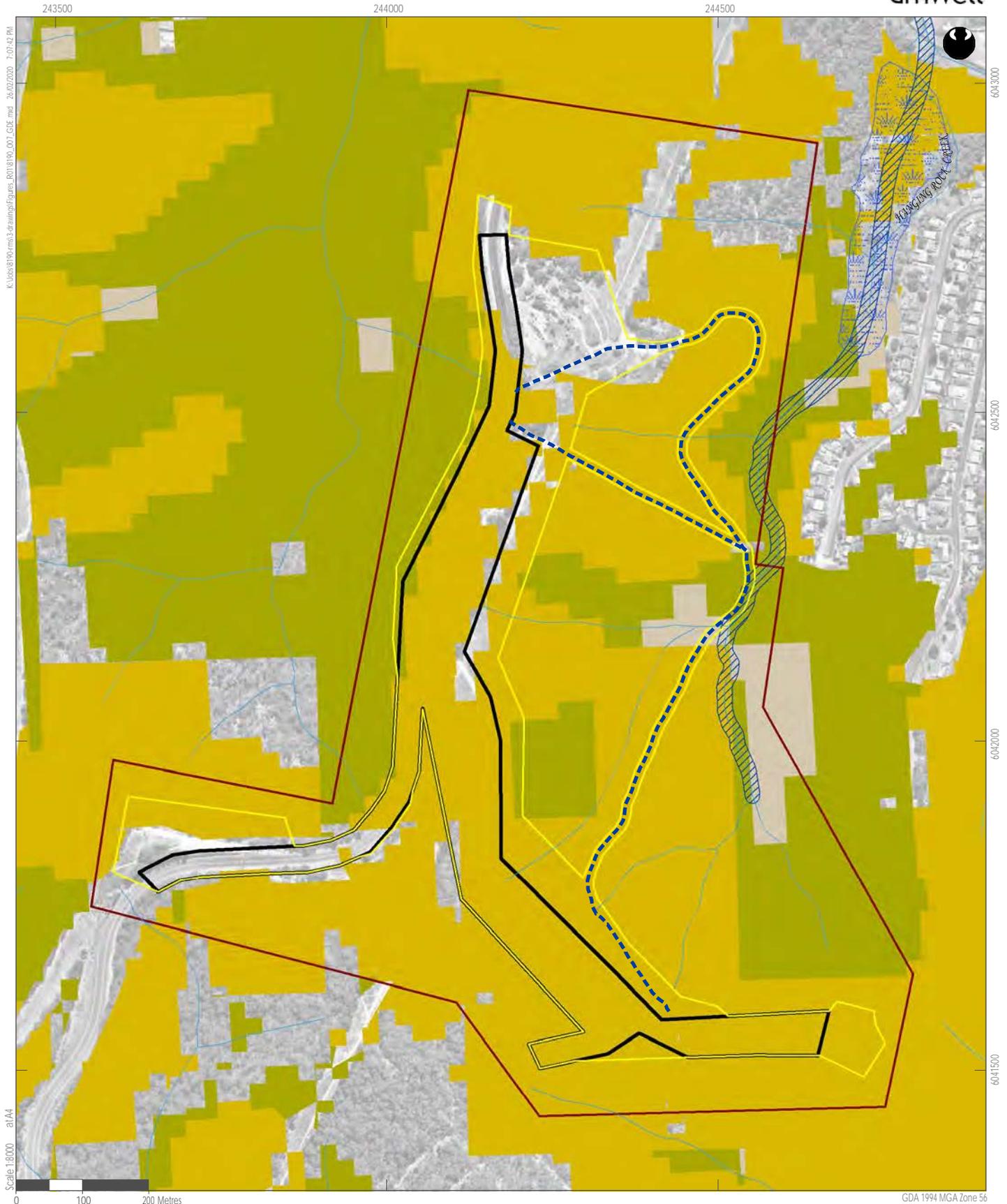
- Baseflow streams (subsurface component and surface/free-water component)
- Groundwater dependent wetlands
- Estuarine and near shore marine ecosystems.

Within the study area, in Hanging Rock Creek there is ephemeral flow and intermittent expression of surface water. No permanent pools were identified in the study area. The absence of permanent flows or surface water means that the creek line does not have baseflow characteristics and is unlikely to be dependent on groundwater. About 50 metres downstream of the study area, a permanent wetland is present on Hanging Rock Creek (Figure 2-4). Due to the limited overland flows, this wetland is a high probability GDE.

The Hanging Rock Creek is likely to support facultative GDEs which are chiefly reliant on surface water but require groundwater in some locations such as permanent wetlands and permanent pools but not in others such as the main channel and ephemeral wetland areas. The areas reliant on groundwater would be considered to be in the facultative-highly-dependent category with other parts of the systems falling in to facultative-proportional category.

Hanging Rock Creek terminates in a small estuarine environment about 2.5 km downstream of the study area. The final 200 metres supports mangroves and mud-flats within the Batemans Bay Marina break-water. The catchment of Hanging Rock Creek between the study area and the estuarine environment has been highly modified by urban and peri-urban development and is unlikely to have natural groundwater flows.

Other smaller Strahler Level 1 streams in the study area which have only ephemeral flow and intermittent expression of surface water are unlikely to have baseflow characteristics and are unlikely to be significantly dependent on groundwater. These systems would be in the facultative-opportunistic category. They are therefore unlikely to be significantly affected by the likely minor influence of the proposal on groundwater.



Legend

- | | |
|-----------------------------|--|
| Study Area | Aquatic Groundwater Dependent Ecosystems |
| Construction Boundary | High potential GDE - from national assessment |
| Operation Boundary | Terrestrial Groundwater Dependent Ecosystems |
| Access Tracks | High potential GDE - from regional studies |
| Watercourses | Low potential GDE - from regional studies |
| Indicative Wetland Boundary | Moderate potential GDE - from regional studies |

FIGURE 3-4

Groundwater dependent ecosystems

3.5.2 Terrestrial groundwater dependent ecosystems

Most of the study area is mapped as having low potential for GDEs; however, areas of moderate to high potential terrestrial GDEs are present in low lying parts of Hanging Rock Creek catchment (Figure 3-4). Due to inconsistencies between the vegetation mapping used in the GDE Atlas and the vegetation mapping completed for the present assessment (Figure 2-1), mapping of potential GDEs was overlaid over the current vegetation mapping to determine potential dependence on groundwater.

Four communities in the study area are identified in the GDE Atlas as having moderate potential for groundwater dependence as shown in Table 3.12. The dominant community in the construction boundary, PCT 1220, has a low potential for groundwater dependence. PCT 1220 is likely to be classified as “vadophytic vegetation” as this community occurs on ridges and slopes associated with well drained soils and are likely disconnected from localised groundwater systems. The low potential GDEs would be classified either as non-dependent ecosystems or as facultative-opportunistic GDEs with only minor interaction with groundwater.

3.5.3 Subterranean groundwater dependent ecosystems

There is no data on the GDE atlas for subterranean GDEs in the region. Apart from the subsurface component of the streams discussed under aquatic ecosystems, no other shallow subterranean GDEs are likely to occur in the study area as the locality lacks the limestone and porous sedimentary geology types most closely associated with these systems.

Table 3.12 Assessment of potential terrestrial GDEs

Ecosystem Name	PCT	Potential for GDE interaction (BoM, 2017)	Type of GDE (Kuginis et al. 2012)	Likely type and degree of groundwater dependence (Kuginis et al. 2012)	General aquifer ecological valuation (OEH 2012)
Batemans Bay Cycad Forest	1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner	Low potential GDE - from regional studies	Non-dependent ecosystems (vadophytic) or possible groundwater dependent terrestrial ecosystem (phreatophytic)	Non-dependent ecosystems or possibly facultative-opportunistic May use groundwater where available during times of water stress but likely to be dependent chiefly on rainfall.	No, low potential GDE
Southern Lowland Wet Forest	1206 Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion	Moderate potential GDE - from regional studies	Groundwater dependent terrestrial ecosystem (phreatophytic)	Facultative-proportional; likely to be dependent in part on groundwater may be modified by changes in groundwater attributes (e.g. in species composition) but is unlikely to be destroyed by them. Likely to be moderately reliant on groundwater particularly during times of water stress.	Yes, the potential GDE supports threatened species listed under the BC Act and the EPBC Act.

Ecosystem Name	PCT	Potential for GDE interaction (BoM, 2017)	Type of GDE (Kuginis et al. 2012)	Likely type and degree of groundwater dependence (Kuginis et al. 2012)	General aquifer ecological valuation (OEH 2012)
South Coast River Flat Forest	1326 Woollybutt – White Stringybark – Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion BC Act listed EEC and EPBC Act listed CEEC	Moderate – potential GDE - from regional studies	Groundwater dependent terrestrial ecosystem (phreatophytic)	Facultative-proportional; likely to be dependent in part on groundwater may be modified by changes in groundwater attributes (e.g. in species composition) but is unlikely to be destroyed by them. Likely to be moderately reliant on groundwater particularly during times of water stress.	Yes, the potential GDE is listed as threatened under both the BC Act and the EPBC Act.
South Coast Swamp Forest Complex <i>Casuarina glauca</i>	1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion BC Act listed EEC and EPBC Act listed EEC	Moderate potential GDE - from regional studies	Groundwater dependent terrestrial ecosystem (phreatophytic)	Facultative-proportional; likely to be dependent in part on groundwater may be modified by changes in groundwater attributes (e.g. in species composition) but is unlikely to be destroyed by them. Likely to be moderately reliant on groundwater particularly during times of water stress.	Yes, the potential GDE is listed as threatened under both the BC Act and the EPBC Act.
Temperate dry rainforest	877 Grey Myrtle dry rainforest of the Sydney Basin Bioregion and	Moderate potential GDE	Groundwater dependent terrestrial	Facultative-proportional; likely to be dependent in part on groundwater may be	Yes, the potential GDE potentially supports threatened species listed

Ecosystem Name	PCT	Potential for GDE interaction (BoM, 2017)	Type of GDE (Kuginis et al. 2012)	Likely type and degree of groundwater dependence (Kuginis et al. 2012)	General aquifer ecological valuation (OEH 2012)
	South East Corner Bioregion	- from regional studies	ecosystem (phreatophytic)	modified by changes in groundwater attributes(e.g. in species composition) but is unlikely to be destroyed by them. Likely to be moderately reliant on groundwater particularly during times of water stress.	under the BC Act and the EPBC Act.

3.6 Threatened species

3.6.1 Threatened flora

No BC Act or EPBC Act listed threatened flora species were detected during targeted surveys throughout suitable habitats in the study area. The potential for occurrence of threatened flora species within the study area is therefore considered to be low.

3.6.2 Threatened fauna

BC Act listed threatened fauna

Table 3.13 shows listed threatened fauna species identified in the habitat assessment with moderate to high potential of occurrence in the study area in the initial assessment. A summary of survey results and revised habitat assessments are included. Full details of the habitat assessment are provided in Annexure B. Species determined to have no potential of occurring within the study area due to habitat constraints are excluded from Table 3.13.

Twenty listed BC Act listed threatened fauna species were identified as having a moderate or greater potential occurrence status following targeted surveys, comprising nine bird species and eleven mammal species (Table 3.16):

- Gang gang cockatoo (*Callocephalon fimbriatum*), vulnerable
- Glossy black-cockatoo (*Calyptorhynchus lathami*), vulnerable
- Varied sittella (*Daphoenositta chrysoptera*), vulnerable
- Little lorikeet (*Glossopsitta pusilla*), vulnerable
- Swift parrot (*Lathamus discolor*), endangered
- Square-tailed kite (*Lophoictinia isura*), vulnerable
- Powerful owl (*Ninox strenua*), vulnerable
- Masked owl (*Tyto novaehollandiae*), vulnerable
- Sooty owl (*Tyto tenebricosa*), vulnerable
- Large-eared pied bat (*Chalinolobus dwyeri*), vulnerable
- Spotted-tail quoll (*Dasyurus maculatus*), vulnerable
- Eastern false pipistrelle (*Falsistrellus tasmaniensis*), vulnerable
- Southern brown bandicoot (*Isodon obesulus obesulus*), endangered
- Large bent-winged bat (*Miniopterus orianae oceanensis*), endangered
- Eastern coastal free-tail bat (*Micronomus norfolkensis*), vulnerable
- Southern myotis (*Myotis macropus*), vulnerable
- Yellow-bellied glider (*Petaurus australis*), vulnerable
- Yellow-bellied sheath-tail-bat (*Saccolaimus flaviventris*), vulnerable
- Greater broad-nosed bat (*Scoteanax rueppellii*), vulnerable
- Grey-headed flying-fox (*Pteropus poliocephalus*), vulnerable.

No threatened populations identified under the BC Act are present in the study area. While searches of NSW BioNet identify records of the “Greater Glider of the Eurobodalla Region” threatened population, this population is bounded in the north by Moruya River and consequently is not present in the landscape surrounding the study area.

Condition and type of habitat within the study area and construction boundary for each identified threatened species is discussed in the following sections, including additional information on the occurrence of each species in the surrounding landscape and the importance of habitat in the study area to the species.

EPBC Act listed threatened fauna

The PMST identified 69 listed threatened species and 57 listed migratory or marine species as potentially occurring within the search area. Habitat assessments (Appendix C) were completed for listed threatened species identified by the PMST, with the exception of obligate marine species, which were excluded from the habitat assessment as the proposal is not located in a marine area and is unlikely to result in marine impacts.

Table 3.13 shows listed threatened species identified in the habitat assessment with low to high potential of occurrence in the study area following targeted surveys. Initial and revised habitat assessments are included in Appendix C. Species initially determined to have no, or low, potential to occur within the study area due to habitat constraints are excluded from further assessment.

Five EPBC Act listed threatened fauna species were identified as having a moderate or greater potential occurrence following targeted surveys and warrant assessments of significance under the EPBC Act:

- Large-eared pied bat (*Chalinolobus dwyeri*), vulnerable
- Spotted-tail quoll (*Dasyurus maculatus*), endangered
- Southern brown bandicoot (*Isodon obesulus obesulus*), endangered
- Swift parrot (*Lathamus discolor*), critically endangered
- Grey-headed flying-fox (*Pteropus poliocephalus*), vulnerable.

No EPBC Act listed threatened populations are likely to occur within the study area.

Table 3.13 shows listed migratory species identified with low to high potential of occurrence. Further consideration of potential impacts in the form of assessment of significance is warranted only for species with a potential of occurrence moderate, high or recorded. Three listed migratory species are identified as having a moderate potential occurrence status and warrant assessments of significance under the Commonwealth EPBC Act:

- Black-faced monarch (*Monarcha melanopsis*), migratory
- Satin flycatcher (*Myiagra cyanoleuca*), migratory
- Rufous fantail (*Rhipidura rufifrons*), migratory.

Table 3.13 Habitat assessment and survey results

Scientific name	Common Name	BC Act status	EPBC Act status	Survey result	Potential occurrence	# Individuals recorded
Birds						
<i>Artamus cyanopterus cyanopterus</i>	dusky woodswallow	V	-	Not detected	Low	0
<i>Callocephalon fimbriatum</i>	gang gang cockatoo	V	-	Recorded foraging. Foraging habitat present in Zones 1, 2 and 5. Not detected during the breeding season. Potential nest trees present.	Recorded Individuals or breeding habitat not detected during the breeding season. Foraging habitat present throughout study area.	2 Record locations shown in Figure 3-5.
<i>Calyptorhynchus lathamii</i>	glossy black-cockatoo	V	-	Recorded foraging. Foraging habitat present throughout vegetation Zones 1, 2 and 5. Not detected in the study area during nest tree surveys. One observation of a fully fledged juvenile begging in October (i.e. 2 months outside the breeding season) indicating	Recorded Foraging habitat present throughout study area. All hollow bearing trees with large or very large hollows are potential breeding habitat. Species breeding habitat includes covering all mature and degraded timber generated (Figure 3-6).	4 Record locations shown in Figure 3-5.

Scientific name	Common Name	BC Act status	EPBC Act status	Survey result	Potential occurrence	# Individuals recorded
				breeding activity in nearby landscape.		
<i>Daphoenositta chrysoptera</i>	varied sittella	V	-	Recorded foraging in the study area. Potential breeding habitat present.	Recorded May utilise all forested habitat in the study area.	5 Record locations shown in Figure 3-5.
<i>Glossopsitta pusilla</i>	little lorikeet	V	-	Recorded foraging in the study area. Potential breeding habitat present.	Recorded May utilise all forested habitat in the study area.	10+ (the majority of records were of calling individuals, numbers were not counted) Record locations shown in Figure 3-5.
<i>Haliaeetus leucogaster</i>	white-bellied sea-eagle	V	-	Not detected. No stick nests present in the study area.	Low May occasionally forage in all habitat in the study area. No breeding habitat present.	0
<i>Hieraaetus morphnoides</i>	little eagle	V	-	Not detected. No stick nests present in the study area.	Low May occasionally forage in all habitat in the study area. No breeding habitat present.	0

Scientific name	Common Name	BC Act status	EPBC Act status	Survey result	Potential occurrence	# Individuals recorded
<i>Lathamus discolor</i>	swift parrot	E	CE	Not detected, however survey effectiveness was limited by drought conditions resulting in no flowering eucalypts present in the study area.	Moderate Foraging habitat present throughout study area, consistent with the surrounding landscape. The area is not identified as important habitat by DPIE.	0
<i>Lophoictinia isura</i>	square-tailed kite	V	-	Recorded flying over study area. No stick nests present in the study area.	Recorded May occasionally forage in all habitat in the study area. No breeding habitat present in the study area	1 Record location shown in Figure 3-5.
<i>Ninox strenua</i>	powerful owl	V	-	Not detected, potential casting recorded. Suitable nesting and roost trees identified.	Moderate May forage in all habitat in the study area. No evidence of breeding detected.	0
<i>Tyto novaehollandiae</i>	masked owl	V	-	Not detected, potential casting recorded.	Moderate May forage in all habitat in the study area.	0

Scientific name	Common Name	BC Act status	EPBC Act status	Survey result	Potential occurrence	# Individuals recorded
				Suitable nesting and roost trees identified	No evidence of breeding detected.	
<i>Tyto tenebricosa</i>	sooty owl	V	-	Recorded. Heard calling along Hanging Rock Creek on several occasions during nocturnal surveys in August and early September. Suitable nesting and roost trees. Roosting and possible breeding activity is likely to occur in or adjacent to the study area.	Recorded during the breeding season. May forage in all habitat in the study area Breeding habitat comprises hollow bearing trees in all mature forest within 100 metres of drainage lines in accordance with the recovery plan (Figure 3-6).	At least one individual calling on two separate survey nights. Observation shown in Figure 3-5.
<i>Monarcha melanopsis</i>	black-faced monarch	-	Mi	Assumed present	Moderate May forage in all habitat in the study area.	0
<i>Myiagra cyanoleuca</i>	satin flycatcher	-	Mi	Assumed present	Moderate May forage in all habitat in the study area.	0
<i>Rhipidura rufifrons</i>	rufous fantail	-	Mi	Assumed present	Recorded	1

Scientific name	Common Name	BC Act status	EPBC Act status	Survey result	Potential occurrence	# Individuals recorded
					May forage in all habitat in the study area.	
Mammals						
<i>Chalinolobus dwyeri</i>	large-eared pied bat	V	V	Suitable breeding habitat absent and suitable foraging habitat assessed as likely absent due to the distance from caves and escarpments, however the species potentially occurs as possible calls were detected at survey point A8.	Moderate No breeding or roosting habitat in or near the study area. May forage in the study area, however unlikely to be important foraging habitat due to absence of caves or escarpments within 2 km of the study area.	Possible calls were detected at anabat survey location A8 (Figure 2-3). Number of records provided for each survey location can be found in Appendix B.
<i>Dasyurus maculatus</i>	spotted-tailed quoll	V	E	Not detected, however, detection likelihood may have been reduced by survey limitations (Section 2.4.7). Based on survey limitations, revised occurrence has been assessed as moderate.	Moderate May forage in all habitat in the study area.	0

Scientific name	Common Name	BC Act status	EPBC Act status	Survey result	Potential occurrence	# Individuals recorded
<i>Falsistrellus tasmaniensis</i>	eastern false pipistrelle	V	-	Suitable foraging and roosting habitat present. Species group recorded.	High May utilise all habitat in the study area. Potential roosting trees are present throughout the forested area.	Species group recorded at all Anabat survey locations (Figure 3-5). Number of records provided for each survey location in Appendix B.
<i>Isodon obesulus obesulus</i>	southern brown bandicoot	E	E	Suitable dense groundcover limited only to low-lying areas, vegetation Zones 1 and 9 (Figure 3-1). Not detected, however detection likelihood may have been reduced by survey limitations (Section 2.4.7) and did not meet Commonwealth Guidelines. Based on survey limitations, revised occurrence has been assessed as moderate.	Moderate (low within construction boundary) Potential habitat present associated with PCT1206 and PCT1326 which support suitable understorey habitat characteristics (Figure 3-6).	0
<i>Miniopterus orianae oceanensis</i>	large bent-winged bat	E	-	Not recorded during Anabat surveys conducted during	Moderate	0

Scientific name	Common Name	BC Act status	EPBC Act status	Survey result	Potential occurrence	# Individuals recorded
				breeding season (Appendix B). Suitable foraging habitat during the non-breeding season present. Roosting habitat absent.	May utilise all habitat in the study area for foraging during the non-breeding season. Breeding habitat or likely non-breeding roost sites are absent.	
<i>Micronomus norfolkensis</i>	eastern coastal free-tail bat	V	-	Suitable foraging and roosting habitat present. Definite calls recorded	Recorded May utilise all forested habitat in the study area. Potential roosting trees are present throughout the forested area (Figure 3-6).	Definite or probable calls recorded at five of eight Anabat survey locations (Figure 2-3). Species group recorded at all Anabat survey locations. Number of records provided for each survey location in Appendix B.
<i>Myotis macropus</i>	southern myotis	V	-	Suitable foraging and roosting habitat present, restricted to 200 metres from wetland. Species group recorded.	Moderate No roosting habitat such as hollow bearing trees or other habitat structures are present in the construction boundary within 200 metres of a waterbody.	Species group recorded at five of eight Anabat survey locations, with most calls recorded at A7 and A8 within 200 metres of waterbody (Figure 2-3). Species group calls at A1, A3 and A4 unlikely to be southern myotis due to distance from

Scientific name	Common Name	BC Act status	EPBC Act status	Survey result	Potential occurrence	# Individuals recorded
						water. Number of records provided for each survey location in Appendix B.
<i>Petauroides volans</i>	greater glider	-	V	Not detected, however past records present. Species highly detectable during nocturnal surveys, hence if present likely to have been recorded. Past records may be yellow-bellied glider.	Low	0
<i>Petaurus australis</i>	yellow-bellied glider	V	-	Recorded	Recorded Due to habitat degradation by timber harvesting, habitat potential is based on unlogged forest in the study area (Figure 3-6). Unlikely to persist or regularly forage in areas recently logged due to exposure.	8 Record locations shown in Figure 3-5
<i>Petaurus norfolkensis</i>	squirrel glider	V	-	Not detected. No calls or potential squirrel gliders detected during	Low	0

Scientific name	Common Name	BC Act status	EPBC Act status	Survey result	Potential occurrence	# Individuals recorded
				spotlighting. Sugar glider calls heard commonly. Majority of small gliders observed during camera trapping had white tail markings, or were present in a group with individuals with white tail markings.		
<i>Phascogale tapoatafa</i>	brush-tailed phascogale	V	-	Not detected	Low.	0
<i>Phascolarctos cinereus</i>	koala	V	V	Not detected Habitat assessment tool score: 3	Low Based on the koala habitat assessment tool (DoE 2014), habitat in the study area scores a value of three and hence does not include habitat critical to the survival of the koala. Based on the 'low' potential occurrence no assessment of significance under the EPBC Act is warranted for the koala.	0

Scientific name	Common Name	BC Act status	EPBC Act status	Survey result	Potential occurrence	# Individuals recorded
<i>Pteropus poliocephalus</i>	grey-headed flying-fox	V	V	No roost sites present. Foraging habitat present but no individuals recorded as winter flowering eucalypts were not flowering due to drought.	High Foraging habitat present throughout study area. No roost sites are present.	0
<i>Saccolaimus flaviventris</i>	yellow-bellied sheath-tail-bat	V	-	Suitable foraging and roosting habitat present. Probable calls detected	High May utilise all forested habitat in the study area. Potential roosting trees are present throughout the forested area (Figure 3-6).	Probable and possible calls detected at A8 and species group recorded at two Anabat survey location, A7 and A8 (Figure 2-3). Number of records provided for each survey location in Appendix B.
<i>Scoteanax rueppellii</i>	greater broad-nosed bat	V	-	Suitable foraging and roosting habitat present. Possible calls recorded and species group calls recorded.	High May utilise all forested habitat in the study area. Potential roosting trees are present throughout the forested area (Figure 3-6).	One possible call recorded at A6 and species group recorded at all Anabat locations except A8 (Figure 2-3). Further detail provided for each survey location in Appendix B.
*V= Vulnerable, E=Endangered, CE = Critically Endangered, Mi = Migratory.						

Gang gang cockatoo

Gang gang cockatoos were observed foraging in the study area in September 2019 (Figure 3-5). While hollow bearing trees suitable for gang gang cockatoo breeding were present, breeding is typically associated with escarpment ranges and tablelands to the west. Searches in October and November did not record any gang gang cockatoos during the breeding season. Consequently, while recorded on the study area, gang gang cockatoos are unlikely to breed there. The study area does not support habitat distinct from elsewhere within the surrounding landscape and is not likely to be important habitat for the species.

The fire impacts are likely to have a short term impact on foraging habitat for gang-gang. Following epicormic resprouting of the canopy and resumption of normal flowering, the study area is likely to support foraging resources within 2 – 5 years, similar to other burnt areas elsewhere in the landscape. The study area does not include any unburnt patches, areas of low fire intensity or other habitat features that comprise an important post-fire refuge for gang gang cockatoo.

Due to the landscape context of the site and absence of gang gang records during the breeding season, the study area is not likely to support any breeding habitat for gang gang cockatoo. Gang gang cockatoos are likely to utilise all timbered habitat in the study area for foraging.

Glossy black cockatoo

Glossy black cockatoos were observed in the study area through direct observation (Figure 3-5) and observation of foraging signs (i.e. chewed black she-oak cones). One important feed species, black she-oak (*Allocasuarina littoralis*), is extensively distributed across the study area. Systematic searches in August did not detect any glossy black cockatoos during the breeding season, with two separate observations of foraging individuals, including one fully fledged begging juvenile, outside the identified breeding season. Targeted searches for suitable nesting trees identified numerous mature trees in the study area with very large hollows potentially suitable as nesting sites for glossy black cockatoo. However, during the breeding season there was no evidence of active use such as extensive white-wash or associated activity.

Potential breeding and potential foraging habitat for glossy black cockatoo is present in the study area. Foraging habitat within the study area has been degraded by recent timber harvesting which has resulted in clearing of extensive areas likely to have supported black she-oak. Patches of foraging habitat remain throughout the degraded areas and are distributed extensively throughout the remainder of the study area.

While the species was not detected during breeding season surveys, suitable hollows are present and the species is likely to breed in the surrounding landscape. A total of 111 hollow bearing trees supporting large or very large hollows potentially suitable for glossy black cockatoo were recorded in the study area (Figure 3-6). The condition of foraging habitat varies substantially across the study area, depending on the degree, type of and time since disturbance. The distribution of large hollow bearing trees in the study area is highly influenced by past timber harvesting and disturbance, with the majority of large hollows restricted to several patches of vegetation along drainage lines.

Breeding and foraging habitat within the study area is likely to be consistent with habitat in large areas of Mogo State Forest to the south and west. Equivalent foraging habitat, comprising vegetation supporting dense or scattered black she-oak, was present in adjacent

areas of Mogo State Forest to the west and south prior to fires. Similarly, the distribution of large hollow bearing trees elsewhere in the surrounding landscape is likely to be consistent with the study area, with clusters of large hollow bearing trees restricted to gullies and protected fragments. Habitat is absent from the immediate urban area of Batemans Bay to the north and east of the study area.

The 2019 – 2020 fires are estimated to have burnt 45 per cent of recorded locations for glossy black cockatoo in NSW (DPIE, 2020). All areas of glossy black cockatoo feeding habitat in the study area were burnt in the fires. The study area does not include any unburnt patches, areas of low fire intensity or other habitat features that comprise an important post-fire refuge for glossy black cockatoo. The fire impacts are likely to have a substantial medium-to-long term impact on both foraging and breeding habitat for glossy black cockatoo. Black she-oak, on which the species is dependent for foraging, will regenerate only from seed and foraging habitat is likely to take 5 to 15 years to recover in the study area.

Glossy black cockatoos require large or very large hollows for breeding. Trees supporting such hollows are more susceptible to and less stable after fire damage during bushfires. While no detailed hollow-bearing tree survey was carried out after the fires, it is expected that a substantial number of the originally surveyed trees supporting large or very large hollows would have been destabilised by or lost during the fires. However, due to the relatively large number of such trees present in the study area, it is assumed that numerous trees with large or very large hollows will persist. Based on the local fire intensity, the impacts in the study area are likely to be consistent with fire impacts elsewhere in the nearby landscape. Due to the potential for regeneration of foraging resources and the expectation that some suitable hollow bearing trees for nesting will persist following the fires, breeding and important foraging habitat has been assumed to be present in all mature and degraded timber where trees supporting suitable large and very large hollows are present (Figure 3-6).

Varied sittella

Varied sittella were observed foraging during diurnal bird surveys in the study area (Figure 3-5). Varied sittella are likely to commonly utilise foraging habitat in the study area and may breed in the study area. The habitat present is consistent with extensive similar habitat present throughout the landscape to the west of the study area, including in adjacent areas of Mogo State Forest. The species does not have specific nesting tree requirements and hence breeding habitat is widespread throughout the landscape. Foraging and potential breeding habitat for varied sittella is assessed as present throughout timbered parts of the study area.

The fire impacts are likely to have a short term impact on habitat for varied sittella. Following epicormic resprouting of the canopy, the study area is likely to support sufficient shelter and foraging resources for foraging and breeding of varied sittella within 2 – 5 years, similar to other burnt areas elsewhere in the landscape. The study area does not include any unburnt patches, areas of low fire intensity or other habitat features that comprise an important post-fire refuge for varied sittella.

Little lorikeet

Little lorikeets were heard and observed flying through the study area on multiple occasions (Figure 3-5). While no flowering eucalypts were recorded in the study area during surveys, due to the exceptionally dry seasonal conditions, the study area is likely to typically support

foraging habitat. The habitat present is consistent with extensive similar habitat present throughout the landscape to the west of the study area, including in adjacent areas of Mogo State Forest. Suitable nesting trees are common in the study area and there is potential for the species to breed in the study area. Similar breeding habitat is likely to be widespread throughout the surrounding landscape, although potentially restricted largely to protected corridors due to extensive timber harvesting activities throughout Mogo State Forest. Foraging and potential breeding habitat for little lorikeet is assessed as present throughout timbered parts of the study area.

The fire impacts are likely to have a short to medium term impact on habitat for little lorikeet. Following epicormic resprouting of the canopy, the study area is likely to support sufficient shelter and foraging resources for foraging and breeding of little lorikeet once flowering of the eucalypt canopy returns to normal within 2 – 5 years, similar to other burnt areas elsewhere in the landscape. The study area does not include any unburnt patches, areas of low fire intensity or other habitat features that comprise an important post-fire refuge.

Swift parrot

Swift parrots are likely to occasionally forage in winter flowering eucalypts present in the study area particularly during years where the abundance of flowering in the landscape is sufficient to draw individuals to the region. Swift parrots were not detected during surveys. While surveys were conducted late in the season and outside the Commonwealth recommended survey period, they were conducted in line with NSW recommended survey periods and documented timing of records in the south coast region. However, due to exceptionally dry seasonal conditions at the time of surveys, winter flowering eucalypts were not flowering in the study area at the time of survey. Consequently, the potential for surveys to detect the species in the study area was limited and the potential for the species to intermittently utilise foraging resources in the study area cannot be discounted.

The habitat present is consistent with extensive similar habitat present throughout the landscape to the west of the study area in adjacent areas of Mogo State Forest. The study area is not located in areas mapped on the DPIE draft important habitat map for the swift parrot. The swift parrot has been assigned a moderate potential for occurrence, despite absence of detection during targeted survey, due to the absence of flowering eucalypts on site. Swift parrot is considered likely to forage throughout the landscape, with equivalent potential foraging habitat present throughout timbered parts of the study area.

The fire impacts are likely to have a short to medium term impact on habitat for swift parrot. Following epicormic resprouting of the canopy, the study area is likely to support sufficient shelter and foraging resources for swift parrot within 2 – 5 years, similar to other burnt areas elsewhere in the landscape to the south and west. The study area does not include any unburnt patches, areas of low fire intensity or other habitat features that comprise an important post-fire refuge for swift parrot.

Square-tailed kite

A square-tailed kite was observed flying above the study area (Figure 3-5) and is likely to utilise native vegetation within the study area for foraging. Extensive similar foraging habitat is present, in the surrounding landscape, with the exception of the immediate urban area of Batemans Bay to the north and east of the study area. While the species may breed in the region and within the identified vegetation types, no large stick nests were observed on the study area and hence breeding habitat is absent. The study area does not comprise important habitat for the species.

The study area does not include any unburnt patches, areas of low fire intensity or other habitat features that comprise an important post-fire refuge for square-tailed kite. While fires are likely to have impacted prey abundance across the landscape, there are not likely to be any site-specific impacts.

Forest owls

Sooty owl was confirmed to be active within Hanging Rock Creek during nocturnal surveys conducted in August and September 2019, with at least one calling individual heard on separate survey nights (Figure 3-5). Powerful owl and masked owl were not confirmed present in the study area during survey. However, these forest owls are anticipated to utilise the landscape and have been assigned a moderate likelihood of occurrence due to the presence of past records in and adjacent to the study area (Figure 3-5).

Detection of sooty owl within the breeding season indicates the likely presence of a roosting site in or adjacent to the study area and potential for this species to utilise the study area for breeding. Sooty owls are known to be faithful to a breeding hollow however are unlikely to return to a nesting location following bushfire. Systematic searches did not identify any trees with evidence of active use such as extensive white-wash or castings. One casting of an undetermined species of forest owl was recorded close to the southern boundary of the study area, outside of the construction boundary (Figure 3-5). As only a single casting was detected at the location, it is unlikely that this site was used as a breeding site and may represent an irregularly utilised roost site. The absence of detection of other owl species does not discount the possibility that they may utilise breeding habitat in some seasons, as the species tend to utilise multiple breeding locations over different years.

The abundance of hollow bearing trees, potential foraging resources and habitat structure in timbered vegetation zones means that there are likely to be an abundance of prey species for forest owls. This was confirmed by the detection of a range of arboreal and small terrestrial mammals in the study area. Targeted searches for nesting or roosting trees in the study area identified 111 mature trees with large and very large hollows in the study area, the majority located within 100 metres of drainage lines potentially suitable for as roosting and/or nesting sites for forest owls (Figure 3-6). The majority of large hollow-bearing trees were located along drainage lines in areas not subject to recent logging. However, scattered large mature trees were present elsewhere in the study area.

The habitat present within the study area is likely to be consistent with extensive areas of similar habitat present throughout the landscape to the west of the study area in adjacent areas of Mogo State Forest. Habitat is likely to be absent from urban areas to the north and east of the study area. All three species are likely to utilise the surrounding landscape. Despite the absence of a confirmed nesting tree, the confirmed presence of sooty owl on multiple survey nights during the breeding season means that areas supporting large hollow-bearing trees within 100 metres of riparian areas should be assumed to comprise breeding habitat for this species. Due to impacts resulting from recent timber harvesting vegetation Zone 5 (Figure 3-1) is not likely to support breeding habitat and has been excluded from the breeding habitat.

The high intensity bush fire that burnt the site on 31 December 2019, severely degraded habitat and foraging resource availability for forest owls. The 2019 – 2020 fires are estimated to have impacted 41 per cent of recorded locations for sooty owl, 37 per cent of recorded locations for masked owl and 26 per cent of recorded locations for powerful owl (DPIE, 2020). The study area does not provide any short term post-fire refuge or foraging resources important for the survival of forest owls in the landscape following the fire.

Sooty owls favour dense midstorey cover in breeding areas, which may take several decades to recover. While typically faithful to a nesting location, it is unlikely that sooty owl will return to a breeding location subject to high intensity fire due to exposure. Suitable sooty owl nesting trees, i.e. trees with large or very large hollows, are more susceptible to and less stable after fire damage during bushfires. While no detailed hollow-bearing tree survey was carried out after the fires, it is expected that a substantial number of the originally surveyed habitat trees would have been destabilised by or lost during the fires. While this may result in a reduction in the abundance of suitable nest and roost trees, due to the abundance of such trees in the study area it is likely that suitable nesting and roosting habitat will persist in the study area. Impacts outside of the study area are likely to have been similar. The high intensity burn and subsequent period without foraging resources or cover, is likely to have removed or substantially reduced the abundance of terrestrial and arboreal mammals on which forest owls are dependent for foraging.

All timbered areas constitute potential foraging habitat for all forest owls. While degraded by fire in the short term, it has been assumed on a precautionary basis that habitat can recover sufficiently to support forest owls and hence potential breeding habitat was identified for sooty owl in accordance with the forest owls recovery plan for intact timbered areas (i.e. Zones 1, 2, 7, 8 and 9) within 100 metres of a mapped drainage line (Figure 3-6). Large and very large tree hollows within this buffer area should be considered potential forest owl nest and roost trees although likelihood of utilisation is reduced by fire in the short to medium term.

Migratory bird species

The rufous fantail, satin flycatcher and black-faced monarch are likely to occur in the broader landscape surrounding and including the study area, especially during northward and southward migration. The study area does not support any significant habitat for these species, as similar and higher quality habitat is extensively distributed throughout the landscape to the south, west and north of the study area.

No un-burnt habitat patches are present which provide post-fire refugia for migratory bird species. It is likely that habitat on the site will recover sufficiently to support habitat for these species within 2 – 5 years. While more likely to be utilised sheltered gullies, these species are considered likely to be present throughout the landscape and no specific habitat polygons have been mapped.

Cave roosting micro-bats

No natural escarpments, caves or mine shafts were identified in the study area or within two km of the study area, hence potential breeding or important roosting habitat for cave-dependent micro-bats, specifically the large bent-winged bat and large-eared pied bat is absent, based on the NSW guidelines for 'Species credit' threatened bats and their habitats (OEH, 2018). Two artificial habitat features potentially providing roosting locations for the large bent-winged bat were identified in the old timber mill site during the habitat assessment; an abandoned building and a timber loading ramp with substantial eroded crevices behind the beams. The abandoned building was burnt during the fire and no longer supports potential habitat. The timber loading ramp was not inspected following the fire but is likely to have been burnt during the fire and no longer provide potential roosting habitat.

Possible large-eared pied bat calls were recorded in the study area during the Anabat surveys (Appendix B). While roosting, breeding and foraging habitat is absent in accordance

with the guidelines for 'Species credit' threatened bats and their habitats (OEH, 2018), the species has been considered present in the landscape for the purposes of significance assessment on a precautionary basis.

No definite or potential large bent-winged bat calls were recorded in the study area during Anabat surveys. This is consistent with the expectation that large bent-winged bats would have been located at maternity roosts during the survey period. Foraging habitat for the large bent-winged bat is likely to be present, however the habitat type and quality is consistent with habitat throughout the surrounding landscape to the west of the study area.

It is unlikely that the bushfire would have any long-term impact on the suitability of foraging habitat in the study area for cave roosting microbats.

Spotted-tailed quoll

The spotted-tailed quoll is known to occur in the largely continuous forested landscape to the south-west and west of Batemans Bay and may occur in the study area. Spotted-tailed quoll have not been recorded in the study area. The study area does not support habitat distinct from elsewhere within the surrounding landscape and is not likely to be important habitat for the species. Due to the limitations of camera trapping survey, the spotted-tailed quoll has been assigned a moderate likelihood of occurrence following surveys. Habitat for spotted-tailed quoll is considered likely to be present throughout the landscape.

37 per cent of recorded locations in NSW have been impacted by fire during the 2019 – 2020 fires (DPIE, 2020). However, the study area was burnt at high intensity and does not contain any refuge patches for the species likely to be important for species recovery. It is unlikely that that the fire will have any long-term impact on the suitability of habitat in the study area for spotted-tailed quoll.

Hollow-dependent micro-bats

Numerous hollow bearing trees are present throughout the study area (Figure 3-6). Analysis of ultrasonic recordings sampled in the study area found that eastern coastal free-tail bat and yellow-bellied sheath-tail bat occur in the study area. Eastern false pipistrelle and greater broad-nosed bat were found to potentially occur in the study area (possible calls of the latter two species which could not be confidently identified to species level were recorded). Anabat survey locations are shown in Figure 2-3 and Table 3.13 includes discussions of which species was detected at each location.

Based on the habitat features present, suitable breeding and roosting habitat for eastern false pipistrelle, eastern coastal free-tail bat, greater broad-nosed bat and yellow-bellied sheath-tail bat should be assumed to be present. Artificial structures and specifically the building and timber loading ramp located within the former timber mill site which may have provided roosting habitat for these species were identified prior to bushfire. Due to the extensive distribution of hollow bearing trees, all areas supporting forest or degraded forest within the study area are likely to be habitat for hollow-dependent micro-bats. Habitat for tree roosting microbats is present throughout the landscape.

It is unlikely that the fire will have any long-term impact on the suitability of habitat in the study area for tree roosting microbats. While a proportion of hollow bearing trees are likely to be lost as a result of fires, the majority of hollow bearing trees, particularly those with smaller hollows, are likely to remain present in the landscape and new habitat will be created as a result of fire scars. The abandoned building was burnt during the fire and no longer supports

potential habitat. The timber loading ramp was not inspected following the fire but is likely to have been burnt during the fire and no longer provide habitat.

Southern brown bandicoot

Potential habitat for southern brown bandicoot was restricted to Zones 1 and 9 (Figure 3.1 and Figure 3-6) which contained variable dense ground cover and shrub layer. Other vegetation zones did not support suitable habitat structure for southern brown bandicoot. Potential but un-verified diggings were observed during surveys for nest trees and roost sites in Zone 1. Due to the limitations of the camera trapping survey resulting from false triggers during the first deployment and bushfire during the second deployment (Section 2.4.7) the species has been assigned a moderate likelihood of occurrence despite not being detected during the survey.

The 2019 – 2020 fires are estimated to have burnt 32 per cent of recorded locations of southern brown bandicoot. The fire has resulted in complete removal of suitable habitat for southern brown bandicoot in the study area. However, on a precautionary basis it is assumed that habitat has the potential to recover within 2 – 5 years, associated with increased groundcover and shrub cover associated with regeneration of fire responsive species.

Southern myotis

Anabat recording detected species groupings including southern myotis at five of eight survey locations (Figure 2-3). Possible southern myotis calls recorded within 200 metres of standing water were assumed, on a precautionary basis, to be valid records whilst possible southern myotis calls recorded outside of this area were considered unlikely to be southern myotis calls. Hollow bearing trees, caves, bridges or culverts within the study area that are also within 200 metres of standing water may provide habitat for Southern Myotis in accordance with NSW guidelines for 'Species credit' threatened bats and their habitats (OEH, 2018). No large culverts or bridges were identified in the study area and no likely roosting colonies were detected. Hollow bearing trees in the north-east of the study area adjacent to the Hanging Rock Creek wetland potentially provide roosting habitat for Southern Myotis. However, no habitat is present in the construction boundary. It is unlikely that the fire will have any long-term impact on the availability of potential roosting trees in the study area, due to the expected retention of the majority of hollow bearing trees and the potential for additional hollows and crevices suitable for microbats to form as a result of the fire.

Yellow-bellied glider

Yellow-bellied gliders were confirmed present in the study area during nocturnal surveys conducted in August 2019 (Figure 3-5). At least three individuals were recorded along Hanging Rock Creek and one individual was recorded west of Princes Highway. Numerous hollow bearing trees are present within the study area and all areas of relatively intact vegetation are likely to be habitat, i.e. Zones 1, 2, 7, 8 and 9 and have been mapped as a species habitat (Figure 3-6). Numerous hollow bearing trees and extensive areas suitable for foraging in the study area provide ideal habitat for the species. Cleared and recently logged areas are unlikely to constitute significant habitat for the yellow-bellied glider but may be occasionally utilised for foraging and dispersal.

This species spends large amounts of time foraging within extensive home ranges (20-85 ha) occupied by family groups of between two and six individuals (Lindenmayer, 2002) at

low overall densities. Based on this, the study area has the potential to support one to three family groups and habitat is limited by the extent of the habitat patch rather than the number of hollows available. Gliders are sensitive to loss of tree hollows, foraging habitats and fragmentation (Russell, 1995). The habitat present is consistent with extensive similar habitat present throughout the landscape to the south and west of the study area in adjacent areas of Mogo State Forest.

Due to the location of the study area on the urban edge and adjacent to Princes Highway, connectivity and edge effects are likely to be greater in the study area relative to more extensive and less fragmented habitat elsewhere in the State Forest. Important habitat areas supporting family groups may potentially be restricted to drainage lines and protected corridors due to extensive timber harvesting activities throughout Mogo State Forest.

There is likely to be limited existing connectivity of yellow-bellied glider to the south but significant barriers to movement are present out of the study area to the west. To the south, while the section of Glenella Road between the Princes Highway and The Ridge Road is unlikely to form a barrier to yellow-bellied glider movement, as indicated by past records in that area (Figure 3-5), the section between The Ridge Road and Heron Road is likely to constitute a barrier. To the west the existing powerline easement and Princes Highway is likely to form a barrier to movement of yellow-bellied glider from the Hanging Rock Creek Catchment. No habitat is present for yellow-bellied glider in urban areas to the east of the study area and limited narrow habitat is present adjacent to the urban boundary north of the study area.

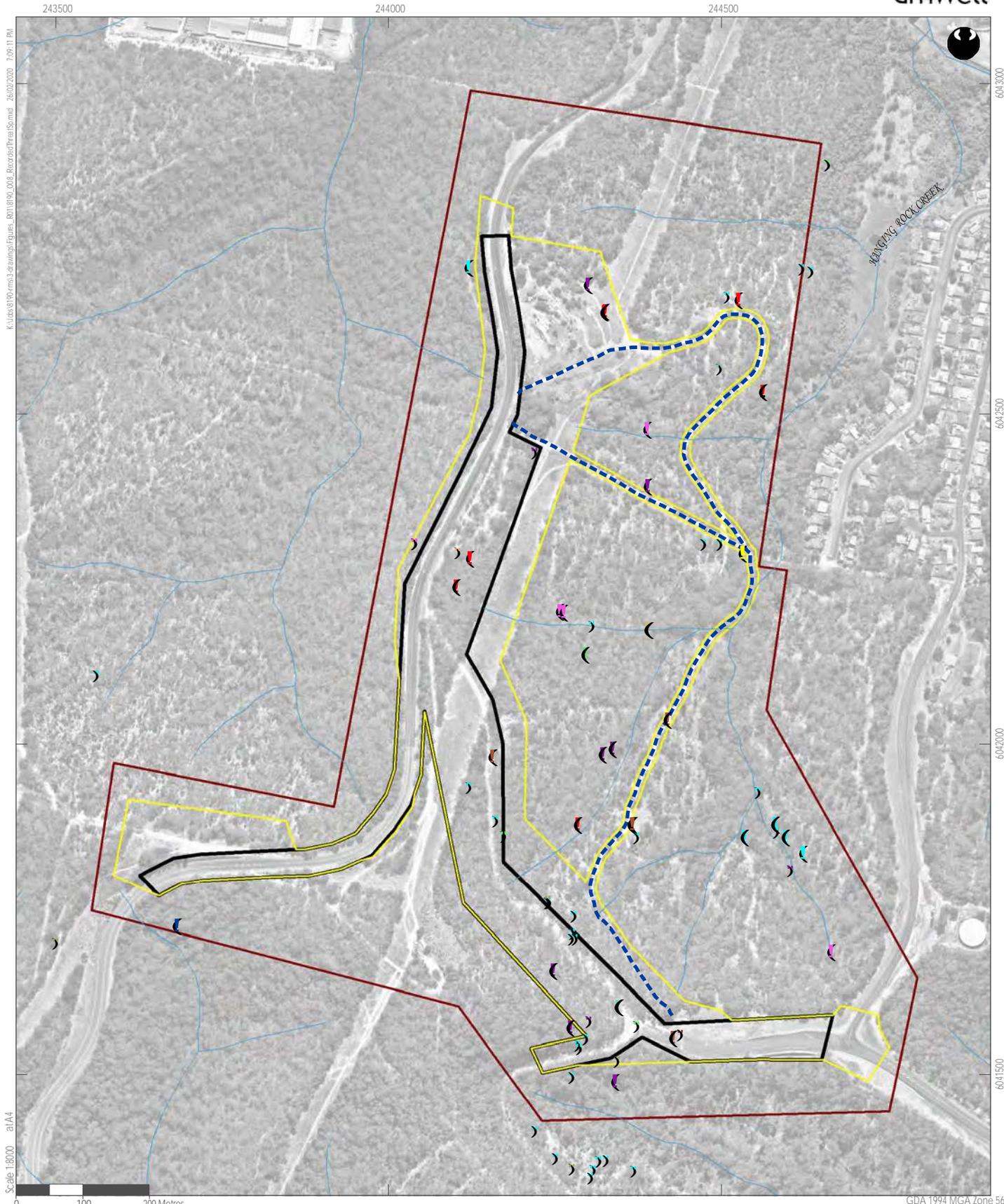
Fire impacts on yellow-bellied glider are variable across the species' range, however the species is likely to be vulnerable to direct mortality and loss of habitat as a result of fire. The 2019 – 2020 fires are estimated to have impacted approximately 54 per cent of recorded locations for the species (DPIE, 2020). Depending on fire intensity, yellow-bellied glider individuals may survive in protected blind hollows high in the canopy. However, due to the high fire intensity in the study area, there is a high probability that most or all individuals did not survive the fire. The study area does not have any unburnt patches or areas of low fire intensity likely to provide refuge and post-fire foraging habitat, which would be important for the species following the fire. In the event that yellow-bellied glider persist at the location, however, these individuals may be important for colonisation of the surrounding landscape.

While the fire was observed to result in destabilisation of large hollow bearing trees within the Study, there are likely to be sufficient hollows remaining post fire for recolonization of yellow-bellied gliders following regeneration of canopy cover from epicormics resprouting. Consequently, while the study area is unlikely to have provided fire refuge for yellow-bellied glider, on a precautionary basis, the species is still assumed to be present, or likely to be present in the future.

Grey-headed flying-fox

The study area contains suitable foraging habitat for grey-headed flying-fox. No grey-headed flying-fox roosts were recorded in the study area during targeted surveys, however past records exist within the study area (Figure 3-5). The nearest roost sites are at the Batemans Bay Water Gardens and Catalina Country Club about 1.5 km from the study area and the species has been recorded in adjacent forestry land. Extensive areas of equivalent potential foraging habitat are present in the landscape to the west of the study area in Mogo State Forest. Recent fires are unlikely to have any long term impact on the suitability of the study area as foraging habitat for grey-headed flying fox, with most canopy eucalypt species likely to resprout epicormically and return to flowering within 3 – 5 years.

Grey-headed flying fox is considered likely to forage throughout timbered areas in the landscape. No important habitat, i.e. roosting habitat, is present in the study area.



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Scale 1:8000 at A4

GDA 1994 MGA Zone 56

- | | | |
|---|--|---|
| <ul style="list-style-type: none"> Study Area Construction Boundary Operation Boundary Access Tracks Watercourses Recorded Threatened Species (Vulnerable - BC Act) Forest owl casting Gang gang cockatoo | <ul style="list-style-type: none">) Glossy black cockatoo) Greater sooty owl) Large-eared pied bat, possible) Little lorikeet) Rufous fantail) Southern myotis, species group) Square-tailed kite) Varied sittella) Yellow-bellied glider | <p>Bionet Atlas Records</p> <ul style="list-style-type: none">) Gang gang cockatoo (Vulnerable - BC Act)) Glossy black cockatoo (Vulnerable - BC Act)) Greater glider (Vulnerable - EPBC Act)) Grey-headed flying fox (Vulnerable - BC Act and EPBC Act)) Little lorikeet (Vulnerable - BC Act)) Masked owl (Vulnerable - BC Act)) Powerful owl (Vulnerable - BC Act)) Yellow-bellied glider (Vulnerable - BC Act) |
|---|--|---|

FIGURE 3-5
Recorded threatened species

243500

244000

244500

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6043000

6042500

6042000

6041500

Scale 1:8000
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0 100 200 Metres

GDA 1994 MGA Zone 56

Legend

- | | | |
|-----------------------|--|----------------------------|
| Study Area | Threatened Fauna Habitat | Large Hollow Bearing Trees |
| Construction Boundary | Glossy black cockatoo (Vulnerable – BC Act) | Hollow Bearing Trees |
| Operation Boundary | Southern Myotis (Vulnerable BC Act) | |
| Access Tracks | Sooty owl (Vulnerable BC Act) | |
| Watercourses | Yellow-bellied glider (Vulnerable BC Act) | |
| | Southern brown bandicoot (EPBC Act – Endangered) | |

FIGURE 3-6
Threatened species habitat

3.7 Aquatic habitats

The waterway habitat assessment and classification is summarised in Table 3.14. Assessment areas and corresponding habitat classes are shown in Figure 2-4.

Key Fish Habitat are habitats which are important to the “sustainability of the recreational and commercial fishing industries, the maintenance of fish populations generally and the survival and recovery of threatened aquatic species” (DPI, 2013).

Hanging Rock Creek downstream to the Clyde River estuary and associated Catalina Lake (south of the golf course) is mapped as key fish habitat by DPI (DPI, 2007). This habitat functions under a natural and artificial regime influenced by land use change such as golf course and urban development.

Within the study area, Hanging Rock Creek does not have any permanent water or defined channel, it is not classified as a Class 1 or Class 2 watercourse and it is not likely to provide habitat for any threatened aquatic species. Immediately downstream of the study area, Hanging Rock Creek forms a permanent wetland surrounded by she-oak swamp forest, supporting aquatic habitat including open water and fringing reeds and rushes. Due to the extreme dry conditions at the time of inspection, wetland water levels were very low. This area was not subject to a detailed assessment.

Detailed aquatic fauna surveys are warranted if a proposal crosses any Class 1 watercourse (major fish habitat) or a Class 2 watercourse (moderate fish habitat) that has been identified as having a moderate or high potential to be occupied by a threatened aquatic species of animal. The construction boundary does not cross any Class 1 or Class 2 watercourses and no habitat for threatened aquatic species listed under the FM Act. Consequently, detailed aquatic survey was not warranted.

Table 3.14 Waterway habitat assessment

Aquatic Assessment Area	Strahler Level [#]	Type	Description	Key Fish Habitat Class*	Bed substrate	Habitat features	Aquatic vegetation
A	3	Ephemeral stream, flooding zone	Indistinct ephemeral drainage line, grassy with no distinct flow line or channel. No permanent or temporary pools present. Evidence of flooding. Connects to permanent wetland outside the study area.	3	Fine sediments, mud	No aquatic habitat present.	No aquatic vegetation present, increasing sedges and reeds (<i>Phragmites australis</i>) present at edge of downstream wetland outside the study area.
B	1, 2	Ephemeral stream	Indistinct ephemeral drainage line, vegetated with non-aquatic species with no distinct flow line or channel. No permanent and very few temporary pools present.	4	Fine sediments, gravel	No aquatic habitat present.	No aquatic vegetation present, increasing sedges and reeds (<i>Phragmites australis</i>) present at edge of downstream wetland outside the study area.

Aquatic Assessment Area	Strahler Level [#]	Type	Description	Key Fish Habitat Class*	Bed substrate	Habitat features	Aquatic vegetation
C	1	Ephemeral stream	Steep, ephemeral stream with a distinct rocky channel, dry at time of assessment. Likely to have flow during rainfall events but few or no temporary pools present.	4	Rock	No aquatic habitat present.	No aquatic vegetation present.
D	1	Ephemeral stream, eastern end includes flooding zone	Indistinct ephemeral drainage line, vegetated with non-aquatic species with no distinct flow line or channel. Connects directly to wetland outside study area	3	Fine sediments, mud.	No aquatic habitat present.	No aquatic vegetation present.

[#]Strahler level is calculated in accordance with the Water Management (General) Regulation 2018 where the order is elevated based on the confluence of streams of the same order (DPI, 2018).

*Key Fish Habitat class is categorised as identified in Table 2.4.

3.8 Areas of outstanding biodiversity value

No areas of outstanding biodiversity value occur within the study area.

3.9 Wildlife connectivity corridors

There are no listed habitat corridors in the region. However, local and regional connectivity of native vegetation and creek/gully corridors are present in the study area.

Connectivity to the west is likely only to be present for mobile species such as birds that can move quickly across open spaces. There are connectivity barriers within the study area, such as the existing Princes Highway, power easements, access tracks and residential housing. The highway is around 40 metres wide and the powerline easement is about 60 metres wide. These act as major barriers to east-west movement of most terrestrial fauna species, as well as arboreal species such as gliders with restricted flight ranges. Despite this, a moderate level of connectivity remains for species with high dispersal ability from the study area to large contiguous native vegetation within Mogo State Forest to the west.

Moderate to high connectivity for species dependent on continuous canopy cover remains to the south, through the section of Glenella Road between the powerline easement and The Ridge Road, linking into adjacent areas of Mogo State Forest. This link is important for breeding, dispersal and foraging for a range of fauna species, particularly threatened fauna with large home ranges, such as yellow-bellied glider and forest owls.

Hanging Rock Creek and associated riparian vegetation provides connectivity to modified habitats in the north comprising the landscaped golf course and contained waterbodies. The creek is also mapped as Key Fish Habitat which drains through the golf course and into estuarine habitats of the Clyde River. Connectivity to the east is restricted by housing and local roads which link to small isolated vegetation.

3.10 State Environmental Planning Policies

Two State Environmental Planning Policies have been identified as potentially applicable to the proposed development:

- State Environmental Planning Policy (Coastal Management) 2018
- State Environmental Planning Policy No. 44 - Koala habitat protection / State Environmental Planning Policy (Koala Habitat Protection) 2019.

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3.10.1 State Environmental Planning Policy (Coastal Management)

The north-eastern corner of the study area intersects the Coastal Environment Areas under the Coastal Management SEPP (Figure 3-7:). This area is not within the construction boundary and consequently the proposal would not directly impact any areas within the coastal environment area.

No nationally important wetlands or marine protected areas are located in the study area. (Figure 3-7:). The Clyde River Estuary is an EPBC Act listed Nationally Important Wetland. It comprises tidal waters and intertidal wetlands of the Clyde River and Cullendulla Creek and is located 2.3 km downstream from the study area in the Hanging Rock Creek catchment (Figure 3-7:). The Clyde River Estuary forms part of Batemans Bay Marine Park which is located 1.5 km west of Princes Highway downstream from the study area on Mcleod's Creek catchment, and 2.3 km to the east and downstream of the study area on Hanging Rock Creek catchment (Figure 3-7:).

One non-protected permanent wetland is present on Hanging Rock Creek, outside but immediately downstream of the study area. This wetland is not within the Coastal Environment Area. The proposal would not directly impact on the Coastal Environment Area, EPBC Act listed Nationally Important Wetlands, or protected marine areas.



FIGURE 3-7
Coastal environment areas adjacent to the study area

3.10.2 Koala habitat protection

Assessment of koala habitat was undertaken in accordance with State Environmental Planning Policy No. 44 - Koala habitat protection (SEPP 44), the applicable legislation at the time of the survey. From 1 March 2020, the State Environmental Planning Policy No. 44 - Koala habitat protection (SEPP 44) is repealed and the State Environmental Planning Policy (Koala Habitat Protection) 2019 (the Koala Habitat Protection SEPP) comes into force. While neither SEPP apply to the proposal as no development consent is required under the State Environmental Planning Policy (Infrastructure) 2007 (the Infrastructure SEPP) and there are therefore no specific obligations, koala habitat has been assessed. While habitat was not assessed under this legislation, the extent of koala habitat as defined under the Koala Habitat Protection SEPP is also presented in the sections below.

SEPP 44

One feed tree species used to define koala habitat in SEPP 44, forest red gum (*Eucalyptus tereticornis*), is present in the study area. This preferred feed species is restricted to 0.61 ha located on the eastern edge of the study area (Vegetation zone 9). The overall patch of vegetation supporting forest red gum, including vegetation outside the study area, is estimated to be less than 2 ha. One koala record, from 2004, is present in the BioNet database search area from within one kilometre of the study area. No breeding populations of koalas are known from the Batemans Bay area. The closest known or potential breeding populations of koalas are about 50 km south of the study area and south of Narooma in Eurobodalla Council Area, at Bredbo in Snowy Monaro Council Area about 80 km south-west of the study area and around Tolwong in Shoalhaven City Council Area about 110 kilometers north of the study area.

The existing record is likely to represent an individual dispersing male, consistent with typical dispersal patterns and are not likely to represent the presence of a local population. A single SAT survey was completed within forest red gum dominated forest in Zone 9, on the basis that forest red gum was a preferred tree species under the repealed SEPP 44. No koala scats were found. Further, koalas were not detected during extensive nocturnal and diurnal fauna surveys, indicating no regular presence of koala in the study area.

Koala populations are not likely to be resident or dependent on the study area for breeding or foraging resources. The study area does not comprise core koala habitat.

Koala Habitat Protection SEPP

Under the Koala Habitat Protection SEPP, the study area supports areas identified on the Koala Development Application Map (i.e. land managed by Transport for NSW) and Site Investigation Areas for Koala Plans of Management (i.e. land managed by Forestry NSW). No approved Koala Plan of Management applies to the study area. The Koala Habitat Protection SEPP identifies an additional 113 tree species as potentially providing koala habitat, including species dominant or co-dominant throughout the study area such as spotted gum (*Corymbia maculata*), white stringybark (*Eucalyptus globoidea*), grey ironbark (*Eucalyptus paniculata*) and blackbutt (*Eucalyptus pilularis*). All timbered areas of the study area therefore supports potential koala habitat as defined in the Koala Habitat Protection SEPP, consistent with the surrounding timbered landscape to the south and west. However, based on the survey results and absence of records, koala populations are not likely to be resident or dependent on the study area for breeding or foraging resources. The study area does not comprise core koala habitat.

3.11 Matters of National Environmental Significance

A Protected Matters Search (PMST_A8371P) was conducted on 12 November 2019. A summary of results of the Protected Matters Search Tool (PMST) for the 10 km by 10 km search area is provided in Table 3.15.

Table 3.15 Protected Matters Search Summary (PMST_ A8371P: 12 November 2019)

MNES	Protected Matters Search Results	Comment
World Heritage Properties	None	There are no World Heritage Properties within or near the study area.
National Heritage Places	None	There are no National Heritage Places within or near the study area.
Wetlands of International Importance	None	There are no wetlands of international importance (listed under the RAMSAR Convention) within or near the study area.
Great Barrier Reef Marine Park	None	The Great Barrier Reef Marine Park is not located in NSW.
Commonwealth Marine Area	None	There are no Commonwealth Marine areas within or near the study area.
Listed Threatened Species	69	<p>The potential for listed threatened flora and fauna species to occur at the study area is addressed in Section 3.6.2. No EPBC Act listed threatened flora are likely to be present.</p> <p>Five EPBC Act listed threatened fauna species were identified as having a moderate or greater potential occurrence following targeted surveys and warrant assessments of significance under the EPBC Act:</p> <ul style="list-style-type: none"> • large-eared pied bat (<i>Chalinolobus dwyeri</i>) - vulnerable • spotted-tail quoll (<i>Dasyurus maculatus</i>) – endangered • southern brown bandicoot (<i>Isodon obesulus obesulus</i>) – endangered

MNES	Protected Matters Search Results	Comment
		<ul style="list-style-type: none"> • swift parrot (<i>Lathamus discolor</i>) – critically endangered • grey-headed flying-fox (<i>Pteropus poliocephalus</i>) – vulnerable. <p>No EPBC Act listed threatened populations are likely to occur in the study area.</p>
Listed Migratory Species	57	<p>The potential for listed migratory fauna species to occur at the study area is addressed in Section 3.6.2.</p> <p>Three listed migratory species are identified as having a moderate potential occurrence and warrant assessments of significance under the Commonwealth EPBC Act:</p> <ul style="list-style-type: none"> • black-faced monarch (<i>Monarcha melanopsis</i>) • satin flycatcher (<i>Myiagra cyanoleuca</i>) • rufous fantail (<i>Rhipidura rufifrons</i>).
Listed Threatened Ecological Communities	6	<p>The potential for listed threatened ecological communities to occur at the study area is addressed in Section 3.4. One EPBC Act listed EEC and one EPBC Act listed CEEC are present in the study area but no EPBC Act listed threatened ecological communities are present within the construction boundary.</p>

4 Impact assessment

The proposal would have potential direct and indirect impacts on a range of biodiversity values including:

- Construction impacts including clearing of native vegetation, loss of threatened fauna habitat, loss of aquatic biodiversity, injury/mortality to wildlife during construction, invasion and spread of weeds, pests and pathogens
- Ongoing operational impacts on wildlife connectivity, adjacent areas (edge effects), hydrology, noise levels, light sensitive fauna, vibration sensitive fauna and groundwater quality.

These impacts are discussed in the following sections.

4.1 Construction impacts

4.1.1 Removal of native vegetation

The extent of native vegetation to potentially be cleared for each identified vegetation zone is summarised in Table 4.1 and shown in Figure 3-1. The maximum extent of the construction boundary is 31.17 ha, of which 15.65 ha lies within the operational boundary. Within this area, construction activities would result in the removal of up to 22.68 ha of native vegetation and 1.34 ha of exotic vegetation.

No BC Act or EPBC Act listed threatened ecological communities would be cleared within the construction boundary.

All native vegetation likely to be disturbed within the construction boundary has been heavily impacted by the high intensity bushfire of 31 January 2020. This assessment has been prepared on the basis of the assumption that native vegetation will regenerate across the study area. Impacts of the proposal are not substantially changed as a result of the fire, as no parts of the study area support unburnt or less intensively burnt vegetation likely to be important as a seed source for natural regeneration of the landscape.

During the preliminary design phase, the construction boundary was refined to avoid impacts on vegetation in sheltered gullies in Hanging Rock Creek catchment, in areas likely to be of particular importance as habitat for sooty owl and yellow-bellied glider. Where possible, the total extent of native vegetation to be cleared would be reduced through refinement of the footprint during detailed design and construction planning.

4.1.2 Threatened ecological communities

The construction of the proposal would not require the removal of any TECs construction boundary study area (Figure 3-3, Table 4.1).

Table 4.1: Potential impacts on vegetation

Zone	PCT	Condition Class	BC Act Status	EPBC Act Status	Area in study area (ha)	Area in construction boundary (ha)	Area in operational boundary (ha)
1	1206 Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion	High	Not listed	Not listed	4.22	0.37	0.16
2	1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion	High	Not listed	Not listed	50.19	13.25	8.03
3	1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion	Degraded grassland	Not listed	Not listed	1.96	1.95	0.13

Zone	PCT	Condition Class	BC Act Status	EPBC Act Status	Area in study area (ha)	Area in construction boundary (ha)	Area in operational boundary (ha)
4	1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion	Derived grassland	Not listed	Not listed	6.90	3.89	1.32
5	1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion	Degraded forest	Not listed	Not listed	26.17	2.33	0.18
6	1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion	Plantings	Not listed	Not listed	1.12	0.89	0.66
7	877 Grey Myrtle dry rainforest of the Sydney Basin	High	Not listed	Not listed	0.58	0.00	0.00

Zone	PCT	Condition Class	BC Act Status	EPBC Act Status	Area in study area (ha)	Area in construction boundary (ha)	Area in operational boundary (ha)
	Bioregion and South East Corner Bioregion						
8	1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion	High	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Swamp Oak Floodplain Forest) EEC	Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland (Coastal Swamp Oak Forest) EEC	0.50	0.00	0.00
9	1326 Woollybutt - White Stringybark - Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion	High	River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (River-Flat Eucalypt Forest) EEC	Illawarra and South Coast Lowland Forest and Woodland CEEC	0.61	0.00	0.00
Total area of TEC					1.11	0.00	0.00
Total native vegetation					92.25	22.68	10.48

Zone	PCT	Condition Class	BC Act Status	EPBC Act Status	Area in study area (ha)	Area in construction boundary (ha)	Area in operational boundary (ha)
11	Roads, tracks, bare ground	N/A	Not listed	Not listed	8.69	7.15	3.95
12	Exotic vegetation in road batter	N/A	Not listed	Not listed	2.36	1.34	1.22
Total area					103.30	31.17	15.65

4.1.3 Removal of threatened fauna habitat

The proposal would result in the removal of up to 22.68 ha of native vegetation that provides foraging and breeding habitat for twenty BC Act listed threatened fauna species, five EPBC Act listed threatened fauna species and three EPBC Act listed migratory species:

- Gang gang cockatoo (*Callocephalon fimbriatum*), vulnerable under the BC Act
- Glossy black-cockatoo (*Calyptorhynchus lathami*), vulnerable under the BC Act
- Varied sittella (*Daphoenositta chrysoptera*), vulnerable under the BC Act
- Little lorikeet (*Glossopsitta pusilla*), vulnerable under the BC Act
- Swift parrot (*Lathamus discolor*), endangered under the BC Act and critically endangered under the EPBC Act
- Square-tailed kite (*Lophoictinia isura*), vulnerable under the BC Act
- Powerful owl (*Ninox strenua*), vulnerable under the BC Act
- Masked owl (*Tyto novaehollandiae*), vulnerable under the BC Act
- Sooty owl (*Tyto tenebricosa*), vulnerable under the BC Act
- Large-eared pied bat (*Chalinolobus dwyeri*), vulnerable under the BC Act and vulnerable under the EPBC Act
- Spotted-tail quoll (*Dasyurus maculatus*), vulnerable under the BC Act and endangered under the EPBC Act
- Eastern false pipistrelle (*Falsistrellus tasmaniensis*), vulnerable under the BC Act
- Southern brown bandicoot (*Isoodon obesulus obesulus*), endangered under the BC Act and endangered under the EPBC Act
- Large bent-winged bat (*Miniopterus orianae oceanensis*), endangered under the BC Act
- Eastern coastal free-tail bat (*Micronomus norfolkensis*), vulnerable under the BC Act
- Southern myotis (*Myotis macropus*), vulnerable under the BC Act
- Yellow-bellied glider (*Petaurus australis*), vulnerable under the BC Act
- Yellow-bellied sheath-tail-bat (*Saccolaimus flaviventris*), vulnerable under the BC Act
- Greater broad-nosed bat (*Scoteanax rueppellii*), vulnerable under the BC Act
- Grey-headed flying-fox (*Pteropus poliocephalus*), vulnerable under the BC Act and vulnerable under the EPBC Act
- Black-faced monarch (*Monarcha melanopsis*), migratory under the EPBC Act
- Satin flycatcher (*Myiagra cyanoleuca*), migratory under the EPBC Act
- Rufous fantail (*Rhipidura rufifrons*), migratory under the EPBC Act.

The maximum extent of potential habitat that would be removed for each species of threatened fauna identified as occurring or likely occurring in the study area is presented in Table 4.2. While habitat in the study area was degraded by fire on 31 December 2019, resulting in loss of vegetation structure and habitat features such as hollow logs and potential loss of hollow bearing trees, it has been assumed for the purposes of this assessment that habitat for the site will regenerate.

Loss of open forest habitats (PCT 1206, PCT 2020) in the construction boundary construction boundary would reduce the availability and range of food resources such as

seeds, nectar, pollen, lerps, gum / resin and invertebrates attracted to these resources. Loss of nectar resources may potentially affect threatened nectar feeding birds and mammals such as little lorikeet, swift parrot, yellow-bellied glider and grey-headed flying-fox.

Loss of tree and shrub species with different bark types and structural layers may also reduce foraging habitat, including prey species for threatened fauna such as varied sittella, square-tailed kite, forest owls and gliders. Loss of foraging resources in the construction boundary would likely be negligible for mobile species in the context of resources available elsewhere in the study area and in the surrounding landscape given the extent of similar habitat to the south and west in adjacent areas of Mogo State Forest and beyond. In the short term, such impacts are likely to be negligible in the context of the recent bushfire impacts.

A total of 72 hollow bearing trees were identified within the construction boundary. Depending on fire survival rates and final vegetation clearing limits, up to 61 hollow bearing trees, including 17 trees supporting approximately 21 large or very large hollows, may be removed within the construction boundary east of Princes Highway. More hollow bearing trees, including eight (8) trees with 14 large or very large hollows and three (3) other hollow bearing trees, may be removed within the construction boundary west of Princes Highway. However, due to boundary revisions, detailed hollow bearing tree surveys were not completed in the full extent of the construction boundary west of Princes Highway and additional hollow bearing trees may be present. 51 identified hollow bearing trees are within the operational boundary, 16 of which support large or very large hollows. While several large hollow bearing trees had fallen following the fire, the majority of hollow bearing trees were still standing at the time of the post-fire inspection. Hollow bearing trees within the construction boundary are likely to be utilised by hollow dependent threatened and non-threatened fauna, including:

- Glossy black-cockatoo (*Calyptorhynchus lathami*)
- Little lorikeet (*Glossopsitta pusilla*)
- Powerful owl (*Ninox strenua*)
- Masked owl (*Tyto novaehollandiae*)
- Sooty owl (*Tyto tenebricosa*)
- Eastern false pipistrelle (*Falsistrellus tasmaniensis*)
- Eastern coastal free-tail bat (*Micronomus norfolkensis*)
- Southern myotis (*Myotis macropus*)
- Yellow-bellied glider (*Petaurus australis*)
- Yellow-bellied sheath-tail-bat (*Saccolaimus flaviventris*)
- Greater broad-nosed bat (*Scoteanax rueppellii*).

While not all hollow bearing trees were mapped in the study area outside the construction boundary, a total of 111 trees supporting large or very large hollows were identified throughout the study area. This indicates that a large number of hollow bearing trees with a wide range of sizes are present in the study area, including in areas outside the construction boundary. Hollow abundance and distribution within the study area is likely to be consistent with surrounding areas of Mogo State Forest managed for timber harvesting, with scattered hollow bearing trees retained in harvested coups and the majority of hollow bearing trees protected in riparian corridors being excluded from timber harvesting.

The fire of 31 January 2019 is likely to have destabilised many trees, including large hollow bearing trees vulnerable to fire, resulting in an overall decrease in the abundance of hollow bearing trees and particularly those containing large hollows, in the study area construction boundary, the study area and throughout Mogo State Forest to the south and west. Fire impacts are likely to be consistent across the landscape both inside and outside the study area and do not impact the significance of habitat resources remaining in the construction boundary.

Removal of hollow bearing trees in the construction boundary is not likely to have a significant impact on the overall abundance of hollows in the study area and equivalent habitat areas in Mogo State Forest to the south and west. Impacts on highly mobile hollow dependent fauna including little lorikeet, eastern false pipistrelle, eastern coastal free-tail bat, yellow-bellied sheath-tail-bat and greater broad-nosed bat are likely to be minimal. No hollow bearing trees are proposed to be removed within the southern myotis mapped habitat present in the study area and hence no impact on potentially habitat for southern myotis would occur (Figure 3-6).

Large or very large hollows are important nesting and roosting habitat for glossy black cockatoos and forest owls. All 26 trees supporting approximately 35 large and very large hollows in the construction boundary have the potential to be utilised by glossy black cockatoo. During the preliminary design phase, the construction boundary was refined to avoid impact on sheltered gullies supporting a high density of hollow bearing trees to minimise impacts on sooty owl. Forest owls are unlikely to use the majority of hollows in the construction boundary, as they prefer hollows in proximity to sheltered gullies. Impacts on forest owls would comprise removal of up to 13 trees in the construction boundary which support 19 large or very large hollows within 100 metres of gullies (Figure 3-6). Following the 2019 – 2020 bushfires, suitability of habitat for breeding of forest owls and glossy black cockatoos is likely to be decreased in the short term due to reduced shelter and foraging resources. These mobile species have the potential to recolonise the site following regeneration and recovery of food sources. As offsetting hollows for large forest owls and glossy black cockatoos has been demonstrated to be ineffective, alternative strategies for offsetting habitat for these species should be investigated.

During the preliminary design phase, the construction boundary was refined to avoid impact on sheltered gullies where yellow-bellied gliders were detected to minimise potential impact on glider trees. Past records on Bionet include records along Glenella Road (Figure 3-5), however and due to the species large home range it must be assumed that the species may utilise hollows throughout potential habitat including inside the construction boundary (Figure 3-6). However, areas degraded by recent logging are unlikely to support yellow bellied gliders. Up to 13.62 ha of yellow bellied glider habitat is likely to be removed. Due to the abundance hollow bearing trees in the study area, removal of hollow bearing trees in the construction boundary is unlikely to have a significant impact on the yellow-bellied glider, particularly if hollow bearing trees are retained where possible. Following the 2019 – 2020 fires in the study area, it is unlikely that yellow-bellied glider persist in the study area due to the absence of unburnt patches or areas burnt at low or moderate intensity. Hence, impacts of the proposal on the species are likely to be negligible.

During the initial assessment, fallen logs (dead wood) and woody debris were a common habitat feature in open forest and degraded forest (Zones 1, 2 and 5). Where associated with a shrubby understorey, these habitat features provide shelter for threatened fauna such as southern brown bandicoot and spotted tailed quoll, as well as for non-threatened fauna which are prey species for forest owls. While the majority of fallen logs and woody debris in

the study area has been burnt in bushfires following site assessment, it is anticipated that destabilisation of trees resulting from the fires will result in substantial tree fall prior to commencement of construction of the proposal. This fallen timber is likely to be important for providing shelter and foraging opportunities for threatened and non-threatened fauna as the study area recovers from the fire.

Table 4.2 Potential impacts on threatened fauna habitat areas

Scientific name	Common Name	BC Act status	EPBC Act status	Habitat in study area	Habitat in construction boundary	Habitat in operational boundary
Birds						
<i>Callocephalon fimbriatum</i> (foraging habitat only)	gang gang cockatoo	V	-	82.27	15.95	8.38
<i>Calyptorhynchus lathamii</i> (foraging and breeding habitat)	glossy black-cockatoo	V	-	82.27	15.95	8.38
<i>Daphoenositta chrysoptera</i>	varied sittella	V	-	82.27	15.95	8.38
<i>Glossopsitta pusilla</i>	little lorikeet	V	-	82.27	15.95	8.38
<i>Lathamus discolor</i> (not important habitat)	swift parrot	E	CE	82.27	15.95	8.38
<i>Lophoictinia isura</i> (foraging habitat only)	square-tailed kite	V	-	92.25	22.68	15.65
<i>Ninox strenua</i> (foraging habitat only)	powerful owl	V	-	82.27	15.95	8.38
<i>Tyto novaehollandiae</i> (foraging habitat only)	masked owl	V	-	82.27	15.95	8.38
<i>Tyto tenebricosa</i> (foraging and breeding habitat)	sooty owl	V	-	28.29 (breeding) 82.27 (foraging)	7.69 (breeding) 15.95 (foraging)	8.38 (foraging)
<i>Monarcha melanopsis</i>	black-faced monarch	-	Mi	82.27	15.95	8.38
<i>Myiagra cyanoleuca</i>	satin flycatcher	-	Mi	82.27	15.95	8.38

Scientific name	Common Name	BC Act status	EPBC Act status	Habitat in study area	Habitat in construction boundary	Habitat in operational boundary
<i>Rhipidura rufifrons</i>	rufous fantail	-	Mi	82.27	15.95	8.38
Mammals						
<i>Chalinolobus dwyeri</i> (foraging habitat, not important)	large-eared pied bat	V	V	82.27	15.95	8.38
<i>Dasyurus maculatus</i>	spotted-tailed quoll	V	E	82.27	15.95	8.38
<i>Falsistrellus tasmaniensis</i>	eastern false pipistrelle	V	-	82.27	15.95	8.38
<i>Isoodon obesulus obesulus</i>	southern brown bandicoot	E	E	4.83	0.37	0.00
<i>Miniopterus orianae oceanensis</i>	large bent-winged bat	E	-	82.27	15.95	8.38
<i>Micronomus norfolkensis</i>	eastern coastal free-tail bat	V	-	82.27	15.95	8.38
<i>Myotis macropus</i>	southern myotis	V	-	5.37	0.33	0.00
<i>Petaurus australis</i>	yellow-bellied glider	V	-	56.10	13.62	8.20
<i>Pteropus poliocephalus</i>	grey-headed flying-fox	V	V	82.27	15.95	8.38
<i>Saccolaimus flaviventris</i>	yellow-bellied sheath-tail-bat	V	-	82.27	15.95	8.38
<i>Scoteanax rueppellii</i>	greater broad-nosed bat	V	-	82.27	15.95	8.38
*V= Vulnerable, E=Endangered, CE = Critically Endangered, Mi = Migratory.						

4.1.4 Removal of threatened flora habitat

No threatened flora species are likely to be present within the construction boundary and consequently no threatened flora habitat is likely to be disturbed.

4.1.5 Hydrology and aquatic habitat impacts

No direct impacts to aquatic biodiversity are likely to occur as a result of the proposal. The construction of the new road may result in minor alterations to hydrology and surface flows in the construction boundary due to changes in landform resulting from cut and fill works. Due to the steep nature of the terrain, the proposal is not likely to result in substantial changes to surface water accumulation and flooding in the surrounding environment. No threatened aquatic species, populations and communities have been recorded or are considered likely to occur within the construction boundary.

Potential impacts on downstream waterways and aquatic habitats outside of the construction boundary may include:

- Changes to turbidity due to potential increase of erosion and sedimentation during construction
- Potential tannins leachate entering waterways from mulch used for landscaping and construction environmental controls.

Recommended mitigation measures to manage changes to turbidity and sedimentation are discussed in Section 5.

4.1.6 Fauna injury and mortality

Injury and mortality of both threatened and non-threatened fauna could occur during construction activities associated with the proposal such as vegetation removal and movement of machinery and plant to, from and in the study area construction boundary.

Construction activities with the potential to cause mortality include the removal of habitat trees in the construction boundary, removal of understorey, groundcover and topsoil and vehicle and machinery movement during construction resulting in collisions with fauna. Hollow dependent fauna are most at risk of injury and mortality from removal of habitat trees during construction. While the 2019 – 2020 bushfire is likely to have resulted in substantial reduction in occupancy of hollows, fire resistant and mobile species such as tree-roosting micro-bats, these species may recolonise hollows in the site in the short term and may be present during construction.

The level of mortality of both non-threatened and threatened species of bird, bat, mammal and large reptiles is likely to be very low with implementation of appropriate mitigation measures (Section 5).

4.1.7 Wildlife connectivity and habitat fragmentation

Temporary barrier effects may increase as a result of widening of existing access tracks during construction. The impact of increased barrier effects is likely to be minimal due to the presence of existing tracks and disturbance of adjacent areas by timber harvesting. In addition, access tracks are unlikely to exceed widths likely to form barriers for threatened species occurring on site, which are mostly mobile species.

4.1.8 Invasion and spread of weeds and pathogens

Existing significant weeds within the construction boundary may be spread and new weed species have the potential to be introduced during construction as a result of movement of soil and organic material for fill or rehabilitation. Five priority weed species were identified in the construction boundary (Section 3.3.2, Figure 3-2):

- Blackberry (*Rubus anglocandicans*)
- Arsenic bush (*Senna septemtrionalis*)
- Boneseed (*Chrysanthemoides monilifera* subsp. *Monilifera*)
- Wild tobacco bush (*Solanum mauritianum*)
- Ground asparagus (*Asparagus aethiopicus*)

Plant and animal pathogens can affect threatened biodiversity through direct mortality and modification to vegetation structure and composition. The following pathogens are considered to have potential to affect the biodiversity within the proposal footprint and are the subject of Key Threatening Process listings:

- Amphibian chytrid fungus (*Batrachochytrium dendrobatidis*)
- Phytophthora root rot fungus (*Phytophthora cinnamomi*)
- Exotic rust fungi of the order Pucciniales (myrtle rust)

These pathogens have potential to occur within the survey area at present, or in the future. The main way in which Phytophthora Root Rot Fungus may be spread is through the movement of infected plant material and/or soil. Myrtle Rust is easily spread by spores, either through contaminated clothing or equipment, insect/animal movement or wind.

Weed and pathogen management measures should be implemented in accordance with the Biodiversity Guidelines (Roads and Traffic Authority, 2011) as part of the project CEMP to minimise the risk of spread and introduction of weeds and pathogens (Section 5). With the implementation of appropriate procedures for the use of vehicles and the movement and importation of materials, the risk of introducing and spreading weeds and pathogens are likely to be low.

4.1.9 Invasion and spread of pests

A range of exotic pest species are present or likely to occur within the study area. European red fox (*Vulpes vulpes*) was recorded present in the study area. Other species such as cats (*Felix catus*), rabbit (*Oryctolagus cuniculus*), black rat (*Rattus rattus*) and house mouse (*Mus musculus*) are likely to be present, due to an urban environment being located nearby.

All construction works would take place in areas previously disturbed or close to existing access tracks, hence new opportunities for pest species to access habitat would not be created. Although exotic pest species already present may benefit from vegetation clearing associated with the proposal, the habitat to be removed is unlikely to have a significant impact on the availability of resources or shelter for native species being preyed upon.

The construction of the proposal is unlikely to have any risk to introduce pest species to any new location where it is currently absent or increase opportunities for spread of pests in the construction boundary or broader study area.

4.1.10 Noise, light and vibration

While the construction phase of the proposal may cause temporary disturbance to animals, the impact from noise emissions are likely to be localised, close to the proposal footprint (up to 100 metres) and are not likely to have a significant long-term impact on wildlife populations.

4.1.11 Impacts on groundwater dependent ecosystems

One potential aquatic GDE, Hanging Rock Creek, was identified in the construction boundary (Figure 3-4). In this location, Hanging Rock Creek comprises a broad indistinct ephemeral flowline dependent on surface runoff without permanent pools and consequently no aquatic GDE is present.

Search of the Atlas of GDEs (BOM, 2019), the potential for terrestrial GDEs to occur within the construction boundary was identified (Figure 3-4). Of three potential terrestrial GDEs identified in the study area (Table 3.12, Figure 3-1) only one, PCT1206, was present within the construction boundary. Temporary construction impacts associated with access tracks may occur within vegetation PCT1206 (vegetation Zone 1, Figure 3-1). This potential GDE is a potential high value GDE. However, no permanent or temporary works with potential to influence groundwater flows or levels would be carried out in the construction boundary. Hence, detailed ecological valuation risk assessment was not completed.

Construction activities would involve minor works associated with existing access tracks and do not involve activities likely to have a high risk of modifying groundwater flows through extraction, changes to surface water penetration or groundwater movement. Due to the steep nature of the terrain in which the proposal would be undertaken and the small extent of the upstream catchment, changed surface flows during construction are unlikely to result in any significant modifications to groundwater inflows. Hence, direct or indirect impacts on GDEs are unlikely to occur as a result of construction activities.

4.2 Operational impacts

4.2.1 Wildlife connectivity and habitat fragmentation

Potential impacts on wildlife connectivity were reviewed with reference to the draft *Wildlife Connectivity Guidelines for Road Projects* (Roads and Traffic Authority, 2011). The Proposal has the potential to have the following impacts on wildlife connectivity through habitat fragmentation due to construction of the new road:

- Permanent barrier effects resulting from widening of the existing unsealed road, potential median treatments, cuttings, embankments and erosion and sediment control measures
- Genetic isolation resulting from habitat fragmentation.

The increased road width, embankments and sealed road character has the potential to reduce opportunities for fauna with limited dispersal capability or that are unlikely to move through exposed unvegetated areas to safely disperse in or out of Hanging Rock Creek Catchment into areas of Mogo State Forest to the south. This is likely to increase the

isolation of less mobile fauna species present in habitat located in Hanging Rock Creek catchment.

Due to the road width requirements for wide cut and fill locations and the location on a steep slope, there is potential for the cleared road corridor to exceed the maximum potential gliding distance for gliding mammals and specifically the BC Act listed yellow-bellied glider. The population of yellow-bellied gliders present within the Hanging Rock Creek catchment is likely to represent one to three family groups and isolation of the habitat fragment has the potential to mean that this locally occurring population would not be viable in the long term unless mitigation measures are implemented to maintain connectivity.

Other threatened species likely to occur in the construction boundary study area are highly mobile and unlikely to be substantially impacted by fragmentation. Some species may be susceptible to isolation within Hanging Rock Creek Catchment as a result of the proposal; small populations may become genetically unviable in the long term if connectivity is not maintained. However, maintaining connectivity is not important for maintaining genetic variability in the landscape as a whole.

Following the 2019 – 2020 fires in the study area, it is unlikely that yellow-bellied glider persist in the study area due to the absence of unburnt patches or areas burnt at low or moderate intensity. Barriers formed by the proposal may reduce the potential for re-colonisation of the habitat patch in Hanging Rock Creek following the fires. The proposal is therefore unlikely to result in fragmentation and isolation such that populations of large gliders in the broader landscape are placed at risk. However, follow up surveys may be warranted to determine whether large threatened gliders persists in habitat in Hanging Rock Creek catchment following the fires and to assess the importance of maintaining connectivity for family groups persisting in this area for recovery of glider populations in the landscape (Section 5). This information would inform whether connectivity infrastructure is required.

Depending on when construction commences and the rate of regeneration, reduced connectivity between habitat in the study area and larger habitat areas in Mogo State Forest to the south and west may also result in a reduced rate of post-fire colonisation of the habitat fragment in the study area and long term reductions in diversity of non-threatened fauna.

4.2.2 Fauna injury and mortality

All roads have potential to result in the mortality or injury of native animals as a result of vehicle collision. Traffic along Glenella Road and the Princes Highway is already present. The proposal would decrease speed at which vehicles travel along Princes Highway and Glenella Road. Road surface would be improved, along with the line of sight, along Glenella Road resulting in reduced risk of vehicle collision with fauna.

Since majority of threatened species likely to occur within the operational boundary are mobile (fly) and generally feed high in the canopy of vegetation, most would be at low risk of roadkill. In the absence of suitable fauna crossing infrastructure to facilitate dispersal, arboreal mammals including threatened fauna such as yellow-bellied glider, may attempt to cross the road at ground level and hence have an increased risk of roadkill mortality. Some mobile species (i.e. threatened forest owls) may forage along forest edges and may be placed at some risk of increased road-strike mortality.

With adequate consideration of factors associated with roadkill in preparation of the detailed design, including consideration of mitigation measures (Section 5), the proposal is unlikely to

result in significant levels of roadkill mortality of threatened species or the ecosystems of the proposal. The likelihood of terrestrial fauna injury and mortality as a result of vehicle collision is likely to be reduced in general due to the proposed speed limits and improvement in road conditions.

4.2.3 Edge effects on adjacent native vegetation and habitat

Edge effects associated with a more defined interface between the road and nearby areas of habitat are likely to comprise:

- Altered soil moisture conditions
- Altered light conditions such as reduced-shading and artificial lighting
- Increased noise and vibration during both construction and operation.

Existing roads and access tracks in the operational boundary, along with other disturbances such as powerline easements and timber harvesting, have resulted in existing edge effects. These edge effects are likely to be increased relative to those along Glenella Road due to the increased width of the road, removal of overhanging vegetation and extensive cut and fill requirements. Given the existing disturbance and edge effects in the study area construction boundary, the increase in edge effects created by the proposal is unlikely to have a significant impact on fauna and flora species likely to be present during operation of the proposal.

4.2.4 Invasion and spread of weeds and pathogens

During operation of the proposal, roadside littering and access into adjacent areas have the potential to cause invasion and spread of weeds and pathogens. However, existing evidence of dumping of garden waste along Glenella Road was observed. This is a high risk activity for spread of weeds and pathogens. Operation of the proposal has the potential to reduce illegal dumping of garden waste in this location as a result of reduced isolation, thus decreasing the opportunity for dumping garden waste in the area.

As Glenella Road is already present along the alignment of the proposal, there would be no introduction of vehicle movement into areas not already available. Consequently vehicle movement during operation of the proposal is unlikely to increase risk of weeds and pathogens being introduced or spread.

4.2.5 Invasion and spread of pests

The operation of the proposal is unlikely to have any risk to introduce pest species to any new location where currently absent. No new movement corridors are being established. Fragmentation and edge effects adjacent to the Operational Footprint may lead to increased competition for resources (e.g. tree hollows) and increased pressure on remaining habitats.

4.2.6 Changes to hydrology

The proposal is likely to result in localised effects on surface hydrology resulting from changed management and volumes of surface flows associated with road operation. Due to

the steep nature of the terrain in which the proposal would be undertaken, small extent of the upstream catchment and absence of permanent streams in the operational boundary, changes to surface flows are likely to be minor in nature.

4.2.7 Noise, light and vibration

The proposal would be likely to result in increased vehicle noise and vibration in areas adjacent to the operational boundary resulting from increased traffic. Permanent road lighting would be installed at the Glenella Road and Princes Highway roundabout and associated approaches at the north-western end of the proposal, and at the intersection between Glenella Road and The Ridge Road at the eastern end of the proposal. Temporary lighting impacts from vehicle movement along Princes Highway or Glenella Road are unlikely to change significantly as a result of the proposal.

While traffic and associated noise and vibration are likely to increase relative to the existing traffic along Glenella Road, existing traffic noise impacts are present along the alignment of the proposal. Noise may affect fauna behaviour due to increased edge effects causing animals to retreat from favourable habitat near noise sources, reducing time spent feeding and resulting in energy depletion, disrupting calling required for reproduction and lower likelihood of survival and reproduction (Larkin, 1996). Decreased sensitivity of wildlife after repeated noises is frequently observed and usually attributed to habituation (Larkin, 1996). It is likely that most animal species within the proposal footprint and surrounds are already habituated to frequent noise exposure from the Princes Highway, Glenella Road and surrounding urban areas to the north and east of the proposal.

The areas potentially affected by light spill at the proposed roundabout extend along Glenella Road to the powerline easement. Habitats adjacent to these approaches are disturbed and fragmented by existing alignments of the Princes Highway, Glenella Road and the powerline easement to the east. Due to this fragmentation, edge effects and noise and light impacts resulting from existing operation of the Princes Highway and Glenella Road, important or undisturbed habitat is absent and the area is unlikely to be important for connectivity for nocturnal species. Disturbance-sensitive species are already likely to avoid areas likely to be impacted. Light spill is likely to occur over more than 200 metres of Glenella Road in this area, it is however unlikely to have any significant impacts in this location.

Direct impact of lights spill from proposed road lighting at the intersection between Glenella Road and The Ridge Road are likely to be minimal. Adjacent areas are already disturbed by light spill from the Glenella Road and Heron Road intersection, as well as by existing road operation, past timber harvesting and associated edge effects. These areas are consequently unlikely to permanently support species sensitive to light disturbance, and the area of occupation of such species is unlikely substantially change.

Sections along Glenella Road and The Ridge Road immediately west and south west of this intersection are currently exposed to little permanent light, and hence contribute to connectivity between habitat in Hanging Rock Creek catchment and adjacent areas of Mogo State Fores to the south. The proposed road lighting at the intersection between Glenella Road and the Ridge Road may reduce the useable extent of potential movement corridors for light sensitive nocturnal fauna in this area. However, in the context of other limitations on connectivity resulting from road construction, this impact is likely to be minor. Impacts may be further minimised during detailed design by restricting the extent of road lighting along the

western and south-western approaches to the intersection between Glenella Road and the Ridge Road.

Light tolerant, or opportunistic species, are likely to continue to utilise lit areas and use by some species, such as fast flying insectivorous bats, may increase due to attraction of prey by light sources. The extent of habitat degraded by permanent lighting is small in the context of surrounding habitat resources and reductions in foraging or denning areas for sensitive species are likely to be minimal. Reduced connectivity for fauna between Hanging Rock Creek catchment and adjacent areas is likely to be minimal due to the restriction of lighting to the intersections and approaches.

Measures to minimise light spill from permanent road lighting at both intersections would be incorporated into detailed design, as specified in Section 5. Measures should include minimising the extent of road lighting along the western and south-western approaches to the intersection between Glenella Road and the Ridge Road.

The proposal is not anticipated to result in any significant increase in the impact of noise, light or vibration on threatened fauna.

4.2.8 Impacts on groundwater dependent ecosystems

Operation of the proposal would be unlikely to have any direct impacts on groundwater dependent ecosystems (Figure 3-4). No groundwater dependent ecosystems are located in the operational boundary. The operational boundary is located high in the landscape running along ridgelines and upper slopes.

Due to the nature of the landscape, surface flows are unlikely to be substantially modified in the landscape and hence it is unlikely that there would be significant changes to surface flows downstream of the operational boundary. Operation of the proposal would not include activities with the potential to impact groundwater, such as extraction, extensive changes to surface water penetration or groundwater movement. Hence, direct or indirect impacts on GDEs are unlikely to occur as a result of operation of the proposal.

4.3 Cumulative impacts

While the local landscape supports a high (76 per cent) proportion of native vegetation cover, areas to the north and east of the proposal have been cleared and extensively modified as a result of urban development and associated infrastructure. The South Batemans Bay Link Road connection to Princes Highway being constructed by Transport for NSW is the final component of the South Batemans Bay Link Road concept plan (Figure 4-1).

Road upgrades associated with the linking of George Bass Drive at Batehaven with the Princes Highway, including extending Heron Road and Catalina, have cumulatively resulted in increased fragmentation of forest around the urban edge (ESC, 2019a). While Mogo State Forest is predominantly vegetated, timber harvesting both within the study area and throughout the landscape to the south and west has contributed to degradation and fragmentation of habitat, particularly through restriction of habitat to protected creek lines and conservation corridors.

Biodiversity assessments for previous council managed components of this upgrade, including George Bass Drive to Curtis Road (Glenella Road) and Glenella Road to The Ridge Road (now Glenella Road) was not available, hence details of biodiversity values impacted as a result of construction and operations are not summarised in detail in this assessment. The REF for the South Batemans Bay Bypass – Stage 1 (ESC, 2013) identified the following ecological impacts:

- Habitat fragmentation impacts, mitigated by construction of a fauna underpass, however rope overpasses were not feasible due to constructability limitations
- Loss of two hollow bearing trees, mitigated by installation of nest boxes in adjacent areas
- Loss of small areas of two NSW listed EECs, river flat eucalypt forest and she-oak swamp forest but areas not sufficient to warrant an offset
- Loss of threatened species habitat but areas not sufficient to warrant an offset.

Due to the position of these roads in the landscape and proximity to the study area, values impacted are similar to those identified in the study area. In particular, the combined impact of these proposals has led to increased fragmentation of native vegetation and habitats around the southern and south-western edge of urban development at Catalina (Batemans Bay).

The cumulative habitat fragmentation impacts of implementation of the South Batemans Link Road Concept Plan includes reduced connectivity for threatened species with limited mobility, such as yellow-bellied glider and southern brown bandicoot. The combined impact is complete or partial isolation of populations in habitat fragments located between Glenella Road in the south and the urban edge in the north and east, from larger habitat areas in Mogo State Forest in the south. While there may be limited movement of these species across Glenella Road, the width of the road corridor and position of the road in the landscape poses a substantial barrier for these species.

The Batemans Bay Bridge and the Nelligen Bridge Replacement Projects are significant Transport for NSW infrastructure projects located within five to ten km of the study area. The Batemans Bay Bridge Replacement Project is not directly connected with the study area and terrestrial biodiversity impacts are restricted largely to the north side of the Clyde River. Nelligen Bridge is located some distance from the study area. Impacts on similar values, such as yellow-bellied glider and hollow dependent fauna, were documented for both proposals.

In a regional context, the scale of direct impacts of all projects, even considered in a cumulative perspective, are minor relative to the highly vegetated landscape predominantly managed as state forests.

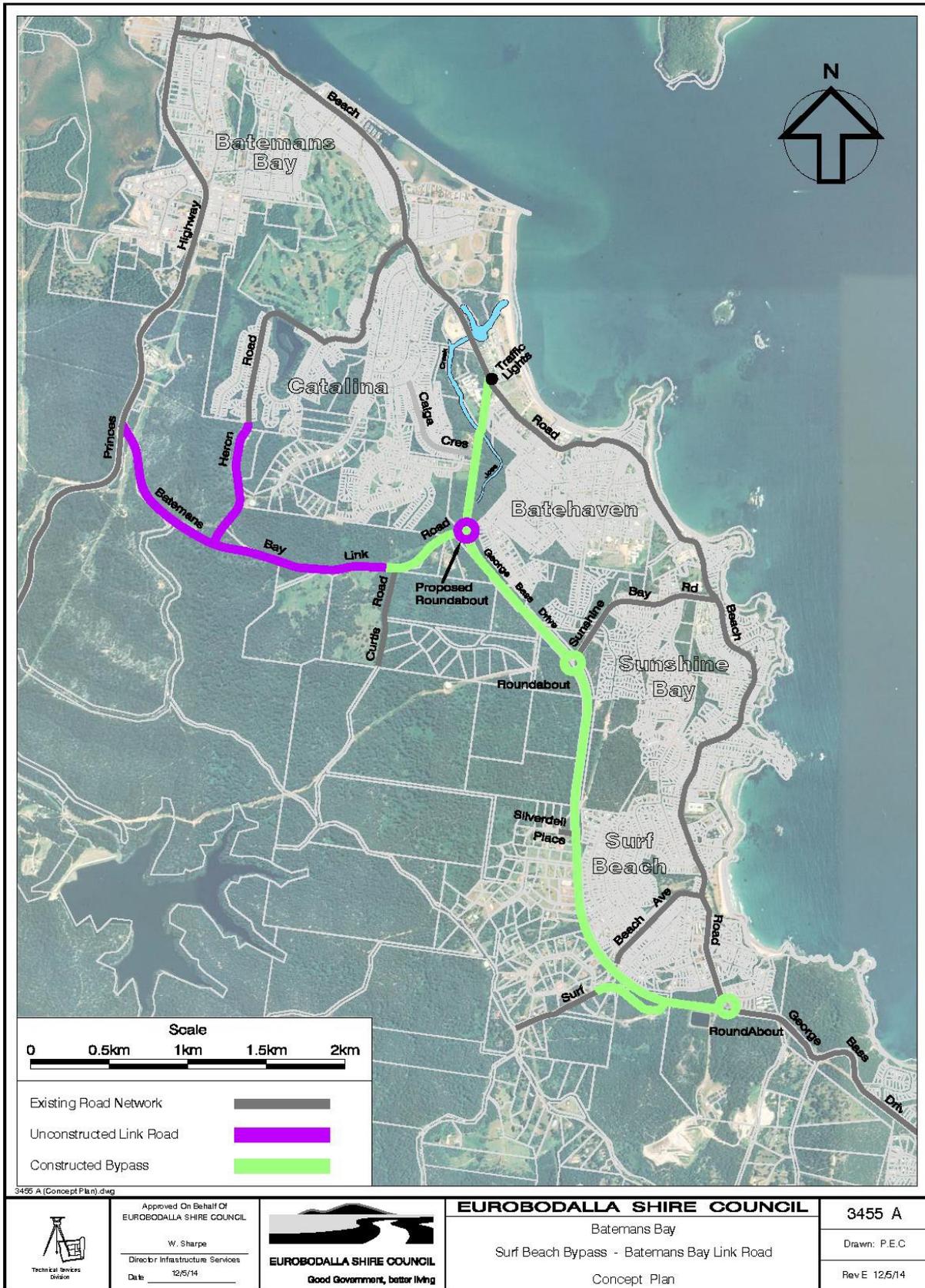


Figure 4-1: Batemans Bay Link Road Concept Plan (ESC 2014)

4.4 Assessments of significance

Assessments of significance have been prepared for each threatened species, population or ecological community with a moderate to high likelihood of occurrence or that have been recorded in the study area (Section 3.5). Assessments of significance have been grouped where species share a similar life history and habitat requirements, allowing similar assessment.

Assessments of significance have been undertaken in accordance with the following published guidelines and requirements:

- Part 7.3 of the Biodiversity Conservation Act 2016
- Significant Impact Guidelines 1.1 – Matters of National Environmental Significance for EPBC Act listed biodiversity (Department of the Environment, 2013b)
- Referral guidelines for species listed under the EPBC Act (Department of the Environment and Energy, 2017b).

Full details of assessments of significance under the BC Act are presented in Appendix E. While habitat in the study area was extensively degraded as a result of the 2019/20 bushfire, tests of significance have been prepared on a precautionary assumption that natural habitat for threatened species will recover in the long term. The conclusions of significance tests under Part 7.3 of the BC Act are summarised in Table 4.3. Full details of assessment of significance under the EPBC Act are presented in Appendix F. The conclusions of EPBC Act assessments of significance are summarised in Table 4.4.

The proposal would be unlikely to have a significant adverse impact on any BC Act or EPBC Act listed threatened species, populations of ecological communities.

Table 4.3: BC Act Significance test summary table

Threatened species	Status	Significance assessment question					Likely significant impact?
		A	B	C	D	E	
yellow-bellied glider	Vulnerable	NS	X	NS	No	NS	No
grey-headed flying-fox	Vulnerable	No	X	No	No	No	No
eastern false pipistrelle	Vulnerable	NS	X	NS	No	NS	No
eastern coastal free-tail bat	Vulnerable	NS	X	NS	No	NS	No
yellow-bellied sheath-tail-bat	Vulnerable	NS	X	NS	No	NS	No
greater broad-nosed bat	Vulnerable	NS	X	NS	No	NS	No
large bent-winged bat	Endangered	No	X	NS	No	NS	No
southern myotis	Vulnerable	NS	X	NS	No	NS	No
square-tailed kite	Vulnerable	No	X	NS	No	No	No
gang gang cockatoo	Vulnerable	NS	X	NS	No	NS	No
glossy black cockatoo	Vulnerable	NS	X	NS	No	NS	No
swift parrot	Endangered	No	X	NS	No	No	No
little lorikeet	Vulnerable	NS	X	NS	No	NS	No
sooty owl	Vulnerable	NS	X	NS	No	NS	No

Threatened species	Status	Significance assessment question					Likely significant impact?
		A	B	C	D	E	
powerful owl	Vulnerable	NS	X	NS	No	NS	No
masked owl	Vulnerable	NS	X	NS	N	NS	No
varied sittella	Vulnerable	NS	X	NS	N	NS	No

Yes = significant negative impact, No = no or positive impact, NS = non-significant negative impact, X= not applicable

Table 4.4: EPBC Act Assessment of Significance summary table

Species	Status	Important population	Likely significant impact?
swift parrot	Critically Endangered	N/A	No
southern brown bandicoot	Endangered	N/A	No
grey-headed flying-fox	Vulnerable	Yes	No

Yes= negative impact, No = no or positive impact, N/A= not applicable.

5 Mitigation

Table 5.1 presents recommended safeguards and mitigation measures addressing potential impacts of the proposal. The recommended safeguards and mitigation measures conform with best practice management measures outlined in *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (Roads and Traffic Authority, 2011) and *Wildlife Connectivity Guidelines: Managing wildlife connectivity on road projects* (Draft November 2011) (Roads and Traffic Authority, 2011).

While bushfires in 2019 – 2020 have degraded native vegetation and are likely to have substantially reduced populations of threatened and non-threatened fauna in the construction boundary, best practice mitigation measures would be required to avoid additional impacts.

If the yellow-bellied glider population in Hanging Rock Creek catchment has survived the 2019 – 2020 bushfire, there is potential for the proposal to partly or completely isolate these family groups from the population in the surrounding landscape. Further assessment of whether individuals persist within the Hanging Rock Creek catchment in spring/summer 2020/21 is warranted to inform planning for connectivity measures.

If a population of yellow-bellied gliders persist in the Hanging Rock Creek catchment following the fire, the population has the potential to be important for the recolonization of the surrounding landscape. If individuals persist in Hanging Rock Creek catchment, design opportunities to maintain connectivity with the extensive potential habitat located in Mogo State Forest to the south should be considered. While yellow-bellied gliders are not frequently recorded utilising glider poles or rope bridges, they have been recorded on at least two occasions in internal Transport for NSW documentation and by Goldingay et al. (2018). Similarly, they are known to utilise isolated trees to assist with dispersal in degraded locations. The objective of connectivity measures would be to maintain dispersal potential for the local glider population present in Hanging Rock Creek, to allow juveniles to find new home ranges and permit a modest degree of gene flow to ensure longevity of the local population persisting within this habitat fragment.

Table 5.1: Mitigation measures

Impact	Mitigation measures	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated
General impacts on biodiversity	Native vegetation clearing will be minimised through detailed design and construction. Vegetation clearing limit drawings will be developed during detailed design to minimise vegetation clearing outside of the operational boundary and be in accordance with Roads and Maritime Standard Specification G40 Clearing and Grubbing, Clause 2.1. Construction drawings will include clearing limits and environmental no-go zones to be retained and to be delineated during construction.	Detailed design	Effective	Loss of native vegetation Loss of fauna habitat
	Pre-clearing surveys will be undertaken in accordance with <i>Guide 1: Pre-clearing process</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (Roads and Traffic Authority, 2011). Hollow-bearing trees to be retained will be identified and marked during the pre-clearing survey. Habitat trees requiring staged-clearing will also be marked during the pre-clearing survey.	Prior to construction	Effective	
	Hollow bearing trees to be retained, in particular trees containing large hollows, will be identified during detailed design and construction planning and marked within the clearing limits drawing.	Detailed design and during construction	Effective	
	Vegetation removal will be undertaken in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (Roads and Traffic Authority, 2011).	During construction	Effective	
	Native vegetation will be re-established in accordance with <i>Guide 3: Re-establishment of native vegetation</i> of the <i>Biodiversity Guidelines:</i>	Post construction	Effective	

Impact	Mitigation measures	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated
	<i>Protecting and managing biodiversity on RTA projects</i> (Roads and Traffic Authority, 2011).			
	Fallen logs will be retained where possible and be either moved into adjacent areas outside the clearing limit but within the construction boundary or stockpiled for later placement as part of the site rehabilitation plan in accordance with <i>Guide 5: Re-use of woody debris and bushrock</i> .	During construction	Proven	
	The unexpected species find procedure is to be followed under <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (Roads and Traffic Authority, 2011) if threatened flora or fauna species or ecological communities, not assessed in the biodiversity assessment, are identified within the construction boundary.	During construction	Proven	
	If residual impacts, after avoidance or mitigation, exceed threshold for offsetting cleared native vegetation or threatened species habitat, a biodiversity offsets strategy will be prepared in accordance with Transport for NSW Guidelines for Biodiversity Offsets (Roads and Maritime, 2016) during detailed design.	Detailed design	Effective	
Removal of threatened species habitat and habitat features	Vegetation clearing will be minimised as specified above. Particular efforts will be made to retain vegetation not subject to timber harvesting along drainage lines confirmed to support yellow-bellied glider and potential sooty owl breeding habitat near Hanging Rock Creek.	Detailed design	Effective	

Impact	Mitigation measures	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated
	<p>A nest box strategy would be developed and implemented targetting tree-roosting microbats, arboreal mammals and little lorikeet to offset hollows suitable for these species to be removed. The strategy would include a new survey of hollow bearing trees in the construction boundary to determine numbers of hollows remaining following the 2019/20 bushfire that would be removed for construction. The strategy will be developed in accordance with <i>Guide 8: Nest boxes of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (Roads and Traffic Authority, 2011) considering practicability and impacts on habitat following the 2019 – 2020 bushfire. The strategy will investigate alternative approaches to offset loss of large and very large hollow bearing trees for forest owls and glossy black cockatoos.</p>	Detailed design	Proven	
Changes to hydrology	Changes to existing surface water flows will be minimised through detailed design.	Detailed design	Effective	Minor alterations to surface water flows.
Fragmentation of identified habitat corridors	<p>A survey to determine whether yellow-bellied gliders persist in the Hanging Rock Creek catchment following the 2019 – 2020 fires will be carried out in spring/summer 2020/21 during detailed design. If present, the importance of individuals for post-fire recovery will be assessed by an ecologist and a connectivity strategy prepared if individuals persist in Hanging Rock Creek catchment.</p> <p>Design opportunities to maintain connectivity with the extensive potential habitat located in Mogo State Forest to the south would be considered. Options to be considered would include potential retention of trees in the verges at a maximum of 30 metres apart and/or installation of glider poles or rope bridges between the</p>	Detailed design	Effective	Reduced connectivity from the Hanging Rock Creek Catchment to Mogo State Forest to the south.

Impact	Mitigation measures	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated
	Glenella Road / Heron Road intersection in the east and where the powerline easement crosses Glenella Road in the west. Connectivity measures would be investigated and implemented in accordance with the <i>Wildlife Connectivity Guidelines for Road Projects</i> (Roads and Traffic Authority, 2011) and with the advice of an experienced ecologist.			
Edge effects on adjacent native vegetation and habitat	Exclusion zones will be set up at the clearing limit in accordance with <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (Roads and Traffic Authority, 2011).	During construction	Effective	Residual impacts on fauna habitat.
Light spill impacts on fauna habitat	Measures to minimise light spill from permanent road lighting at both intersections would be investigated during detailed design. Measures would include consideration to minimise the extent of road lighting along the western and south-western approaches to the intersection between Glenella Road and the Ridge Road.	Detailed design	Effective	Residual impacts on fauna habitat immediately adjacent to the intersection and approaches.
Injury and mortality of fauna	Fauna will be managed in accordance with <i>Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (Roads and Traffic Authority, 2011).	During construction	Effective	While the measures described are effective in minimising fauna injury and mortality, they are unlikely to completely prevent it. Some loss of individuals of native animal species is likely to occur during construction and operation of the road. However, the potential mortality of fauna is
	Where possible, clearing of hollow bearing trees supporting large or very large hollows would be undertaken outside the breeding season for glossy black cockatoo and sooty owl (i.e. April to August). Where clearing of hollow bearing trees supporting large or very large hollows must be completed within the breeding season, searches for active nests would be undertaken in accordance with <i>Guide 1: Pre-</i>	During construction	Effective	

Impact	Mitigation measures	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated
	<p><i>clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (Roads and Traffic Authority, 2011) and clearing of active nests would be avoided.</p>			<p>unlikely to significantly impact local native animal populations.</p>
	<p>Habitat removal will be undertaken in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (Roads and Traffic Authority, 2011)</p>	<p>During construction</p>	<p>Effective</p>	
	<p>Minimising road-kill will be considered in the detailed design of the road and associated infrastructure (e.g. culverts, fencing) and landscaping.</p>	<p>Detailed design</p>	<p>Effective</p>	
<p>Invasion and spread of weeds</p>	<p>Weed species will be managed in accordance with the South East Regional Strategic Weed Management Plan (Local Lands Services, 2018), species-specific weed control programs implemented by Eurobodalla Shire Council (ESC, 2020) and <i>Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (Roads and Traffic Authority, 2011).</p>	<p>During construction</p>	<p>Effective</p>	<p>Minor proliferation of non-noxious weeds likely to occur at edges of disturbed areas but these are unlikely to invade adjacent undisturbed areas or prevent the reestablishment of native vegetation.</p>
<p>Invasion and spread of pathogens and disease</p>	<p>Pathogens will be managed in accordance with <i>Guide 7: Pathogen Management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (Roads and Traffic Authority, 2011).</p>	<p>During construction</p>	<p>Effective</p>	<p>Minimal. With the implementation of these procedures, the risk of introducing pathogens would be low.</p>

6 Offset strategy

In the event that residual impacts, after avoidance or mitigation, exceed thresholds, a biodiversity offsets strategy would be required in accordance with the Transport for NSW Guidelines for Biodiversity Offsets (Roads and Maritime, 2016). The offsets strategy may include retiring credits, retiring credits under the variation rules, paying into the Biodiversity Conservation Fund or progressing Stewardship Site Agreements on suitable properties in accordance with the Guidelines for Biodiversity Offsets (Roads and Maritime, 2016).

Table 6.1 provides guidance to determine if offsets should be considered for a proposal assessed in accordance with the Guidelines for Biodiversity Offsets (Roads and Maritime, 2016). Offset thresholds were assessed for all species credit species or ecosystem credit species recorded or determined to have a moderate to high likelihood of occurrence. Based on the construction boundary, clearing of habitat exceeds the thresholds for two species credit species, glossy black cockatoo and sooty owl. The total area of species credit species polygons determined in accordance with the BAM that would require offset for potential clearing in the construction boundary is:

- 15.95 ha of glossy black cockatoo breeding habitat comprising
 - 0.37 ha of PCT1206
 - 15.58 ha of PCT1220.
- 7.69 ha of sooty owl breeding habitat comprising:
 - 0.37 ha of PCT1206
 - 7.32 ha of PCT1220.

Clearing of habitat for ecosystem credit species would also exceed the threshold. 0.89 hectares of planted native vegetation (i.e. vegetation zone 6) does not require offsetting under the Guidelines for Biodiversity Offsets (Roads and Maritime, 2016). The total area of native vegetation that would require offsetting for potential clearing of ecosystem credit species habitat in the construction boundary is 21.79 ha, comprising:

- 0.37 ha of PCT1206
- 21.42 ha of PCT1220.

The above offset calculations are indicative only based on the construction boundary. The clearing limit would be refined during detailed design and construction planning. The final extent of impacts based on the clearing limit would guide the final biodiversity offsets strategy.

Table 6.1. Consideration of Biodiversity Offsets

Description of activity or impact (Roads and Maritime, 2016)	Consideration of offsets recommended by guideline (Roads and Maritime, 2016)	Applicable to proposal	Species	Area requiring offset in construction boundary (ha)	Offset recommendations for proposal
Works involving clearing of vegetation planted as part of a road corridor landscaping program (this includes where threatened species or species comprising listed ecological communities have been used for landscaping purposes)	No	Yes	N/A	None	Offsetting of vegetation cleared from Zone 6 not required.
Works involving clearing of nationally listed threatened ecological community (TEC) or nationally listed threatened species habitat.	Where clearing >1 ha of a TEC or habitat in moderate to good condition	Yes	swift parrot	15.95	No important foraging habitat as identified by DPEI has been identified. Offsetting of PCTs in accordance with the NSW process for ecosystem credit species is appropriate due to the absence of detection or important habitat.

Description of activity or impact (Roads and Maritime, 2016)	Consideration of offsets recommended by guideline (Roads and Maritime, 2016)	Applicable to proposal	Species	Area requiring offset in construction boundary (ha)	Offset recommendations for proposal
			spotted tailed quoll	15.95	Assumed present based on landscape occurrence and no important habitat is present. Offsetting of PCTs in accordance with the NSW process for ecosystem credit species is appropriate due to the absence of detection or important habitat.
			grey-headed flying fox	15.95	No roosting habitat is impacted. Offsetting of PCTs in accordance with the NSW process for ecosystem credit species is appropriate.
Works involving clearing of NSW listed threatened species habitat where the species is a species credit species as defined in the OEH Threatened Species Profile Database (TSPD).	Where clearing > 1ha or where the species is the subject of an SIS	Yes There would be clearing of >1 ha of habitat for	glossy black-cockatoo (breeding habitat)	15.95	Offsetting in accordance with the Guideline for Biodiversity Offsets (Roads and Maritime, 2016) is appropriate.
		species	sooty owl (breeding habitat)	7.69	

Description of activity or impact (Roads and Maritime, 2016)	Consideration of offsets recommended by guideline (Roads and Maritime, 2016)	Applicable to proposal	Species	Area requiring offset in construction boundary (ha)	Offset recommendations for proposal
Works involving clearing of NSW listed threatened species habitat and the species is an ecosystem credit species as defined in OEH's Threatened Species Profile Database (TSPD).	Where clearing > 5ha or where the species is the subject of an SIS	Yes There would be clearing of >5 ha of habitat for ecosystem credit species.	eastern coastal free-tailed bat	15.95	Offsetting in accordance with the Guideline for Biodiversity Offsets (Roads and Maritime, 2016) is appropriate.
			eastern false pipistrelle	15.95	
			gang gang cockatoo (foraging habitat)	15.95	
			glossy black cockatoo (foraging habitat)	15.95	
			greater broad-nosed bat	15.95	
			grey-headed flying-fox	15.95	
			large bent-winged bat (foraging habitat)	15.95	

Description of activity or impact (Roads and Maritime, 2016)	Consideration of offsets recommended by guideline (Roads and Maritime, 2016)	Applicable to proposal	Species	Area requiring offset in construction boundary (ha)	Offset recommendations for proposal
			little lorikeet	15.95	
			sooty owl (foraging habitat)	15.95	
			masked owl (foraging habitat)	15.95	
			powerful owl (foraging habitat)	15.95	
			square-tailed kite (foraging habitat)	21.79	
			varied sittella	15.95	
			yellow-bellied glider	13.62	
			yellow-bellied sheath-tail-bat	15.95	

7 Conclusion

The proposal would generally follow the alignment of Glenella Road (formerly known as The Ridge Road) between the Princes Highway and Heron Road to complete the South Batemans Bay Link Road project. The study area is located on land owned and managed by Transport for NSW, Forestry Corporation of NSW and Eurobodalla Shire Council. Existing land uses are roadway and forestry.

The study area was found to support five PCTs:

- 1206 Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion
- 1220 Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner Bioregion
- 877 Grey Myrtle dry rainforest of the Sydney Basin Bioregion and South East Corner Bioregion
- 1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion
- 1326 Woollybutt - White Stringybark - Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion.

Three WONS and one weed with a control duty under the *Biosecurity Act 2015* were recorded within or adjacent to the construction boundary.

Vegetation meeting diagnostic criteria for two BC Act listed EECs, one EPBC Act listed EEC and one EPBC Act listed CEEC is present in the study area:

- PCT1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion, meets diagnostic criteria for:
 - Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Swamp Oak Floodplain Forest) BC Act listed EEC
 - Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community (Coastal Swamp Oak Forest) EPBC Act listed EEC.
- PCT1326: Woollybutt – White Stringybark – Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion in the study area meets diagnostic criteria for:
 - River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (River-Flat Eucalypt Forest) BC Act listed EEC
 - Illawarra and south coast lowland forest and woodland EPBC Act listed CEEC.

Significant habitat features observed within the study area comprise numerous hollow bearing trees with a range of hollow sizes suitable for hollow dependent fauna and foraging resources for a number of species including black she-oak suitable for glossy black cockatoo and prolifically flowering eucalypt species suitable for nectar dependent species.

Twenty BC Act listed threatened fauna species, six EPBC Act listed threatened fauna species and three EPBC Act listed migratory species were identified as having a moderate or greater potential occurrence status following targeted surveys. No BC Act or EPBC Act

listed threatened flora were detected or determined to be likely to be present in the study area following targeted surveys.

The proposal would remove up to 22.68 ha of native vegetation, including 0.89 ha of planted vegetation, belonging two PCTs (1206 and 1220) within the construction boundary. An additional 1.34 ha of non-native vegetation and 7.15 ha of bare ground, sealed and gravel road surfaces are present in the construction boundary. Depending on post-fire survival and vegetation identified for retention during detailed design and construction planning, up to 72 hollow bearing trees, which are potential habitat for a range of threatened hollow dependent fauna, would be removed. The exact location and quantity of vegetation and habitat removal would be further refined through the detailed design phase.

No threatened ecological communities listed under the BC Act or the EPBC Act are present in the construction boundary or would be impacted by the proposal.

Assessments of significance under Part 7.3 of the BC Act were conducted for all BC Act listed threatened species, populations and ecological communities likely to be affected by the proposal (Appendix E). Through these assessments, it was considered that the proposal is unlikely to have a significant impact on any threatened species, population or ecological communities.

Given that the proposal is not likely to lead to a significant impact on threatened species, populations, ecological communities or their habitats, a Species Impact Statement is not required to support this proposal.

Under the Roads and Maritime Activities Strategic Assessment, potential impacts must be considered in the REF and tests of significance under the EPBC Act have been included in Appendix F. Separate tests of significance under the EPBC Act were prepared for each EPBC Act listed threatened species likely to be present. A single combined test of significance under the EPBC Act was prepared for listed migratory bird species likely to occur in the study area.

No significant impacts on EPBC Act listed species are likely to occur and the EPBC Act Strategic Assessment is not triggered by the proposal.

While unlikely due to fire intensity, if the yellow-bellied glider population in Hanging Rock Creek catchment has survived the 2019 – 2020 bushfire, there is potential for the proposal to partly or completely isolate these family groups from the population in the surrounding landscape. Further assessment of whether individuals persist within the Hanging Rock Creek catchment would be warranted to inform planning for connectivity measures.

The proposal exceeds habitat clearing thresholds for offsetting identified in the Guideline for Biodiversity Offsets (Roads and Maritime, 2016) for two species credit species and fifteen ecosystem credit species as defined in the OEH Threatened Species Profile Database (TSPD). Subject to vegetation clearing minimisation efforts, preparation of an offsets strategy would be required in accordance with the Guideline for Biodiversity Offsets (Roads and Maritime, 2016) to meet the following offset requirements for potential clearing in the construction boundary is:

- 15.95 ha of glossy black cockatoo breeding habitat, consistent with species polygons developed in accordance with the BAM
- 7.69 ha of sooty owl breeding habitat, consistent with species polygons developed in accordance with the BAM
- 0.37 ha of PCT1206 for ecosystem credit species

- 21.42 ha of PCT1220 for ecosystem credit species.

To minimise residual adverse impacts on native vegetation and threatened fauna, the mitigation measures described in Section 5 must be implemented. Measures to minimise clearing of native vegetation and threatened fauna habitat should be implemented during detailed design and construction, including undertaking the works in the manner specified in and in accordance with the Biodiversity Guidelines (Roads and Traffic Authority, 2011).

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Appendix A Flora species recorded

Recorded flora

Family	Scientific Name	Common name	Status		Cover in each plot*															Incidental
			TSC Act	EPBC Act	V05	V09	V04	V11	V06	V01	V03	V02	V15	V07	V10	V08	V16	V13	V14	
Anthericaceae	<i>Arthropodium paniculatum</i>	pale vanilla-lily			0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0	0
Apiaceae	<i>Centella asiatica</i>	Indian pennywort			0	0	0	0	0	0	0	0	0.03	0	0	0	0	0	0	0.01
Apiaceae	<i>Daucus glochidiatus</i>	native carrot			0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0
Apiaceae	<i>Foeniculum vulgare*</i>	fennel			0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0
Apiaceae	<i>Platysace lanceolata</i>	Shrubby platysace			0	0.01	0.01	0.01	0	0	0.01	0.01	0	0	0	0	0	0	0	0
Apocynaceae	<i>Parsonsia straminea</i>	common silkpod			0	0	0	0	0	0	0	0	0.15	0	0	0.01	0.05	0.2	0.3	
Apocynaceae	<i>Tylophora barbata</i>	bearded tylophora			0	0	0	0	0	0.01	0	0	0	0	0	0.01	0	0.3	0.02	
Araliaceae	<i>Hydrocotyle acutiloba</i>	pennywort			0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.02	
Araliaceae	<i>Hydrocotyle algida</i>	pennywort			0	0	0	0.01	0	0	0	0	0	0.01	0	0	0	0	0	
Araliaceae	<i>Hydrocotyle bonariensis*</i>	largeleaf pennywort			0.03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Araliaceae	<i>Polyscias sambucifolia</i>	elderberry panax			0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0	

Family	Scientific Name	Common name	Status		Cover in each plot*															Incidental
			TSC Act	EPBC Act	V05	V09	V04	V11	V06	V01	V03	V02	V15	V07	V10	V08	V16	V13	V14	
Asparagaceae	<i>Asparagus aethiopicus*</i>	ground asparagus			0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0
Asteraceae	<i>Bidens pilosa*</i>	cobblers pegs			0.01	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0
Asteraceae	<i>Brachyscome</i> sp.				0	0	0	0	0	0	0	0.01	0	0	0.01	0	0	0	0	0
Asteraceae	<i>Cassinia aculeata</i>	dolly bush			0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0
Asteraceae	<i>Cassinia arcuata</i>				0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0
Asteraceae	<i>Cirsium vulgare*</i>	spear thistle			0.01	0	0	0.01	0.01	0	0	0	0.01	0	0	0	0	0	0	0
Asteraceae	<i>Conyza bonariensis*</i>	flatleaf fleabane			0	0	0	0	0.01	0	0	0	0	0	0.01	0	0	0	0	0
Asteraceae	<i>Euchiton gymnocephalus</i>	creeping cudweed			0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0
Asteraceae	<i>Euchiton</i> sp.				0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0
Asteraceae	<i>Gamochaeta americana*</i>	cudweed			0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0
Asteraceae	<i>Hypochaeris glabra*</i>	smooth catsear			0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0
Asteraceae	<i>Hypochaeris radicata*</i>	catsear			0.01	0	0	0	0.01	0	0	0	0	0.01	0.01	0	0	0	0	0

Family	Scientific Name	Common name	Status		Cover in each plot*															Incidental
			TSC Act	EPBC Act	V05	V09	V04	V11	V06	V01	V03	V02	V15	V07	V10	V08	V16	V13	V14	
Asteraceae	<i>Lagenifera</i> sp.				0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0
Asteraceae	<i>Lagenifera stipitata</i>	blue-bottle daisy			0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0
Asteraceae	<i>Leontodon taraxacoides</i> *	lesser hawkbit			0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0
Asteraceae	<i>Leptinella longipes</i>				0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0
Asteraceae	<i>Olearia tenuifolia</i>	thin-leaf daisy-bush			0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0
Asteraceae	<i>Senecio linearifolius</i>	fireweed			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01
Asteraceae	<i>Senecio minimus</i>				0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0
Asteraceae	<i>Sonchus asper</i> *	prickly sowthistle			0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Asteraceae	<i>Taraxacum</i> sp.	dandelion			0	0	0	0	0.01	0	0	0	0	0	0.01	0	0	0	0	0
Asteraceae	<i>Vernonia cinerea</i>	iron weed			0	0	0	0.01	0	0	0	0	0	0.01	0	0	0	0	0	0
Blechnaceae	<i>Blechnum cartilagineum</i>	gristle fern			0	0	0	0	0	0.1	0	0	0	0	0	0	0	0.1	0	0
Blechnaceae	<i>Doodia aspera</i>	prickly rasp fern			0	0	0.01	0	0	0	0	0	0	0	0	0	0	0.3	0.05	0
Campanulaceae	<i>Lobelia alata</i>				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01
Campanulaceae	<i>Lobelia anceps</i>				0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0

Family	Scientific Name	Common name	Status		Cover in each plot*															Incidental
			TSC Act	EPBC Act	V05	V09	V04	V11	V06	V01	V03	V02	V15	V07	V10	V08	V16	V13	V14	
Campanulaceae	<i>Pratia purpurascens</i>	whiteroot			0	0	0	0.06	0	0	0	0.01	0.01	0.01	0	0	0	0	0.01	
Campanulaceae	<i>Wahlenbergia gracilis</i>	sprawling bluebell			0	0	0.01	0.01	0	0	0	0.01	0	0.01	0.01	0	0	0	0	
Campanulaceae	<i>Wahlenbergia stricta</i>	Australian bluebell			0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	
Caryophyllaceae	<i>Stellaria flaccida</i>	starwort			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	
Casuarinaceae	<i>Allocasuarina littoralis</i>	black she-oak			0	0.01	0	0.02	0.01	0	0	0.01	0	0.01	0.01	0.05	0	0.01	0	
Casuarinaceae	<i>Casuarina glauca</i>	Swamp oak			0	0	0	0	0	0	0	0	0.6	0	0.01	0	0	0	0	
Chenopodiaceae	<i>Einadia nutans</i>	climbing saltbush			0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	
Convolvulaceae	<i>Dichondra repens</i>	kidney weed			0	0	0.01	0	0	0.01	0	0	0.05	0.01	0	0.01	0	0	0	
Cyperaceae	<i>Cyperus</i> sp.				0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	
Cyperaceae	<i>Gahnia aspera</i>	rough saw-sedge			0	0	0	0	0	0	0	0	0	0	0	0	0	0.02	0	
Cyperaceae	<i>Gahnia melanocarpa</i>	black-fruit saw-sedge			0	0	0	0.01	0	0.02	0	0	0.05	0.02	0	0.01	0	0	0.05	
Cyperaceae	<i>Lepidosperma laterale</i>	variable sword-sedge			0	0.01	0.01	0.05	0.02	0	0.01	0.02	0.02	0.01	0	0.05	0.01	0.03	0.01	

Family	Scientific Name	Common name	Status		Cover in each plot*															Incidental
			TSC Act	EPBC Act	V05	V09	V04	V11	V06	V01	V03	V02	V15	V07	V10	V08	V16	V13	V14	
Cyperaceae	<i>Lepidosperma urophorum</i>	rapier sword-sedge			0	0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	
Dennstaedtiaceae	<i>Hypolepis muelleri</i>	harsh ground fern			0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	
Dennstaedtiaceae	<i>Pteridium esculentum</i>	bracken			0	0	0	0.05	0	0.1	0	0	0.02	0	0	0	0	0.05	0.1	
Dicksoniaceae	<i>Calochlaena dubia</i>	rainbow fern			0	0	0	0.01	0	0.6	0	0	0	0	0	0	0	0	0	
Dilleniaceae	<i>Hibbertia aspera</i>	rough guinea flower			0	0	0.01	0	0.01	0	0	0.01	0	0.01	0	0.01	0	0	0	
Dilleniaceae	<i>Hibbertia diffusa</i>	wedge guinea flower			0	0	0.01	0.01	0	0	0	0	0	0.01	0	0	0	0	0	
Ericaceae	<i>Leucopogon juniperinus</i>	prickly beard-heath			0	0	0	0	0.02	0	0	0	0	0.01	0	0	0	0	0	
Ericaceae	<i>Leucopogon lanceolatus</i>	lance beard-heath			0	0.01	0	0.01	0.01	0.01	0	0.01	0	0.01	0	0.01	0	0	0	
Fabaceae	<i>Acacia falcata</i>	hickory wattle			0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	
Fabaceae	<i>Acacia implexa</i>	hickory wattle			0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	
Fabaceae	<i>Acacia irrorata</i>	green wattle			0	0.01	0	0	0	0.05	0	0	0	0	0	0.01	0	0	0	

Family	Scientific Name	Common name	Status		Cover in each plot*															Incidental
			TSC Act	EPBC Act	V05	V09	V04	V11	V06	V01	V03	V02	V15	V07	V10	V08	V16	V13	V14	
Fabaceae	<i>Acacia longifolia</i>	golden wattle			0	0.01	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0
Fabaceae	<i>Acacia longissima</i>	white sally wattle			0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fabaceae	<i>Acacia mabellae</i>	Mabels wattle			0	0	0.05	0	0	0	0.02	0	0	0	0	0	0	0.05	0	0
Fabaceae	<i>Acacia mearnsii</i>	black wattle			0	0	0	0	0	0	0	0	0	0	0.05	0	0	0	0	0.03
Fabaceae	<i>Acacia obtusifolia</i>	blunt leaf wattle			0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fabaceae	<i>Acacia paradoxa</i>	kangaroo thorn			0.01	0	0	0.01	0	0	0	0	0	0.01	0.01	0.05	0	0	0	0
Fabaceae	<i>Acacia saligna</i> *	golden wreath wattle			0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0
Fabaceae	<i>Acacia</i> sp.1				0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0
Fabaceae	<i>Acacia</i> sp.				0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fabaceae	<i>Bossiaea obcordata</i>	spiny bossiaea			0	0.01	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0
Fabaceae	<i>Daviesia ulicifolia</i>	gorse bitter pea			0.01	0	0	0	0	0	0	0.05	0	0.01	0	0	0	0	0	0
Fabaceae	<i>Desmodium brachypodum</i>	large tick-trefoil			0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0
Fabaceae	<i>Desmodium</i> sp.				0	0	0.01	0	0	0	0	0.01	0	0	0.01	0	0	0	0	0

Family	Scientific Name	Common name	Status		Cover in each plot*															Incidental	
			TSC Act	EPBC Act	V05	V09	V04	V11	V06	V01	V03	V02	V15	V07	V10	V08	V16	V13	V14		
Fabaceae	<i>Glycine clandestina</i>	twining glycine			0	0	0	0.01	0	0	0.01	0.01	0	0.01	0.01	0	0	0	0		
Fabaceae	<i>Glycine clandestina</i> var. <i>clandestina</i>	twining glycine			0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	
Fabaceae	<i>Glycine tabacina</i>	variable glycine			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01		
Fabaceae	<i>Hardenbergia violacea</i>	false sarsaparilla			0.01	0.01	0.01	0	0	0	0.01	0.01	0	0.01	0.01	0	0	0	0		
Fabaceae	<i>Indigofera australis</i>	Australian indigo			0.01	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0		
Fabaceae	<i>Podolobium ilicifolium</i>	prickly shaggy pea			0	0.01	0	0	0.01	0	0.01	0.01	0	0	0	0	0	0	0		
Fabaceae	<i>Pulteana daphnoides</i>	large-leaf bush-pea			0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0		
Fabaceae	<i>Senna pendula</i> var. <i>glabrata</i>				0	0	0.01	0	0	0	0.01	0	0	0	0	0	0	0	0		
Fabaceae	<i>Senna pendula</i> *				0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0		
Fabaceae	<i>Trifolium campestre</i> *	hop clover			0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0		
Fabaceae	<i>Trifolium repens</i> *	white clover			0.01	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0		

Family	Scientific Name	Common name	Status		Cover in each plot*															Incidental
			TSC Act	EPBC Act	V05	V09	V04	V11	V06	V01	V03	V02	V15	V07	V10	V08	V16	V13	V14	
Gentianaceae	<i>Centaurium erythraea</i> *	common centaury			0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	
Gentianaceae	<i>Sebaea ovata</i>	yellow centaury			0	0	0	0	0.01	0	0	0	0	0	0.01	0	0	0	0	
Goodeniaceae	<i>Goodenia ovata</i>	hop goodenia			0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	
Haloragaceae	<i>Gonocarpus teucrioides</i>	Raspwort			0	0	0	0.01	0.01	0	0	0.01	0	0.01	0	0	0	0.01	0	
Hypericaceae	<i>Hypericum gramineum</i>	small St. Johns wort			0	0	0	0	0.01	0	0	0	0	0.01	0	0	0	0	0	
Iridaceae	<i>Patersonia</i> sp.	native iris			0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	
Juncaceae	<i>Juncus</i> sp.				0.01	0	0	0	0	0	0	0	0	0.01	0.01	0	0	0	0	
Lauraceae	<i>Cassytha glabella</i>	slender devils twine			0	0	0	0	0.01	0	0	0	0	0.01	0	0	0	0	0	
Linaceae	<i>Linum trigynum</i> *	French flax			0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	
Lomandraceae	<i>Lomandra longifolia</i>	spiny-headed mat-rush			0.01	0	0.03	0.01	0.4	0.01	0.01	0	0	0.02	0	0.01	0	0	0.2	
Lomandraceae	<i>Lomandra multiflora</i>	many-flowered mat-rush			0	0.01	0.01	0.01	0	0	0.01	0	0	0	0	0	0	0	0	
Luzuriagaceae	<i>Eustrephus latifolius</i>	wombat berry			0	0.01	0.01	0	0	0.01	0.01	0	0.02	0.01	0	0.01	0	0.01	0.03	

Family	Scientific Name	Common name	Status		Cover in each plot*															Incidental	
			TSC Act	EPBC Act	V05	V09	V04	V11	V06	V01	V03	V02	V15	V07	V10	V08	V16	V13	V14		
Luzuriagaceae	<i>Geitonoplesium cymosum</i>	scrambling lily			0	0	0.01	0	0	0	0.01	0	0	0	0	0.01	0.01	0	0.01		
Menispermaceae	<i>Stephania japonica</i>	snake vine			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	
Moraceae	<i>Ficus coronata</i>	sandpaper fig			0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0		
Myrtaceae	<i>Backhousia myrtifolia</i>	grey myrtle			0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0		
Myrtaceae	<i>Corymbia gummifera</i>	red bloodwood			0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0		
Myrtaceae	<i>Corymbia maculata</i>	spotted gum			0.03	0.15	0.3	0.05	0.01	0.15	0.2	0.05	0	0.01	0	0.1	0.1	0.3	0		
Myrtaceae	<i>Eucalyptus globoidea</i>	white stringybark			0	0	0	0.05	0	0	0	0.05	0	0.01	0	0.15	0	0	0		
Myrtaceae	<i>Eucalyptus sieberi</i>	silvertop ash			0	0	0.1	0	0	0	0	0	0	0	0	0	0.1	0.1	0		
Myrtaceae	<i>Eucalyptus muelleriana</i>	yellow stringybark			0	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0		
Myrtaceae	<i>Eucalyptus paniculata</i>	grey ironbark			0.02	0.05	0.05	0	0	0	0.3	0.05	0	0	0	0	0	0	0		
Myrtaceae	<i>Eucalyptus pilularis</i>	blackbutt			0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0		
Myrtaceae	<i>Eucalyptus tereticornis</i>	forest red gum			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3		

Family	Scientific Name	Common name	Status		Cover in each plot*															Incidental
			TSC Act	EPBC Act	V05	V09	V04	V11	V06	V01	V03	V02	V15	V07	V10	V08	V16	V13	V14	
Myrtaceae	<i>Leptospermum juniperinum</i>	prickly tea-tree			0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	
Myrtaceae	<i>Leptospermum lanigerum</i>	woolly teatree			0	0	0	0	0	0	0	0	0	0.3	0	0	0	0	0	
Myrtaceae	<i>Leptospermum polygalifolium</i>	tantoon			0	0	0	0	0.05	0	0	0	0	0.2	0	0.02	0	0.05	0.2	
Myrtaceae	<i>Leptospermum</i> spp.	teatree			0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Myrtaceae	<i>Sannantha pluriflora</i>	tall baeckea			0	0	0	0	0	0	0	0	0	0.01	0	0.01	0	0	0	
Oleaceae	<i>Notelaea longifolia</i>	large mock-olive			0	0	0.03	0	0	0	0	0	0	0	0	0	0.02	0	0	
Orchidaceae	<i>Diuris</i> sp.	donkey orchid			0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	
Orchidaceae	<i>Microtis</i> sp.	onion orchid			0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	
Orchidaceae	<i>Thelymitra</i> sp.	sun orchid			0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	
Oxalidaceae	<i>Oxalis perennans</i>	grassland wood sorrel			0	0	0	0.01	0.01	0	0	0	0	0	0	0	0	0	0	
Oxalidaceae	<i>Oxalis</i> sp.	wood sorrel			0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0	
Pallaviciniaceae	<i>Symphyogyna</i> spp.				0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	
Phormiaceae	<i>Dianella caerulea</i>	blue flax-lily			0	0.01	0.01	0.02	0.03	0	0	0.01	0	0	0	0.01	0	0.01	0	

Family	Scientific Name	Common name	Status		Cover in each plot*															Incidental
			TSC Act	EPBC Act	V05	V09	V04	V11	V06	V01	V03	V02	V15	V07	V10	V08	V16	V13	V14	
Phormiaceae	<i>Dianella longifolia</i>	blueberry lily			0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0
Phormiaceae	<i>Dianella revoluta</i>	blueberry lily			0	0.01	0	0	0	0.01	0	0.01	0	0.02	0	0	0.01	0	0	0
Phyllanthaceae	<i>Breynia oblongifolia</i>	coffee bush			0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	
Phyllanthaceae	<i>Poranthera microphylla</i>	small poranthera			0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0
Pittosporaceae	<i>Bursaria spinosa</i>	blackthorn			0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	
Pittosporaceae	<i>Pittosporum revolutum</i>	wild yellow jasmine			0	0.01	0.02	0.01	0	0	0	0	0	0	0	0.01	0	0	0	
Pittosporaceae	<i>Pittosporum undulatum</i>	native daphne			0	0	0	0	0	0.05	0	0	0.05	0	0	0	0.01	0.15	0.01	
Plantaginacea	<i>Plantago lanceolata</i> *	Lambs tongues			0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	
Poaceae	<i>Aristida vagans</i>	threeawn speargrass			0	0	0	0	0.3	0	0	0.03	0	0.01	0	0	0	0	0	
Poaceae	<i>Cynodon dactylon</i>	couch grass			0.01	0	0	0	0.1	0	0	0	0	0.03	0.6	0	0	0	0	
Poaceae	<i>Dactylis glomerata</i> *	cocksfoot			0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	
Poaceae	<i>Dichelachne inaequiglumis</i>				0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	

Family	Scientific Name	Common name	Status		Cover in each plot*															Incidental
			TSC Act	EPBC Act	V05	V09	V04	V11	V06	V01	V03	V02	V15	V07	V10	V08	V16	V13	V14	
Poaceae	<i>Dichelachne</i> sp.	plumegrass			0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0	
Poaceae	<i>Echinopogon</i> sp.	hedgheg grass			0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	
Poaceae	<i>Entolasia marginata</i>	bordered panic			0	0	0.01	0	0	0.03	0	0	0.02	0	0	0	0	0.01	0.1	
Poaceae	<i>Entolasia stricta</i>	wiry panic			0	0.01	0	0.02	0.01	0.05	0	0.01	0	0.02	0	0.01	0	0	0	
Poaceae	<i>Eragrostis</i> sp.	lovegrass			0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	
Poaceae	<i>Holcus lanatus</i> *	Yorkshire fog			0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Poaceae	<i>Imperata cylindrica</i>	blady grass			0	0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	
Poaceae	<i>Lolium perenne</i> *	perennial ryegrass			0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Poaceae	<i>Microlaena stipoides</i>	weeping grass			0	0	0	0.05	0.02	0	0	0	0	0.01	0	0	0	0	0	
Poaceae	<i>Oplismenus imbecillis</i>	creeping beard grass			0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	
Poaceae	<i>Panicum simile</i>	two-colour panic			0	0	0.01	0	0	0	0	0.02	0	0.01	0	0	0	0	0	
Poaceae	<i>Pennisetum clandestinum</i> *	Kikuyu grass			0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	

Family	Scientific Name	Common name	Status		Cover in each plot*															Incidental
			TSC Act	EPBC Act	V05	V09	V04	V11	V06	V01	V03	V02	V15	V07	V10	V08	V16	V13	V14	
Poaceae	<i>Phragmites australis</i>	common reed			0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	
Poaceae	<i>Poa meionectes</i>	short snow-grass			0	0	0.01	0.01	0	0	0	0	0	0	0	0	0	0.01	0	
Poaceae	<i>Poa sieberiana</i>	common snow-grass			0	0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	
Poaceae	<i>Poa</i> sp.	tussock grass			0	0	0	0	0.01	0	0	0.05	0	0.1	0	0	0	0	0	
Poaceae	<i>Rytidosperma longifolium</i>	long-leaved wallaby grass			0	0	0.01	0	0	0	0.2	0.01	0	0.1	0	0.01	0	0	0	
Poaceae	<i>Rytidosperma pallidum</i>	silvertop wallaby grass			0	0.01	0	0.1	0	0	0	0	0	0	0	0	0	0	0	
Poaceae	<i>Themeda australis</i>	kangaroo grass			0	0	0.01	0	0.1	0	0.01	0	0	0.05	0.01	0	0	0	0	
Poaceae	<i>Vulpia myuros</i> *	rats tail fescue			0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
polypodiaceae	<i>Pyrrhosia rupestris</i>	rock felt fern			0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	
Primulaceae	<i>Anagallis arvensis</i> *	scarlet pimpernel			0	0	0	0	0	0	0	0	0	0.01	0.01	0	0	0	0	
Primulaceae	<i>Rapanea howittiana</i>	brush muttonwood			0	0	0	0	0	0	0	0	0.02	0	0	0	0	0	0.01	

Family	Scientific Name	Common name	Status		Cover in each plot*															Incidental
			TSC Act	EPBC Act	V05	V09	V04	V11	V06	V01	V03	V02	V15	V07	V10	V08	V16	V13	V14	
Proteaceae	<i>Persoonia linearis</i>	narrow-leaved geebung			0	0.01	0.01	0	0.01	0	0.01	0.01	0	0	0	0	0	0	0	
Proteaceae	<i>Persoonia mollis</i>	soft geebung			0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	
Pteridaceae	<i>Adiantum aethiopicum</i>	common maidenhair			0	0	0	0	0	0	0	0	0	0.01	0	0	0	0.01	0.01	
Pteridaceae	<i>Adiantum formosum</i>	black stem			0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	
Pteridaceae	<i>Cheilanthes sieberi</i>	poison rock fern			0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	
Pteridaceae	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	poison rock fern			0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	
Ranunculaceae	<i>Clematis aristata</i>	old mans beard			0	0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	
Ranunculaceae	<i>Clematis glycinoides</i>	headache vine			0	0	0	0	0	0	0.01	0	0	0	0	0.01	0	0.01	0	
Rhamnaceae	<i>Pomaderris lanigera</i>	woolly pomaderris			0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	
Rosaceae	<i>Rubus parvifolius</i>	native raspberry			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	
Rubiaceae	<i>Galium binifolium</i>				0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	

Family	Scientific Name	Common name	Status		Cover in each plot*															Incidental
			TSC Act	EPBC Act	V05	V09	V04	V11	V06	V01	V03	V02	V15	V07	V10	V08	V16	V13	V14	
Rubiaceae	<i>Opercularia hispida</i>	hairy stinkweed			0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	
Rubiaceae	<i>Opercularia varia</i>	variable stinkweed			0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	
Rubiaceae	<i>Pomax umbellata</i>				0	0	0	0.01	0.01	0	0	0.01	0	0	0	0	0	0	0	
Rutaceae	<i>Zieria smithii</i>	sandfly zieria			0	0	0.01	0	0	0	0	0	0	0	0	0	0	0.01	0	
Santalaceae	<i>Exocarpos cupressiformis</i>	cherry ballart			0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	
Sapindaceae	<i>Guioa semiglauca</i>	guioa			0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	
Smilacaceae	<i>Smilax glyciphylla</i>				0	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0	
Solanaceae	<i>Solanum mauritianum*</i>	wild tobacco bush			0	0	0	0.01	0	0	0	0.01	0.01	0	0	0	0	0	0.02	
Solanaceae	<i>Solanum prinophyllum</i>	forest nightshade			0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	
Solanaceae	<i>Solanum pungetium</i>	eastern nightshade			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	
Stackhousiaceae	<i>Stackhousia monogyna</i>	creamy candles			0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	
Stylidiaceae	<i>Stylidium graminifolium</i>	grass trigger-plant			0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	

Family	Scientific Name	Common name	Status		Cover in each plot*															Incidental
			TSC Act	EPBC Act	V05	V09	V04	V11	V06	V01	V03	V02	V15	V07	V10	V08	V16	V13	V14	
Thymelaeaceae	<i>Pimelea linifolia</i>	slender rice flower			0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	
Uvulariaceae	<i>Schelhammera undulata</i>	lilac lily			0	0	0	0.02	0	0	0	0	0	0	0	0	0	0	0	
Verbenaceae	<i>Verbena rigida</i> *	veined verbena			0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	
Violaceae	<i>Viola hederacea</i>	ivy-leaved violet			0	0	0	0	0	0	0	0	0.01	0.01	0	0	0	0	0.02	
Vitaceae	<i>Cissus hypoglauca</i>	water vine			0	0	0	0	0	0	0	0	0	0	0	0	0.03	0	0.2	
Zamiaceae	<i>Macrozamia communis</i>	burrawang			0	0.05	0.05	0.02	0	0.02	0.3	0.05	0	0	0	0.01	0.01	0	0	

Note: *Cover should be determined in accordance with the BAM.

Appendix B Fauna species recorded

Recorded fauna

Taxa/Fauna group	Scientific Name	Common name	Status	
			BC Act	EPBC Act
Birds				
Acanthizidae	<i>Acanthiza lineata</i>	Striated Thornbill	-	-
Acanthizidae	<i>Acanthiza nana</i>	Yellow Thornbill	-	-
Acanthizidae	<i>Acanthiza pusilla</i>	Brown Thornbill	-	-
Meliphagidae	<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill	-	-
Accipitridae	<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk	-	-
Accipitridae	<i>Accipiter novaehollandiae</i>	Grey Goshawk	-	-
Accipitridae	<i>Lophoictinia isura</i>	Square-tailed Kite	V	-
Aegothelidae	<i>Aegotheles cristatus</i>	Australian Owlet-nightjar	-	-
Psittaculidae	<i>Alisterus scapularis</i>	Australian King-Parrot	-	-
Meliphagidae	<i>Anthochaera carunculata</i>	Red Wattlebird	-	-
Cacatuidae	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	-	-
Cuculidae	<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo	-	-
Meliphagidae	<i>Caligavis chrysops</i>	Yellow-faced Honeyeater	-	-
Cacatuidae	<i>Callocephalon fimbriatum</i>	Gang gang Cockatoo	V	-
Cacatuidae	<i>Calyptorhynchus lathami</i>	Glossy Black Cockatoo	V	-
Cuculidae	<i>Chalcites lucidus</i>	Shining Bronze-Cuckoo	-	-
Anatidae	<i>Chenonetta jubata</i>	Australian Wood Duck	-	-
Climacteridae	<i>Climacteris affinis</i>	White-browed Treecreeper	-	-
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrike-thrush	-	-
Columbidae	<i>Columba leucomela</i>	White-headed Pigeon	-	-
Cuckooshrike	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	-	-
Cuckooshrike	<i>Coracina papuensis</i>	White-bellied Cuckoo-shrike	-	-
Climacteridae	<i>Cormobates leucophaea</i>	White-throated Treecreeper	-	-
Corvidae	<i>Corvus coronoides</i>	Australian Raven	-	-
Corvidae	<i>Corvus mellori</i>	Little Raven	-	-

Taxa/Fauna group	Scientific Name	Common name	Status	
			BC Act	EPBC Act
Artamidae	<i>Cracticus torquatus</i>	Grey Butcherbird	-	-
Alcedinidae	<i>Dacelo novaeguineae</i>	Laughing Kookaburra	-	-
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	-
Cacatuidae	<i>Eolophus roseicapilla</i>	Galah	-	-
Petroicidae	<i>Eopsaltria australis</i>	Eastern Yellow Robin	-	-
Acanthizidae	<i>Gerygone mouki</i>	Brown Gerygone	-	-
Psittaculidae	<i>Glossopsitta concinna</i>	Musk Lorikeet	-	-
Psittaculidae	<i>Glossopsitta pusilla</i>	Little Lorikeet	V	-
Artamidae	<i>Gymnorhina tibicen</i>	Australian Magpie	-	-
Hirundinidae	<i>Hirundo neoxena</i>	Welcome Swallow	-	-
Columbidae	<i>Leucosarcia melanoleuca</i>	Wonga Pigeon	-	-
Columbidae	<i>Macropygia phasianella</i>	Brown Cuckoo-Dove	-	-
Maluridae	<i>Malurus cyaneus</i>	Superb Fairy-wren	-	-
Meliphagidae	<i>Meliphaga lewinii</i>	Lewins Honeyeater	-	-
Meliphagidae	<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater	-	-
Meliphagidae	<i>Melithreptus lunatus</i>	White-naped Honeyeater	-	-
Menuridae	<i>Menura novaehollandiae</i>	Superb Lyrebird	-	-
Estrildidae	<i>Neochmia temporalis</i>	Red-browed Finch	-	-
Strigidae	<i>Ninox boobook</i>	Southern Boobook	-	-
Oriolidae	<i>Oriolus sagittatus</i>	Olive-backed Oriole	-	-
Pachycephalidae	<i>Pachycephala pectoralis</i>	Golden Whistler	-	-
Pardalotidae	<i>Pardalotus punctatus</i>	Spotted Pardalote	-	-
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote	-	-
Hirundinidae	<i>Petrochelidon nigricans</i>	Tree Martin	-	-
Meliphagidae	<i>Philemon corniculatus</i>	Noisy Friarbird	-	-
Meliphagidae	<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	-	-
Psittaculidae	<i>Platycercus elegans</i>	Crimson Rosella	-	-
Podargidae	<i>Podargus strigoides</i>	Tawny Frogmouth	-	-
Psophodidae	<i>Psophodes olivaceus</i>	Eastern Whipbird	-	-
Ptilonorhynchidae	<i>Ptilonorhynchus violaceus</i>	Satin Bowerbird	-	-
Rhipiduridae	<i>Rhipidura fuliginosa</i>	Grey Fantail	-	-

Taxa/Fauna group	Scientific Name	Common name	Status	
			BC Act	EPBC Act
Acanthizidae	<i>Sericornis frontalis</i>	White-browed Scrubwren	-	-
Artamidae	<i>Strepera graculina</i>	Pied Currawong	-	-
Psittaculidae	<i>Trichoglossus moluccanus</i>	Rainbow Lorikeet	-	-
Tytonidae	<i>Tyto tenebricosa</i>	Greater Sooty Owl	V	-
Turdidae	<i>Zoothera lunulata</i>	Bassian Thrush	-	-
Zosteropidae	<i>Zosterops lateralis</i>	Silvereye	-	-
Mammals				
Acrobatidae	<i>Acrobates pygmaeus</i>	Feathertail Glider	-	-
Canidae	<i>Vulpes vulpes</i>	European Red Fox	-	-
Dasyurids / Muridae	<i>Not identified</i>	Antechinus / small rodent		
Macropodidae	<i>Not identified</i>	Kangaroo / Wallaby		
Petauridae	<i>Petaurus australis</i>	Yellow-bellied Glider	V	-
Petauridae	<i>Petaurus breviceps</i>	Sugar Glider	-	-
Phalangeridae	<i>Trichosurus vulpecula</i>	Common Brushtail Possum	-	-
Tachyglossidae	<i>Not identified</i>	Echidna		
Molossidae	<i>Austronomus australis</i>	White-striped free-tailed bat		
Vespertilionidae	<i>Chalinolobus dwyeri</i> (possible)	Large-eared pied bat	V	V
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's wattled bat		
Vespertilionidae	<i>Chalinolobus morio</i>	Chocolate wattled bat		
Molossidae	<i>Mormopterus norfolkensis</i>	Eastern coastal free-tailed bat	V	-
Molossidae	<i>Mormopterus ridei</i>	Eastern free-tailed bat		
Rhinolophidae	<i>Rhinolohus megaphyllus</i>	Eastern horsehoe-bat		
Emballonuridae	<i>Saccolaimus flaviventris</i> (probable)	Yellow-bellied sheath-tailed bat	V	-
Vespertilionidae	<i>Scoteanax rueppellii</i> (possible)	Greater broad-nosed bat	V	-
Vespertilionidae	<i>Vespadelus regulus</i>	Southern forest bat		
Vespertilionidae	<i>Vespadelus vulturnis</i>	Little forest bat		
Vespertilionidae	<i>Falsistrellus tasmaniensis</i> / <i>Scotorepens orion</i>	Species group (calls not distinguishable)	V	-

Taxa/Fauna group	Scientific Name	Common name	Status	
			BC Act	EPBC Act
Vespertilionidae	<i>Myotis macropus</i> / <i>Nyctophilus geoffroyi</i> / <i>Nyctophilus gouldi</i>	Species group (calls not distinguishable)	V	-
Vespertilionidae	<i>Vespadelus darlingtoni</i> / <i>Vespadelus regulus</i>	Species group (calls not distinguishable)		
Reptiles				
Scincidae	Not identified	Skink	-	-
Varanidae	<i>Varanus varius</i>	Lace Monitor		
*V= Vulnerable, E=Endangered, CE = Critically Endangered, Mi = Migratory.				

Detailed Anabat Survey Records

Certainty	Species / Species Group	# Records per Site							
		A1	A2	A3	A4	A5	A6	A7	A8
Definite	<i>Austronomus australis</i>	42	44	33	36	16	19	11	6
Definite	<i>Chalinolobus gouldii</i>	4	1	2	3	0	0	0	0
Definite	<i>Chalinolobus morio</i>	1	0	0	0	1	0	2	0
Definite	<i>Mormopterus (Micronomus) norfolkensis</i>	0	0	0	0	0	3	2	0
Definite	<i>Mormopterus (Micronomus) ridei</i>	22	37	19	12	12	12	21	0
Definite	<i>Rhinolophus megaphyllus</i>	4	108	2	0	0	2	4	1
Definite	<i>Vespadelus regulus</i>	0	1	13	5	31	2	0	3
Definite	<i>Vespadelus vulturnus</i>	1	0	30	4	1	2	3	3
Possible	<i>Austronomus australis</i>	0	0	1	0	0	0	0	0
Possible	<i>Chalinolobus dwyeri</i>	0	0	0	0	0	0	0	10
Possible	<i>Chalinolobus gouldii</i>	1	3	19	1	0	0	4	7
Possible	<i>Chalinolobus morio</i>	0	1	0	0	0	0	0	0
Possible	<i>Mormopterus norfolkensis (Micronomus)</i>	0	0	0	0	0	2	0	1
Possible	<i>Mormopterus ridei (Micronomus)</i>	2	1	2	9	2	9	0	0
Possible	<i>Saccolaimus flaviventris</i>	0	0	0	0	0	0	0	5
Possible	<i>Scoteanax rueppellii</i>	0	0	0	0	0	1	0	0
Possible	<i>Vespadelus regulus</i>	0	0	2	0	2	0	0	0
Possible	<i>Vespadelus vulturnus</i>	0	0	0	0	1	0	0	0
Probable	<i>Austronomus australis</i>	0	1	2	1	3	1	0	1
Probable	<i>Chalinolobus gouldii</i>	3	7	5	4	1	1	1	0
Probable	<i>Chalinolobus morio</i>	0	5	1	0	1	1	1	2
Probable	<i>Mormopterus (Micronomus) norfolkensis</i>	2	0	0	0	1	6	1	3
Probable	<i>Mormopterus (Micronomus) ridei</i>	13	14	6	16	4	39	13	5
Probable	<i>Rhinolophus megaphyllus</i>	0	4	0	0	0	0	0	0
Probable	<i>Saccolaimus flaviventris</i>	0	0	0	0	0	0	0	1
Probable	<i>Vespadelus regulus</i>	0	0	13	2	6	1	0	2
Probable	<i>Vespadelus vulturnus</i>	0	2	69	7	4	6	7	1

Certainty	Species / Species Group	# Records per Site							
		A1	A2	A3	A4	A5	A6	A7	A8
Species groups	<i>Austronomus australis</i> / <i>Saccolaimus flaviventris</i>	0	0	0	0	0	0	0	7
Species groups	<i>Chalinolobus gouldii</i> / <i>Mormopterus (Micronomus) norfolkensis</i> / <i>Mormopterus ridei</i>	0	0	4	19	1	27	10	5
Species groups	<i>Chalinolobus gouldii</i> / <i>Mormopterus ridei</i>	16	47	35	93	11	66	59	22
Species groups	<i>Chalinolobus gouldii</i> / <i>Saccolaimus flaviventris</i>	0	0	0	0	0	0	2	10
Species groups	<i>Chalinolobus gouldii</i> / <i>Scoteanax rueppellii</i>	1	3	21	3	2	7	6	0
Species groups	<i>Chalinolobus morio</i> / <i>Vespadelus vulturnus</i>	9	208	136	37	9	49	43	19
Species groups	<i>Falsistrellus tasmaniensis</i> / <i>Scotorepens orion</i>	1	1	1	0	0	2	1	1
Species groups	<i>Falsistrellus tasmaniensis</i> / <i>Scotorepens orion</i> / <i>Scoteanax rueppellii</i>	0	7	8	1	2	63	12	19
Species groups	<i>Mormopterus (Micronomus) norfolkensis</i> / <i>Mormopterus (Micronomus) ridei</i>	1	1	1	6	1	45	8	18
Species groups	<i>Myotis macropus</i> / <i>Nyctophilus geoffroyi</i> / <i>Nyctophilus gouldi</i>	2	0	2	3	0	0	12	11
Species groups	<i>Vespadelus darlingtoni</i> / <i>Vespadelus regulus</i>	0	0	10	16	1	1	2	6

Appendix C

Habitat assessment table

Habitat assessment table

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
Threatened Ecological Communities						
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (NSW BC Act)	EEC	-	This ecological community occurs in coastal catchments, usually at elevations less than 20 m and typically within 30 km of the coast. The canopy layer is dominated by <i>Casuarina glauca</i> with some emergent eucalyptus species including <i>E. tereticornis</i> , <i>E. botryoides</i> , <i>E. grandis</i> and <i>E. longifolia</i> .	Known	Initial: High Revised: Low (recorded in study area, absent from construction boundary)	PCT1232 (Zone 8) is present in the study area and has the potential to meet criteria for this EEC. No vegetation meeting criteria for this EEC is present in the construction boundary.
Coastal Swamp Oak (<i>Casuarina glauca</i>) Forest of New South Wales and South East Queensland ecological community (EPBC Act)	-	E	The structure of Coastal Swamp Oak Forest can vary from forest to woodland depending on its location in the landscape and disturbance history. The canopy layer is dominated by <i>Casuarina glauca</i> . A number of <i>Eucalyptus</i> spp. can emerge from the canopy, with typical examples including <i>Eucalyptus tereticornis</i> , <i>E. botryoides</i> , <i>E. grandis</i> , <i>E. longifolia</i> , or <i>E. robusta</i> .	Known	Initial: High Revised: Low (recorded in study area, absent from construction boundary)	PCT1232 (Zone 8) is present in the study area and has the potential to meet criteria for this EEC. No vegetation meeting criteria for this EEC is present in the construction boundary.
Illawarra and South Coast lowland forest and woodland ecological community	-	CE	The typical form of the ecological community is a woodland with a tall shrub layer and/or a grassy ground cover. <i>E.tereticornis</i> is present and often dominant in the mature tree canopy. Other co-occurring tree species include: <i>Angophora floribunda</i> ; <i>E. bosistoana</i> ; and <i>E.</i>	Known	Initial: High Revised: Low (recorded in study area, absent from	PCT1326 (Zone 9) is present in the study area and has the potential to meet criteria for this CEEC. No vegetation meeting criteria for this CEEC is present in the construction boundary.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
			<i>eugenioides</i> , <i>E. botryoides</i> , <i>E. globoidea</i> and <i>E. longifolia</i> and <i>E. quadrangulata</i> .		construction boundary)	
Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion	EEC	-	This community comprises vegetation types that occupy the Illawarra coastal plain and escarpment foothills. Characteristic tree species include <i>Eucalyptus tereticornis</i> , <i>Eucalyptus eugenioides</i> , <i>Eucalyptus longifolia</i> , <i>Eucalyptus bosistoana</i> and <i>Melaleuca decora</i> . The understorey is not necessarily grassy as moist forest vegetation types are also included within this broad community.	Absent	Low	The study area is outside of the bioregion in which this ecological community occurs.
Lowland Grassy Woodland in the South East Corner Bioregion	-	CE	The ecological community is associated with rainshadow areas (mean annual rainfall 750 – 1100 mm/year) on undulating terrain and fertile soils at altitudes below 500 metres above sea level (asl). The ecological community typically occurs as a grassy woodland but may also exhibit a more open forest structure. The canopy is typically dominated by <i>Eucalyptus tereticornis</i> and/or <i>Angophora floribunda</i> . A large proportion of the species diversity in the ecological community is found in the grasses and forbs of the ground layer.	Known	Initial: Moderate Revised: Low	No vegetation that meets the classification requirements of this community is present in the study area.
Lowland Grassy Woodland in the South East Corner Bioregion	EEC	-	Lowland Grassy Woodland in the South East Corner bioregion is a grassy woodland characterised by an overstorey that is usually dominated by <i>E. tereticornis</i> , often with <i>E.</i>	Known	Initial: Moderate	No vegetation that meets the classification requirements of this

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
			<i>globoidea</i> and/or <i>A. floribunda</i> and other eucalypts at some sites.		Revised: Low	community is present in the study area.
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia	-	CE	Littoral Rainforest and Coastal Vine Thickets of Eastern Australia typically occurs close to the coast from northern Queensland southwards to eastern Victoria and on offshore islands. The Littoral Rainforest and Coastal Vine Thickets of Eastern Australia typically has tall trees as part of the canopy but not always. The height of the canopy plants varies depending on the degree of exposure and can range from one to 25 metres. Emergent trees may be present above the canopy, for example species from the genera <i>Araucaria</i> (Bunya and Hoop pines in the northern bioregions only), <i>Banksia</i> or <i>Eucalyptus</i> . The ground layer of the vegetation typically is sparse.	Known	None	No vegetation that meets the classification requirements of this community is present in the study area.
Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC	-	The plant species of this community are predominantly rainforest species. Several species have compound leaves and vines may be a major component of the canopy. These features differentiate littoral rainforest from forest or scrub but while the canopy is dominated by rainforest species, scattered emergent individuals of sclerophyll species, such as <i>A. costata</i> , <i>Banksia integrifolia</i> , <i>E.</i>	Known	None	No vegetation that meets the classification requirements of this community is present in the study area.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
			<i>botryoides</i> and <i>E. tereticornis</i> occur in many stands.			
Natural Temperate Grassland of the South Eastern Highlands	-	CE	Natural temperate grassland is a natural grassland community dominated by a range of perennial grass species and, in highly intact sites, containing a large range of herbaceous species in many plant families, including daisies, peas, lilies and orchids. It occurs at altitudes up to around 1200 m and as low as 250 m in some parts of its distribution. It occurs on a wide range of topographic positions and on soils derived from a variety of substrates, including granites, basalts, sediments, colluvium and alluvium. It is a naturally treeless or sparsely treed community (less than 10 per cent projective foliage cover from woody plants), which is characterised by native tussock grasses that are typically up to 1.0 m in height.	-	None	No vegetation that meets the classification requirements of this community is present in the study area. The site is outside of the altitudinal range for this community.
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC	-	Found on the river flats of the coastal floodplains. It has a tall open tree layer of eucalypts, which may exceed 40 m in height. While the composition of the tree stratum varies considerably, the most widespread and abundant dominant trees include <i>Eucalyptus tereticornis</i> , <i>E. amplifolia</i> , <i>Angophora floribunda</i> and <i>A. subvelutina</i> . A layer of small trees may be present, including <i>Melaleuca decora</i> , <i>M.</i>	Known	Initial: High Revised: Low (recorded in study area, absent from construction boundary)	Vegetation with the potential to meet criteria for this EEC is present in the north-east of the study area. No vegetation meeting criteria for this EEC is present in the construction boundary.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
			<i>stypelioides</i> , <i>Backhousia myrtifolia</i> , <i>Melia azaderach</i> , <i>Casuarina cunninghamiana</i> and <i>C. glauca</i> . Scattered shrubs are present. The groundcover is composed of abundant forbs, scramblers and grasses			
Subtropical and Temperate Coastal Saltmarsh	-	V	Subtropical and Temperate Coastal Saltmarsh occurs in the intertidal zone on the shores of estuaries and lagoons that are permanently or intermittently open to the sea. It is frequently found as a zone on the landward side of mangrove stands. Occasionally mangroves are scattered through the saltmarsh.	0	None	No vegetation that meets the classification requirements of this community is present in the study area.
Coastal saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions	EEC	-	Coastal saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions occurs in the intertidal zone on the shores of estuaries and lagoons that are permanently or intermittently open to the sea. It is frequently found as a zone on the landward side of mangrove stands.	0	None	No vegetation that meets the classification requirements of this community is present in the study area.
Plants						
Thick-lipped Spider-orchid, daddy long-legs (<i>Caladenia tessellata</i>)	E	V	Requires low, dry sclerophyll woodland with a heathy or sometimes grassy understorey on clay loams or sandy soils, specifically in dry, low brittle gum (<i>E. mannifera</i>), inland scribbly gum (<i>E. rossii</i>) and <i>Allocasuarina</i> spp.	0	Initial: Low	No suitable habitat is present in the study area.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
			woodland with a sparse understorey and stony soil.			
chefs cap correa (<i>Correa baeuerlenii</i>)	V	V	Occurs in riparian sites within forests of various eucalypts, including silvertop ash (<i>Eucalyptus sieberi</i>), yellow stringybark (<i>E. muelleriana</i>), blue-leafed stringybark (<i>E. agglomerata</i>) and spotted gum (<i>Corymbia maculata</i>), or she-oak woodland. It may also be found in near-coastal rocky sites.	1	Initial: Moderate Revised: Low	Suitable habitat occurs in the study area. Nearby known populations at Deep Creek Dam and Nelligen. Marginal habitat may be present in gully heads in the construction boundary. Surveyed absent from the construction boundary and gullies in the study area.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
leafless tongue-orchid (<i>Cryptostylis hunteriana</i>)	V	V	The leafless tongue-orchid has been reported to occur in a wide variety of habitats including heathlands, heathy woodlands, sedgeland, <i>Xanthorrhoea</i> spp. plains, dry sclerophyll forests (shrub/grass sub-formation and shrubby sub-formation), forested wetlands, freshwater wetlands, grasslands, grassy woodlands, rainforests and wet sclerophyll forests (grassy sub-formation). Soils are generally considered to be moist and sandy, however, this species is also known to grow in dry or peaty soils.	3	Initial: Moderate Revised: Low	Suitable habitat is potentially present in the study area Area, although soil types are likely to be marginal throughout much of study area Area. Known from several sites between Nowra and Batemans Bay. Surveyed absent from the construction boundary.
Tangled bedstraw (<i>Galium australe</i>)	E	-	Tangled Bedstraw is widespread in Victoria and Tasmania and is also found in South Australia (and ACT Territory in Jervis Bay). Following a taxonomic revision, many recent records in NSW have been re-determined as other species. Tangled Bedstraw has been recorded historically in the Nowra (Colymea) and Narooma areas and is extant in Nadgee Nature Reserve, south of Eden.	1	Initial: Moderate Revised: Low	Potential habitat is present in <i>Eucalyptus tereticornis</i> dominated forest in the study area. Suitable habitat is absent from the construction boundary.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
East Lynne midge-orchid (<i>Genoplesium vernale</i>)	V	V	The East Lynne midge orchid grows in dry sclerophyll woodland and forest extending from close to the coast to the adjoining coastal ranges. The East Lynne midge orchid is currently known from only a narrow belt, about 12 km wide, of predominantly dry sclerophyll Forest from 17 km south of Batemans Bay to 24 km north of Ulladulla.	0	Initial: Moderate Revised: Low	Occurs in dry sclerophyll forest in the greater Batemans Bay area. No core habitat is present in the study area. Vegetation throughout much of the study area is, however, consistent with the two southern occurrences of the species southwest of Mogo. Confirmed flowering at East Lynne reference site. Surveyed absent from the construction boundary.
Wingless raspwort (<i>Haloragis exalata</i> subsp. <i>exalata</i>)	V	V	Square raspwort appears to require protected and shaded damp situations in riparian habitats. Square raspwort occurs in 4 widely scattered localities in eastern NSW. It is disjunctly distributed in the Central Coast, South Coast and North Western Slopes botanical subdivisions of NSW.	0	Initial: Moderate Revised: Low	Potential habitat is present in she-oak swamp forest in the study area. Recorded at Tomakin and Durrass Lake. No suitable habitat is present in the construction boundary.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
tall knotweed (<i>Persicaria elatior</i>)	V	V	Tall knotweed normally grows in damp places, especially beside streams and lakes. It occasionally occurs in swamp forest or associated with disturbance.	1	Initial: Moderate Revised: Low	Small area of potential suitable habitat is present in the north-west of the study area. Recorded at Batehaven and Tomakin. No suitable habitat is present in the construction boundary.
Bodalla pomaderris (<i>Pomaderris bodalla</i>)	V	-	Bodalla pomaderris is currently known to occur on the south coast between Bodalla and Merimbula and in the upper Hunter Valley near Muswellbrook. On the south coast Bodalla pomaderris occurs in moist open forest along sheltered gullies or along stream banks.	1	Initial: Moderate Revised: Low	Potential habitat occurs in the study area. Nearest record from Deep Creek Dam/Bimbimbie area. Restricted riparian habitat is present in the construction boundary. Surveyed absent from within the construction boundary and gullies in the study area.
scrub turpentine (<i>Rhodamnia rubescens</i>)	CE	-	Occurs in coastal districts north from Batemans Bay in New South Wales, about 280 km south of Sydney, to areas inland of Bundaberg in Queensland. Populations of <i>R. rubescens</i> typically occur in coastal regions and occasionally extend inland onto escarpments. Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils.	1	Initial: Moderate Revised: Low	Potential habitat is present in the study area. Restricted riparian habitat is present in the construction boundary. Surveyed absent from within the construction boundary and gullies in the study area.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
Austral toadflax (<i>Thesium australe</i>)	V	V	Austral toadflax is found in very small populations scattered across eastern NSW, along the coast and from the Northern to Southern Tablelands. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast.	0	None	No suitable habitat is present in the study area. No records nearby the study area.
Warty zieria (<i>Zieria tuberculata</i>)	V	V	Warty zieria grows in the Mt Dromedary and Tilba Tilba area. A total of 13 sites are currently known and the total population (all age classes) is about 3,000 plants. The Warty Zieria grows in heath amongst rocky outcrops on rain forest edges and in tall forest and shrubland.	0	Low	No suitable habitat is present in the study area which is outside of the known species distribution. No records nearby the study area.
Amphibians						
giant burrowing frog (<i>Heleioporus australiacus</i>)	V	V	Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based.	0	Initial: Moderate Revised: Low	Marginal potential habitat is present in the study area. Strahler level 1 and 2 drainage lines and areas within 300 metres may provide habitat. No records nearby the study area. Species has a disjunct distribution and is not known to occur in the Batemans Bay region.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
green and golden bell frog (<i>Litoria aurea</i>)	E	V	Large populations in NSW are located around the metropolitan areas of Sydney, Shoalhaven and mid north coast. It inhabits marshes, dams and stream-sides, particularly those containing bullrushes (<i>Typha</i> spp.) or spikerushes (<i>Eleocharis</i> spp.)	1	Initial: Low	No suitable habitat is present in the study area. Potential habitat may be present in the wetlands to the north-east of the study area however there are no recent records in the search area.
Littlejohns tree frog (<i>Litoria littlejohni</i>)	V	V	Restricted to sandstone woodland and heath communities at mid to high altitude. It forages both in the tree canopy and on the ground and it has been observed sheltering under rocks, leaf litter and low vegetation in heath based forests and woodland. It is not known from coastal habitats.	0	None	No suitable habitat is present in the study area. No records nearby the study area.
Birds						
common sandpiper (<i>Actitis hypoleucos</i>)		Mi	The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity and is mostly found around muddy margins or rocky shores and rarely on mudflats.	0	Initial: None	No suitable habitat is present in the study area. Nearest records from Cullendulla Creek and Malua Bay.
regent honeyeater (<i>Anthochaera phrygia</i>)	CE	CE	Inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. NSW the distribution is very patchy and mainly confined to the two main breeding areas at Capertee Valley and the Bundarra-Barraba region and surrounding fragmented woodlands.	0	Initial: Low	Potential winter flowering eucalypts which may be foraging habitat is present within the study area, however key species are absent.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
			Birds are also found in drier coastal woodlands and forests. The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland and riparian forests of River She-oak. These habitats have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Key eucalypt species include Mugga Ironbark, Yellow Box, Blakelys Red Gum, White Box and Swamp Mahogany. Nectar and fruit from the mistletoes are also eaten during the breeding season.			No important habitat, as mapped by DPIE, is present. No BioNet records within the search area. Regent honeyeater may be an occasional visitor but habitat similar to the study area is widely distributed in the local area and the species is not dependent on the available habitat.
Pacific swift (<i>Apus pacificus</i>)	-	Mi, Ma	The pacific swift leaves its breeding grounds in Siberia from August–September. They usually arrive in Australia around October. In NSW, the pacific swift is recorded in all regions. They mostly occur over inland plains but sometimes above foothills or in coastal areas. They prefer dry, open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. They are also found at treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes. They sometimes occur above rainforests, wet sclerophyll forest or open forest or plantations of pines. The pacific swift is an aerial eater, flying anywhere from 1 m to 300 m above the ground to forage.	0	Initial: Low	May occasionally utilise airspace above the study area. However, this species is unlikely to utilise habitats in the study area itself.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
eastern great egret (<i>Ardea alba</i>)	-	Mi, Ma	The eastern great egret has a widespread distribution in Australia and occurs in a wide range of wetland habitats including inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small and natural and artificial wetlands.	0	Initial: Low	No suitable habitat is present in the study area, although potential habitat is present in the wetlands to the north-east of the study area.
cattle egret (<i>Ardea ibis</i>)	-	Mi, Ma	The cattle egret has a widespread distribution in Australia and occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. Cattle egret often forage away from water on low lying grasslands, improved pastures and croplands.	0	Initial: Low	No suitable habitat is present in the study area, although potential habitat is present in the wetlands to the north-east of the study area. Recorded nearby at Water Garden Town Park, Nelligen and Mogo.
dusky woodswallow (<i>Artamus cyanopterus cyanopterus</i>)	V	-	The dusky woodswallow occurs in southern and eastern Australia in dry, open eucalypt forests and woodlands, including mallee associations and in farmland, shrubland and heathland.	2	Initial: Moderate Revised: Low	Suitable habitat is potentially present in the study area. One record from Batemans Bay area. Not detected during diurnal bird surveys.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
Australasian bittern (<i>Botaurus poiciloptilus</i>)	E	E	Inhabits temperate freshwater wetlands and occasionally estuarine reedbeds, with a preference for permanent waterbodies with tall dense vegetation. The species prefers wetlands with dense vegetation, including sedges, rushes and reeds. Freshwater is generally preferred, although dense saltmarsh vegetation in estuaries and flooded grasslands are also used by the species.	0	None	No suitable habitat is present in the study area, although potential habitat is present in the wetlands to the north-east of the study area.
sharp-tailed sandpiper (<i>Calidris acuminata</i>)	-	Mi	In Australasia, the sharp-tailed sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation.	0	None	No suitable habitat is present in the study area, although potential habitat is present in the wetlands to the north-east of the study area.
red knot (<i>Calidris canutus</i>)	-	E, Mi	In Australasia the red knot mainly inhabit intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs.	0	None	No suitable habitat is present in the study area.
curlew sandpiper (<i>Calidris ferruginea</i>)	E	CE, Mi	The curlew sandpiper mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons and also around non-tidal swamps, lakes and lagoons near the coast and ponds in saltworks and sewage farms.	0	None	No suitable habitat is present in the study area, although potential habitat is present in the wetlands to the north-east of the study area.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
pectoral sandpiper (<i>Calidris melanotos</i>)	-	Mi	In Australasia, the pectoral sandpiper prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.	0	None	Likely to occasionally occur in airspace above the study area. However, no suitable habitat is present in the study area.
red-necked stint (<i>Calidris ruficollis</i>)	-	Mi	In Australia, red-necked stints are found on the coast, in sheltered inlets, bays, lagoons, estuaries, intertidal mudflats and protected sandy or coralline shores. They may also be seen in saltworks, sewage farms, saltmarsh, shallow wetlands including lakes, swamps, riverbanks, waterholes, bore drains, dams, soaks and pools in saltflats, flooded paddocks or damp grasslands.	0	None	Likely to occasionally occur in airspace above the study area. However, no suitable habitat is present in the study area.
gang gang cockatoo (<i>Callocephalon fimbriatum</i>)	V	-	In summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands and often found in urban areas. Eucalypt tree species with hollows greater than 9 cm diameter.	18	Initial: High Revised: Recorded.	Suitable tree hollows are present, however, the species typically breeds in association with the coastal ranges and breeding habitat is unlikely to be present in the study area. Has been recorded in close proximity to the study area. Foraging recorded during surveys in September 2019. Species was not recorded during searches conducted in the breeding season

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
						during October and November 2019.
glossy black-cockatoo (<i>Calyptorhynchus latham</i>)	V	-	Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Dependent on large hollow-bearing eucalypts for nest sites.	93	Initial: High Revised: Recorded	Hollow-bearing trees suitable for breeding are present in the study area. A restricted area of suitable foraging habitat is present in the study area. A begging juvenile was recorded in the study area during October 2019 and chewed <i>Allocasuarina littoralis</i> cones have been recorded throughout the study area.
double-banded plover (<i>Charadrius bicinctus</i>)	-	Mi	The double-banded plover is found on littoral, estuarine and fresh or saline terrestrial wetlands and also saltmarsh, grasslands and pasture. It occurs on muddy, sandy, shingled or sometimes rocky beaches, bays and inlets, harbours and margins of fresh or saline terrestrial wetlands such as lakes, lagoons and swamps, shallow estuaries and rivers. The species is sometimes associated with coastal lagoons, inland saltlakes and saltworks.	0	Initial: None	No suitable habitat is present in the study area. Nearest records from Broulee and South Durras.
brown treecreeper (<i>Climacteris picumnus victoriae</i>)	V	-	Found in eucalypt woodlands (including box-gum woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands	2	Initial: Low	No suitable habitat is present in the study area and this species is

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
			dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and river red gum (<i>Eucalyptus camaldulensis</i>) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains.			rarely found in coastal environments. Very few records from the NSW south coast, however two within 10 km of the study area. Surveyed absent.
oriental cuckoo (<i>Cuculus optatus</i>)	-	Mi	The oriental cuckoo is a regular though uncommon migrant to Australia, where it spends the non-breeding season (Sept- May) in coastal regions across northern and eastern Australia as well as offshore islands. The oriental cuckoo occurs in monsoon rainforest, wet sclerophyll forest and open woodlands and appears quite often along edges of forests, or ecotones between forest types.	0	Initial: Low	Potentially suitable habitat is present in the study area. Habitat similar to the study area is widely distributed in the local area and the species is not dependent on the available habitat. The species may be an occasional visitor to the locality. Very few records from the NSW south coast and no BioNet records in the search area.
varied sittella (<i>Daphoenositta chrysoptera</i>)	V	-	Inhabits most of mainland Australia except the treeless deserts and open grasslands. It inhabits eucalypt forests and woodlands, especially rough-barked species and mature	10	Initial: High	Potentially suitable habitat is present in the study area. Has been

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
			smooth-barked gums with dead branches, mallee and Acacia woodland.		Revised: Recorded	recorded at several locations in the Batemans Bay area. Recorded during surveys of the study area.
Eastern bristlebird (<i>Dasyornis brachypterus</i>)	E	E	Occurs in three disjunct populations: southern QLD/northern NSW; central (Jervis Bay/Barren Grounds Nature Reserve and Budderoo National Park); and southern (Nadgee Nature Reserve and Croajingalong National Park in the vicinity of the NSW/Victorian border). Habitat for central and southern populations is characterised by dense, low vegetation including heath and open woodland with a heathy understorey.	0	None	Species restricted to disjunct populations. No suitable habitat present in the study area or Batemans Bay region.
Latham's snipe (<i>Gallinago hardwickii</i>)	-	Mi	In Australia, Latham's snipe occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies)	0	Initial: Low	No suitable habitat is present in the study area, although potential habitat is present in the wetlands to the north-east of the study area.
Swinhoes snipe (<i>Gallinago megala</i>)	-	Mi, Ma	Non-breeding habitat: shallow freshwater wetlands of various kinds including paddy fields and sewage farms, with bare mud or shallow water for feeding, with nearby vegetation cover. Records in Australia mainly from the Top End	0	Initial: Low	No suitable habitat is present in the study area, although potential habitat is present in the wetlands to the north-east of the study area.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
			of the Northern Territory and from north-western Western Australia.			
pin-tailed snipe (<i>Gallinago stenura</i>)	-	Mi, Ma	During non-breeding period the Pin-tailed Snipe occurs most often in or at the edges of shallow freshwater swamps, ponds and lakes with emergent, sparse to dense cover of grass/sedge or other vegetation. The species distribution within Australia is not well understood. There are confirmed records from NSW, south-west Western Australia, Pilbara and the Top End.	0	Initial: Low	No suitable habitat is present in the study area, although potential habitat is present in the wetlands to the north-east of the study area.
little lorikeet (<i>Glossopsitta pusilla</i>)	V	-	Mostly occur in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range and in remnant woodland patches and roadside vegetation on the western slopes. Nest in small hollows (entrance approx. 3 cm) of Eucalyptus spp.	29	Initial: High Revised: Recorded	Suitable foraging and breeding habitat occurs in the study area. Recorded in the study area.
painted honeyeater (<i>Grantiella picta</i>)	V	V	The species inhabits mistletoes in eucalypt forests/woodlands, riparian woodlands of black box and river red gum, box-ironbark-yellow gum woodlands, acacia-dominated woodlands, paperbarks, casuarinas, callitris and trees on farmland or gardens. The species prefers woodlands which contain a higher number of mature trees, as these host more mistletoes. The species is sparsely distributed from south-	0	Initial: Low	Potentially suitable habitat is present in the study area, consistent with habitat widespread throughout the landscape, however this species is rarely found in coastal environments.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
			eastern Australia to north-western Queensland and eastern Northern Territory. The greatest concentrations and almost all records of breeding come from inland slopes of the Great Dividing Range between the Grampians, Victoria and Roma, Queensland.			Very few records from the NSW south coast.
sooty oystercatcher (<i>Haematopus fuliginosus</i>)	V	-	Occurs on rocky shorelines and headlands, stony beaches, offshore islands and exposed reefs and only occasionally on sandy beaches.	30	Initial: None	No suitable habitat is present in the study area.
pied oystercatcher (<i>Haematopus longirostris</i>)	E	-	Inhabits marine littoral habitats, including islands. It occupies muddy, sandy, stony or rocky estuaries, inlets and beaches, particularly intertidal mudflats and sandbanks in large marine bays.	47	Initial: None	No suitable habitat is present in the study area.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
white-bellied sea-eagle (<i>Haliaeetus leucogaster</i>)	V	Ma	<p>This species inhabits coastal and inland riverine areas with large areas of open water. Breeding habitat is located near water and predominantly within tall open forest and woodland. The nest is a large structure made of sticks. Foraging habitat is large areas of open water as well as open terrestrial habitats such as grasslands. They forage either from a perch or whilst in flight.</p> <p>Breeding habitat is live large old trees within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines AND the presence of a large stick nest within tree canopy; or an adult with nest material; or adults observed duetting within breeding period.</p>	19	Initial: Moderate Revised: Low	<p>Likely to utilise airspace above the study area as the species is known to breed in the Clyde River estuary. Likelihood that the study area may be used as foraging habitat or breeding habitat is low due to the distance from the coast or large waterbodies.</p> <p>Habitat similar to the study area is widely distributed in the local area and no evidence of breeding (i.e. stick nests) was observed.</p>
little eagle (<i>Hieraaetus morphnoides</i>)	V	-	<p>Distributed throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. Occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. Requires tall living trees for building a large stick nest and preys on birds, reptiles and mammals and occasionally carrion.</p> <p>Breeding habitat is live (occasionally dead) large old trees within suitable vegetation AND the presence of a male and female; or female</p>	1	Initial: Moderate Revised: Low	<p>Likely to occasionally utilise airspace above the study area. Potentially suitable foraging and breeding habitat is present in the study area, however equivalent habitat is widely distributed in the local area and no evidence of breeding (i.e. stick nests) was recorded during targeted survey.</p>

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
			with nesting material; or an individual on a large stick nest in the top half of the tree canopy.			
white-throated needletail (<i>Hirundapus caudacutus</i>)	-	Mi	This species is predominantly aerial within Australia, however they have been recorded roosting in trees in both forests and woodlands within dense foliage either in the canopy or within hollows. This species breeds in northern Asia. And migrates south between September-October.	3	Initial: Low	Likely to utilise airspace above the study area. However, this species is unlikely to utilise habitat in the study area.
Caspian tern (<i>Hydroprogne caspia</i>)	-	Mi, Ma	Occurs near the coast, in extensive wetlands, on coastal and interior beaches and sheltered estuaries. Feeds exclusively on fish and nests close to the coast.	3	None	Unlikely to occur in airspace above the study area due to a lack of suitable habitat. Some records from Batemans Bay.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
swift parrot (<i>Lathamus discolor</i>)	E	CE	In NSW mostly occurs on the coast and south west slopes, occurring in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany, Spotted Gum, Red Bloodwood, Mugga Ironbark and White Box.	6	Initial: High Revised: Moderate	Suitable foraging habitat occurs in the study area. Breeding occurs exclusively in Tasmania. Visitation rates depend on flowering of appropriate Eucalyptus spp. Some recent records in the vicinity of the study area. Not detected during targeted surveys, however flowering Eucalypts were absent from the study area during the survey due to exceptionally dry seasonal conditions. Recommend retain a moderate likelihood of occurrence.
bar-tailed godwit (<i>Limosa lapponica baueri</i>)	-	Mi, V	The bar-tailed godwit is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays.	1	None	No suitable habitat is present within the study area.
bar-tailed godwit (<i>Limosa lapponica menzbieri</i>)	-	Mi, CE	The bar-tailed godwit is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays.	0	None	No suitable habitat is present within the study area. The species generally occurs in north-west W.A and is considered an unlikely visitor to the study area.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
square-tailed kite (<i>Lophoictinia isura</i>)	V	-	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. Kites will need be in attendance to confirm breeding sites.	13	Initial: Moderate Revised: Recorded	Suitable foraging habitat is present in the study area. Recorded at several sites in the Batemans Bay area. Recorded above the study area during October 2019. No stick nests were observed in the study area during targeted searches hence the area is unlikely to be utilised for breeding.
rainbow bee-eater (<i>Merops ornatus</i>)	-	Ma	Occurs mainly in open forests and woodlands, shrublands and in various cleared or semi-cleared habitats, including farmland and areas of human habitation.	0	Initial: Low	Potential low quality suitable habitat, consistent with habitat extensively distributed throughout the wider landscape, is present within the study area, however no BioNet records are present in the search area.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
black-faced monarch (<i>Monarcha melanopsis</i>)	-	Mi	The black-faced monarch mainly occurs in rainforest ecosystems, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical rainforest, subtropical rainforest, mesophyll thicket/shrubland, warm temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest.	0	Initial: Moderate Revised: Moderate	Restricted areas of marginal habitat potentially used during migration are present in the study area. The black-faced monarch may be an occasional visitor but habitat similar to the study area is widely distributed in the local area and the species is unlikely to be dependent on available habitat. Small areas of marginal habitat are present in the construction boundary.
spectacled monarch (<i>Monarcha trivirgatus</i>)	-	Mi	Occurs in the understorey of rainforest, well-timbered gullies and waterside vegetation in eastern Australia.	0	Initial: Low	No suitable habitat is present in the study area. Species generally found further to the north.
satin flycatcher (<i>Myiagra cyanoleuca</i>)	-	Mi	Summer breeding range from Qld to Tas, winter migration to NE Qld. Satin Flycatchers inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands often near wetlands or watercourses and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests.	0	Initial: Moderate Revised: Moderate	Restricted areas of habitat potentially used during migration present in the study area. Very restricted areas of potential habitat present in the construction boundary. The satin flycatcher is likely to be an irregular visitor but habitat similar to the study area is widely distributed in the local area and the species is unlikely to be dependent on available habitat.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
orange-bellied parrot (<i>Neophema chrysogaster</i>)	-	CE	Orange-bellied parrots occur almost exclusively in coastal and sub-coastal areas, preferring peninsulas and islands. Saltmarshes, littoral (shore) heathlands and low scrublands are preferred habitats as well as grassy areas.	0	None	No suitable habitat is present in the study area.
barking owl (<i>Ninox connivens</i>)	V	-	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey on these fertile riparian soils.	0	Initial: Low	Suitable foraging and nesting habitat is present, however recent confirmed records are absent from the proximity of the study area. Barking owl may be an occasional visitor but habitat similar to the study area is widely distributed in the local area and the species is unlikely to be dependent on available habitat.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
powerful owl (<i>Ninox strenua</i>)	V	-	Is endemic to eastern and south-eastern Australia, being widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered, mostly historical records on the western slopes and plains in NSW. Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. They require large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. Powerful Owls nest in large tree hollows (at least 0.5m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old.	24	Initial: High Revised: Moderate	Suitable foraging habitat, roosting and nesting habitat present in study area. A large number of historical and recent records occur within and in proximity to, the study area, suggesting ongoing use of the area by this species. Not detected during targeted surveys however potential roost and nest trees are present.
far eastern curlew (<i>Numenius madagascariensis</i>)	-	CE, Mi	The far eastern curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass.	7	None	No suitable habitat is present in the study area
little curlew (<i>Numenius minutus</i>)	-	Mi	The little curlew is most often found feeding in short, dry grassland and sedgeland, including dry floodplains and blacksoil plains, which have scattered, shallow freshwater pools or areas seasonally inundated. Open woodlands with a grassy or burnt understorey, dry saltmarshes, coastal swamps, mudflats or sandflats of estuaries or beaches on sheltered coasts, mown lawns, gardens, recreational areas,	0	None	No suitable habitat is present in the study area. Potential habitat is present in the wetlands to the north-east of the study area.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
			ovals, racecourses and verges of roads and airstrips are also used.			
whimbrel (<i>Numenius phaeopus</i>)	-	Mi	The whimbrel is often found on the intertidal mudflats of sheltered coasts. It is also found in harbours, lagoons, estuaries and river deltas, often those with mangroves but also open, unvegetated mudflats. It is occasionally found on sandy or rocky beaches, on coral or rocky islets, or on intertidal reefs and platforms.	1	None	No suitable habitat is present in the study area.
eastern osprey (<i>Pandion haliaetus</i>)	V	Mi, Ma	Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.	7	Initial: Moderate Revised: Low	May utilise airspace above the study area as the species is likely to utilise foraging and breeding in the Clyde River estuary. Likelihood that the study area may be used as foraging habitat or breeding habitat is low due to adjacent urbanisation and the distance from the coast or large waterbodies. Habitat similar to the study area is widely distributed in the local area and no evidence of breeding (i.e. stick nests) observed.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
flame robin (<i>Petroica phoenicea</i>)	V	-	Endemic to south eastern Australia and ranges from near the Queensland border to south east South Australia and also in Tasmania. In NSW, it breeds in upland areas and in winter, many birds move to the inland slopes and plains. In NSW it breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. It migrates in winter to more open lowland habitats such as grassland with scattered trees and open woodland on the inland slopes and plains.	1	Initial: Low	No suitable habitat is present in the study area.
grey plover (<i>Pluvialis squatarola</i>)	-	Mi	The species is only occasionally recorded along the coast of NSW. Found on muddy, rocky and sandy wetlands, shores, paddocks, saltmarsh, coastal golf courses, estuaries and lagoons.	1	None	No suitable habitat is present in the study area.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
rufous fantail (<i>Rhipidura rufifrons</i>)	-	Mi	This species is a summer breeding migrant to SE Australia. They occur in the undergrowth of rainforests/wetter Eucalypt forests/gullies. Preference for deep shade and is often seen close to the ground. The rufous fantail feeds on insects, in the middle and lower levels of the canopy. Constructs a small compact cup nest, suspended from a tree fork about 5 m from the ground.	0	Initial: High Revised: Recorded	Restricted areas of habitat potentially used during migration present in the study area. The rufous fantail is likely to be an irregular visitor but habitat similar to the study area is widely distributed in the local area and the species is unlikely to be dependent on available habitat. Identified in proximity to the study area in 2005 by NGH Environmental. Recorded in the study area. Restricted areas of potential habitat present in the construction boundary.
Australian painted snipe (<i>Rostratula australis</i>)	-	E, Mi	Inhabits shallow inland wetlands, either freshwater or brackish water bodies. nests on the ground amongst tall reed-like vegetation near water and feeds near the waters edge and on mudflats.	0	None	No suitable habitat is present in the study area.
common tern (<i>Sterna hirundo</i>)	-	Mi	A non-breeding migrant to Australia, where it is widespread and common on the eastern coast south to eastern Victoria and common on parts of the northern coast, mainly east of Darwin. Commonly observed in near-coastal waters, both on ocean beaches, platforms and headlands and in sheltered waters, such as	1	None	No suitable habitat is present in the study area.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
			bays, harbours and estuaries with muddy, sandy or rocky shores.			
little tern (<i>Sternula albifrons</i>)	E	Mi	Almost exclusively coastal, preferring sheltered environments; however, may occur several km from the sea in harbours, inlets and rivers (with occasional offshore islands or coral cay records). Nests in small, scattered colonies in low dunes or on sandy beaches just above high tide mark near estuary mouths or adjacent to coastal lakes and islands.	0	None	No suitable habitat is present in the study area.
Australian fairy tern (<i>Sternula nereis nereis</i>)	V	-	Within Australia, the Fairy Tern occurs along the coasts of Victoria, Tasmania, South Australia and Western Australia; occurring as far north as the Dampier Archipelago near Karratha. Found in a variety of habitats including offshore, estuarine or lake islands, wetlands and mainland coastline. The species been known from New South Wales in the past but it is unknown if it persists in this region. Nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation. Roosts on beaches.	0	None	No suitable habitat is present in the study area.
hooded plover (<i>Thinornis rubricollis</i>)	E	V	In south-eastern Australia hooded plovers prefer sandy ocean beaches, especially those that are broad and flat, with a wide wave-wash zone for feeding, much beachcast seaweed and backed by sparsely vegetated sand-dunes	4	None	No suitable habitat is present in the study area.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
			for shelter and nesting. Occasionally hooded plovers are found on tidal bays and estuaries, rock platforms and rocky or sand-covered reefs near sandy beaches and small beaches in lines of cliffs			
common greenshank (<i>Tringa nebularia</i>)	-	Mi	The common greenshank is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass. Habitats include embayments, harbours, river estuaries, deltas and lagoons and are recorded less often in round tidal pools, rock-flats and rock platforms.	0	None	No suitable habitat is present in the study area.
masked owl (<i>Tyto novaehollandiae</i>)	V	-	Occurs throughout NSW, roosting and nesting in heavy forest. Hunts over open woodland and farmland, with a home range of 500 - 1000 ha. The main requirements are tall trees with suitable large hollows for nesting and roosting and adjacent areas for foraging. Feeds on small mammals.	14	Initial: High Revised: Moderate	Suitable foraging habitat, roosting and nesting habitat present in study area. Historical and recent records occur within and in proximity to, the study area, suggesting ongoing use of the area by this species. Not detected during targeted surveys however potential roost and nest trees are present.
sooty owl (<i>Tyto tenebricosa</i>)	V	-	Inhabits subtropical and warm temperate rainforest and moist or dry eucalypt forest with a well-developed mid-storey of trees or shrubs.	9	Initial: High	Suitable foraging habitat, roosting and nesting habitat present in study area. A number of hHistorical and

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
			Roost and nest sites for the species occur in gullies. Utilise large hollows for nesting and prey on other hollow dependent species. Roost in hollows or dense vegetation.		Revised: Recorded	recent records occur within and in proximity to, the study area, suggesting sustained habitation of the area by this species. Identified in the study area by NGH Environmental in 2005. Recorded present in the study area during targeted surveys in the breeding season.
Mammals						
large-eared pied bat (<i>Chalinolobus dwyeri</i>)	V	V	Roosts in disused mine shafts, caves, overhangs and disused fairy martin nests for shelter and to raise young. Also potentially roost in tree hollows. Occurs in low to mid-elevation dry open forest and woodlands, preferably with extensive cliffs, caves or gullies. Is largely restricted to the interface of sandstone escarpment (for roost habitat) and relatively fertile valleys (for foraging habitat).	0	Initial: Low Revised: Moderate	No suitable breeding or foraging habitat is present in the study area. The study area is located south of the known distribution range and there are no records in the search area. Possible (unconfirmed) calls were detected at one Anabat location.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
spotted-tailed quoll (<i>Dasyurus maculatus</i>)	V	E	Utilises a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites.	1	Initial: Moderate Revised: Moderate	Potentially suitable habitat is present in the study area, including fallen logs. It is unlikely that the species inhabits the study area. A single past record of this species in the locality in 2014. It may be an occasional visitor but habitat similar to the study area is widely distributed in the local area. Not detected during targeted surveys, however due to camera triggering error did not meet full 14 days of survey area. Assume habitat present.
eastern false pipistrelle (<i>Falsistrellus tasmaniensis</i>)	V	-	Prefers moist habitats, with trees taller than 20 m. Generally, roosts in eucalypt hollows but has also been found under loose bark on trees or in buildings.	4	Initial: High Revised: High	Suitable foraging habitat and large hollows present in study area. Probable identification in the study area by NGH Environmental in 2005. Species group recorded during Anabat surveys.
southern brown bandicoot (<i>Isodon obesulus obesulus</i>)	E	E	NSW distribution almost exclusively restricted to coastal fringe. Habitats including heathland, shrubland, sedgeland, heathy open forest and woodland and are usually associated with infertile, sandy and well drained soils but can be found in a range of soil types. Within these	1	Initial: Moderate Revised: Moderate	Potential habitat is present in the study area but restricted to Zones 1 and 9. Other zones do not support suitable under storey habitat structures for the species. Possible signs (ground disturbance)

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
			vegetation communities they typically inhabit areas of dense ground cover.			observed during habitat inspection in Zone 1. Potential habitat is absent from the majority of the construction boundary, with the exception of strips of Zone 1 adjacent to access tracks and roads.
large bent-winged bat (<i>Miniopterus orianae oceanensis</i>)	V	-	Large bent-winged bats occur along the east and north-west coasts of Australia. Caves are the primary roosting habitat but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Hunt in forested areas, catching moths and other flying insects above the tree tops. Cumberland dry sclerophyll forests are identified as a potential vegetation type used by this species.	8	Initial: High Revised: High	No potential breeding or roosting habitat such as caves, mines or tunnels in the study area, however suitable foraging habitat during the non-breeding season is present. Records are present within the search area. Not recorded during Anabat surveys conducted during breeding season. Likely to be present during non-breeding season.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
eastern coastal freetail-bat (<i>Micronormus norfolkensis</i>)	V	-	Inhabits dry eucalypt forest and coastal woodlands, along with riparian zones in rainforest and wet sclerophyll forest. Forages above the forest canopy or at forest edges. Known to roost in tree hollows but occasionally found in buildings.	14	Initial: High Revised: Recorded	Suitable foraging habitat and large hollows present in study area. Identified in the study area by NGH Environmental in 2005. Calls recorded during Anabat surveys.
southern myotis (<i>Myotis macropus</i>)	V	-	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools.	9	Initial: Moderate Revised: Moderate	The north-east of the study area is located within 200 metres of standing water, hence potential roosting habitat is present in the north-east of the construction boundary. No foraging habitat is present in the study area. Species group recorded, hence potentially present and a species polygon generated based on proximity to wetland areas.
yellow-bellied glider (<i>Petaurus australis</i>)	V	-	Typically occurs in tall, mature eucalypt forest in regions of high rainfall but is also known to occur in drier areas. Preference for resource rich forests where mature trees provide nesting hollows and tree species composition with adequate food resources, including winter-flowering Eucalypts and sap-rich trees.	215	Initial: High Revised: Recorded	Suitable foraging habitat and large hollows present in study area. A number of historical and recent records occur within and in proximity to, the study area, suggesting sustained habitation of the area by this species. Identified in the study area by NGH Environmental in 2005. Recorded

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
						in the study area during nocturnal surveys.
squirrel glider (<i>Petaurus norfolkensis</i>)	V	-	The squirrel glider inhabits dry sclerophyll forest and woodland. In NSW, potential habitat includes Box-Ironbark forests and woodlands in the west, the river red gum forests of the Murray Valley and the eucalypt forests of the northeast. Individuals have also been recorded in a diverse range of vegetation communities, including blackbutt, forest red gum and red bloodwood forests, coastal banksia heathland and grey gum/spotted gum/grey ironbark dry hardwood forests of the central NSW coast. The squirrel glider is nocturnal and shelters in tree hollows. This species is capable of gliding up to 50m.	1	Initial: Moderate Revised: Low	The wet sclerophyll forest in the study area is marginal potential habitat for the squirrel glider. Not recorded during nocturnal stag-watch, spotlight or listening surveys. Not recorded during camera trapping for arboreal species with majority of glider individuals observed with, or in-association with other individuals with, visible white tail markings.
greater glider population in the Eurobodalla local government area (<i>Petauroides volans</i>)	E		Eucalypt forests and woodlands, preferring mature forest with numerous large tree hollows. Folivorous, usually selecting habitats with a diversity of Eucalypt species. Sensitive to habitat fragmentation, restricted to gliding locomotion and reluctant to disperse through non-native habitat. Population in the Eurobodalla local government area.	0	None	The endangered population does not occur in the study area. This population of Greater Gliders on the south coast of NSW is bounded by the Moruya River to the north, Coila Lake to the south and the Princes Highway and cleared land exceeding 700 m in width to the west.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
greater glider (<i>Petauroides volans</i>)		V	Eucalypt forests and woodlands, preferring mature forest with numerous large tree hollows. Folivorous, usually selecting habitats with a diversity of Eucalypt species. Sensitive to habitat fragmentation, restricted to gliding locomotion and reluctant to disperse through non-native habitat.	48	Initial: High Revised: Low	Suitable foraging habitat and large hollows present in study area. Historical and recent records occur within and in proximity to, the study area, suggesting habitation of the area by this species. Identified in the study area by NGH Environmental in 2005. Not detected during nocturnal surveys and due to the high detectability and low home range has been assessed as likely to be absent.
brush-tailed rock-wallaby (<i>Petrogale penicillata</i>)	-	V	This species prefers rocky habitats, including loose boulder-piles, rocky outcrops, steep rocky slopes, cliffs, gorges, isolated rock stacks and tree limbs. Preference for north-facing slopes and cliff lines. A range of vegetation types are associated with brush-tailed rock-wallaby habitat, including dense rainforest, wet sclerophyll forest, vine thicket, dry sclerophyll forest and open forest.	0	None	No suitable habitat is present in the study area. No records in the Batemans Bay area.
brush-tailed phascogale (<i>Phascogale tapoatafa</i>)	V	-	Patchy distribution over the coast of Australia; in NSW is generally found to the east of the Great Dividing Range. Prefers dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter but will also inhabit	1	Initial: Moderate Revised: Low	Suitable habitat occurs in the study area, however similar habitat is widely distributed in the local area. A single past record of this species in the search area from 1997. The

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
			heath, swamps, rainforest and wet sclerophyll forest.			species may be an occasional visitor but is unlikely to be dependent on the study area for its lifecycle. Not detected during camera trapping for arboreal mammals.
koala (<i>Phascolarctos cinereus</i>)	V	V	In NSW, Koalas occur along the coast, extending west to the Darling Riverine Plains and Mulga Lands bioregions in the north of the state; to the Cobar Peneplain bioregion in the centre of the state; and to the Riverina and eastern most parts of the Murray-Darling Depression bioregions in the south. Koalas naturally inhabit a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by Eucalyptus species, however Koala numbers in south eastern NSW are very low.	1	Initial: Moderate Revised: Low	Low densities of the species occur in this region and no breeding populations are present in the search area. Potential marginal foraging habitat is present in the study area with a restricted patch of one feed tree species identified in SEPP44, <i>Eucalyptus tereticornis</i> , present in the study area but absent from the construction boundary. One secondary feed species, <i>Eucalyptus globoidea</i> is present at low densities in parts of the study area. Extensive equivalent habitat is present throughout the landscape. One record in the search area from 2004 is likely to represent an individual dispersing male. The species may be an occasional visitor but is not resident or

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
						dependent on the study area for breeding or foraging resources.
long-nosed potoroo (<i>Potorous tridactylus tridactylus</i>)	-	V	Inhabits coastal heaths and dry and wet sclerophyll forests, with sandy loam soils. Dense understorey with occasional open areas is an essential part of habitat and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. Require dense vegetation for shelter and access to fungi. It is mainly nocturnal, hiding by day in dense vegetation - however, during the winter months animals may forage during daylight hours.	0	Initial: Low	No suitable habitat is present in the study area. No records in the Batemans Bay area.
New Holland mouse (<i>Pseudomys novaehollandiae</i>)	-	V	Inhabit open heathlands, open woodlands with a heathland understorey and vegetated sand dunes. Nest in burrows and have a preference for deeper top soils and softer substrates to aid digging. Spends considerable time foraging above-ground for food in areas of high floristic diversity.	0	Initial: Low	No suitable habitat is present in the study area.
grey-headed flying-fox (<i>Pteropus poliocephalus</i>)	V	V	Occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are commonly found in gullies, close to water, in vegetation with a dense canopy. They travel up to 50 km to forage, on the nectar and pollen of	146	Initial: High Revised: High	Potential foraging and roosting habitat is present in the study area. This species is common in Batemans Bay and has previously been recorded in the study area. Two flying-fox camp locations, one nationally significant, are present

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
			native trees, in particular Eucalyptus, Melaleuca and Banksia and fruits of rainforest trees and vines.			within 2 km north and north-east of the study area. No flying-fox roosting locations are present in the study area. Foraging habitat is present, consistent with habitat extensively distributed throughout the landscape.
yellow-bellied sheath-tail-bat (<i>Saccolaimus flaviventris</i>)	V	-	Inhabits eucalypt rainforest, sclerophyll forest and open woodland vegetation. Availability of tree hollows is important for access to roosting sites.	5	Initial: High Revised: High	Suitable habitat is present in the study area, including numerous tree hollows. The species is likely to be widespread throughout the landscape.
greater broad-nosed bat (<i>Scoteanax rueppellii</i>)	V	-	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings.	6	Initial: High Revised: High	Suitable habitat is present in the study area, including numerous tree hollows. The species is likely to be widespread throughout the landscape.
Aquatic Species	FM Act					
Australian grayling (<i>Protorocetes marena</i>)	E		Migratory species that spawns in the lower freshwaters of coastal rivers and spends about 6 months in coastal seas as larvae/juveniles before migrating back into freshwater rivers and	N/A	None	Known to utilise habitat in the Clyde and Buckenbowra River upstream of the Clyde River estuary. No suitable habitat is present in the study area. Hanging Rock Creek

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records within 10 x 10 km search area centred on the study area (BioNet)	Likelihood of occurrence	Comments
			streams where they remain for the rest of their life-cycle.			downstream of the study area has insufficient catchment or flow to be potential habitat.
*CEEC = Critically Endangered Ecological Community, EEC = Endangered Ecological Community, V= Vulnerable, E=Endangered, CE = Critically Endangered, Mi = Migratory, Ma = Marine.						

Appendix D Assessment of candidate vegetation zones against criteria for BC Act listed EECs

Two BC Act listed Endangered Ecological Communities (EECs) potentially occur in the study area based on known associations with PCTs present:

- Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Swamp Oak Floodplain Forest)
- River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (River-Flat Eucalypt Forest).

No PCTs associated with any BC Act listed EECs are present in the construction boundary.

Vegetation zones in the study area potentially conforming to BC Act listed EECs are as follows:

- Zone 8 supporting PCT1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion in high condition has the potential to meet diagnostic criteria for either Swamp Oak Floodplain Forest or River-Flat Eucalypt Forest
- Zone 9, supporting PCT1326: Woollybutt – White Stringybark – Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion in high condition, has the potential to meet diagnostic criteria for River-Flat Eucalypt Forest.

Swamp Oak Floodplain Forest

Table D.1 provides an assessment of Zone 8 against the criteria for the Swamp Oak Floodplain Forest EEC. Vegetation within Zone 8 conforms to the NSW BC Act listed community.

Table D.1 Diagnostic criteria for NSW BC Act listed Swamp Oak Floodplain Forest EEC

Criteria	Zone 8 – PCT1232 – High condition
Is the site on the coastal floodplain of the NSW North Coast, Sydney Basin or South East Corner bioregion?	Yes The PCT1232 is within the South East Corner bioregion.
Is the site associated with humic clay or sandy loams soils?	Yes
Is the site subject to waterlogging and/or below the highest flood level?	Yes
Is the site dominated by Swamp Oak or Swamp Paperbark?	Yes The PCT1232 canopy is dominated by swamp oak.
Are any characteristic shrub and/or ground layer species present?	Yes PCT1232 supports characteristic shrub and ground layer species including: <ul style="list-style-type: none"> • Indian pennywort • Angled lobelia • Bordered panic • Ribbon grass • common reed • Common silkpod.

Criteria	Zone 8 – PCT1232 – High condition
Meets criteria for Swamp Oak Floodplain Forest	Yes

River-Flat Eucalypt Forest

Table D.2 provides an assessment for Zones 8 and 9 against the criteria for the NSW BC listed River-Flat Eucalypt Forest EEC. Zone 8 does not meet diagnostic criteria for the EEC. Zone 9 meets diagnostic criteria for inclusion in the EEC.

Table D.2 Diagnostic criteria for the NSW BC Act listed River-Flat Eucalypt Forest EEC

Criteria	Zone 8	Zone 9
Is the site south of Port Stephens in the NSW North Coast, Sydney Basin or South East Corner bioregions (refer to map)?	Yes	Yes
Is the site on the coastal floodplain (see “What is the Coastal Floodplain”)?	Yes The area occurs along an area of level floodplain on a small drainage line upstream of a wetland. It is about between 10 - 30 m in elevation.	Yes The area occurs along an area of level floodplain on a small drainage line upstream of a wetland. It is about between 10 - 30 m in elevation.
Is the site on silty, clay or sandy loam soil with a lack of deep humic layers and has little or no saline (salt) influence?	Yes Yes, there is a humic sedimentary soil with no saline influence.	Yes Yes, there is a humic sedimentary soil with no saline influence.
Is the site located on a river flat or terrace in an upper part of the Coastal Floodplain (check for active or dormant drainage lines in the area)?	Yes The area occurs along an area of level floodplain on a small drainage line upstream of a wetland. The site is in the upper extent of the floodplain.	Yes The area occurs along an area of level floodplain on a small drainage line upstream of a wetland. The site is in the upper extent of the floodplain.
Does the site consist of an open forest or woodland with a mixture of Eucalypt or Angophora trees, particularly Forest Red Gum, Cabbage Gum or Broad-leaved Apple (see table)?	No The canopy is dominated by swamp she-oak.	Yes The canopy is dominated by forest red gum.
Are there any characteristic shrub and/or ground layer species present (see table)?	Yes	Yes

Criteria	Zone 8	Zone 9
	Diversity is low relative to that expected.	Some characteristic species are present.
Are there relatively low numbers of She-oaks, Paperbarks or Swamp Mahogany trees?	No She-oaks are the dominant canopy species.	Yes She-oaks, paperbarks and Swamp Mahogany are absent.
Meets criteria for River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	No The site is not dominated by characteristic canopy species.	Yes

Lowland Grassy Woodland in the South East Corner Bioregion

Table D.3 provides an assessment for Zone 9 against the criteria for the NSW BC ACT listed Lowland Grassy Woodland in the South East Corner Bioregion. Zone 9 does not meet diagnostic criteria for the EEC but is more consistent with River-Flat Eucalypt Forest on the basis of the landscape position. It is noted that PCT1326 has not been associated with the BC Act listed Lowland Grassy Woodland in the South East Corner Bioregion in the VIS Classification Database (OEH 2019).

Table D.3 Justification of NSW BC listed Lowland Grassy Woodland in the South East Corner Bioregion

Criteria	Zone 9
Is the site in the South East Corner Bioregion of NSW?	Yes
Is the vegetation open forest or woodland with a grassy ground layer, or derived native grassland?	No The vegetation is a forest however, it does not comprise of a grassy ground layer.
Is the site on low, rolling hills in an area less than 500 m in elevation?	No The community occurs on river-flats in the head of the coastal floodplains, not on low rolling hills. It is approximately between 10 - 30 m in elevation.
Is the site in a rain shadow area which receives about 700–1100 mm rain per annum?	Yes The study area is located on the low-lying rainshadow areas of the South Coast and receives between 560 – 1256 mm with the average of 916 mm per annum (BOM 2019).
Does the tree layer, if present, contain forest red gum, rough-barked apple and/or white stringybark?	Yes The tree layer is dominated by forest red gum.

Criteria	Zone 9
BC Act – Lowland Grassy Woodland in the South East Corner Bioregion	No The community is a shrubby forest and occurs on river-flats not rolling hills.

Appendix E Assessment of candidate vegetation zones against criteria for EPBC Act listed EECs and CEECs

The PMST identified six EPBC Act listed threatened ecological communities potentially occurring in the search area:

- Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland EEC
- Illawarra and south coast lowland forest and woodland CEEC
- Littoral Rainforest and Coastal Vine Thickets of Eastern Australia CEEC
- Lowland Grassy Woodland in the South East Corner Bioregion CEEC
- Natural Temperate Grassland of the South Eastern Highlands CEEC
- Subtropical and Temperate Coastal Saltmarsh Vulnerable Community (VEC).

Based on the vegetation assessment and preliminary review of diagnostic criteria, vegetation potentially conforming to two EPBC Act listed ecological communities were identified as present in the study area:

- One vegetation zone, Zone 8, supporting PCT1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion in high condition, has the potential to meet diagnostic criteria for:
 - Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland (Coastal Swamp Oak Forest) Endangered ecological community
 - Illawarra and south coast lowland forest and woodland Critically Endangered ecological community.
- One vegetation zone, Zone 9, supporting PCT1326: Woollybutt – White Stringybark – Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion, has the potential to meet diagnostic criteria for the Illawarra and south coast lowland forest and woodland critically endangered ecological community.

No other vegetation zones in the study area have the potential to meet the diagnostic criteria for any EPBC Act listed ecological communities. No vegetation zones in the construction boundary have the potential to meet the diagnostic criteria for any EPBC Act listed ecological communities.

Coastal Swamp Oak Forest

Table E.1 provides an assessment of Zone 8, supporting PCT1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion, against the key diagnostic features for the EPBC listed Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community (Coastal Swamp Oak Forest).

Zone 8 conforms to the diagnostic features of the Coastal Swamp Oak and is generally consistent with other typical characteristics identified in the conservation advice (DoE, 2018). Table E.2 provides an assessment against Coastal Swamp Oak Forest condition class thresholds identified in the conservation advice (DoE, 2018) for Zone 8. Zone 8 meets thresholds to be classified as a high quality patch (Category B) due to the size of the patch (including adjacent areas outside the study area) and it is predominantly native vegetation.

Table E.1 Diagnostic criteria for the Coastal Swamp Oak Forest

Criteria	Zone 8 - PCT1232 – High Condition
Occurs from south-east Queensland to southern NSW within the South Eastern Queensland, NSW North Coast, Sydney Basin, or South East Corner bioregions.	Yes

Criteria	Zone 8 - PCT1232 – High Condition
	PCT1232 is within the South East Corner Bioregion.
Occurs in coastal catchments at elevations up to 50 m ASL, typically less than 20 m ASL, on coastal flats, floodplains, drainage lines, lake margins, wetlands and estuarine fringes where soils are at least occasionally saturated, water-logged or inundated. There are also minor occurrences on coastal dune swales or flats, particularly deflated dunes and dune soaks.	Yes PCT1232 occurs at the elevation between 10 – 30 m ASL and is found along a flat.
Occurs on soils derived from unconsolidated sediments (including alluvium), typically hydrosols (grey-black clay-loam and/or sandy loam soils) and sometimes organosols (peaty soils). It may occur in transitional soils (or catenas) where shallow unconsolidated sediments border lithic substrates.	Yes Wetland edge supporting unconsolidated organic-rich sediments, which are potentially hydrosols or organosols.
Has an open woodland, woodland, forest, or closed forest structure, with a tree canopy that has a total crown cover of at least 10 per cent.	Yes PCT1232 is a forest with a crown cover of at least 10 per cent.
Has a canopy of trees dominated by <i>Casuarina glauca</i> (swamp-oak, swamp she-oak).	Yes PCT1232 canopy is dominated by swamp-oak.
Meets diagnostic criteria diagnostic criteria for Coastal Swamp Oak Forest critically endangered ecological community:	Yes

Table E.2 Condition class thresholds assessment for Coastal Swamp Oak Forest

Category	Description	Response
High quality Category A	<ul style="list-style-type: none"> Predominately native vegetation Large patch size (at least 5 ha) 	No
High quality Category B	<ul style="list-style-type: none"> Predominately native vegetation in a medium size patch (between 2 to 5 ha) Small size patch (at least 0.5 but less than 2 ha) that is predominately native vegetation and is connected to large native vegetation (greater than 5 ha) 	Yes The zone supports predominately native vegetation with few weed species present. The patch size within the study area is 0.50 ha, however, based

Category	Description	Response
		on review of aerial imagery, the total patch size is likely to be between about 3 and 5 ha in size.
High quality Category C	<ul style="list-style-type: none"> Predominately native vegetation Small size patch (at least 0.5 but less than 2 ha) 	No
Good quality Category B	<ul style="list-style-type: none"> Mostly native understorey in a large patch (at least 5 ha) 	No
Good quality Category C	<ul style="list-style-type: none"> Mostly native understorey in a medium size patch (between 2 to 5 ha) Small size patch (at least 0.5 but less than 2 ha) that is mostly native understorey and is connected to large native vegetation (greater than 5 ha) 	No
Moderate quality Category C	<ul style="list-style-type: none"> Large or medium size patch with some native understorey 	No
Condition class:		High-quality Category B

Illawarra and south coast lowland forest and woodland

Table E.3 provides an assessment of Zone 8, supporting PCT1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion and Zone 9, supporting PCT1326: Woollybutt – White Stringybark – Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion and its vegetation zone against the key diagnostic criteria for the EPBC Act listed Illawarra and south coast lowland forest and woodland Critically Endangered ecological community. The following additional site characteristics features identified in the conservation advice (DoE 2018) were also considered:

- A sub-canopy of melaleuca species, tree-sized Acacias and/or swamp oak (*Casuarina glauca*) is often present.
- The ecological community occurs on a variety of substrates, most commonly fine grained sedimentary or plutonic rocks, from which sandy loam to loam soils with moderately high fertility are derived.
- The ecological community is not likely to be present where there is:
 - a high abundance of, or any layer dominated by rainforest-associated plant species, particularly palms or tree ferns
 - a high abundance of plant species associated with coastal sands
 - *Corymbia maculata* (spotted gum) dominant in the canopy.

Zone 8 does not conform to the diagnostic criteria of the Illawarra and south coast lowland forest and woodland Critically Endangered ecological community.

Zone 9 conforms to the diagnostic criteria of the Illawarra and south coast lowland grassy woodland. Table E.4 provides an assessment against Illawarra and south coast lowland grassy woodland condition class thresholds identified in the in the Conservation Advice (DoEE, 2016) for Zone 9. Zone 9 was identified as meeting Category B - High condition class.

Table E.3 Diagnostic criteria for Illawarra and south coast lowland forest and woodland

Criteria	Zone 9	Zone 9
The ecological community occurs within the state of New South Wales in the Jervis, Ettrema and Illawarra subregions of the Sydney Basin Bioregion and the Bateman subregion of the South East Corner Bioregion.	Yes The area is located in the Bateman subregion of the South East Corner Bioregion.	Yes The area is located in the Bateman subregion of the South East Corner Bioregion.
The ecological community occurs between 5 and 350 m ASL, on the coastal plain or foothills between the immediate coastal strip and the escarpment. The ecological community is a woodland with at least 10 per cent canopy cover.	Yes The area occurs between 10 – 30 m ASL and in the coastal foothills. There is greater than 10 percent canopy cover.	Yes The area occurs between 10 – 30 m A and in the coastal foothills. There is greater than 10 percent canopy cover.
<i>Eucalyptus tereticornis</i> (forest red gum) is always present in the mature tree canopy. Other characteristic tree canopy species include <i>Angophora floribunda</i> (rough-barked apple); <i>E. bosistoana</i> (coast grey box); <i>E. botryoides</i> (bangalay); <i>E. eugenioides</i> (thin-leaved stringybark); <i>E. globoidea</i> (white stringybark); <i>E. longifolia</i> (woollybutt); and/or <i>E. quadrangulata</i> (coastal white box).	No The zone is dominated by swamp she-oak (<i>Casuarina glauca</i>). Characteristic tree species, including forest red gum (<i>Eucalyptus tereticornis</i>), are absent.	Yes The canopy within the zone is dominated by forest red gum (<i>Eucalyptus tereticornis</i>).
The understorey varies between sites and contains: <ul style="list-style-type: none"> a ground layer of grasses, herbs and sedges to a height of about 1 m; and/or a shrubby layer to a height of about 2 m. 	Yes Supports a mixed grassy and shrubby layer (e.g. acacias) dominated by grasses and sedges to a height of 1 metre.	Yes Supports a shrubby layer (e.g. acacias) to a height of 2 metres high supporting species consistent with the conservation advice.
Meets diagnostic criteria for Illawarra and south coast lowland forest and woodland critically endangered ecological community:	No	Yes

Table E.4 Condition class thresholds assessment for Illawarra and south coast lowland forest and woodland

Category	Description	Zone 9
A. High condition class (A larger patch with good quality native understorey)	<ul style="list-style-type: none"> Patch size is at least 2 ha At least 50 per cent of its total perennial understorey vegetation cover* is comprised of native species 	No

Category	Description	Zone 9
	with at least 6 native plant species per 0.5 ha in the ground layer	
B. High condition class (A patch with very good quality native understorey with a species rich ground layer)	<ul style="list-style-type: none"> Patch size is at least 0.5 ha At least 70 per cent of the perennial understorey vegetation cover is comprised of native species with at least 10 native plant species per 0.5 ha in the ground layer 	<p>Yes</p> <p>Within the study area, the patch size 0.61 ha, which is less than 2 ha. Based on review of aerial imagery, the total patch size, including <i>E. tereticornis</i> dominated vegetation in similar condition in adjacent areas is likely to be between about 1 – 2 ha in size.</p> <p>A 20 x 50 m plot identified 26 native species and confirmed that greater than 70 per cent of perennial understorey vegetation cover is comprised of native species.</p>
C. Moderate condition class (A patch with good quality native understorey)	<ul style="list-style-type: none"> Patch size is at least 0.5 ha At least 50 per cent of its total perennial understorey vegetation cover* is comprised of native species with at least 6 native plant species per 0.5 ha in the ground layer 	No
D. Moderate condition class (A patch that makes other important ecological contributions)	<ul style="list-style-type: none"> Patch size is at least 0.5 ha At least 30 per cent of total perennial understorey vegetative cover is comprised of native species AND <ul style="list-style-type: none"> the patch is contiguous with another patch of native vegetation (at least 1 ha in area) the patch has at least one large locally indigenous tree (at least 60 cm diameter at breast height (dbh)), or at least one tree with hollows 	No
Condition class:		Category B - High condition class

Appendix F Five-part Tests of Significance under the NSW Biodiversity Conservation Act 2016

Threatened species, endangered populations and threatened ecological communities (TECs) listed under the BC Act and considered to have moderate to high potential to occur (based on known distribution and habitat requirements) or that have been recorded within the study area and with reasonable potential to be significantly impacted by the proposed minor works are addressed in detail in the following five-part tests of Significance. This assessment is conducted in accordance with Section 7.3 of the BC Act. Tests of significance have been undertaken in 13 individual or grouped assessments for the 20 threatened species identified based on consistency of life-cycle and habitat requirements:

- Gang gang cockatoo (*Callocephalon fimbriatum*), vulnerable
- Glossy black-cockatoo (*Calyptorhynchus lathamii*), vulnerable
- Varied sittella (*Daphoenositta chrysoptera*), vulnerable
- Little lorikeet (*Glossopsitta pusilla*), vulnerable
- Swift parrot (*Lathamus discolor*), endangered
- Square-tailed kite (*Lophoictinia isura*), vulnerable
- Forest owls (Sooty owl (*Tyto tenebricosa*), vulnerable; powerful owl (*Ninox strenua*), vulnerable; masked owl (*Tyto novaehollandiae*), vulnerable)
- Tree-roosting micro-bats (eastern false pipistrelle (*Falsistrellus tasmaniensis*), vulnerable; eastern coastal free-tail bat (*Micronomus norfolkensis*), vulnerable; yellow-bellied sheath-tail-bat (*Saccolaimus flaviventris*), vulnerable; greater broad-nosed bat (*Scoteanax rueppellii*), vulnerable; greater broad-nosed bat (*Scoteanax rueppellii*), vulnerable and southern myotis)
- Cave-roosting micro-bats (Large bent-winged bat (*Miniopterus orianae oceanensis*), endangered; large-eared pied bat (*Chalinolobus dwyeri*), vulnerable)
- Spotted-tail quoll (*Dasyurus maculatus*), vulnerable
- Southern brown bandicoot (*Isodon obesulus obesulus*), endangered
- Yellow-bellied glider (*Petaurus australis*), vulnerable
- Grey-headed flying-fox (*Pteropus poliocephalus*), vulnerable.

Gang gang cockatoo – Vulnerable

The gang gang cockatoo inhabits upland areas of tall mountain forest and woodlands during spring and summer, where it most often breeds. During autumn and winter the gang gang cockatoo migrates to lower altitudes of open eucalypt forests and woodlands. Gang gang cockatoos were observed foraging in the study area in September 2019. No gang gang cockatoos were recorded during the breeding season. While hollow bearing trees suitable for gang gang cockatoo breeding were present, breeding is typically associated with escarpment ranges and tablelands to the west and is unlikely to occur in the study area. Consequently, while recorded at the study area, gang gang cockatoos are unlikely to breed in the study area. The study area does not support habitat distinct from elsewhere within the surrounding landscape and is not likely to be important habitat for the species. Fire impacts are likely to have temporarily reduced the potential for gang gang cockatoo to forage in the Mogo State Forest and foraging habitat is assumed to regenerate once canopy trees recover and start fruiting.

Table F.1 Five part test of significance in accordance with Part 7.3 of the BC Act: gang-gang cockatoo

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
Criteria	a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
Response	Potential impacts on gang gang cockatoos are associated with the direct loss of foraging habitat. There are unlikely to be any adverse impacts on the life cycle of the species.
Criteria	<p>b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:</p> <p>(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or</p> <p>(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction</p>
Response	Not applicable
Criteria	<p>c) in relation to the habitat of a threatened species or ecological community:</p> <p>(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity and:</p> <p>(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity and</p> <p>(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality</p>
Response	<p>(i) The removal of up to 15.95 ha of suitable foraging habitat for the gang gang cockatoos resulting from construction of the proposal is likely to have a negligible impact on feeding opportunities of this species in the landscape.</p> <p>(ii) The proposed works are unlikely to fragment the population of this species and is unlikely to create a barrier to movements across the landscape.</p> <p>(iii) Foraging habitat in the study area is similar in type and condition to habitat distributed extensively throughout the landscape, particularly in Mogo State Forest to the south and west, and is not important to the long-term survival of gang gang cockatoo.</p> <p>The study area burned on 31 December 2019 at an intensity that resulted in the understory, midstorey and canopy of the entire site being burnt or scorched. The majority of the landscape south and west of the study area was also burnt. Given the intensity of the fire in the study area, the vegetation does not currently support suitable habitat, or a potential refugia in the short-term, for this species. Consistent with certain affected parts of the surrounding landscape the vegetation of the study area is expected to slowly recover over the coming decades to the extent that it will support foraging habitat in the future.</p>
Criteria	d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)
Response	The proposal would not impact on any declared area of outstanding biodiversity value.
Criteria	e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process
Response	The 'Clearing of native vegetation' would also result in the removal of 15.95 ha of suitable foraging habitat for gang gang cockatoos in the construction boundary. This would have a negligible increase in the impact of this key threatening process (KTP) on gang gang cockatoo in the context of the surrounding landscape.

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
	While there is potential for other KTPs of relevance to this species to be affected by the proposal, these KTPs are likely to be able to be adequately managed by Transport for NSW's standard environmental management measures.
Conclusion	It is unlikely that there would be a significant adverse impact on the gang gang cockatoo as a result of the proposal.

Glossy black cockatoo – Vulnerable

The glossy black cockatoo feeds largely on the seeds of she-oaks (*Allocasuarina* sp. and *Casuarina* sp.) trees and rely on these species for foraging habitat. Glossy black cockatoo's nest in large tree hollows, usually in large Eucalypts. These requirements of both feeding and nesting habitat can limit their breeding habitat to areas where both large *Eucalyptus* and *Allocasuarina* sp. trees are present in close proximity.

Glossy black cockatoo were recorded in the study area through direct observation and observation of foraging signs (i.e. chewed black she-oak cones). One important feed species, black she-oak (*Allocasuarina littoralis*), is extensively distributed across the study area. Systematic searches in August did not detect any glossy black cockatoos during the breeding season, with all observations outside the identified breeding season. Targeted searches for suitable nesting trees identified numerous mature trees in the study area with very large hollows potentially suitable as nesting sites for glossy black cockatoo. However, during the breeding season there was no evidence of active use such as extensive white-wash or associated activity.

Potential breeding and potential foraging habitat for glossy black cockatoo is present in the study area. Foraging habitat within the study area has been degraded by recent timber harvesting which has resulted in clearing of extensive areas likely to have supported black she-oak. Patches of foraging habitat remain throughout the degraded areas and are scattered extensively throughout the remainder of the study area.

While the species was not detected during breeding season surveys, suitable hollows are present and the species is likely to breed in the surrounding landscape. Begging fully fledged juveniles were detected after the breeding season. The condition of foraging habitat varies substantially across the study area, depending on the degree, type of and time since disturbance. The distribution of large hollow bearing trees in the study area is highly influenced by past timber harvesting and disturbance, with the majority of large hollows restricted to several patches of vegetation along drainage lines.

Breeding and foraging habitat within the study area is likely to be consistent with habitat in large areas of Mogo State Forest to the south and west. Foraging habitat, comprising of vegetation supporting dense or scattered black she-oak is present in adjacent areas of Mogo State Forest to the west and south. Similarly, the distribution of large hollow bearing trees elsewhere in the surrounding landscape is likely to be consistent with the study area, with clusters of large hollow bearing trees restricted to gullies and protected fragments. Habitat is absent from the immediate urban area of Batemans Bay to the north and east of the study area.

All areas of glossy black cockatoo feeding habitat in the study area were burnt in the fires. The study area does not include any unburnt patches, areas of low fire intensity or other habitat features that comprise an important post-fire refuge for glossy black cockatoo. The fire impacts are likely to have a substantial medium-to-long term impact on both foraging and breeding habitat for glossy black cockatoo. Black she-oak, on which the species is dependent for foraging, will regenerate only from seed and foraging habitat is likely to take 5 to 15 years to recover in the study area. Due to the requirement for extensive hollow

development in trees suitable for glossy black cockatoo breeding, trees containing suitable breeding hollows for the species are more likely to be destabilised by fires, however, it has been assumed that the majority of suitable trees would persist. Based on the local fire intensity, the impacts in the study area are likely to be consistent with fire impacts elsewhere in the nearby landscape. Foraging habitat is likely to take five to 15 years to recover after the fires.

On the assumption that habitat in the study area will regenerate in the long term, breeding habitat for glossy black cockatoo is assumed to be present, covering all timbered areas in the study area on the basis that there is foraging habitat in proximity to large hollow bearing trees.

Table F.2 Five part test of significance in accordance with Part 7.3 of the BC Act: glossy black cockatoo

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
Criteria	f) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction
Response	Potential impacts on glossy black-cockatoos largely associated with the direct loss of potential breeding and foraging habitat. The removal of up to 25 trees supporting approximately 35 large and very large hollows with suitable dimensions for the glossy black cockatoo has the potential to influence availability of nesting sites in the study area, however given a total of 111 trees supporting large and very large hollows were identified in the study area, it is unlikely that the proposal would reduce the reproductive success of these species. However, large hollows to be removed are marginal breeding habitat as they are located distant from waterbodies. Clearing of trees should be undertaken outside the breeding season for glossy black cockatoo, or following confirmation by a qualified ecologist that breeding is not occurring in trees to be removed, in lines with Biodiversity Guidelines (Roads and Traffic Authority, 2011). It is unlikely that the proposal would impact the life cycle of glossy black cockatoo.
Criteria	g) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: (iii) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or (iv) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Response	Not applicable
Criteria	h) in relation to the habitat of a threatened species or ecological community: (iv) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity and: (v) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity and (vi) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality
Response	(i) The removal of up to 25 trees supporting potentially suitable hollows for the glossy black cockatoo may reduce the number of potential breeding sites for the species present in the landscape. The removal of up to 15.95 ha (Zones 1, 2 and 5) of suitable foraging habitat for the glossy black-cockatoos may adversely impact the feeding opportunities of this species. In the short term, removal of foraging habitat would have a negligible impact as all black-she oak has been burnt and foraging habitat will need to regenerate before able to support glossy black cockatoo.

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
	<p>(ii) The proposed works are unlikely to fragment the populations of this species and is unlikely to create a barrier to movements across the landscape.</p> <p>(iii) Suitable large hollows and black she-oak are both important habitat features for glossy black cockatoo. However, in the context of the local landscape, where black she-oak is widely distributed and large hollow bearing trees are common in areas protected from timber harvesting, it is unlikely that the habitat in the proposal is important for the long-term survival of the species.</p> <p>The study area burned on 31 December 2019 at an intensity that resulted in the understory, midstorey and canopy of the entire site being burnt or scorched. These fires are likely to have had a significant adverse impact on glossy black cockatoo populations and the availability of unburnt foraging and breeding habitat. The majority of the landscape south and west of the study area was also burnt. Given the intensity of the fire in the study area, the vegetation does not currently support suitable habitat, or a potential refugia in the short-term, for this species. Consistent with affected parts of the surrounding landscape the vegetation of the study area is expected to recover to the extent that it will support suitable habitat in the future.</p>
Criteria	i) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)
Response	The proposal would not impact on any declared area of outstanding biodiversity value.
Criteria	j) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process
Response	<p>The proposal would potentially increase impacts of the ‘Clearing of native vegetation’ and ‘loss of hollow bearing trees’ KTPs on glossy black cockatoo. The removal of up to 25 trees supporting suitable hollows and 15.95 ha (Zones 1, 2 and 5) of suitable foraging habitat for the glossy black cockatoos may adversely impact these species in the area. In the context of surrounding habitat resources in the landscape, the extent of clearing and hollow bearing tree removal is not likely to substantially increase threats to glossy black cockatoo.</p> <p>While there is potential for other KTPs of relevance to this species to be affected by the proposal, these KTPs are likely to be able to be adequately managed by Transport for NSW’s standard environmental management measures.</p>
Conclusion	It is unlikely that there would be a significant adverse impact on the glossy black cockatoo as a result of the proposal.

Varied sittella – Vulnerable

The varied sittella is a small sedentary bird that inhabits eucalypt woodlands and forests. The varied sittella hunts for arthropods living in the bark and dead branches of trees where it works its way down as it hunts.

Varied sittella was observed foraging during diurnal bird surveys. Varied sittella are likely to commonly utilise foraging habitat in the study area and may breed in the study area. The habitat present is consistent with extensive similar habitat present throughout the landscape to the west of the study area, including in adjacent areas of Mogo State Forest. The species does not have specific nesting tree requirements and hence breeding habitat is widespread throughout the landscape. Foraging and nesting habitat is likely to have regenerated to a point suitable for supporting varied sittella within two to three years.

Table F.3

Five part test of significance in accordance with Part 7.3 of the BC Act: varied sittella

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
Criteria	a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction
Response	The proposal is unlikely to have any adverse impacts on the life cycle of varied sittella.
Criteria	b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Response	Not applicable
Criteria	c) in relation to the habitat of a threatened species or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity and: (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality
Response	(i) The proposal would result in clearing of up to 15.95 ha (Zones 1, 2 and 5) of suitable breeding and foraging habitat for the varied sittella. Vegetation in Zone 5 is already highly degraded by recent timber harvesting. (ii) The proposed works would increase fragmentation of habitat in the study area, though is unlikely to create a major barrier to movement of varied sittella across the landscape. (iii) The site does not comprise important habitat for the long-term survival of varied sittella. The study area was affected by bushfire on 31 December 2019 at an intensity that resulted in the understorey, midstorey and canopy of the entire site being burnt or scorched. The majority of the landscape south and west of the study area was also burnt. Given the intensity of the fire in the study area, the vegetation does not currently support suitable habitat, or comprise a potential post fire refuge in the short-term. Consistent with certain affected parts of the surrounding landscape, the vegetation of the study area is expected to recover to the extent that it will support suitable habitat in the future.
Criteria	d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)
Response	The proposal would not impact on any declared area of outstanding biodiversity value.
Criteria	e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process
Response	The proposal would result in the 'Clearing of native vegetation' with the removal of up to 15.95 ha (Zones 1, 2 and 5) of suitable breeding and foraging habitat for the varied sittella, in addition, the proposal would result in 'Removal of dead wood and dead trees' which are valuable feeding habitat

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
	<p>for the varied sittella. This would to have a negligible increase in the impact of this key threatening process on varied sittella.</p> <p>While there is potential for other KTPs of relevance to this species to be affected by the proposal, these KTPs are likely to be able to be adequately managed by Transport for NSW's standard environmental management measures.</p>
Conclusion	It is unlikely that there would be a significant adverse impact on the varied sitella as a result of the proposal.

Little lorikeet – Vulnerable

Little lorikeet was heard and observed flying through the study area on multiple occasions. While no flowering eucalypts were recorded in the study area during surveys, due to the exceptionally dry seasonal conditions, the study area is likely to typically support both foraging and breeding habitat. The habitat present is consistent with extensive similar habitat present throughout the landscape to the west of the study area, including in adjacent areas of Mogo State Forest. Suitable nesting trees, i.e. trees with small to medium hollows, are common in the study area. Similar breeding habitat is likely to be widespread throughout the surrounding landscape, although potentially restricted largely to protected corridors due to extensive timber harvesting activities throughout Mogo State Forest. Due to the dominance of epicormically resprouting eucalypts in the study area, foraging habitat for little lorikeet is likely to regenerate within three to five years when winter flowering eucalypts recommence flowering. The availability of suitable small hollows is unlikely to change substantially in the long term however utilisation of hollows is likely to be dependent on the recovery of canopy cover and foraging habitat.

Table F.4 Five part test of significance in accordance with Part 7.3 of the BC Act: little lorikeet

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
Criteria	a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction
Response	The removal of up to 72 trees supporting more than 100 hollows in size classes that may be used by little lorikeets as breeding habitat is likely to affect reduce nesting opportunities in the immediate location. Similar densities of hollow bearing trees are likely present elsewhere in the surrounding areas of the study area and Mogo State Forest. The proposed action is not likely to have an adverse effect on the life cycle of little lorikeet to the extent that a viable local population of this species is likely to be placed at risk of extinction. Clearing of trees should be undertaken outside the breeding season for little lorikeet in line with the Biodiversity Guidelines (Roads and Traffic Authority, 2011).
Criteria	b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Response	Not applicable
Criteria	c) in relation to the habitat of a threatened species or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity and: (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality
Response	(i) The extent of habitat to be cleared comprises a reduction of up to 15.95 ha (Zones 1, 2 and 5) of suitable foraging habitat and the removal of more than 100 hollows of suitable size classes for little lorikeet.

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
	<p>(ii) Due to the high mobility of the species, the proposed works would not fragment a population of this species and is very unlikely to create a barrier to movements across the landscape.</p> <p>(iii) Foraging and breeding habitat in the study area is similar in type and condition to habitat distributed extensively throughout the landscape, particularly in Mogo State Forest to the south and west. Consequently, habitat to be cleared is unlikely to be important for the survival of the little lorikeet.</p> <p>The study area was affected by bushfire on 31 December 2019 at an intensity that resulted in the understorey, midstorey and canopy of the entire site being burnt or scorched. The majority of the landscape south and west of the study area was also burnt. Given the intensity of the fire in the study area, the vegetation does not currently support suitable habitat, or potential post fire refugia in the short-term, for this species. Consistent with certain affected parts of the surrounding landscape, the vegetation of the study area is expected to recover to the extent that it will support suitable habitat in the future.</p>
Criteria	d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)
Response	The proposal would not impact on any declared area of outstanding biodiversity value.
Criteria	e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process
Response	<p>The proposal would potentially increase impacts of the 'Clearing of native vegetation' and 'loss of hollow bearing trees' KTPs on little lorikeet. The removal of up to 72 hollow bearing trees, supporting more than 100 potentially suitable hollows, and 15.95 ha of suitable foraging habitat for the little lorikeet may adversely impact these species in the immediate area. However, in the context of surrounding habitat resources in the landscape, the extent of clearing and hollow bearing tree removal is not likely to substantially increase threats to little lorikeet.</p> <p>While there is potential for other KTPs of relevance to this species to be affected by the proposal, these KTPs are likely to be able to be adequately managed by Transport for NSW's standard environmental management measures.</p>
Conclusion	It is unlikely that there would be a significant adverse impact on the little lorikeet as a result of the proposal.

Swift parrot – Endangered

The swift parrot is mostly nectarivorous and feeds on flowering *Eucalyptus* and *Corymbia* trees or on sugar-rich resources such as lerps and honeydew (Brereton, Mallick and Kennedy, 2004). It occurs throughout the south-east coast of Australia in autumn and winter. During the spring and summer, the parrot breeds in Tasmania before migrating north dispersing into the mainland in the wintering period to feed on mature forest trees. Dominant feeding trees for the swift parrot on the South Coast include swamp mahogany (*Eucalyptus bothryoides*), forest red gum or drier forests and woodlands comprising a high density of spotted gum (Menkhorst 1999, Saunders and Heinsohn 2008).

Swift parrots are likely to occasionally forage in winter flowering eucalypts present in the study area particularly during years where the abundance of flowering in the landscape is sufficient to draw individuals to the region. Foraging hotspots for swift parrot are known throughout the study locality which provide a reliable quantity and quality of nectar resources in dominated patches of spotted gum, particularly in Mogo State Forest and nearby Boyne State Forest, Benandarah State Forest and Currowan State Forest to the

north. The site is not located in areas mapped on the DPIE draft important habitat map for swift parrot, however, areas in the study area's locality are considered to be priority foraging habitats and are important for the long-term survival of non-breeding migrants which are repeatedly visited between seasons (Saunders and Tzaros, 2011).

Twenty-minute bird census surveys were undertaken throughout patches of suitable habitat in the study area during August 2019. The swift parrot was not detected. However, there are areas of vegetation containing profuse flowering resources, such as spotted gum in the study area, particularly in PCT 1206 and PCT 1220. Survey effectiveness was limited as, due to drought conditions, winter flowering eucalypts were not flowering at the time of survey and hence the species has been assumed present. There are six recorded sightings on the Bionet Atlas database from within 10 km of the study area, mostly to the west in Mogo State Forest. While foraging habitat is assumed present important habitat has not been identified by DPIE for swift parrot at this location.

Due to the dominance of epicormically resprouting eucalypts in the study area, foraging habitat for swift parrot is likely to regenerate within three to five years when winter flowering eucalypts recommence flowering.

Table F.5 Five part test of significance in accordance with Part 7.3 of the BC Act: swift parrot

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
Criteria	a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction
Response	Potential impacts on the swift parrot are associated with the direct loss of foraging habitat, including nectar-producing trees and shrubs. Autumn-winter flowering eucalypts, such as those present in the study area are important for the over-wintering life-cycle of swift parrot in the coastal regions of NSW. Extensive areas of similar habitat are present in the local landscape, particularly in Mogo State Forest to the south and east of the study area. Habitat in and around the study area has not been identified as important habitat in draft important habitat mapping for the swift parrot. Consequently, a reduction of up to 15.95 ha of suitable foraging habitat for the swift parrot along the current alignment is unlikely to have an adverse effect on the life cycle of the species such that the viable local population is likely to be placed at risk of extinction.
Criteria	b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Response	Not applicable
Criteria	c) in relation to the habitat of a threatened species or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity and: (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
Response	<p>(i) The proposal is likely to result in clearing of up to 15.95 ha (Zones 1, 2 and 5) of suitable foraging habitat for the Swift Parrot. The local, contiguous extent of suitable foraging habitat is estimated at approximately 34,848 ha, this would be reduced by around 0.04 per cent.</p> <p>(ii) Due to the high mobility of swift parrot, the proposed works would not fragment a population of this species or and is very unlikely to create a barrier to movements across the landscape. The swift parrot is a very wide-ranging and highly mobile species capable of moving considerable distance to access seasonally available food resources.</p> <p>(iii) Native vegetation in the study area is likely to be utilised for individuals travelling and foraging through the landscape. Habitat in and around the study area has not been identified as important habitat in draft important habitat mapping for the swift parrot. Considering the large extent of uncleared winter flowering eucalypts in the region (i.e. Mogo State Forest, Boyne State Forest, Benandarah State Forest, Currowan State Forest), the habitat that would be impacted by the proposal is unlikely to be important for the long-term survival of the Swift Parrot.</p> <p>The study area was affected by bushfire on 31 December 2019 at an intensity that resulted in the understorey, midstorey and canopy of the entire site being burnt or scorched. The majority of the landscape south and west of the study area was also burnt. Given the intensity of the fire in the study area, the vegetation does not currently support suitable habitat, or foraging habitat potentially important during the fire recovery period, for this species. Consistent with certain affected parts of the surrounding landscape the vegetation of the study area is expected to recover to the extent that it will support suitable habitat in the future.</p>
Criteria	d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)
Response	The proposal would not impact on any declared area of outstanding biodiversity value.
Criteria	e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process
Response	<p>The proposal would result in potential increased impacts of 'Clearing of native vegetation' with the removal of up to 15.95 ha of suitable breeding and foraging habitat for this species. Considering the large extent of uncleared winter flowering eucalypts in the region (i.e. Mogo State Forest, Boyne State Forest, Benandarah State Forest, Currowan State Forest), the small extent of clearing is unlikely to result in an increase in the impacts of this key threatening process on swift parrot.</p> <p>While there is potential for other KTPs of relevance to this species to be affected by the proposal, these KTPs are likely to be able to be adequately managed by Transport for NSW's standard environmental management measures.</p>
Conclusion	It is unlikely that there would be a significant adverse impact on the swift parrot as a result of the proposal.

Square-tailed kite – Vulnerable

The square-tailed kite is a specialist predator of passerine birds, most commonly the nestlings of honeyeaters. The square-tailed kite is found in a variety of ecosystem types but shows a preference for timbered riparian zones. The home range of the square-tailed kite is very large, hunting over an area of more than 100 square km.

Square-tailed kite was observed flying above the study area and is likely to utilise native vegetation within the study area for foraging. Extensive similar foraging habitat is present, in the surrounding landscape with the exception of the immediate urban area of Batemans Bay to the north and east of the study area. While the species may breed in the region and within the identified vegetation types, no large stick nests were observed on the study area and hence breeding habitat is absent. The site does not comprise important habitat for the species.

Table F.6 Five part test of significance in accordance with Part 7.3 of the BC Act: square-tailed kite

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
Criteria	a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction
Response	The proposed works are unlikely to have any adverse impacts on the lifecycle of the square-tailed kite. No breeding locations were present.
Criteria	b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Response	Not applicable
Criteria	c) in relation to the habitat of a threatened species or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity and: (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality
Response	(i) A reduction of up to 22.68 ha of suitable foraging habitat for the square-tailed kite along the current alignment is unlikely to greatly affect the feeding opportunities of this species, which typically occupies very large ranges. (ii) The proposed works would not fragment a population of this species and is very unlikely to create a barrier to movements across the landscape. (iii) The habitat present is unlikely to be important for the survival of square-tailed kite populations or local occurrences. The study area burned on 31 December 2019 at an intensity that resulted in the understory, midstorey and canopy of the entire site being burnt or scorched. The majority of the landscape south and west of the study area was also burnt. Given the intensity of the fire in the study area, the vegetation does not currently support suitable habitat, or a potential refugia in the short-term, for this species. Consistent with certain affected parts of the surrounding landscape the vegetation of the study area is expected to recover to the extent that it will support suitable habitat in the future.
Criteria	d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
Response	The proposal would not impact on any declared area of outstanding biodiversity value.
Criteria	e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process
Response	<p>The proposal would result in the 'Clearing of native vegetation' with the removal of up to 22.68 ha of suitable foraging habitat for the square-tailed kite. Clearing resulting from this proposal would have a negligible increase on the impact of this KTP on square-tailed kite.</p> <p>While there is potential for other KTPs of relevance to this species to be affected by the proposal, these KTPs are likely to be able to be adequately managed by Transport for NSW's standard environmental management measures.</p>
Conclusion	The proposed works are likely to have a negligible impact on square-tailed kite.

Sooty owl, powerful owl, masked owl - Vulnerable

The forest owls are predatory birds that hunt over large ranges, primary feeding on ground and tree dwelling mammals such as gliders, possums and rats. Large and very large hollows are required by the forest owls for roosting and breeding purposes. The powerful owl inhabits a range of habitats from dry sclerophyll forest to rainforest, whereas the masked owl tends to favour dry *Eucalypt* forests and woodlands and the sooty owl favours rainforests and moist *Eucalypt* forests. All three species have previously been detected in or adjacent to the study area and sooty owl was confirmed present along Hanging Rock Creek during nocturnal surveys conducted in August.

Sooty owl was confirmed to be active within Hanging Rock Creek during nocturnal surveys conducted in August and September 2019, with at least one calling individual heard on separate survey nights. Powerful owl and masked owl were not confirmed present in the study area during survey. However, due to the presence of numerous past records in and adjacent to the study area, they are anticipated to utilise the landscape for foraging and have been assigned a moderate likelihood of occurrence on this basis.

Detection of sooty owl within the breeding season indicates the likely presence of a roosting site in or adjacent to the study area and potential for this species to utilise the study area for breeding. Sooty owls are known to be faithful to a breeding hollow. Systematic searches did not identify any trees with evidence of active use such as extensive white-wash or castings. One casting of an undetermined species of forest owl, was recorded close to the southern boundary of the study area, outside the construction boundary, however based on the absence of multiple castings this did not appear to represent a regularly utilised roost site. The absence of detection of other owl species does not discount the possibility that they may utilise breeding habitat in some seasons, as the species tend to utilise multiple breeding locations over different years.

The abundance of hollow bearing trees, potential foraging resources and habitat structure in timbered vegetation zones means that there are likely to be an abundance of prey species for forest owls. This was confirmed by the detection of a range of arboreal and small terrestrial mammals in the study area. Targeted searches for nesting or roosting trees in the study area identified numerous mature with large and very large hollows within 100 metres of drainage lines potentially suitable for as roosting and/or nesting sites for forest owls. The majority of large hollow bearing trees were located along drainage lines in areas not subject to recent logging, however scattered large mature trees were present elsewhere in the study area.

The habitat present within the study area is likely to be consistent with extensive areas of similar habitat present throughout the landscape to the west of the study area in adjacent areas of Mogo State Forest. Habitat is likely to be absent from urban areas to the north and east of the study area. All three species are likely to utilise the surrounding landscape. Despite the absence of a confirmed nesting tree, the confirmed presence of sooty owl on multiple survey nights during the breeding season means that areas supporting large hollow-bearing trees within 100 metres of riparian areas should be assumed to comprise breeding habitat for this species. Zone 5 is not likely to support breeding habitat due to the extensive disturbance.

Fire impacts have resulted in opening up of the midstorey and destabilisation of many trees with suitable large and very large hollows. Due to the abundance of suitable hollows in the landscape, it has been assumed that not all potential nesting trees have been impacted by bushfire. In the short term, foraging opportunity in burnt areas is likely to be reduced due to the loss of potential prey species.

While degraded by fire in the short term, it has been assumed on a precautionary basis that habitat can recover sufficiently to support forest owls, including breeding habitat for sooty owl. Breeding habitat for sooty owl has been mapped in intact timbered areas (i.e. Zones 1, 2, 7 8 and 9) within 100 metres of a mapped drainage line. Foraging habitat for all forest owls is predicted to occur throughout timbered areas. Large and very large tree hollows within this buffer area should be considered potential forest owl nest and roost trees, although certain areas may have reduced likelihood due to disturbance levels.

Table F.7 Five part test of significance in accordance with Part 7.3 of the BC Act: forest owls

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
Criteria	a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction
Response	Potential impacts on forest owls is largely associated with the direct loss of potential breeding and foraging habitat. The removal of up to 13 trees with 19 potentially suitable hollows for large forest owls within 100 metres of drainage has the potential to impact breeding of sooty owl. However, core riparian habitat with large hollow bearing trees has been avoided through refinement of the construction boundary and surveys identified numerous suitable breeding hollows in the local area which would be retained. In the short term, however, breeding is unlikely to occur in the study area due to the impacts of bushfire. Clearing of trees should be undertaken outside the breeding season for sooty owl, or following confirmation by a qualified ecologist that breeding is not occurring in trees to be removed, in lines with the Biodiversity Guidelines (Roads and Traffic Authority, 2011). The study area is located on the edge of Mogo State Forest and extensive areas of suitable breeding habitat for forest owls. It is unlikely that the proposal would impact the life cycle of forest owls such that any local populations are placed at risk of extinction.
Criteria	b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Response	Not applicable
Criteria	c) in relation to the habitat of a threatened species or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity and:

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
	<ul style="list-style-type: none"> (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality
Response	<ul style="list-style-type: none"> (i) The proposal has the potential to result in clearing of up to 7.69 ha of breeding habitat for sooty owl including up to 13 trees supporting potentially suitable hollows. However, the construction boundary has been adjusted to avoid impacts on the most likely areas of breeding habitat, such that the majority of suitable nest and roost trees would be retained in the study area. (ii) Due to the high mobility of forest owls, the proposed works are unlikely to create a barrier to movements of these species across the landscape. Isolation of native vegetation in the Hanging Rock Creek catchment has the potential to reduce the availability of food species within the core habitat area. (iii) Habitat avoided by the proposal in Hanging Rock Creek has the potential to be breeding habitat for sooty owl which is known to utilise this area however, core potential breeding habitat and the majority of suitable nest trees have been avoided. Habitat to be cleared predominantly comprises disturbed habitat around the head of Hanging Rock Creek, which, while part of habitat utilised by large forest owls in the landscape, is less likely to be used for breeding. Up to 15.95 ha of foraging habitat for forest owls would be cleared. The study area was affected by bushfire on 31 December 2019 at an intensity that resulted in the understorey, midstorey and canopy of the entire site being burnt or scorched. The majority of the landscape south and west of the study area was also burnt. Given the intensity of the fire in the study area, the vegetation does not currently support suitable habitat, nor is it likely to support foraging or breeding habitat important for the recovery of forest owls. Consistent with the surrounding landscape the vegetation of the study area is expected to recover in the long term to the extent that it will support suitable habitat in the future. Due to the extensively vegetated nature of the landscape to the west of the study area and the extensive distribution of potential habitat for forest owls (assuming no fire impacts), while potentially important for a local breeding pairs prior to fires, potential habitat in the study area is unlikely to be important for the long-term survival of forest owls in the local landscape
Criteria	d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)
Response	The proposal would not impact on any declared area of outstanding biodiversity value.
Criteria	e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process
Response	The proposal would potentially increase impacts of the 'Clearing of native vegetation' and 'loss of hollow bearing trees' KTPs on forest owls. The removal of up to 13 trees supporting up to 19 potentially suitable sized hollows within 100 metres of drainage lines and the removal of suitable foraging habitat may adversely impact these species in the study area. In the context of surrounding habitat resources in the landscape, the extent of clearing and hollow bearing tree removal is not likely to substantially increase threats to the survival of large forest owls.
Conclusion	<p>The reproductive success of sooty owl may be reduced as a result of the removal of up to 7.69 ha of breeding habitat and 13 trees supporting suitable hollows.</p> <p>The feeding opportunities for the three large forest owl species are likely to be reduced locally, with the removal of up to 22.68 ha (Zones 1, 2, 3, 4, 5 and 6) of suitable foraging</p>

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
	habitat for the Powerful Owl and the Masked Owl and of up to 15.95 ha (Zones 1, 2 and 5) of suitable foraging habitat for the Sooty Owl. However, this reduction in foraging habitat is unlikely to significantly affect the forest owls' ability to access adequate food, due to their ability to hunt over large distances.

Cave roosting micro-bats (large bent-winged bat and large-eared pied bat) – Vulnerable

No natural escarpments, caves or mine shafts were identified in the study area or within two km of the study area, hence potential breeding or important roosting habitat for cave-dependent micro-bats, specifically the large bent-winged bat and large-eared pied bat is absent, based on the NSW guidelines for 'Species credit' threatened bats and their habitats (OEH, 2018). Foraging habitat for large-eared pied bat is absent in accordance with the guidelines for 'Species credit' threatened bats and their habitats (OEH, 2018), the species has been considered present in the landscape for the purposes of significance assessment on a precautionary basis due to the detection of a possible call. Foraging habitat for the large bent-winged bat is likely to be present, however the habitat type and quality is consistent with habitat throughout the surrounding landscape to the west of the study area. It is unlikely that the bushfire would have any long-term impact on the suitability of foraging habitat in the study area for cave roosting microbats.

Table F.8 Five part test of significance in accordance with Part 7.3 of the BC Act: cave roosting micro-bats

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
Criteria	a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction
Response	The proposed works are not likely to adversely impact large bent-winged bat breeding or migratory behaviour or large-eared pied-bat breeding behaviour. No likely roosting or breeding locations are located in the study area or within 2 km of the study area. There is not likely to be any adverse effect on the life cycle of either species.
Criteria	b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Response	Not applicable.
Criteria	c) in relation to the habitat of a threatened species or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity and: (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity and

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
	(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality
Response	<ul style="list-style-type: none"> (i) There may be a reduction by up to 15.95 ha (Zones 1, 2, 5 and 6) of potential large bent-winged bat and large-eared pied bat foraging habitat. (ii) The proposal is unlikely to fragment any habitat for large bent-winged bat or large-eared pied bat such that dispersal is impacted. (iii) No important habitat is likely to be removed, fragment, modified or isolated. (iv) The study area burned on 31 December 2019 at an intensity that resulted in the understory, midstorey and canopy of the entire site being burnt or scorched. The majority of the landscape south and west of the study area was also burnt. Given the intensity of the fire and absence of roosting locations, habitat in the construction boundary is unlikely to have provided refuge during the fire for cave roosting microbats and is therefore unlikely to be important for recolonization following the fire. Consistent with certain affected parts of the surrounding landscape the vegetation of the study area is expected to recover to the extent that it will support suitable habitat in the future.
Criteria	d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)
Response	The proposal would not impact on any declared area of outstanding biodiversity value.
Criteria	e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process
Response	<p>The proposal would result in the 'Clearing of native vegetation' of up to 15.95 ha of suitable foraging habitat for cave roosting bats.</p> <p>While there is potential for other KTPs of relevance to this species to be affected by the proposal, these KTPs are likely to be able to be adequately managed by Transport for NSW's standard environmental management measures.</p>
Conclusion	The proposal is unlikely to have a significant adverse impact on large bent-winged bat or large-eared pied bat.

Spotted-tailed quoll - Endangered

The spotted-tailed quoll occurs in a range of forest types in eastern Australia and require suitable den sites such as rock crevices, caves, hollow logs, burrows and tree hollows. The spotted-tailed quoll is likely to occur in the largely continuous forested landscape to the south-west and west of Batemans Bay including the study area. The study area does not support habitat distinct from elsewhere within the surrounding landscape and is not likely to be important habitat for the species. The impacts of construction and operation of the proposal would be confined to loss of habitat caused by direct clearing or damage to native vegetation during the construction phase.

However, the study area was burnt at high intensity during the 2019 – 2020 fires and does not contain any refuge patches for the species likely to be important for species recovery. It is unlikely that the fire will have any long-term impact on the suitability of habitat in the study area for spotted-tailed quoll.

Table F.9

Five part test of significance in accordance with Part 7.3 of the BC Act: spotted-tailed quoll

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
Criteria	a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction
Response	The proposed action is unlikely to have any adverse impacts on the life cycle of spotted-tailed quoll such that a viable local population of the species is likely to be placed at risk of extinction given the importance of the habitat and the extent of potential habitat likely to be removed. Habitat present is not known to play a specific role in the lifecycle of the species.
Criteria	b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Response	Not applicable.
Criteria	c) in relation to the habitat of a threatened species or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity and: (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality
Response	i) The proposal would result in clearing of up to 15.95 ha (Zones 1, 2 and 5) of potential habitat for the spotted-tailed quoll. ii) The proposal may increase fragmentation and patch isolation by increasing the distance between the remaining vegetation patches, particularly patches on the east side of the highway however this is unlikely to prevent spotted-tailed quoll from dispersing through such areas. iii) Habitat potentially removed and fragmented is unlikely to be important for the long-term survival of spotted-tailed quoll in the region. The study area burned on 31 December 2019 at an intensity that resulted in the understory, midstorey and canopy of the entire site being burnt or scorched. The majority of the landscape south and west of the study area was also burnt. Given the intensity of the fire in the study area, the vegetation does not currently support suitable habitat, or a potential refugia in the short-term, for this species. Consistent with certain affected parts of the surrounding landscape the vegetation of the study area is expected to recover to the extent that it will support potential habitat in the future.
Criteria	d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)
Response	The proposal would not impact on any declared area of outstanding biodiversity value.
Criteria	e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
Response	<p>The proposal would result in the 'Clearing of native vegetation' with the removal of 15.95 ha (zones 1, 2 and 5) of potential habitat for this species. The clearing of native vegetation and removal of dead trees occurring as a result of the proposed action constitute a key threatening process, however the extent of clearing and habitat removal is negligible in the context of habitat available in the surrounding areas of Mogo State Forest.</p> <p>While there is potential for other KTPs of relevance to this species to be affected by the proposal, these KTPs are likely to be able to be adequately managed by Transport for NSW's standard environmental management measures.</p>
Conclusion	It is unlikely that there would be a significant adverse impact on spotted-tailed quoll as a result of the proposal.

Tree roosting micro-bats (eastern false pipistrelle, eastern coastal free-tail bat, yellow-bellied sheath-tail-bat, greater broad-nosed bat, southern myotis) – Vulnerable

Numerous hollow bearing trees are present throughout the study area. Based on the habitat features present, suitable breeding and roosting habitat for eastern false pipistrelle, eastern freetail-bat, greater broad-nosed bat, yellow-bellied sheath-tail-bat and southern myotis should be assumed to be present. All areas supporting forest or degraded forest within the study area are likely to be habitat for hollow-dependent micro-bats. Although the southern myotis generally roosts in caves, it is also able to utilise tree hollows located within 200 metres of water sources. Given that there are no caves in the study area, the southern myotis is assessed alongside tree-roosting micro-bats rather than with cave-roosting bats in Table F.8. As potential southern myotis calls were recorded in the study area, areas within 200 metres of standing water may support potential roosting habitat for the species.

Table F.10 Five part test of significance in accordance with Part 7.3 of the BC Act: tree roosting micro-bats

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
Criteria	a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction
Response	Potential impacts on the tree roosting bats are associated with the direct loss of breeding and foraging habitat. The removal of up to 72 hollow bearing trees that may be used by tree roosting bats as breeding habitat is likely to affect their reproductive success in the immediate vicinity of proposal, however this is not likely to disrupt the overall lifecycle of the local population. No hollow bearing trees would be removed within the mapped potential southern myotis habitat. Works within the species habitat for southern myotis is unlikely to have any impact on the species.
Criteria	b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: <ul style="list-style-type: none"> (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
Response	Not applicable
Criteria	<p>c) in relation to the habitat of a threatened species or ecological community:</p> <p>(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity and:</p> <p>(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity and</p> <p>(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality</p>
Response	<p>i) The removal of up to 72 hollow bearing trees that may be used by tree roosting bats as breeding habitat is likely to be negligible in the context of the relatively high abundance of hollow bearing trees present in the landscape. A reduction in up to 15.95 ha (Zones 1, 2, 5 and 6) of suitable foraging habitat for the tree roosting bats along the current alignment is similarly unlikely to affect the feeding opportunities of this species in the context of resources available in the study area and surrounding landscape. Artificial structures in the old timber mill site which may provide roosting habitat would also be removed. No hollow bearing trees would be removed within the potential southern myotis habitat. Works within the mapped habitat for southern myotis is unlikely to have any impact on the species.</p> <p>ii) The proposed works are unlikely to create a significant barrier to movements of tree-roosting microbats across the landscape.</p> <p>iii) Roosting and foraging habitat to be removed is very similar to habitat located extensively throughout Mogo State Forest to the south and west of the study area and is not likely to be important for the long-term survival of the species. The study area burned on 31 December 2019 at an intensity that resulted in the understory, midstorey and canopy of the entire site being burnt or scorched. The majority of the landscape south and west of the study area was also burnt. Given the intensity of the fire, habitat in the construction boundary is unlikely to have provided refuge during the fire for hollow roosting microbats and is therefore unlikely to be important for recolonization following the fire. Consistent with certain affected parts of the surrounding landscape the vegetation of the study area is expected to recover to the extent that it will support suitable habitat in the future.</p>
Criteria	d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)
Response	The proposal would not impact on any declared area of outstanding biodiversity value.
Criteria	e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process
Response	<p>The proposal would result in the 'Clearing of native vegetation' and 'loss of hollow bearing trees' with the removal of up to 72 hollow bearing trees which may be used as breeding sites and of up to 15.95 ha of suitable foraging habitat for tree roosting bats. The extent of clearing and dead tree removal is not likely to substantially increase threats to tree roosting microbats in the context of habitat available in the surrounding areas of Mogo State Forest.</p> <p>While there is potential for other KTPs of relevance to this species to be affected by the proposal, these KTPs are likely to be able to be adequately managed by Transport for NSW's standard environmental management measures.</p>

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
Conclusion	The proposal would result in local reductions in breeding and foraging habitat for tree roosting microbats, however this would not have a significant adverse impact on eastern false pipistrelle, eastern freetail-bat, greater broad-nosed bat, yellow-bellied sheath-tail-bat or southern myotis.

Southern brown bandicoot - Endangered

The southern brown bandicoot prefers sandy soils with scrubby vegetation and/or areas with low ground cover that are burnt from time to time. A mosaic of post fire vegetation is important for this species. They have a patchy distribution and are found in south-eastern NSW, east of the Great Dividing Range south from the Hawkesbury River.

Potential suitable habitat occurs in dense understory vegetation along Hanging Rock Creek in Zone 1 and Zone 9 on the eastern boundary of the study area. Impacts to potential southern brown bandicoot habitat is limited to access track upgrades along the creek and drainage lines west of Princes Highway in Zone 1. Up to 0.37 ha of potential habitat would be impacted in the construction boundary and no habitat is present in the operational boundary. All habitat was intensely burnt during the 2019 – 2020 fires and the species is consequently unlikely to persist in the study area. There is, however, potential for habitat to regenerate in the study area in the medium to long term.

Table F.11 Five part test of significance in accordance with Part 7.3 of the BC Act: southern brown bandicoot

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
Criteria	f) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction
Response	The proposed action is unlikely to have any impacts on the life cycle of southern brown bandicoot.
Criteria	g) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: (iii) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or (iv) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Response	Not applicable.
Criteria	h) in relation to the habitat of a threatened species or ecological community: (iv) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity and: (v) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity and (vi) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
Response	<p>iv) The area of local occupancy for this species is potentially in surrounding state forests and conservation reserves with understorey vegetation structure within 50-80 per cent foliage cover. The majority of native vegetation in the study area does not constitute habitat for the species, with the construction boundary avoiding impacts on most potential habitat. A total of up to 0.37 ha of native vegetation with characteristics potentially suitable for bandicoot is likely to be cleared, which is negligible in the broader landscape context.</p> <p>v) The proposal may increase fragmentation and patch isolation by increasing the distance between the remaining vegetation east side of the highway and Mogo State Forest to the south. The study area is already fragmented by Princes Highway, Genella Road, the power easement and urban development, the proposal is likely to further increase the existing level of fragmentation of the patch in the study area.</p> <p>vi) Habitat potentially removed and fragmented is unlikely to be important for the long-term survival of southern brown bandicoot in the region, if present. The study area burned on 31 December 2019 at an intensity that resulted in the understorey, midstorey and canopy of the entire site being burnt or scorched. The majority of the landscape south and west of the study area was also burnt. Given the intensity of the fire in the study area and the loss of habitat features required by southern brown bandicoot, the species is unlikely to have survived in the study area. Consistent with certain affected parts of the surrounding landscape the vegetation of the study area is expected to recover to the extent that it will support potential habitat in the future.</p>
Criteria	i) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)
Response	The proposal would not impact on any declared area of outstanding biodiversity value.
Criteria	j) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process
Response	<p>The proposal would result in the 'Clearing of native vegetation' with the removal of up to 0.37 ha (zone 1) of suitable breeding and foraging habitat for this species. The proposal would result in 'Removal of dead wood and dead trees' which are valuable shelter and feeding habitat for the species. The clearing of native vegetation and removal of dead trees occurring as a result of the proposal constitute action of a key threatening process, however the extent of clearing and habitat removal is negligible in the context of habitat available in the surrounding areas of Mogo State Forest and the local population is not threatened by the activity.</p> <p>While there is potential for other KTPs of relevance to this species to be affected by the proposal, these KTPs are likely to be able to be adequately managed by Transport for NSW's standard environmental management measures.</p>
Conclusion	The proposal is considered unlikely to have a significant adverse impact on the southern brown bandicoot. The majority of suitable habitat in the study area would be avoided and only a small area of degraded potential habitat would be disturbed.

Yellow-bellied glider – Vulnerable

Yellow-bellied gliders have a patchy distribution along the coast and montane ranges of eastern Australia from central Queensland to south-east Victorian. Yellow-bellied gliders are usually associated with tall, mature wet eucalypt forest in high rainfall areas.

This species spends large amounts of time foraging within extensive home ranges (20-85 ha) occupied by family groups of between two and six individuals (Lindenmayer, 2002) at low overall densities. The diet of this species includes plant exudates (sap, nectar, honeydew and manna) as well as insects. Sap is tapped from the trunks of trees via chewed "V" shaped incisions or in some cases extended vertical incisions (Goldingay & Kavanagh 1991). The shedding of bark by tree species is considered important for the gathering of invertebrates and honeydew. Hollows for nest sites (den trees) are vital, including suitable food trees. Gliders are sensitive to loss of tree hollows, foraging habitats and fragmentation (Russell 1995).

Yellow-bellied glider were confirmed present in the study area during nocturnal surveys conducted in August 2019. At least three individuals were recorded along Hanging Rock Creek and one individual was recorded west of Princes Highway. Numerous hollow bearing trees are present within the study area and all areas of relatively intact vegetation are likely to be habitat, i.e. Zones 1, 2, 7, 8 and 9. Cleared and recently logged areas are unlikely to constitute habitat for yellow-bellied glider. The study area has the potential to support one to three family groups and habitat is limited by the extent of the habitat patch rather than the number of hollows available.

The habitat present is consistent with extensive similar habitat present throughout the landscape to the south and west of the study area in adjacent areas of Mogo State Forest. Due to the location of the study area on the urban edge and adjacent to Princes Highway, connectivity and edge effects are likely to be greater in the study area relative to more extensive and less fragmented habitat elsewhere in the State Forest. Important habitat areas supporting family groups may potentially be restricted to drainage lines and protected corridors due to extensive timber harvesting activities throughout Mogo State Forest.

Fire impacts on yellow-bellied glider are variable across the species' range, however the species is likely to be vulnerable to direct mortality and loss of habitat as a result of fire. The 2019 – 2020 fires are estimated to have impacted approximately 54 per cent of recorded locations for the species (DPIE, 2020). Depending on fire intensity, yellow-bellied glider individuals may survive in protected in blind hollows high in the canopy, however due to the high fire intensity in the study area, there is a high probability that most or all individuals did not survive the fire. The study area does not have any unburnt patches, or areas of low fire intensity likely to provide refuges and post-fire foraging habitat, which would be important for the species following the fire. In the event that yellow-bellied gliders persist at the location, however, these individuals may be important for colonisation of the surrounding landscape.

Table F.12 Five part test of significance in accordance with Part 7.3 of the BC Act: yellow-bellied glider

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
Criteria	a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction
Response	The proposal avoids the core breeding habitat in Hanging Rock Creek and is not likely to directly interfere with the life cycle of the locally occurring family groups or the local population present in Mogo State Forest to the south and west of the study area. The study area is not located at any sites important for the life cycle of the local population in Mogo State Forest.
Criteria	b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
Response	Not applicable
Criteria	<p>c) in relation to the habitat of a threatened species or ecological community:</p> <ul style="list-style-type: none"> (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity and: (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality
Response	<ul style="list-style-type: none"> i) The proposal would remove up to 13.62 ha (Zones 1, 2) of foraging and breeding habitat for this species. This represents about 22 per cent of native vegetation in the Hanging Rock Creek catchment. The proposal would impact on foraging opportunities of family groups occupying the Hanging Rock Creek catchment, result in a reduction in potential den trees available in the landscape. However, core habitat for the species, being large hollow bearing trees low in the landscape in areas not directly impacted by timber harvesting, would be avoided by the works. Sufficient habitat is likely to remain in the Hanging Rock Creek to support at least one family group, however long term viability may be reduced. The works are not likely to impact the long term survival of the species in the broader locality, with extensive areas of occupied habitat present in Mogo State Forest to the south and west of the study area. ii) The proposal is likely to increase fragmentation and reduce dispersal capability of family groups occurring in the Hanging Rock Creek catchment by removing access to the south into adjacent areas of Mogo State Forest. Connectivity is already highly constrained, with connectivity to the west limited by the Princes Highway, power easements and urban development and the proposal is likely to remove the last feasible corridor for the species to the south across the existing Ridge Road. Due to their width and position in the landscape recently constructed parts of Glenella Road are likely to constitute a barrier. Fragmentation has a potential to have adverse impacts on locally occurring family groups within the study area but is unlikely to have any adverse impacts on long term survival of populations in the surrounding areas of Mogo State Forest. iii) Habitat within the Hanging Rock Creek catchment is unlikely to be important for the survival of yellow-bellied glider in the surrounding area, as extensive areas of habitat known to support the species are present in Mogo State Forest. The area has not been identified as important habitat. The study area burned on 31 December 2019 at an intensity that resulted in the understory, midstorey and canopy of the entire site being burnt or scorched. The majority of the landscape south and west of the study area was also burnt. Given the intensity of the fire in the study area is high and consistent with the surrounding landscape it is unlikely to have supported a refuge for the species during the fire from which the species may be able to colonise the surrounding landscape. Consistent certain with affected parts of the surrounding landscape the vegetation of the study area is expected to recover to the extent that it will support suitable habitat in the future. If the yellow-bellied glider population in Hanging Rock Creek catchment has survived the 2019 – 2020 bushfire, there is potential for the proposal to partly or completely isolate these family groups from the population in the surrounding landscape. Further assessment of whether individuals persist within the Hanging Rock Creek catchment may be warranted to inform planning for connectivity measures. Due to the alignment of the proposal along The Ridge Road, where there is a steep slope and the extent of cut and fill required, retention of trees in a median to retain connectivity for gliders is

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
	not feasible. The location of the proposed road on a steep slope is also likely to limit gliding distance substantially. If a population of yellow-bellied gliders persist in the Hanging Rock Creek catchment following the fire, the population has the potential to be important for the recolonization of the surrounding landscape.
Criteria	d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)
Response	The proposal would not impact on any declared area of outstanding biodiversity value.
Criteria	e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process
Response	<p>The proposal may result in the action of two key threatening processes (KTPs): the 'Clearing of native vegetation' with the removal of up to 13.62 ha (zones 1, 2 and 5) of suitable breeding and foraging habitat for this species and 'loss of hollow-bearing trees' which are potential denning habitat for the species. The clearing of native vegetation and removal of dead trees occurring as a result of the proposal constitute action of a KTP, however the extent of clearing and habitat removal is negligible in the context of habitat available in the surrounding areas of Mogo State Forest and the local population is not threatened by the activity.</p> <p>While there is potential for other KTPs of relevance to this species to be affected by the proposal, these KTPs are likely to be able to be adequately managed by Transport for NSW's standard environmental management measures.</p>
Conclusion	After consideration of the factors above, the proposal is likely to have negative impacts on locally occurring family groups of yellow-bellied glider in the study area but unlikely to have a significant adverse impact on the population of this species in the locality.

Grey-headed flying-fox – Vulnerable

Grey-headed flying-fox exists as a single interconnected population in Australia. No roost camps were recorded in the study area during targeted surveys and the proposal would not impact on any known permanent roosting, breeding / maternity site. The nearest roost sites are at the Batemans Bay Water Gardens and Catalina Country Club approximately 1.5 km from the study area and the species has been recorded in adjacent forestry land. The roost camp at Batemans Bay Water Gardens is identified as nationally significant. Extensive areas of equivalent potential foraging habitat are present in the landscape to the west of the study area in Mogo State Forest. The impacts of construction and operation of the proposal would be confined to loss of feeding habitat caused by direct clearing or damage to native vegetation during the construction phase.

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
Criteria	a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction
Response	Potential impacts on the grey-headed flying-fox are associated with the direct loss of foraging habitat. No roosting habitat would be impacted hence there would be no adverse impacts on the life-cycle of the species.
Criteria	b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Response	Not applicable
Criteria	c) in relation to the habitat of a threatened species or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity and: (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality
Response	i) A reduction in up to 15.95 ha (Zones 1, 2 and 5) of suitable foraging habitat for the grey-headed flying-fox along the current alignment would impact the feeding opportunities of this species. The extent of habitat to be removed is negligible in relation to similar habitat present elsewhere in the landscape. ii) The proposed works would not fragment a population of this species and is very unlikely to create a barrier to movements across the landscape. iii) The foraging habitat to be removed is similar to habitat present throughout the landscape to the south and east and is not important to the species. No important habitat (i.e. roosts) would be directly or indirectly impacted by the proposal. The study area burned on 31 December 2019 at an intensity that resulted in the understory, midstorey and canopy of the entire site being burnt or scorched. The majority of the landscape south and west of the study area was also burnt. Given the intensity of the fire, habitat in the study area does not provide important post-fire foraging resources. The vegetation of the study area is expected to recover to the extent that it will support suitable foraging habitat in the future.
Criteria	d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)
Response	The proposal would not impact on any declared area of outstanding biodiversity value.
Criteria	e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process

Test	The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
Response	The proposal would result in the 'Clearing of native vegetation' with the removal of up to 15.95 ha (Zones 1, 2 and 5) of suitable foraging habitat for the grey-headed flying-fox. The extent of clearing would have a negligible impact on grey-headed flying-fox in the context of habitat available in the surrounding areas of Mogo State Forest and the local population is not threatened by the activity. While there is potential for other KTPs of relevance to this species to be affected by the proposal, these KTPs are likely to be able to be adequately managed by Transport for NSW's standard environmental management measures.
Conclusion	The reduction of foraging habitat is unlikely to significantly affect the grey-headed flying-fox.

Appendix G Assessment of Significance under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act requires an Assessment of Significance relating to the potential impacts of an action on listed Matters of National Significance (MNES). An Assessment of Significance has been prepared according to the requirements of the Significant Impact Guidelines (DoE 2013) for threatened and migratory species that have the potential to occur in the vicinity of the study area. Identified EPBC listed species are:

- Critically Endangered species:
 - Swift parrot (*Lathamus discolor*)
- Endangered species:
 - Spotted-tailed quoll (*Dasyurus maculatus*)
 - Southern brown bandicoot (*Isodon obesulus obesulus*)
- Vulnerable species:
 - Large-eared pied bat (*Chalinolobus dwyeri*)
 - Grey-headed flying-fox (*Pteropus poliocephalus*)
- Migratory species:
 - Black-faced monarch (*Monarcha melanopsis*)
 - Satin flycatcher (*Myiagra cyanoleuca*)
 - Rufous fantail (*Rhipidura rufifrons*)

Large-eared Pied bat – Vulnerable

The large-eared pied bat is dependent on escarpments and cave roosting habitat, such as natural caves and mineshafts as well as artificial structures such as bridges and buildings and foraging habitat is typically areas within two km of such habitat (OEH, 2018). No escarpments, natural caves or mine shafts were identified in the study area, or within two kilometers of the study area, hence important roosting and foraging habitat for this species is absent. Despite this, possible large-eared pied bat calls were recorded in the study area and the species has been assumed present in the landscape on a precautionary basis.

Table G.1 Assessment of Significance in accordance with Significant Impact Guidelines 1.1 – Matter of National Environmental Significance under the EPBC Act: microbats (large-eared pied bat and southern myotis)

	An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:
Criteria	Lead to a long-term decrease in the size of an important population
Response	No potential roost or breeding sites would be disturbed as a result of the proposal. The reduction of foraging habitat of up to 15.95 ha is likely to be negligible in the context of equivalent foraging habitat present in the surrounding landscape. The proposed action is unlikely to lead to a long-term decrease in the size of an important population of large-eared pied bat.
Criteria	Reduce the area of occupancy of an important population
Response	The removal of up to 15.95 ha of large-eared pied bat foraging habitat is unlikely to reduce the area of occupancy of an important population of large-eared pied bat. An important population is unlikely to be present.
Criteria	Fragment an existing important population into two or more populations

	An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:
Response	The proposal would not fragment an important population of the large-eared pied bat given the dispersal capability of this species and the extent of vegetation to be removed. An important population is unlikely to be present.
Criteria	Adversely affect habitat critical to the survival of a species
Response	No habitat critical to the survival of large-eared pied bat, i.e. occupied roosting sites or adjacent foraging habitat as defined in the NSW guidelines for identification of bat habitat (OEH, 2018) would be adversely impacted by the proposed action.
Criteria	Disrupt the breeding cycle of an important population
Response	The proposed action is unlikely to disrupt the breeding cycle of an important population of large-eared pied bat given no breeding habitat is present in the study area. No important population is present.
Criteria	Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
Response	<p>Up to 15.95 ha of suitable foraging habitat would be removed as a result of the proposed action however this is unlikely to cause the large-eared pied bat to decline. Disturbance of foraging habitat in the study area is not identified as likely to influence population sizes as it is not located within two km of natural caves or escarpments likely to provide roosting or breeding habitat.</p> <p>The study area burned on 31 December 2019 at an intensity that resulted in the understory, midstory and canopy of the entire site being burnt or scorched. The majority of the landscape south and west of the study area was also burnt. Given the intensity of the fire in the study area, the vegetation does not currently support suitable habitat, or a potential refugia in the short-term, for this species. Consistent with certain affected parts of the surrounding landscape the vegetation of the study area is expected to recover to the extent that it will support suitable habitat in the future.</p>
Criteria	Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat
Response	No invasive species likely to be harmful to the large-eared pied bat are likely to become established as a result of the proposal.
Criteria	Introduce disease that may cause the species to decline, or
Response	There are no known disease issues affecting this species. There is potential for equipment, machinery and personnel to spread disease including phytophthora (<i>Phytophthora cinnamomi</i>) and/or myrtle rust (<i>Austropuccinia psidii</i>) affecting trees and shrubs in foraging habitat, however Transport for NSW procedures implemented adequately manage the risk of introduction of plant pathogens.
Criteria	Interfere substantially with the recovery of the species.
Response	The proposal would not interfere with activities being implemented for the recovery of large-eared pied bat.

	An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:
Conclusion	The proposal is unlikely to have a significant adverse impact on large-eared pied bat.

Spotted-tailed quoll – Endangered

Refer to species summary in Appendix F.

Table G.2 Assessment of Significance in accordance with Significant Impact Guidelines 1.1 – Matter of National Environmental Significance under the EPBC Act: spotted-tailed quoll

	An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:
Criteria	Lead to a long-term decrease in the size of a population of a species
Response	The reduction of potential or suitable habitat for spotted-tailed quoll by 15.95 ha is likely to be negligible in the context of equivalent foraging habitat present in the surrounding landscape. The affected area of foraging habitat would represent a small percentage of the total extent of important foraging vegetation types present within a 50 km radius of the proposal. Given the relative widespread nature of similar native vegetation in surrounding state forest in the locality and the lack of breeding habitat in the study area the proposal is not expected to lead to any long-term decrease in the size of the population.
Criteria	Reduce the area of occupancy of the species
Response	The proposal would remove 15.95 ha of potential habitat for the spotted-tailed quoll in a single patch.
Criteria	Fragment an existing population into two or more populations
Response	It is unlikely that the proposal would fragment an existing population into two or more populations given the extent of habitat to be removed.
Criteria	Adversely affect habitat critical to the survival of a species
Response	The habitat that would be impacted by the project is not considered to be habitat critical for the survival of the species, given that is unlikely to support breeding individuals.
Criteria	Disrupt the breeding cycle of a population
Response	While suitable den trees and hollow logs occur within the construction boundary, there are no elements of the breeding cycle of any important population of spotted-tailed quoll that would be disrupted at local, regional or national scales. Recent fire impacts have substantially decreased the availability of hollow logs, however it is likely that following post-fire tree fall would result in new hollow logs being introduced to the landscape.

	An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:
Criteria	Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
Response	<p>While the habitat clearance is likely to result in the potential decline in foraging habitat the extent of remaining habitat likely to be present in the surrounding area, including adjacent areas of Mogo State forest, is such that there is unlikely to be any decline in the spotted-tailed quoll population. Isolation of potential habitat in Hanging Rock Creek catchment is unlikely to impact spotted tailed quoll which are highly mobile.</p> <p>The study area was affected by bushfire on 31 December 2019 at an intensity that resulted in the understorey, midstorey and canopy of the entire site being burnt or scorched. The majority of the landscape south and west of the study area was also burnt. Given the intensity of the fire in the study area, the vegetation does not currently support suitable habitat, or a potential refugia in the short-term, for this species. Consistent with certain affected parts of the surrounding landscape the vegetation of the study area is expected to recover to the extent that it will support suitable habitat in the future.</p>
Criteria	Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat
Response	No invasive species likely to be harmful to the spotted-tailed quoll would be introduced as a result of the proposal.
Criteria	Introduce disease that may cause the species to decline, or
Response	There are no known disease issues affecting this species. There is potential for equipment, machinery and personnel to spread disease including phytophthora (<i>Phytophthora cinnamomi</i>) and/or myrtle rust (<i>Austropuccinia psidii</i>) to degrade foraging habitat. However, Transport for NSW procedures implemented adequately manage the risk of introduction of plant pathogens.
Criteria	Interfere substantially with the recovery of the species.
Response	The proposal is unlikely to result in any actions likely to interfere substantially with the recovery of spotted-tailed quoll.
Conclusion	The proposal is unlikely to have a significant adverse impact on spotted-tailed quoll. While the proposal will result in clearing of potential habitat, increase local fragmentation and may increase isolation of potential habitat in the Hanging Rock Creek catchment, this is unlikely to cause populations to decline or have a significant adverse impact on a population.

Southern brown bandicoot – Endangered

Refer to species summary in Appendix F.

Table G.3 Assessment of Significance in accordance with Significant Impact Guidelines 1.1 – Matter of National Environmental Significance under the EPBC Act: southern brown bandicoot

	An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:
Criteria	Lead to a long-term decrease in the size of a population of a species
Response	Southern brown bandicoot could forage and breed mostly to the east of the study area in habitats along Hanging Rock Creek, where understorey vegetation structure is within 50-80 per cent foliage cover. Disturbance to habitat is likely to be restricted to use of access tracks during construction, with no permanent impacts likely. The proposal is unlikely to remove a significant proportion of suitable habitat within the construction boundary, with up to 0.37 ha of disturbed habitat adjacent to existing access tracks and roads where edge effects already exist. The new road would not be located adjacent to potential habitat for southern brown bandicoot and hence there is likely to be minimal increase the risk of vehicle strike on individuals. Therefore, impacts are likely to be temporary and the proposal is unlikely to displace or disturb individuals such that there is a long-term decrease in the size of a population of the species.
Criteria	Reduce the area of occupancy of the species
Response	The proposal is unlikely to remove a significant proportion of suitable habitat within the construction boundary, with up to 0.37 ha of disturbed habitat adjacent to existing access tracks and roads where edge effects already exist. There may be minor indirect impacts to remaining areas of habitat due to edge effects, however the operational impacts would be located distant from potential habitat and are unlikely to reduce the area of occupancy of the species. Impacts are likely to be temporary, or located in marginal habitat where there are existing impacts and the proposal is unlikely to reduce the area of occupancy of the species.
Criteria	Fragment an existing population into two or more populations
Response	The proposal is likely to increase fragmentation of native vegetation in the landscape, resulting in patch isolation of potential habitat in Hanging Rock Creek catchment by increasing the distance between the remaining vegetation patches on the east side of the highway between Catalina. There is no existing connectivity of suitable habitat for the species, with vegetation communities present in the corridor typically having insufficient groundcover to support southern brown bandicoot. Vegetation in the surrounding area is fragmented by existing road developments, however the proposal would increase the width of vegetation separation along the alignment. The study area is already highly fragmented by Princes Highway, power easement and urban development, however the proposal is likely to further isolate the habitat fragment particularly in the south. While the proposal may isolate individuals present in the Hanging Rock Creek Catchment, there are extensive areas of similar habitat in Mogo State Forest to the south and if present this is where the majority of individuals would persist. While the proposal may contribute to isolating effects of potential habitat in Hanging Rock Creek catchment, there is limited potential for the proposal would fragment an existing population into two or more populations.
Criteria	Adversely affect habitat critical to the survival of a species
Response	The potential habitat that would be impacted by the project is not considered to be habitat critical for the survival of the species. There are no recent local records and the majority of potential habitat in the east of the study area, outside the construction boundary.

	An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:
Criteria	Disrupt the breeding cycle of a population
Response	There are no elements of the breeding cycle of southern brown bandicoot that would be disrupted at local, regional or national scales.
Criteria	Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
Response	<p>The disturbance or clearance of up to 0.37 ha of potential habitat and isolation of potential habitat in the Hanging Rock Creek catchment is unlikely to result in declines in the total population of the species.</p> <p>The study area was affected by bushfire on 31 December 2019 at an intensity that resulted in the understorey, midstorey and canopy of the entire site being burnt or scorched. The majority of the landscape south and west of the study area was also burnt. Given the intensity of the fire in the study area, it is unlikely that individuals survived in the study area and there is no potential post fire foraging habitat for this species in the short term. Consistent with certain affected parts of the surrounding landscape the vegetation of the study area is expected to recover to the extent that it will support suitable habitat in the future.</p>
Criteria	Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat
Response	No invasive species likely to be harmful to the southern brown bandicoot would be introduced as a result of the proposal.
Criteria	Introduce disease that may cause the species to decline, or
Response	There are no known disease issues affecting this species. There is potential for equipment, machinery and personnel to spread disease including phytophthora (<i>Phytophthora cinnamomi</i>) and/or myrtle rust (<i>Austropuccinia psidii</i>) to degrade foraging habitat. However, Transport for NSW procedures implemented adequately manage the risk of introduction of plant pathogens.
Criteria	Interfere substantially with the recovery of the species.
Response	The proposal would not interfere with activities being implemented for the recovery of southern brown bandicoot.
Conclusion	The proposal is unlikely to have a significant adverse impact on the southern brown bandicoot. The majority of potential habitat in the study area will be avoided and while the proposal would increase local fragmentation and may increase isolation of potential habitat in the Hanging Rock Creek catchment, this is unlikely to cause populations to decline or have a significant adverse impact on the local population.

Swift parrot – Critically Endangered

Refer to species summary presented in Appendix F

Table G.4 Assessment of Significance in accordance with Significant Impact Guidelines 1.1 – Matter of National Environmental Significance under the EPBC Act: swift parrot

	An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:
Criteria	Lead to a long-term decrease in the size of a population of a species
Response	The proposal is likely to result in a reduction in 15.95 ha of suitable foraging habitat for the Swift Parrot. The study locality is likely to be foraging habitat for swift parrot, due to the prevalence of high nectar producing winter flowering spotted gum in the region and evidence of site fidelity, particularly in Mogo State Forest and nearby Boyne State Forest, Benandarah State Forest and Currowan State Forest. Any individuals that use vegetation in the study area are likely passing through the landscape while foraging and, due to the large extent of similar habitat in the landscape are not constrained to use habitat in the study area. Habitat within the study area has not been identified on the draft important habitat map being prepared by DPIE. Given the large areas of remaining suitable foraging habitat in nearby State Forests and other conservation areas, the proposal is unlikely to lead to a long-term decrease in the size of the Swift Parrot population.
Criteria	Reduce the area of occupancy of the species
Response	Swift parrot is highly mobile and forages widely across the landscape when present in coastal NSW during winter. The area of local occupancy for this species in surrounding state forests and conservation reserves is estimated at approximately 34,848 ha. A reduction in 15.95 ha of suitable foraging habitat for the swift parrot across the whole proposal would be negligible in the context of potential foraging habitat in the local area. The local, contiguous extent of the suitable foraging habitat would be reduced by around 0.04 per cent and would have a small reduction on the area of local foraging occupancy for the population of swift parrot.
Criteria	Fragment an existing population into two or more populations
Response	Due to the species life history and highly mobile nature, the proposal would not fragment an existing population of swift parrot into two or more populations.
Criteria	Adversely affect habitat critical to the survival of a species
Response	<p>Habitat critical to the survival of a species refers to areas that are necessary for activities such as:</p> <ul style="list-style-type: none"> • Foraging, breeding, roosting, or dispersal • For the long-term maintenance of the species including the maintenance of other species essential to the survival of the species, such as pollinators • To maintain genetic diversity and long-term evolutionary development • For the reintroduction of populations or recovery of the species. <p>For swift parrot, winter flowering eucalypt forests in coastal NSW are critical to the survival of swift parrot. Considering the large extent of foraging habitat similar to that in the study area in the surrounding landscape Mogo State Forest and nearby Boyne State Forest, Benandarah State Forest and Currowan State Forest relative to the scale of the area to be cleared (15.95 ha), the impacts on habitat critical to the survival of swift parrot are anticipated to be negligible. The local, contiguous extent of suitable foraging habitat is estimated at approximately 34,848 ha, this would be reduced by around 0.04 per cent. Given the small loss of critical foraging habitat by the proposal</p>

	An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:
	in the region, the overall swift parrot critical habitat is unlikely to be adversely affected by the proposal.
Criteria	Disrupt the breeding cycle of a population
Response	The swift parrot is known only to breed at Tasmania (mostly in the south east) and the proposal would not adversely impact the breeding cycle of the species, or a population of the species.
Criteria	Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
Response	<p>Native vegetation in the study area is likely to be important for swift parrot individuals travelling and foraging through the landscape. Considering the high amount of important nectar resources in the region (i.e. Mogo State Forest, Boyne State Forest, Benandarah State Forest, Currowan State Forest), the habitat that would be impacted by the proposal is unlikely to be highly important to the long-term survival of the Swift Parrot. The extent of impacts is highly unlikely to result in a decline in swift parrot populations.</p> <p>The study area was affected by bushfire on 31 December 2019 at an intensity that resulted in the understorey, midstorey and canopy of the entire site being burnt or scorched. The majority of the landscape south and west of the study area was also burnt. Given the intensity of the fire in the study area, the study area is unlikely to support important post-fire foraging habitat but canopy species are likely to return to normal flowering within five years. Consistent with the surrounding landscape the vegetation of the study area is expected to recover to the extent that it will support suitable habitat in the future.</p>
Criteria	Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat
Response	No invasive species likely to be harmful to the swift parrot would be introduced as a result of the proposal.
Criteria	Introduce disease that may cause the species to decline, or
Response	There are no known disease issues affecting this species. There is potential for equipment, machinery and personnel to spread disease including phytophthora (<i>Phytophthora cinnamomi</i>) and/or myrtle rust (<i>Austropuccinia psidii</i>) to degrade foraging habitat. However, Transport for NSW procedures implemented adequately manage the risk of introduction of plant pathogens.
Criteria	Interfere substantially with the recovery of the species.
Response	The project does not interfere with the objectives and actions of the National Recovery Plan for the Swift Parrot. The project would not conflict with the recovery of this species. The project investigation areas have been selected on the basis of avoiding as much habitat as possible.
Conclusion	The proposal is considered unlikely to have a significant adverse effect on the Swift Parrot due to the relatively low impact on foraging resources, given the large amount of important foraging habitat remaining in the region (i.e. Mogo State Forest, Boyne State Forest, Benandarah State Forest and Currowan State Forest). The proposal is unlikely to place the Swift Parrot at an elevated risk of extinction.

Grey-headed flying-fox – Vulnerable

The Grey-headed flying-fox exists as a single interconnected population in Australia. As such, it is considered to be a single important population. Grey-headed flying-fox (*Pteropus poliocephalus*) is likely to forage in the study area based on the abundance of suitable nectar resources (i.e. Spotted Gum). No roost camps were recorded in the study area during targeted surveys and the proposal would not impact on any known permanent roosting, breeding / maternity site. The nearest roost sites are at the Batemans Bay Water Gardens and Catalina Country Club approximately 1.5 km from the study area and the species has been recorded in adjacent forestry land. The roost camp at Batemans Bay Water Gardens is identified as nationally significant. Extensive areas of equivalent potential foraging habitat are present in the landscape to the west of the study area in Mogo State Forest. The impacts of construction and operation of the proposal would be confined to loss of feeding habitat caused by direct clearing or damage to native vegetation during the construction phase. Foraging habitat in the study area was temporarily degraded by the 2019 – 2020 bushfires and is likely to recover once epicormics resprouting eucalypts resume flowering.

Table G.5 Assessment of Significance in accordance with Significant Impact Guidelines 1.1 – Matter of National Environmental Significance under the EPBC Act: grey-headed flying-fox

	An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:
Criteria	Lead to a long-term decrease in the size of an important population of a species
Response	The reduction of potential foraging habitat for grey-headed flying-fox by 15.95 ha is likely to be negligible in the context of equivalent foraging habitat present in the surrounding landscape. The affected area of foraging habitat would represent a small percentage of the total extent of important foraging vegetation types present within a 50 km radius of the proposal. Given the relative widespread nature of similar native vegetation in surrounding state forest in the locality and abundance of higher quality foraging habitat within the feeding range of roost sites, the proposal is not expected to lead to any long-term decrease in the size of the important population.
Criteria	Reduce the area of occupancy of an important population
Response	The area of occupancy of the grey-headed flying-fox is not known but the species exists as one interconnected population along the eastern Australian coastal belt from Rockhampton in central Queensland to Melbourne in Victoria. The area occupied by this species would remain the same after the proposal. No impact to area of occupancy is expected.
Criteria	Fragment an existing important population into two or more populations
Response	Highly mobile species such as bats are expected to be less impacted by fragmentation. The grey-headed flying-fox is particularly well adapted to accessing widely spaced habitat resources given its mobility and preference for seasonal fruits and blossom in differing parts of the landscape. The proposal would not fragment an important population of the grey-headed flying-fox. Individuals would still be able to disperse between roosts along the east Australian coast.
Criteria	Adversely affect habitat critical to the survival of a species
Response	This species typically exhibits very large home range and grey-headed flying-fox is known to travel distances of at least 50 km from roost sites to access seasonal foraging resources. There are no known roost camps within the study area and does not provide critical roosting habitat. However, there are roost sites approximately 1.5 km from the study area at the Batemans Bay Water Gardens and Catalina Country Club. The draft recovery plan for the grey-headed flying-fox identifies critical foraging habitat for this species as:

	An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:
	<ul style="list-style-type: none"> • Productive during winter and spring, when food bottlenecks have been identified • Known to support populations of >30,000 individuals, within an area of 50 km radius of a camp site • Productive during the final weeks of gestation and during the weeks of birth, lactation and conception (Sept-May) • Productive during the final stages of fruit development and ripening in commercial crops affected by Grey-headed Flying-foxes • Known to be continuously occupied as a camp site. <p>Native vegetation within the study area may constitute critical foraging habitat as it supports winter flowering eucalypts. However, the affected area of critical foraging habitat would represent a small percentage of the total extent of important foraging vegetation types present within a 50 km radius of the camp sites described. Given the relative widespread nature of similar vegetation in the locality and abundance of higher quality foraging habitat within the feeding range of the population, the proposal is not expected to adversely affect foraging habitat critical to the survival of this species in this region.</p>
Criteria	Disrupt the breeding cycle of an important population
Response	The proposal would not impact on any known roost camp / breeding or maternity site and would not disrupt the breeding cycle of any populations of grey-headed flying-fox.
Criteria	Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
Response	No evidence of a roost camp has been identified within the study area, however 15.95 ha of potential foraging habitat would be removed, which is negligible in the context of the large extent of similar forest dominated by winter flowering eucalypts with 50 km of the study area (i.e. Mogo State Forest, Boyne State Forest, Benandarah State Forest, Currowan State Forest. The proposal is not expected to lead to any decline in the population of grey-headed flying-fox.
Criteria	Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat
Response	No invasive species likely to be harmful to the grey-headed flying-fox would be introduced as a result of the proposal.
Criteria	Introduce disease that may cause the species to decline, or
Response	There are no known disease issues affecting this species. There is potential for equipment, machinery and personnel to spread disease including phytophthora (<i>Phytophthora cinnamomi</i>) and/or myrtle rust (<i>Austropuccinia psidii</i>) to degrade foraging habitat. However, Transport for NSW procedures implemented adequately manage the risk of introduction of plant pathogens.
Criteria	Interfere substantially with the recovery of the species.
Response	The Draft National Recovery Plan for the outlines the following actions: <ul style="list-style-type: none"> • Identify and protect foraging habitat critical to the survival of grey-headed flying-foxes across their range • Enhance winter and spring foraging habitat for grey-headed flying-foxes

	An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:
	<ul style="list-style-type: none"> • Identify, protect and enhance roosting habitat critical to the survival of grey-headed flying-foxes • Significantly reduce levels of deliberate grey-headed flying-foxes destruction associated with commercial horticulture • Provide information and advice to managers, community groups and members of the public that are involved with controversial flying-fox camps • Produce and circulate educational resources to improve public attitudes toward grey-headed flying-foxes promote the recovery program to the wider community and encourage participation in recovery actions • Monitor population trends for the grey-headed flying-foxes • Assess the impacts on grey-headed flying-foxes of electrocution on powerlines and entanglement in netting and barbed wire and implement strategies to reduce these impacts • Oversee a program of research to improve knowledge of the demographics and population structure of the grey-headed flying-foxes • Maintain a National Recovery Team to oversee the implementation of the grey-headed flying-fox National Recovery Plan. <p>The recovery actions listed above are largely not applicable to the proposal and accordingly is not expected to interfere substantially with the recovery of the species.</p>
Conclusion	The proposal is unlikely to have a significant adverse impact on the grey-headed flying-fox.

Migratory species – satin flycatcher, black-faced monarch and rufous fantail

This assessment considers migratory birds listed under the EPBC Act known to, or likely to occur in the study area, being:

- Satin flycatcher (*Myiagra cyanoleuca*)
- Black-faced monarch (*Monarcha melanopsis*)
- Rufous fantail (*Rhipidura rufifrons*).

Rufous fantail occur in the study area and satin flycatcher and black-faced monarch are very likely to occur in the study area, especially during northward and southward migration. The study area supports suitable and marginal foraging habitat for these species. Similar habitat is extensively distributed throughout the landscape to the south and west.

Table G.6 Assessment of Significance in accordance with Significant Impact Guidelines 1.1 – Matter of National Environmental Significance under the EPBC Act– Migratory species

	An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:
Criteria	Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species
Response	The vegetation in the study area likely does not constitute important rufous fantail, satin flycatcher or black-faced monarch habitat as the vegetation in the study area do not meet the important

	An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:
	<p>habitat thresholds described in the Draft Referral Guidelines for 14 birds listed as migratory under the EPBC Act (Commonwealth of Australia 2015). Similar, or higher quality, habitat is extensively distributed throughout the landscape to the south and west, including in adjacent areas of Mogo State Forest.</p> <p>The study area burned on 31 December 2019 at an intensity that resulted in the understory, midstorey and canopy of the entire site being burnt or scorched. The majority of the landscape south and west of the study area was also burnt. Given the intensity of the fire in the study area, the vegetation does not currently support suitable habitat, or a potential refugia in the short-term, for this species. Consistent with certain affected parts of the surrounding landscape the vegetation of the study area is expected to recover to the extent that it will support suitable habitat in the future.</p>
Criteria	Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or
Response	Weed invasion can be associated with construction. Transport for NSW procedures implemented adequately manage the risk of introduction or spread of weeds and it is highly unlikely that any weeds harmful to habitat for the migratory passerine birds would become established in the habitat area.
Criteria	Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.
Response	The proposed action would not seriously disrupt the lifecycle of rufous fantail, satin flycatcher or black-faced monarch of an ecologically significant proportion of the population of these species.
Conclusion	It is unlikely that the proposal would have a significant adverse impact on rufous fantail, satin flycatcher or black-faced monarch.

