Cambewarra dam decommissioning

Review of Environmental Factors

Shoalhaven City Council

6 June 2024

→ The Power of Commitment

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Terms and definitions

Term	Definition
AHIP	Aboriginal Heritage Impact Permit
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BDAR	Biodiversity Development Assessment Report
BOM	Bureau of Meteorology
BTEXN	Benzene, toluene, ethylbenzene, xylenes and naphthalene
CEMP	Construction Environmental Management Plan
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DECC	Department of Environment and Climate Change
DPI	NSW Department of Primary Industries
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EP&A Regulation	*Environmental Planning and Assessment Regulation 2021* (NSW)
EPA	Environment Protection Authority
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth)
EPL	Environment Protection Licence
FM Act	*Fisheries Management Act 1994* (NSW)
GHD	GHD Pty Ltd
ICNG	Interim Construction Noise Guideline
LEP	Local Environmental Plan
LGA	Local government area
Limit of works	Refers to the area that would be directly impacted by the proposed works, as shown in **Figure 2.1**.
Locality	Encompasses the broader area, generally within a ten kilometre radius of the subject land.
Mitigation	Reduction in severity
MNES	Matters of national environmental significance
NML	Noise management level
NPW Act	*National Parks and Wildlife Act 1974* (NSW)
OCP	Organochlorine pesticides
OEH	Office of Environment and Heritage
OPP	Organophosphate pesticides
PAH	Polynuclear aromatic hydrocarbons
PCT	Plant Community Type
PMST	(Department of Climate Change, Energy, the Environment and Water) Protected matters search tool
POEO Act	*Protection of the Environmental Operations Act 1997* (NSW)
Subject land	Collectively refers to the council owned lots that contain Cambewarra dam and its reservoir, that may be accessed during the proposed works, as shown in **Figure 2.1**.
Proposed works	Refers to all works associated with the decommissioning of Cambewarra dam and reclamation of the subject land, as described in **Section 2.3**.
RBL	Rating background level (noise)
REF	Review of Environmental Factors
SEPP	State Environment Planning Policy

Term	Definition
SES	State Emergency Service
SHR	State Heritage Register
SIS	Species Impact Statement
SLEP	Shoalhaven Local Environmental Plan (SLEP)
Study area	Encompasses the subject land and the area that may be indirectly impacted by the proposal, as relevant to searches and investigations.
TEC	Threatened Ecological Community
TPZ	Tree Protection Zone, as defined by Australian Standard *AS 4970-2009 Protection of Trees on Construction Sites*
Transport and Infrastructure SEPP	State Environmental Planning Policy (Transport and Infrastructure) 2021 (NSW)
TRH	Total recoverable hydrocarbons
WAL	Water Access Licence
WM Act	*Water Management Act 2000* (NSW)
WSP	Water Sharing Plan

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1. Introduction

1.1 Purpose of this report

GHD Pty Ltd (GHD) has been engaged by Shoalhaven City Council (SCC) to prepare a Review of Environmental Factors (REF) for the proposed Cambewarra dam decommissioning (the proposed works). SCC is the proponent and determining authority for the proposed works under Part 5 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) (refer to **Section 4**).

The potential environmental impacts of the proposed works are assessed in this REF in accordance with Division 5.1 of the EP&A Act, the factors listed under clause 171(2) of the NSW *Environmental Planning and Assessment Regulation 2021* (EP&A Regulation) and other relevant legislation including the NSW *Biodiversity Conservation Act 2016* (BC Act), the NSW *Fisheries Management Act 1994* (FM Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). In doing so, the REF helps to fulfil the requirements of section 5.5 of the EP&A Act, which requires that SCC examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

1.2 Scope and limitations

This report: has been prepared by GHD for Shoalhaven City Council and may only be used and relied on by Shoalhaven City Council for the purpose agreed between GHD and Shoalhaven City Council as set out in **Section 1.1** of this report.

GHD otherwise disclaims responsibility to any person other than Shoalhaven City Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

2. Proposed works and location

2.1 Location

The proposed works would be undertaken on the existing Cambewarra dam, located at the end of Tannery Road in Cambewarra NSW, about 1.1 km north of Cambewarra Village and nine kilometres northwest of Nowra. The subject land is in a rural locality in the City of Shoalhaven Local Government Area (LGA).

Land associated with Cambewarra dam where the proposed works would be undertaken includes four land parcels owned by SCC known as:

– Lot 2 DP 938370
– Lot 1 DP 938370
– Lot 1 DP 1160346
– Lot 2 DP 1160346 (Tannery Road reserve).

Access may also be required to Lot 1 DP 182153 during construction works. The location of the subject land is shown in **Figure 2.1**

For the purposes of this REF, the following definitions are employed:

– '*proposed works*' refers to all works associated with the decommissioning of Cambewarra dam and reclamation of the subject land, as described in **Section 2.3**.
– '*construction*' refers to the activities involved in delivering the proposed works including demolition of the dam and landscaping associated with stabilisation and reconstruction of Cambewarra Creek through the impoundment area. The term also refers to the phase during which works would be undertaken, upon completion the '*operation'* phase would commence.
– '*subject land*' collectively refers to the council owned lots that contain Cambewarra dam and its reservoir, that may be accessed during the proposed works.
– '*limit of works*' refers to the area that would be directly impacted by the proposed works.
– '*study area*' encompasses the subject land and the area that may be indirectly impacted by the proposal, as relevant to searches and investigations.
– '*locality*' encompasses the broader area, generally within a 10 km radius of the subject land.

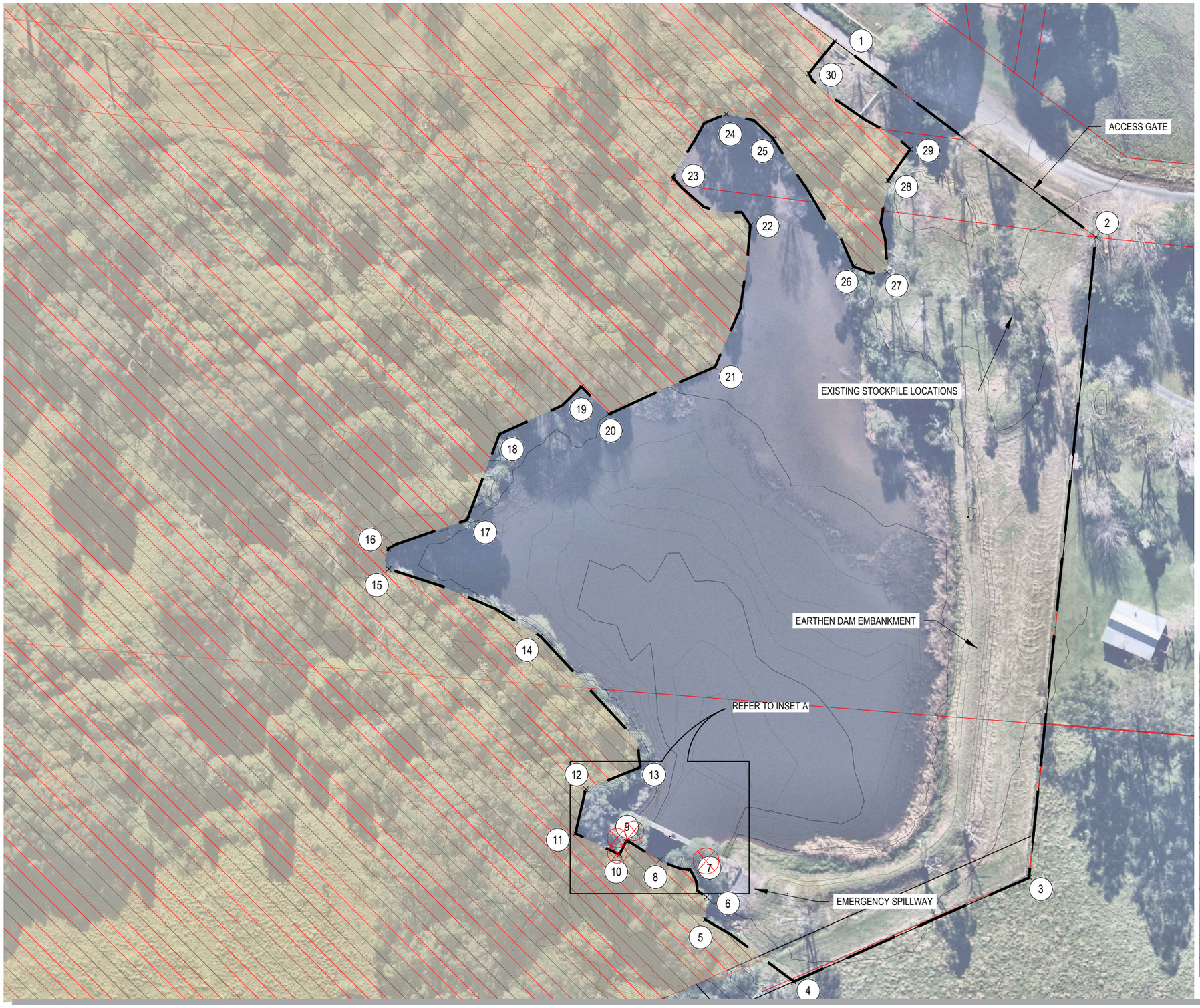
2.2 Existing asset

Cambewarra dam is a composite concrete gravity and earth fill embankment dam, which is owned and maintained by SCC. The dam is located on Cambewarra Creek, an ephemeral creek, which is a tributary of Good Dog Creek. The concrete gravity dam wall is 40 m long and has a maximum height of 8.4 m. The earth fill embankment is located on the eastern side of the reservoir and has a total length of 150 m with a maximum height of 2.3 m.

The dam comprises two spillways, including a 10 m wide cut along the eastern, or right abutment (with a two metre slot to accommodate low flows) and a six metre wide emergency spillway formed of gabion sidewalls adjacent to the western, or left abutment. The spillway discharges downstream into Cambewarra Creek through a steep unlined rock chute. A redundant cast iron water transfer pipe is located along Cambewarra Creek, from a valve within in the dam wall to the southeastern perimeter of the subject land.

The dam was constructed in 1910 and was previously used as a water storage reservoir, providing a water source to the township of Nowra. The dam has not been used as a water supply reservoir since 1980 and has not served any useful purpose to SCC for the last 40 years.

In 2013, the dam spillway was subject to modifications as it did not meet flood safety criteria required by the NSW Dam Safety Committee (now Dams Safety NSW). Remedial modifications included increasing the capacity of the spillway and construction of an additional spillway. These modifications reduced the reservoir storage capacity from 50 ML to 28 ML.



GENERAL NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. ALL LEVELS ARE IN METRES AND RELATED TO AUSTRALIAN HEIGHT DATUM (AHD).
3. THIS DESIGN IS BASED ON DRONE LIDAR SURVEY SUPPLIED BY SHOALHAVEN CITY COUNCIL.
4. CONTRACTOR TO CONFIRM DIMENSIONS PRIOR TO WORK.
5. RESTRICTED AREA IS APPROXIMATE AND BASED ON PREVENTING DISTURBANCE TO EXISTING VEGETATION.

LEGEND:

SITE LIMITS

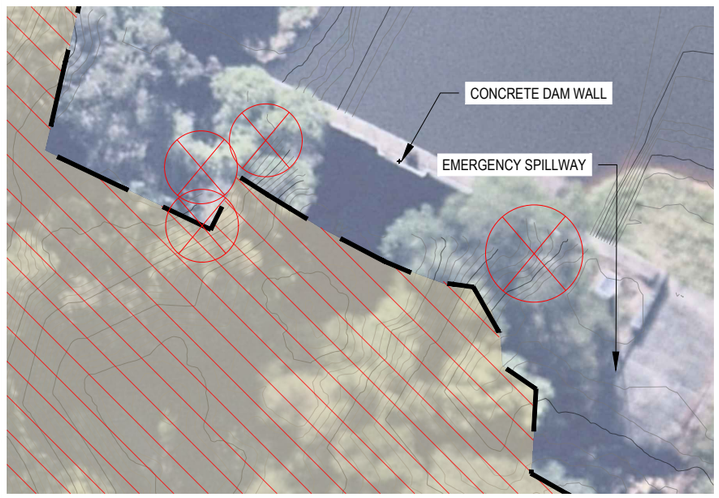
PROPERTY BOUNDARY

RESTRICTED ENVIRONMENTAL AREA (SEE NOTE 5)

TREES TO BE REMOVED

SETOUT POINTS - SITE LIMITS		
POINT	EASTING	NORTHING
1	276590.720	6146021.984
2	276654.528	6145974.115
3	276638.257	6145817.946
4	276580.673	6145792.469
5	276559.080	6145807.592
6	276559.395	6145813.131
7	276555.331	6145819.782
8	276548.047	6145822.206
9	276539.931	6145826.679
10	276538.167	6145823.505
11	276527.372	6145828.636
12	276529.935	6145839.522
13	276543.181	6145844.686
14	276518.859	6145876.797
15	276481.787	6145893.176

SETOUT POINTS - SITE LIMITS		
POINT	EASTING	NORTHING
16	276481.678	6145898.122
17	276500.956	6145905.170
18	276508.866	6145926.143
19	276528.835	6145937.632
20	276535.609	6145931.061
21	276561.466	6145942.470
22	276570.110	6145977.022
23	276551.427	6145988.452
24	276564.208	6146004.251
25	276575.798	6145998.202
26	276595.396	6145967.126
27	276603.456	6145965.746
28	276603.714	6145988.027
29	276609.167	6145995.662
30	276584.411	6146014.096



SHOALHAVEN CITY COUNCIL
CAMBEWARRA DAM DECOMMISSIONING

GENERAL ARRANGEMENT PLAN

Project Number 12628715
Revision A
Date JUNE 2024

Figure 2.1

Plot Date: 3 June 2024 - 1:48 PM Plotted by: Roberto Balberan Cad File No: \\ghdnet\ghd\ph\Manila\Projects\21\12628715\CADD\Drawings\12628715-G003 -FIG.dwg

2.3 Proposed works

SCC is planning on decommissioning Cambewarra dam, including removal of the existing concrete gravity dam and reclamation of the reservoir. The key components of the proposed works include:

– Complete removal of the mass gravity concrete structure to ground level. Foundations below the natural ground level would be retained.
– Removal of the earth embankment dam surrounding the eastern portion of the reservoir and the stockpile from the northeastern portion of the site. Soil from the earth embankment and stockpile would be reinstated across the drained reservoir ground surface to cap deposited sediments and reclaim a near-natural ground level surface.
– Decommissioning of the emergency spillway including removal of reno mattress and rip rap downstream of the reno mattress. Materials from the emergency spillway would be reused, if suitable, for stabilisation of Cambewarra Creek within the drained reservoir area.
– Formation and construction of an erosion-resistant channel, connecting the inlet of Cambewarra Creek to the location of the existing dam wall.
– Associated vegetation removal required for access and earthworks.
– Site reclamation, including stabilisation and revegetation of exposed ground surfaces.

The proposal footprint is shown in **Figure 2.1** and a cross-section of the proposed dam removal is shown in **Figure 2.2**. The proposed works are described in more detail in **Section 2.4**.

Following completion of the proposed works, there would be no further operational maintenance activities required on the subject land.

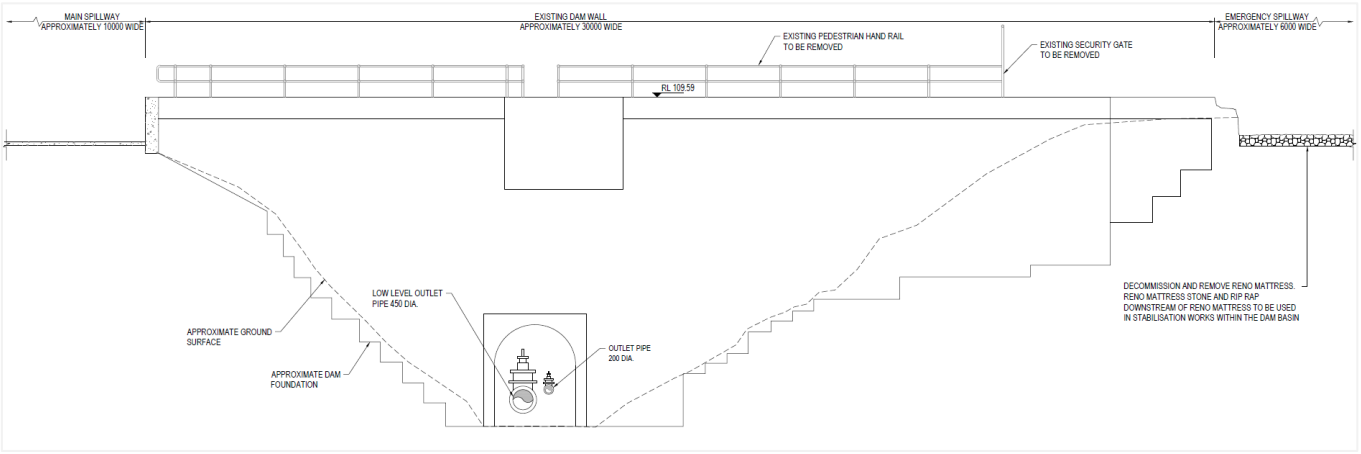


Figure 2.2 Cross-section of the indicative dam decommissioning extent (detailed design drawing 12628715-C002)

2.4 Construction methodology

2.4.1 Overview

The detailed design and construction methodology for the proposed works are still to be determined and would be updated at a later stage. Indicative activities for construction are expected to be as follows:

– **Establishment of construction access**: Including construction of a construction access track from Tannery Road to the drained reservoir floor of the existing dam wall. Some areas of Tannery Road may need to be upgraded or widened to provide suitable access for heavy construction vehicles (e.g. large mobile crane and dump trucks). These works could possibly involve road realignment, road widening, vegetation removal, culvert reinforcement/replacement, and overhead utility modification.

- **Reservoir dewatering**: While the reservoir is currently subject to a program of actively managing water levels to minimise the potential impacts of dewatering during the delivery of the proposed works, it is anticipated there will be some residual water within the impoundment area that needs to be released before works commence. The reservoir would be completely drained by opening of the scour valve. Construction would need to be undertaken during a period forecast for dry weather to ensure the reservoir remains as dry as possible. However, some flooding to the subject land may be expected and unavoidable during construction.
- **Demolition of dam and emergency spillway**: The handrails, trunnion and outlet pipes would be disassembled and/or saw-cut and removed in pieces using a crane. The water transfer pipe running south along Cambewarra Creek, would be cut and capped near the location of the dam wall. The remainder of the dam and emergency spillway would be progressively demolished to natural ground level using a medium sized excavator (e.g. 30 tonne) and a hydraulic hammer (see **Figure 2.2**).

  If possible, and subject to testing, excavated concrete and other existing rip rap and reno mattress material where suitable, would be reused on site. Concrete sourced from the demolished dam would be subject to being crushed on site to a nominal 300mm thickness (but ranging from 200-400 mm thick) for use as a bedding layer for rip-rap erosion protection lining the channel. Alternately, excavated concrete would be removed from site for disposal if determined to be unsuitable for reuse.
- **Demolition of earth embankment dam and stockpile, and capping of sediment**: The earth embankment and existing stockpile would be excavated and, subject to testing and classification (refer to **Section 6.6**), would be graded across the drained reservoir site to cap deposited sediments and reclaim a near-natural ground level surface (see **Figure 2.**). If unsuitable for reuse on site, soil would be removed from the site and disposed of at an appropriately licenced facility. Deposited sediments and soils deemed to be contaminated, and/or vulnerable to erosion, would be excavated and removed from site at an appropriately licenced facility. Disposal would be subject to testing and classification (refer to **Section 6.6**).
- **Reinstatement and channelisation of Cambewarra Creek:** Due to siltation of the reservoir formed by Cambewarra dam, there is a significant lack of channelisation of Cambewarra Creek and other creeks which discharge into Cambewarra Creek. Therefore, a channel would be excavated between the location of the current dam wall and the location where Cambewarra Creek currently discharges into the reservoir at full supply level (see **Figure 2.**, **Figure 2.4** and **Figure 2.5**). Another smaller channel would be excavated, connecting the unnamed minor creek line from the western side of the reservoir to Cambewarra Creek.

  Final design of the waterway channels will incorporate features that reduce velocities and replicate the natural riffle-run-pool sequence of Cambewarra Creek that are characteristic of this part of the catchment. The following design features have been included in the design of the proposed channel construction:

  - minimised channel slope to prevent velocity build up and erosion potential,
  - avoidance of sharp bends, which would enhance velocity around outside banks causing streambank erosion,
  - integration of rip-rap and rocky channel bedding to facilitate turbulence and velocity reduction.
- **Provision of erosion control structures**: After removal of the dam and construction of channels, erosion control and ground stabilisation features would be implemented. Reclaimed reservoir sediments would be capped with a minimum 100 mm thick layer of soil from the earth embankment dam and stockpiles already present on the subject land. This capping would prevent erosion of deposited sediments that are otherwise highly susceptible to erosion. The indicative cross-section channel structure would include a 300 mm thick layer of crushed concrete as channel bedding overlain by a 500 mm thick layer of facing rip rap (see **Figure 2.5**). Surrounding channels, the overbanks would be stabilised with coir matting. All areas capped with soil would be seeded with a suitable grass mix.
- **Revegetation and rehabilitation**: Revegetation and stabilisation would be undertaken in accordance with an approved landscape and revegetation management plan that includes a schedule of plants to be included both in stabilising exposed soils and in assisted regeneration of riparian vegetation appropriate to the location and surrounding native vegetation communities. The revegetation management plan would include a combination of hydromulching and replanting using native species, as shown in **Figure 2.6**. This would be subject to a minimum six-month defects liability period (DLP) to ensure successful establishment of plants with an accompanying program to aid establishment including watering and weeding as appropriate.

– **Disestablishment and clean-up**: After construction and reinstatement activities are completed, all construction plant, temporary site compounds and stockpiles would be removed from the site.

The decommissioning methodology and sequence is indicative only and would be confirmed by the construction contractor in consultation with SCC prior to the proposed works commencing.

Figure 2.3 *Indicative plan of civil earthworks (detailed design drawing 12628715-C010)*

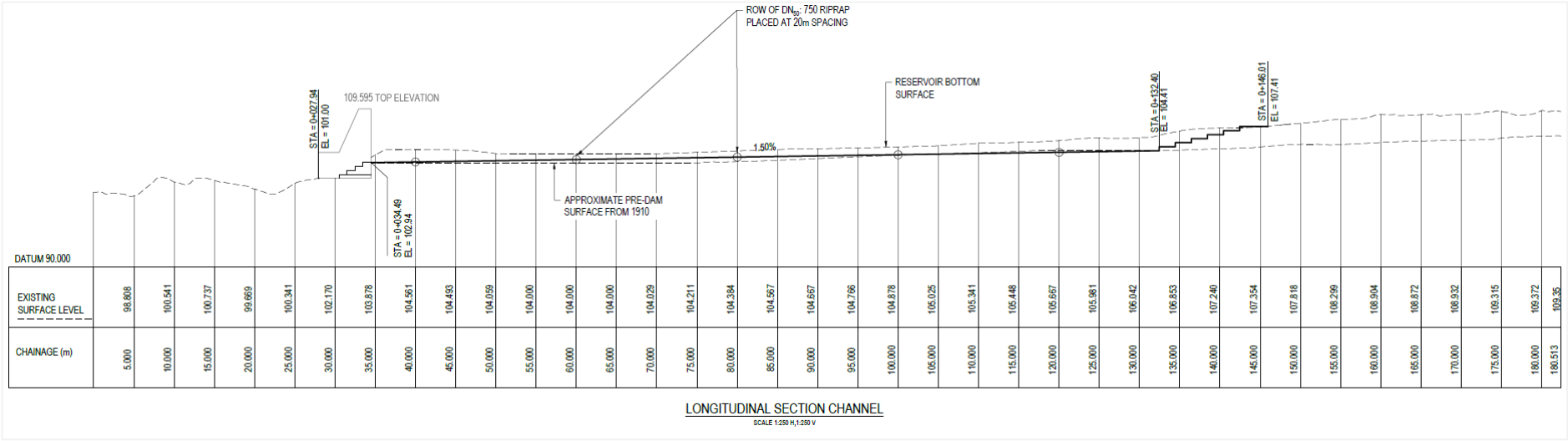


Figure 2.4 Long-section of the indicative channelisation of Cambewarra Creek (detailed design drawing 12628715-C011)

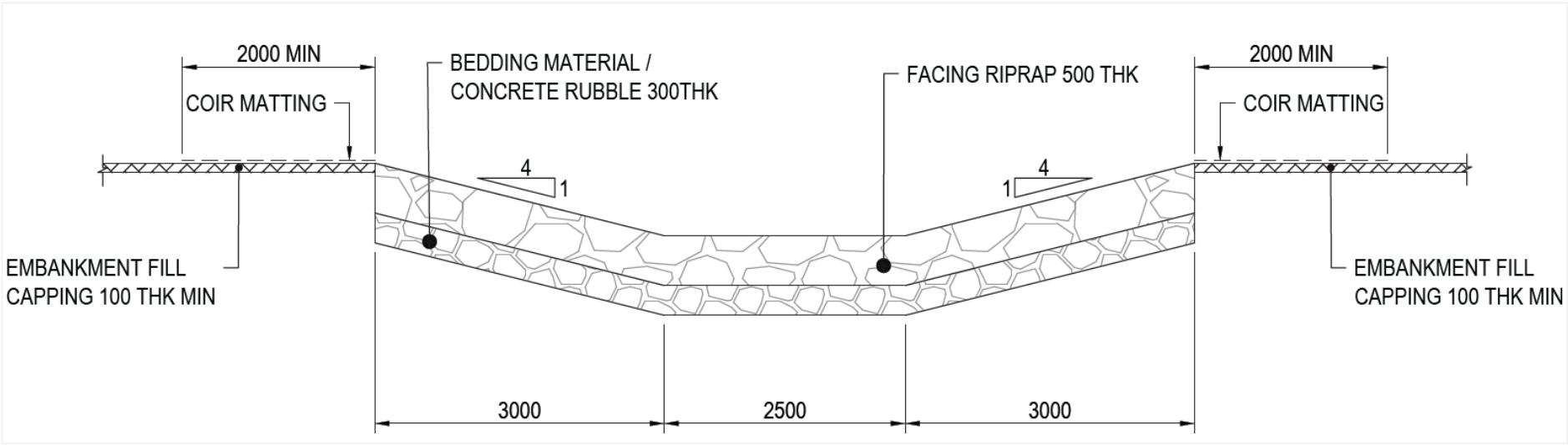


Figure 2.5 Typical cross-section of the channel and bank augmentation of Cambewarra Creek (detailed design drawing 12628715-C012)

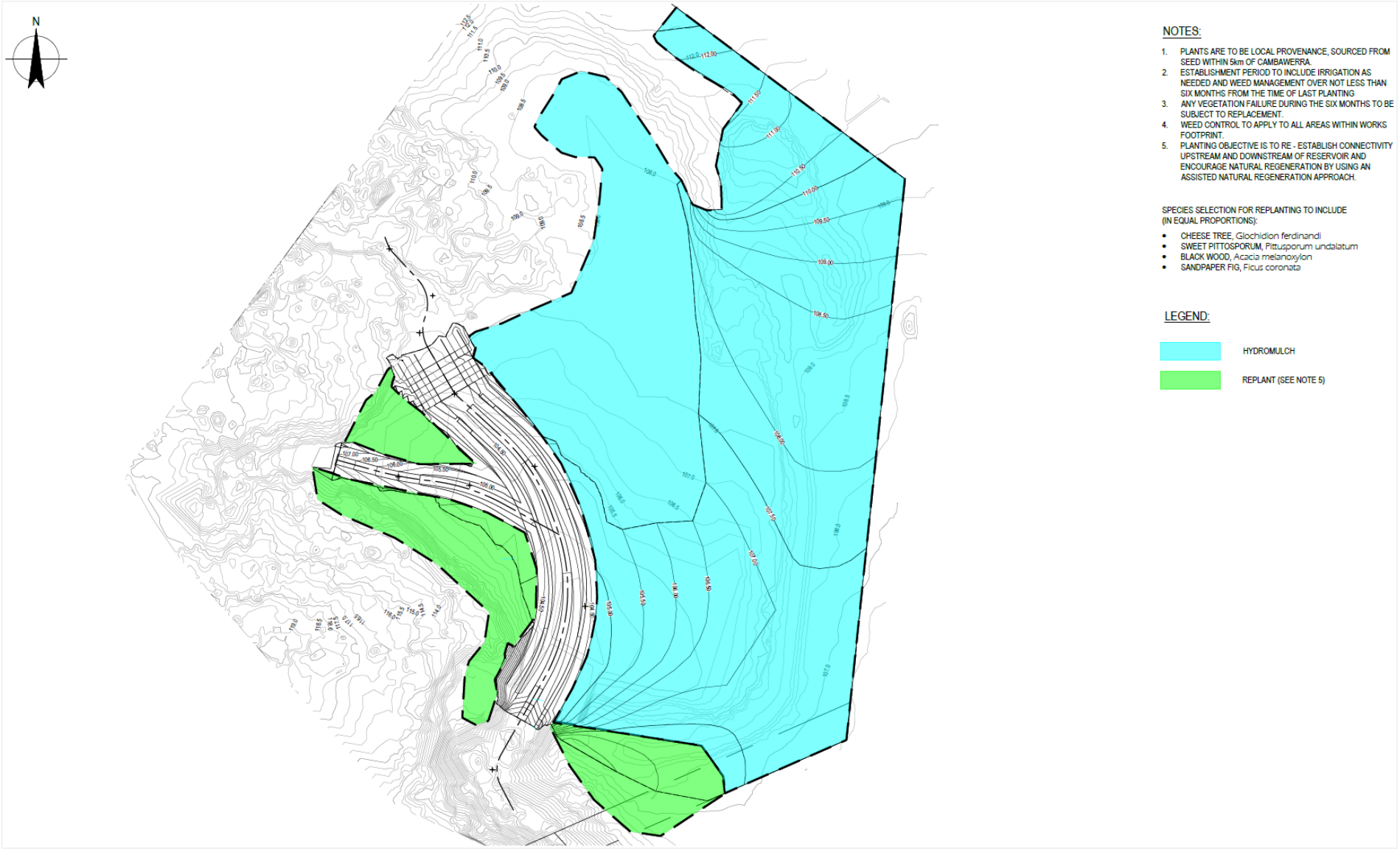


Figure 2.6 Planting plan (detailed design drawing 12628715-E001)

2.4.2 Governance

Prior to the commencement of any work on the subject land, a Construction Environmental Management Plan (CEMP) would be prepared by the contractor and approved by SCC. The CEMP would developed in accordance with the framework of AS/NZS ISO 14001:2016 Environmental Management Systems.

The purpose of the CEMP would be to describe how the contractor would implement controls to manage environmental impacts of the proposed works. It would demonstrate how compliance with State and Federal regulatory requirements would be met including any specific requirements of permits or relevant approvals that may apply.

The CEMP would provide a 'road map' for the implementation of environmental management during construction. Mitigation measures described by this REF and any associated approval, SCC policy or as prescribed by licencing and permitting conditions would be included in the CEMP.

2.4.3 Construction hours and duration

Working hours for all activities would be in accordance with the *Interim Construction Noise Guideline* (ICNG) (DECC, 2009) and *Draft Construction Noise Guideline* (EPA, 2021):

– Monday to Friday 7:00 am to 6:00 pm
– Saturday 8:00 am. to 1:00 pm
– no work on Sundays or Public Holidays.

Any work outside of these hours would require out of hours work permits and additional management measures for sensitive receivers (refer to **Section 6.8**).

The anticipated construction commencement and expected decommissioning duration would be updated after the design has progressed and construction methodology developed.

2.4.4 Plant and equipment

Plant and equipment anticipated to be required during the proposed works include:

– 30-tonne excavator and hydraulic hammer
– large mobile crane
– 12-tonne dump trucks
– delivery vehicles including trucks
– workers transport vehicles
– jackhammer
– hand tools
– generators
– compressor
– water cart
– grader
– bobcat.

Equipment to be used would be confirmed by the contractor during construction planning.

2.4.5 Traffic management and access

The proposed works would be undertaken on SCC owned land which is accessed through a locked gate from Tannery Road. Tannery Road is a minor rural access, no-through road and has low numbers of residential traffic. Parking by construction workers is anticipated to occur on site in a designated parking area located in the northeast of the subject land, adjacent to the entry from Tannery Road. Traffic management, including traffic control at intersections and alternating one directional traffic, may be required for the proposed works (refer to **Section 6.9**).

2.4.6 Ancillary facilities

A site construction compound is proposed to be established in the northeast of the site, upon entry from Tannery Road. The site construction compound would include, as required, office facilities, machinery and equipment storage, and car parking for workers. The construction compound would be appropriately fenced and furnished with signage outlining construction contact details and site access restrictions.

The proposed works involve decommissioning and rehabilitation so is unlikely to require substantial laydown of materials or a designated laydown area. Laydown and stockpiling sites will be sited anywhere within the limit of works, as guided by construction staging and practical accessibility considerations. However, laydown and stockpiling would be preferentially undertaken in existing disturbed areas (e.g. the location of the existing stockpile site or ground of the reclaimed reservoir, if not constrained by bogginess), and in locations that would minimise the need for rehandling of materials. Placement of laydown and stockpile sites would consider potential environmental impacts, including erosion and vegetation impacts, in accordance with mitigation measures specified in Section 7.1.

2.4.7 Public utility adjustment

The subject land includes underground utilities from two providers, including:

– A buried Telstra cable, along the northeastern edge adjacent to Tannery Road.
– Water transfer main, along the eastern edge with two connections intersecting the site:
  - Transecting Lot 2 DP 938370, from Cambewarra dam in a north-westerly direction to Lot 1 DP182153.
  - Transecting Lot 2 DP 1160346, in an easterly direction from the east of the site. This connection intersects the upper extent of the reservoir.

The utilities would not require adjustment and would be avoided and/or protected during the proposed works, except for the water transfer main connecting Cambewarra dam to Lot 1 DP182153. This water transfer main is redundant, and would be sawn off and capped, to prevent unnecessary impact to Cambewarra Creek and the surrounding vegetation.

There are no overhead utilities in the subject land. However, a low hanging overhead telecommunication line with collocated electricity supply lines cross Tannery Road three times within 500 m east of the subject land. This could present a constraint to large vehicles (e.g. mobile crane) and may require restringing or relocation prior to construction.

Relevant utility providers would be contacted during design development and construction to inform of the potential for utility disruption, and as required for utility protection and relocation.

3. Need and options considered

3.1 Need for the proposal

Cambewarra dam was constructed more than 100 years ago and has served no useful purpose to SCC for the last 40 years. The dam is an aging asset which requires annual operational and maintenance costs.

Reforms to NSW dam safety requirements were made in 2019, with the enactment of the *Dams Safety Regulation 2019*, and formation of Dams Safety NSW (formerly NSW Dam Safety Committee) to administer the regulation. Continued operation of the dam would incur significant capital costs to comply with the requirements of the *Dams Safety Regulation 2019*, including:

– Dam safety operations (e.g. routine studies and documentation) and upgrades
– Payment of a dam owner operational levy.

Continued maintenance of Cambewarra dam SCC would require substantial ongoing capital costs for the purpose of maintaining redundant infrastructure. Therefore, SCC intends to decommission the dam to negate the need for ongoing maintenance.

3.2 Options considered

Three options were considered as part of the *Cambewarra dam decommissioning - Concept Options Report* prepared by GHD in March 2021 (GHD, 2021a). The options were considered using a multi-criteria analysis, as informed by a preliminary site investigation and taking into account:

– Social, cultural and heritage aspects (social)
– Protection and enhancement of the environment (environmental)
– Legal requirements (legal)
– Technical aspects (technical)
– Economic viability (economic).

These options are described in the below sections. The multi-criteria analysis concluded that Option 3 was the preferred option as it was anticipated to result in better outcomes for social, environmental and legal aspects. Option 3 was identified as being slightly limited from a technical standpoint, but not to a degree that outweighed other benefits in consideration of all aspects. The economic viability of all options was similar, with each predicted to cost around $3,000,000 (± 200,000).

SCC has reviewed the concept options report and has selected to proceed with Option 3. Option 3 forms the basis of the current design intent and is assessed within this REF.

3.2.1 Option 1 – Partial removal of the concrete dam wall

This option would provide a lower-cost solution involving lowering the height of the dam. Lowering the height of the dam would reduce storage capacity, thus reducing the consequence of potential dam failures. The dam would be lowered to a depth just above the existing silt level on the upstream side of the dam. As a result, sediment removal and/or infill works would be minimised. Key features of the option would include:

– Removal of a 10 wide by five metre deep section of the existing concrete dam wall in the centre of the dam
– Removal of an additional three metre wide by 1.1 m deep low flow slot
– Provision of a concrete apron slab downstream to prevent erosion of the foundation.
– Decommissioning and removal of the existing pipework, and emergency spillway erosion structures.

Key benefits of the option would be:

– Reduced costs
– Maintenance of some of the dam for heritage conservation value
– Reduced construction duration.

3.2.2 Option 2 – Partial removal via excavation of a channel at the right abutment

This option would involve the construction of an additional channel on the right abutment to bypass flow around the existing dam wall. The option would result in a similar discharge to option 1. Key features of the option would include:

– Partial removal of the existing dam wall, including the spillway training wall
– Excavation of a 10 m wide channel by four metre deep channel.
– Excavation of an inner two metre wide by 1.1 m deep channel slot.
– Provision of shotcrete and rock bolts for slope protection.
– Decommissioning and removal of emergency spillway erosion structures.

Key benefits of the option would be:

– Maintenance of most of the dam for heritage conservation value
– Maintenance of existing sediment
– Reduced construction duration.

3.2.3 Option 3 – Full removal of the concrete dam wall

This option would involve the complete removal of the concrete dam wall apart from the foundations, which are below the natural ground surface. This option would be the costliest due to the extent of demolition and silt removal works. Key features of the option include:

– Full removal of the concrete dam structure
– Removal of silt
– Provision of erosion protection to the creek bank.

Key benefits of the option would be

– Restoration of natural flow regime and fish passage
– Removal of SCC ownership responsibilities
– Greater opportunity to repurpose or dispose of the land.

4. Statutory context and permissibility

4.1 New South Wales legislation

The EP&A Act forms the legal platform for development assessment and approval in NSW. All development in NSW is assessed in accordance with the provisions of the EP&A Act.

Planning instruments are made under Part 3 of the EP&A Act and outline required development assessment and control provisions for different types of development. Relevant planning instruments include State Environmental Planning Policies (SEPPS) and Local Environmental Plans (LEPs).

Part 4 of the EP&A Act provides for the identification of development that requires development consent, and states in section 4.1, that:

> "*If an environmental planning instrument provides that specified development may be carried out without the need for development consent, a person may carry the development out, in accordance with the instrument, on land to which the provision applies*"
>
> and
>
> **"***Environmental assessment of the development may nevertheless be required under Division 5.1.*"

Section 2.159 of the *State Environmental Planning Policy (Transport and Infrastructure) 2021* (Transport and Infrastructure SEPP) permits that development for the purpose of 'water storage facilities' may be carried out by or on behalf of a public authority on land zoned as RU1 Primary Production. Under clause 2.159(6) of the Transport and Infrastructure SEPP, development includes works undertaken in connection with dams, catchment management works, construction works and environmental management works.

The proposed works are consistent with the definition of development for the purpose of 'water storage facilities' and is located on land zoned RU1. Therefore, the proposed works do not require development consent under Part 4 of the EP&A Act, but instead requires assessment under Division 5.1 of the EP&A Act. This REF provides this assessment to address section 5.5 of the EP&A Act which requires that:

> "*For the purpose of attaining the objects of this Act relating to the protection and enhancement of the environment, a determining authority in its consideration of an activity shall, notwithstanding any other provisions of this Act or the provisions of any other Act or of any instrument made under this or any other Act, examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity*."

The applicability of other relevant legislation is considered in Table 4.1 in relation to permissibility and the need for licences, permits and approvals.

Table 4.1 Permissibility and approvals

Legislation	Application	Permissibility
State Environmental Planning Policies		
State Environmental Planning Policy (Resilience and Hazards) 2021 (Resilience and Hazards SEPP)	Chapter 2 of the Resilience and Hazards SEPP provides provisions for land use planning in the coastal zone in a manner consistent with the objectives of the *Coastal Management Act 2016* (NSW). The proposed works do not affect coastal land or land declared as a coastal management area. Therefore, the provisions of Chapter 2 of the Resilience and Hazards SEPP do not apply to the proposed works, and development consent is not required.	Permissible

Legislation	Application	Permissibility
State Environmental Planning Policy (Transport and Infrastructure) 2021 (Transport and Infrastructure SEPP)	The Transport and Infrastructure SEPP facilitates the effective delivery of infrastructure across NSW. Clause 2.159(2) of the Transport and Infrastructure SEPP permits development for the purpose of water storage facilities to be carried out by or on behalf of a public authority on land zoned as RU1. As per clause 1.259(6), development includes works in connection with dams, catchment management works, construction works and environmental management works. As the proposed works are for the purpose of decommissioning a water supply system, and would be carried out by SCC, it can be assessed under Division 5.1 of the EP&A Act and development consent is not required. Part 2.2 of the Transport and Infrastructure SEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. Consultation, including consultation required under the Transport and Infrastructure SEPP (where applicable), is discussed in **Section 5.1** of this REF.	Permissible, subject to Division 5.1 EP&A Act assessment
State Environmental Planning Policy (Biodiversity and Conservation) 2021 (Biodiversity and conservation SEPP)	Chapter 3 and Chapter 4 of the Biodiversity and Conservation SEPP encourages the proper conservation and management of areas of natural vegetation that provide habitat for koalas. Chapter 3 and 4 apply to land zoned RU1, RU2 or RU3 in the City of Shoalhaven LGA, as identified in Schedule 2 of the SEPP. As development consent is not required for the proposal, the development control requirements of Chapter 3 and Chapter 4 do not apply.	Permissible
State Environmental Planning Policy (Planning Systems) 2021 (Planning Systems SEPP)	Chapter 2 of the Planning Systems SEPP defines development that is State significant development (SSD), State significant infrastructure (SSI), critical SSI (CSSI) or regionally significant development (RSD). The proposal does not meet the definition of SSD, SSI or CSSI or RSD under the Planning Systems SEPP and does not require approval under Division 5.2 of the EP&A Act.	Permissible
Local Environmental Plan		
Shoalhaven Local Environmental Plan 2014 (SLEP)	The subject land is zoned under the SLEP as RU1 Primary Production. Under RU1, water supply systems are permitted with consent. However, the provisions of the Transport and Infrastructure SEPP prevail over the SLEP. Therefore, the provisions of the SLEP do not apply and development consent is not required for the proposed works. Nevertheless, the proposed works are generally consistent with the objectives of land zoned RU1.	Permissible
Other legislation		
Environmental Planning and Assessment Regulation 2021 (EP&A Regulation)	Clause 171(2) of the EP&A Regulation lists the factors to be taken into account when consideration is being given to the likely impact of an activity on the environment for the purposes of Part 5 of the EP&A Act. These factors are addressed in **Appendix A.** If the proposed works requires an approval or permit under any of the following provisions, then publication on SCC's website or the NSW planning portal is required under clause 171(4): – Subclause 171(4)(b)(i): *Fisheries Management Act 1994*, sections 144, 201, 205 or 219. – Subclause 171(4)(b)(i): *Protection of the Environment Operations Act 1997*, section 47-49 or 122.	Permissible
Wilderness Act 1987 (Wilderness Act)	The Wilderness Act provides for the identification, protection, and management of areas of declared wilderness. The proposed works do not affect a wilderness area.	Permissible
Crown Land Management Act 2016 (CLM Act)	The CLM Act provides the legislative framework for the administration and management of Crown land. Activities undertaken on Crown land, require approval by the Minister for Crown land. The proposed works would not affect Crown land.	Permissible

Legislation	Application	Permissibility
Aboriginal Land Rights Act 1983 (ALR Act)	The ALR Act establishes Aboriginal Land Councils (at State and local levels) and the process for land claims. Aboriginal land claims pertain to areas of vacant Crown land. The subject land is not located on Crown land so does not require consultation and approval under the ALR Act.	Permissible
Biodiversity Conservation Act 2016 (BC Act)	The purpose of the BC Act is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future. The BC Act lists threatened species, populations and ecological communities, as well as critical habitat and key threatening processes that must be considered when assessing the effects of an activity. The BC Act outlines the factors to be considered when making an assessment. If a significant impact is deemed likely following this assessment, a species impact statement (SIS) or a Biodiversity Development Assessment Report (BDAR) may be required. Matters protected under the BC Act, have been assessed in **Section 6.3**, and where relevant in accordance with the five-part test in section 7.3 of the BC Act. The assessments have concluded that the proposed works are unlikely to result in a significant impact to biodiversity matters protected under the BC Act.	Permissible
Fisheries Management Act 1994 (FM Act)	The FM Act lists threatened species of fish and marine vegetation, including endangered populations, ecological communities and key threatening processes. Significant impacts on threatened species, populations, ecological communities of fish and marine vegetation require an SIS under the FM Act. Potential impacts to aquatic biodiversity are discussed in **Section 6.3**, and are not considered significant. The FM Act also outlines certain offences, which are not permitted, unless a permit has been given by the Minister. The proposed works would require a Part 7 FM Act permit for: – Dredging and/or reclamation – section 200 – Obstruct fish passage – section 219. The NSW Department of Primary Industries (DPI) Fisheries applies a general, but unpublished, policy that does not require the abovementioned activities to be undertaken with a permit. However, this is not published policy and the requirement for a Part 7 permit should be confirmed in writing with DPI Fisheries. Under clause 218(5), SCC is required to notify the Minister of the proposed works prior to giving development approval.	Permissible with permits and notification.
National Parks and Wildlife Act 1974 (NPW Act)	The NPW Act governs the establishment, preservation and management of national parks, historic sites and certain other areas, and the protection of certain animals, native plants and Aboriginal relics. The proposed works are not located in land declared as part of the National Park estate. Section 86 of the NPW Act identifies offences relating to Aboriginal objects, including disturbing land to discover an artefact. Section 87 of the NPW Act requires a permit to be obtained to remove any artefacts, while section 90 requires consent to knowingly destroy, deface or damage a relic or Aboriginal place. A Due Diligence assessment was undertaken to inform the REF and is provided in **Section 6.4**. The assessment concluded that an impact to Aboriginal items is unlikely and an Aboriginal Heritage Impact Permit (AHIP) is not required.	Permissible
Heritage Act 1977 (Heritage Act)	The Heritage Act aims to ensure that the heritage of NSW is identified and conserved. It provides protection for items, such as places, buildings, works, relics, moveable objects, precincts or land that have been identified, assessed and listed on the State Heritage Register (SHR). There are no SHR listed items within proximity of the subject land.	Permissible

Legislation	Application	Permissibility
Contaminated Land Management Act 1997 (CLM Act)	The CLM Act establishes a process for investigating and (where appropriate) remediating land that is considered to be contaminated. Section 59(2) of the Act requires notification of significantly contaminated sites. Section 60 of the Act requires landowners to report any contamination that represents a significant risk of harm to human health or the environment to the NSW Environment Protection Authority (EPA). The subject land is not considered to be a significantly contaminated site and does not pose a significant risk of harm to human health or the environment.	Permissible
Protection of the Environment Operations Act 1997 (POEO Act)	The POEO Act requires the issue of an environment protection licence (EPL) for scheduled activities (being activities listed in Schedule 1 of the POEO Act), the issue of pollution offences, and generally the control of water, air and noise pollution and the management of wastes. The proposed works are not defined as a scheduled activity. and would not require an EPL. However, concrete from demolition of the dam and material recovered from the spillway would meet the definition of 'waste' under the POEO Act. EPA guidelines indicate that consent is required to retain demolition waste onsite. The dam material, should be subject to waste classification and assessment as to suitability for reuse in streambank stabilisation.	Permissible
The Water Management Act 2000 (WM Act)	The WM Act applies where a water sharing plan (WSP) is issued under the Act. The subject land is located within the area subject to the Water Sharing Plan for the *Greater Metropolitan Region Unregulated River Water Sources 2023*. The proposed works are therefore subject to the requirements of the WM Act and all water extraction or usage must be undertaken in accordance with the WSP. Water access from the site is not expected to occur so a Water Access Licence (WAL) is not expected to be required. Division 1A of the WM Act outlines offences relating to works within or adjacent to waterways. The proposed works would be undertaken on waterfront land (within 40 metres of the bed of a river or estuary) and as such comprises a controlled activity under the WM Act. However, public authorities such as SCC are exempt from obtaining a controlled activity approval under clause 41 of the *Water Management (General) Regulation 2018* (NSW). However, water supply work (section 91B) and drainage work (section 91C) would require a licence under section 90 of the WM Act.	Permissible with water management work approvals.

4.2 Commonwealth legislation

4.2.1 *Environment Protection and Biodiversity Conservation Act* 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) protects matters of national environmental significance (MNES) and other matters concerning the protection of the whole of the environment on Commonwealth land or through Commonwealth actions. The EPBC Act requires that actions likely to significantly impact MNES or the environment of Commonwealth land, be referred to the Commonwealth for approval.

A search of the Department of Climate Change, Energy, the Environment and Water (DCCEWW) protected matters search tool (PMST) was undertaken for the proposed works on 14 February 2024, with a 10 kilometre buffer (see search report in Appendix B). The impact of the proposed works on MNES or the environment of Commonwealth land is summarised in **Table 4.2**. Potential impacts on biodiversity MNES are discussed further in **Section 6.3**. Providing that the limit of works presented in **Figure 2.1** is complied with, the proposed works are not likely to significantly impact any MNES or Commonwealth land. Therefore, referral to the Commonwealth is not required.

Table 4.2 EPBC Act protected matters search results

Protected matter	Matters within the locality	Comments	Potential impact
Matters of national environmental significance			
World Heritage Property	None	N/A	Nil
National Heritage Places	None	N/A	Nil
Wetlands of International Importance	None	N/A	Nil
Great Barrier Reef Marine Park	None	N/A	Nil
Commonwealth Marine Areas	None	N/A	Nil
Threatened Ecological Communities (TECs)	8	The subject land contains moist forest vegetation communities, which may constitute the 'Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion' critically endangered ecological community. Vegetation communities could not be confirmed as the TEC, but have been treated as such under the precautionary principle. The limit of works would exclude all areas of rainforest and possible TEC, with the exception of four non-diagnostic rainforest trees. Therefore, there are unlikely to be any significant impacts to TECs. TECs are discussed further in **Section 6.3**.	Not likely to be significant
Threatened Species	111	The subject land may provide occasional habitat for a variety of threatened species, including arboreal and ground-dwelling mammals, birds, amphibians, reptiles and plants. Potential impacts to threatened species are discussed further in **Section 6.3**.	Not likely to be significant
Migratory species	57	The subject land may provide occasional habitat for a variety of migratory species, including terrestrial and wetland birds. Potential impacts to migratory species are discussed in **Section 6.3**.	Not likely to be significant
Other matters			
Commonwealth Land	155	There is no Commonwealth land located on or adjacent to the subject land. Commonwealth lands occurring in the buffer area are associated with: – Australian Postal Commission – Australian Telecommunications Commission – Defence Service Homes Corporation – Defence Housing Authority. No area of Commonwealth land would be affected by the proposed works	Nil
Commonwealth Heritage Places	1	Bundanon Trust Property is located eight kilometres southwest of the subject land. The proposed works would have no direct or indirect impact on this property.	Nil
Marine Species	68	The proposed works would have no direct or indirect impact on listed marine species.	Nil
Whales and Other Cetaceans	None	The proposed works would have no direct or indirect impact on whales and other cetaceans.	Nil
Critical Habitats	None	N/A	Nil
Commonwealth Reserves Terrestrial	None	N/A	Nil
Australian Marine Parks	None	N/A	Nil

4.2.2 Native Title Act 1993

The *Native Title Act 1993* (Native title Act) recognises and protects native title. The Native Title Act covers actions affecting native title and the processes for determining whether native title exists and compensation for actions affecting native title. It establishes the Native Title Registrar, the National Native Title Tribunal, the Register of Native Title Claims, the Register of Indigenous Land Use Agreements, and the National Native Title Register.

All affected land in the subject land is freehold land owned by SCC. Therefore, consultation and approval from native title claimants is not required.

4.3 Strategic plans

4.3.1 Illawarra Shoalhaven Regional Plan 2041

The *Illawarra Shoalhaven Regional Plan 2041* (Regional Plan) guides the NSW Government's land use planning priorities and decisions for the region. It provides an overarching framework to guide more detailed land use plans, development proposals and infrastructure funding decisions. The Regional Plan has four key themes:

– A productive and innovative region
– A sustainable and resilient region
– A region that values people and places
– A smart and connected region.

The proposed works predominantly align with the sustainable and resilient region theme, particularly in relation to the following objectives:

Objective 11*: Protect important environmental assets*

– The proposed works has been designed to minimise potential impacts arising from development in accordance with the avoid, minimise and offset hierarchy. Construction of the proposed works would follow the same hierarchy.
– Riparian corridors (e.g. of Cambewarra Creek) would be managed in consideration of natural physical processes to improve and manage downstream water quality and catchment health.

Objective 16: *Support the development of a circular economy*

– Opportunities for material recycling and repurposing would be explored and implemented during delivery of the proposed works.

Objective 17: *Secure water resource*

– The proposed works would involve removal of a potential (but currently redundant) water resource. However, removal of the water resource would minimise ongoing impacts to water catchments, including downstream impacts and groundwater sources, through restoration of a natural flow regime. Detailed design of the proposed works will aim to maintain or improve water quality in Cambewarra Creek and downstream waterways.

Beyond the proposed works, SCC would consider other themes and objectives of the regional Plan in determining future use of the land. SCC would consider the following objectives:

Objective 9: *Promote agriculture innovation, sustainability and value-add opportunities*

– The subject land occurs just outside of the 'biophysical strategic agricultural land' zoning featured on the resources map for Illawarra-Shoalhaven, so may be suitable for agricultural purposes.

Objective 14: *Enhance and connect parks, open spaces and bushland with walking and cycling paths*

– Subject to SCC determination on the appropriate future use of the subject land, the proposed works may provide opportunities for public leisure while maintaining natural values of the environment.

Objective 19*: Deliver housing that is more diverse and affordable*

– Subject to SCC determination on the appropriate future use of the subject land, the proposed works may establish conditions suitable for rural residential purposes.

4.3.2 Shoalhaven 2031 Community Strategic Plan

The Community Strategic Plan (Strategic Plan) informs decision making for long-term planning of development in the City of Shoalhaven LGA. The Strategic Plan has four key priorities:

1. Resilient, Safe, Accessible and Inclusive Communities
2. Sustainable, Liveable Environments
3. Thriving local economic that meet community needs
4. Effective, Responsible and Authentic Leadership.

The proposed works aligns with the priority for a sustainable, liveable environment, in particular with objectives:

– 2.1. *Manage our infrastructure for long term sustainability to meet community need*. The proposed works would remove existing infrastructure that serves no purpose to the community. Continued management of the redundant asset (Cambewarra dam) would require unnecessary ongoing effort and expenditure and is not sustainable long term.

– 2.2. *Manage growth and development with respect for environmental & community values*. The proposed works would be consistent with the existing neighbourhood character and would be sensitive to environmental values (see priority 2.3).

– 2.3. *Protect the natural environment and enhance sustainability*. The proposed works has been planned and designed to minimise impacts to the environment, including by minimising biodiversity loss and maximising and enhancing waterway health and quality. The proposed works would involve rehabilitation of the site, including the return of a natural flow regime and terrestrial biodiversity enhancement of the former reservoir. The proposed works would be undertaken in a way which minimises resource wastage and maximises recycling and repurposing.

4.4 Confirmation of statutory position

The proposal is categorised as development for the purpose of a water storage system and is being carried out by or on behalf of a public authority. Under clause 2.159 of the Transport and Infrastructure SEPP, the proposal is permissible without development consent. The proposal is not SSD, SSI, CSSI or RSD and can be assessed and approved under Division 5.1 of the EP&A Act.

The SCC is the determining authority for the proposal. This REF fulfils SCC's obligation under section 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 the activity.

Additional approvals and permits would be required for the proposed works, including:

– Part 7 FM Act permit for Dredging and/or Reclamation (refer section 200 of FM Act)
– Part 7 FM Act permit for Obstruct Fish Passage (refer section 219 of FM Act)
– Section 90 WM Act approval for Water Supply Work (refer section 91B of WM Act)
– Section 90 WM Act approval for Drainage Work (refer to section 91C of WM Act)
– EP&A Regulation publication, only if Part 7 FM Act permit is required.

In addition, clause 218(5) of the FM act, requires that SCC notifies the Minister of the proposed works prior to SCC giving approval for the proposed works.

5. Consultation

5.1 Transport and Infrastructure SEPP consultation

Part 2.2 of Transport and Infrastructure SEPP (clauses 2.10 to 2.17) outlines the requirements for consultation for public infrastructure projects. Clauses 2.10, 2.11, 2.12 and 2.14 apply to consultation required with councils. As SCC is the proponent for the proposal, it is assumed this consultation will be undertaken as required internally.

Clause 2.13 requires consultation with the State Emergency Services (SES) for certain types of developments on flood liable land. The proposal is not located within a flood planning area and the requirements of clause 2.13 do not apply. However, the subject land is located on a tributary of Good Dog Creek, which is declared downstream as an existing flood planning area. While not compulsory, consultation with SES is recommended due to the nature of the proposed works and change to the flow regime.

Clause 2.15 describes consultation required with authorities other than councils. The relevance of the requirements of this clause to the proposal is summarised in Table 5.1. No consultation under this clause is required.

Table 5.1 Transport and Infrastructure SEPP consultation

Clause 2.15 – Consultation with public authorities other than councils	Yes	No
Do the works involve:		
a. Development adjacent to land reserved under the *National Parks and Wildlife Act 1974* or to land acquired under Part 11 of that Act—the Office of Environment and Heritage		✓
b. Development on land in Zone C1 National Parks and Nature Reserves or in a land use zone that is equivalent to that zone—the Office of Environment and Heritage		✓
c. Development comprising a fixed or floating structure in or over navigable waters—Transport for NSW		✓
d. Development that may increase the amount of artificial light in the night sky and that is on land within the dark sky region as identified on the dark sky region map—the Director of the Observatory		✓
e. Development on Defence communications facility buffer land within the meaning of clause 5.15 of the Standard Instrument—the Secretary of the Commonwealth Department of Defence		✓
f. Development on land in a mine subsidence district within the meaning of the Mine Subsidence Compensation Act 1961—the Mine Subsidence Board		✓
g. Development on, or reasonably likely to have an impact on, a part of the Willandra Lakes Region World Heritage Property—the World Heritage Advisory Committee and Heritage NSW		✓

5.2 Community and stakeholder consultation

As the proposed works involve works requiring a permit under the FM Act, public exhibition of the REF must be undertaken to meet requirements of Clause 171(4) of the EP&A Regulation (refer to **Section 4.1**). Accordingly this REF will be publicly notified on SCCs website and/or the NSW planning portal and a review of responses published before the proposed works commences.

SCC would consult with relevant stakeholders, such as service providers, prior to construction to identify possible interactions and develop procedures to reduce the potential for utility damage or interruptions.

SCC would notify landowners and the community prior to works commencing, and as required with residents impacted by noise (refer to **Section 6.8**). The proposed works would be documented on SCC's website giving notification of timing and potential disruptions.

6. Assessment of likely environmental impacts

6.1 Surface Water

6.1.1 Existing environment

The subject land is located within the Shoalhaven River catchment on Cambewarra Creek, a second order stream. Cambewarra Creek, along with two first order streams are dammed by Cambewarra dam to form Cambewarra dam reservoir. The Cambewarra dam reservoir has a capacity of 28 ML and forms a reservoir with a surface area up to 1.5 ha. The total area of the catchment dammed by Cambewarra dam is about 143.7 ha. About 500 m downstream of the subject land, Cambewarra Creek discharges into Good Dog Creek. Good Dog Creek discharges into Bomaderry Creek and further into the Shoalhaven River.

During normal operation and at full supply surface water flows over the primary spillway, a steep unlined rock chute, into Cambewarra Creek. Because the reservoir is not used for water supply, it is expected to seasonally maintain a full, or near full capacity. However, seasonal variation and regulation (of the dam scour valve) would impact the natural flow regime in the following ways:

– Reduction in flood severity, in events where the reservoir is not at full capacity at the onset of rainfall and is able to reduce the volume of flood waters conveyed downstream.
– Exacerbation of drought impacts, in events where the loss of volume (from evaporation and groundwater percolation) is quicker than the volume of inflows. This may result in reduced reservoir water levels, and the prevention of downstream flows.

The subject land is not located in a current drinking water catchment or in a flood prone area. However, a flood prone area is located downstream of the subject land, on Good Dog Creek.

The creeks entering Cambewarra dam reservoir are typically well shaded by riparian vegetation. However, due to the shallow depth of the reservoir in relation to the open solar exposure and potential for long residence times, the current reservoir would likely contribute to increased surface water temperatures. This would be particularly apparent during summer and low flow periods.

Surface water quality at the site was assessed during a preliminary site investigation (PSI) undertaken in November 2020 (GHD, 2021b), and in a supplementary contamination assessment, undertaken in February 2024. In total, the two sampling events involved the collection of seven surface water samples, from across the reservoir.

The supplementary sampling program described the water as brown in colour and slightly turbid, with no visual or olfactory indicators of contamination. Contaminants identified in the PSI and supplementary assessment included:

Trace metals:

– In 2020, all four samples recorded exceedances of the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018) for fresh water (99% species protection) ecological criteria for copper, zinc, lead and nickel. Exceedances were recorded for cadmium in two of four samples.
– In 2024, one of three samples recorded exceedances of the 99% species protection level for freshwater ecological criteria for zinc and copper. The difference in results presents an apparent decrease in heavy metal contamination of surface water between 2020 and 2024.
– None of the samples exceeded criteria for the protection of human health.

Pesticides:

– In 2020, one sample recorded an exceedance in Endosulfan, a pesticide. Endosulfan is a broad-spectrum pesticide, that was formerly used in commercial horticultural and agricultural applications (APVMA, 2005), prior to being banned in 2010.
– In 2024, pesticides (including organochlorine pesticides (OCPs) and organophosphate pesticides (OPPs)) were not detected.

Hydrocarbons, and petrol related chemicals, including benzene, toluene, ethylbenzene, xylenes and naphthalene (BTEXN), polynuclear aromatic hydrocarbons (PAH) and total recoverable hydrocarbons (TRH), were not detected in water samples in 2020 or 2024.

Given the presence of heavy metal pollutants in surface water, Cambewarra dam reservoir may currently act as a water quality management reservoir, potentially improving downstream water quality by promoting the settlement and biodegradation or biological uptake of pollutants from the water column. Conversely, Cambewarra dam may promote unnatural accumulation of naturally occurring trace metals, causing elevated and potentially harmful concentrations of trace metals at the subject land.

Notwithstanding, the reservoir is currently being managed by SCC to minimise the stored water levels in the lead up to undertaking the proposed works. This involves the release valve being maintained in an open position to allow any retained water to be released as it accumulates. Due to the current state of the pipe below the release valve being partially obstructed, the rate of flow is relatively slow, anecdotally requiring up to a week for the reservoir to empty if filled. Further to this, the relatively narrow diameter of the pipe (450mm) also limits the potential rate of discharge not withstanding the restricted flow due to partial obstruction. The effect of this management regime would be to:

– Assist in dewatering sediments, particularly in the shallower areas of the impoundment area. This would assist in minimising the potential for bogging of vehicles and release of disturbed sediments upon commencement of the proposed works.
– Lowering ground water levels in a staged manner. This would assist in reducing the potential impact to adjacent vegetation which has become accustomed to the artificially high groundwater created by the reservoir. The alternative if the staged approach were not to be taken would be a sudden permanent reduction in groundwater when the proposed works commence potentially leading to vegetation shock and related health decline. A reduced groundwater level would also assist in minimising the potential for vehicle bogging in areas adjacent to the impoundment area and improving ground conditions for the ancillary and temporary works.
– Minimise the potential for sudden release of concentrated pollutants from the reservoir upon commencement of the proposed works. Continual and low volume release from the dam would act to maximise the dilution of any potential contaminants. It would also minimise the potential for ecological effects downstream due to temperature and other chemistry differences in the event of a sudden release of water that may otherwise occur if dewatering was to be initiated at the commencement of the proposed works.

As a result of the current water management approach, the flow regime in currently Cambewarra creek is likely to be more representative of the post-construction conditions as opposed to conditions in the past when the dam has been managed at full supply level with discharge occurring over the spillway.

Through the active management of the stored water levels in the reservoir ahead of the commencement of proposed works, the several key risks have been substantially mitigated. In particular, had draining of the reservoir been initiated at the commencement of proposed works downstream receivers may have been exposed to contaminants recorded in the surface water. This may include the following effects:

– Trace metals may present a toxicity hazard to plants, animals and human water users, if consumed in sufficient concentrations.
– Endosulfan is acutely toxic and an endocrine regulator, with potentially significant health implications for aquatic species such as fish, but also for humans if consumed in water or food (APVMA, 2005). These impacts can include neurotoxicity (known to cause death in fish) and hormonal regulation (thought to prevent breeding in fish). Endosulfan persists well in soils which can contaminate downstream waterways as a result of erosion and downstream transport.

6.1.2 Discussion

Construction

While the active management of the reservoir water levels would mitigate some of the potential impacts had dewatering not occurred until the commencement of the proposed works, further risks to surface water quality remain relevant to the construction phase. In particular:

– Acid Sulfate Soils (ASS) may have broad ranging impacts, including damage and death of aquatic animals and plants, damage to instream infrastructure (such as weirs), and human illness through consumption of toxic water (refer to **Section 6.11**).
– There is also a possibility of accidental spills from construction plant, such as hydrocarbons and mechanical fluids, which could also reduce water quality and toxicity.

Mobilisation of contaminants is only expected to have negligible impacts, if any, due to the concentrations of existing contaminants in the subject land and the dilution that would occur when mixing with downstream receiving waterways. Owing to the existing flow regime involving continual discharge of surface water through the release value, the proposed works are not expected to increase mobilisation of contaminants. Further to this, mitigation measures would be implemented to avoid preventable spills and respond effectively in the event of an unanticipated incident.

Construction activities including excavation, dredging, dewatering and stockpiling, would result in substantial soil and sediment disruption with the potential to negatively impact upon water quality. These activities would also include on site concrete crushing, which would generate small particles of concrete and dust. These activities have the capacity to result in the suspension of unconsolidated sediments and release of pollutants that may be held within sediments or soils, into surface water.

The exposure of sediments within the impoundment area may also be vulnerable to erosion following draining of the reservoir prior to stabilisation works and revegetation. Suspended sediment would reduce downstream water quality and would contribute to sedimentation of waterways. Such erosion could occur by either:

– wind generated dust formed by the drying of previously submerged and unconsolidated sediments, or
– rain and overland water flow across the exposed sediments leading to the creation of new channels through sediments that have previously settled at the bottom of the reservoir.

Noting the potential for disturbed soils to result in the release of sediment, the installation of temporary sediment and erosion control measures will be an integral component of the proposed works. This aspect represents one of the key areas of environmental risk and will need to be comprehensively and actively managed. Surface water management is essential to managing this risk and is to be managed with the development and implementation of an erosion and sediment control plan (ESCP) as a sub-plan to the CEMP.

Operation

The proposed works would restore a flow regime of Cambewarra Creek more reflective of the natural, pre-dam conditions. Restoration of an unimpeded flow regime would have positive impacts on downstream receivers, including aquatic animals which require natural flow regimes for habitat, movement, and breeding cues (refer to **Section 6.3**).

A hydrology and flood modelling assessment has been undertaken as part of the *Cambewarra dam decommissioning - Decommissioning Design Report – Phase 1* (GHD, 2024). The modelling demonstrated that there would be a slight reduction in median peak discharge following decommissioning of Cambewarra dam. This is because the dam may initially attenuate stormwater before overspilling at higher discharge volumes. The hydrology and flood modelling assessment concluded that removal of the dam may marginally reduce flood risk and severity downstream of the dam.

During its operational life, Cambewarra dam may have served a water quality management function through the settling of suspended sediment, and biodegradation or uptake of excessive nutrients and other potential pollutants. This would have been particularly notable at the early part of the 20th century when vegetation removal was active and extensive (see **Appendix F**). The removal of Cambewarra dam would therefore eliminate this function and may expose existing sediments and pollutants that have settled in Cambewarra Creek to ongoing erosion by flowing water. Conversely, the dam may currently facilitate unnatural accumulation of naturally occurring trace metals and nutrients, which are essential to plants. Therefore, the proposed works may prevent localised contamination and toxicity, and instead may make essential trace metals and nutrients more available in surface water for downstream receivers.

6.1.3 Mitigation

Mitigation measures provided in **Table 6.1** would be implemented to minimise potential impacts to surface water.

Table 6.1 Proposed mitigation measures – surface water

Impact	Management measure	Timing	Responsibility
Erosion and sedimentation	Erosion and sediment controls are to be prescribed and implemented in accordance with an approved ESCP, and in accordance with the mitigation measures in **Section 6.6.3**.	Construction	Contractor
	Erosion and sediment controls are to be maintained daily during construction. Additional inspections of sediment and erosion control measures must be undertaken prior to any predicted rainfall event reaching the site that would lead to surface water runoff. Inspections are to ensure control measures remain effective and can withstand the predicted weather conditions.	Construction	Contractor
	Rehabilitation will be undertaken as soon as possible, in all areas subject to reclamation and ground disturbance, including ground stabilisation and provision of vegetative groundcover in all disturbed areas. Sediment and erosion controls (including dust) must be maintained until vegetation cover is established and self-sustaining.	Construction	Contractor
	Visual monitoring (i.e. turbidity, hydrocarbon spills/slicks, etc.) of Cambewarra Creek will be undertaken on a regular basis to identify any potential spills or deficient erosion and sediment controls. A record will be kept of these inspections.	Construction	Contractor
Contamination	Vehicle wash downs, refuelling, fuel decant and vehicle maintenance must occur offsite or in a designated bunded area more than 40 m from any drainage line.	Construction	Contractor
	Contamination hazards must be managed in accordance with the mitigation measures provided in **Section 6.6.3**.	Construction	Contractor
	All materials (e.g. Fuel, contaminated soil) that have the potential to contaminate surface water or groundwater must be stored at least 40 m away from any watercourses and on flat grades.	Construction	Contractor
Flooding and hydrology	A flood contingency plan must be in place so that any stockpiles, machinery, equipment, etc. are relocated in the event of a known upcoming large rainfall or flood event. This will include forecast monitoring at a minimum frequency of weekly.	Pre-construction	Contractor
	Earthworks, including demolition, capping and channel formation works, must not be undertaken within 20 m of Cambewarra Creek, during or immediately following (at least one day depending on extent of rain) rainfall events, when water levels are elevated or when ground conditions would result in bogging.	Construction	Contractor
	Should there be an accumulation of water in the reservoir at the point of commencing the proposed works, drainage the reservoir must be undertaken gradually, to not exceed natural peak flow volumes that may otherwise cause flooding.	Construction	SCC
	Design of the Cambewarra Creek channel must incorporate features that reduce velocities and replicate the natural riffle-run-pool sequence of Cambewarra Creek that would be characteristic of this part of the catchment. Design features should include: - minimise channel slope to prevent velocity build up and erosion potential, - replicate, as far as possible, natural channel morphology, in regard to cross-sectional bank gradients/channel depth and width, - avoid integrating sharp bends, which may enhance velocity around the outside bank causing streambank erosion, - integrate alternate pool, riffle and run sequences, - integrate rip-rap or other rocky substrate to facilitate turbulence and velocity reduction.	Pre-construction	SCC

Due to the likely volumes of sediment, contaminants, surface water flows, and with implementation of mitigation measures described in **Table 6.1**, downstream water quality impacts are not expected to be significant.

Overall, the proposed works are expected to have a beneficial effect on the environment through the restoration of natural flow regimes, with further potential benefits on downstream flood mitigation and natural nutrient cycles and pathways.

6.2 Groundwater

6.2.1 Existing environment

The subject land is located in the Sydney Basin Hydrogeological province and forms part of the WSP for the Greater Metropolitan Region Groundwater Sources 2023[1]. Groundwater hydrogeology at the subject land is characterised by extensive fractured or fissured aquifers of low to moderate productivity. Groundwater flow systems are described as local flow systems in Palaeozoic rocks or Mesozoic intrusives. The flow direction is not known but is likely to be in a southeasterly direction towards Good Dog Creek, consistent with surface topography.

A review of the Bureau of Meteorology (BOM) groundwater explorer (BOM, 2023b) did not contain any groundwater bores within one kilometre of the subject land. The nearest groundwater bore is located approximately 1.3 km to the northwest of the subject land. The bore is registered for stock and domestic purposes and was originally drilled to 34 m depth. However, the depth of groundwater is not known. The next closest groundwater bore is located almost 5 km to the southeast. The depth of groundwater is not known at this bore. However, the bore was drilled to 54 m and has a screen at 17 – 18 m, potentially indicating the depth at which groundwater was observed.

The BOM groundwater dependent ecosystems map (BOM, 2023a) identifies the subject land as having a high probability of groundwater dependent ecosystems. However, there are no known springs or any interaction of groundwater at the surface of the subject land.

As discussed in **Section 6.1**, active management of the reservoir level us being undertaken by SCC to reduce the volume of stored water ahead of the commencement of proposed works. Due to the lowered dam levels, it is expected this would be lowering the artificially elevated groundwater in close proximity to the impoundment area. Despite this, the small diameter of the pipe and partial obstruction have the combined effect of a greatly reduce rate of discharge. As such it is likely that high volume and high intensity rainfall events are likely to result in a temporary increase in the stored volume. This would influence the groundwater level and it is likely that there would be fluctuations in the groundwater until such times as the proposed works have concluded. As a result, it is likely this would have the effect of:

– Mitigating the transition to the post construction phase where groundwater levels are likely to be more reflective of conditions prior to construction of the dam.
– Providing a transitionary period that would have the benefit to adjacent vegetation to allowing some adaptation to a locally reduced ground water level.

6.2.2 Discussion

Construction

The proposed works would require excavation and dredging to natural ground level and to the depth of existing dam wall foundations. Therefore, direct interaction with groundwater is highly unlikely. There are no nearby groundwater wells that would be used during construction for dust suppression, or any other purpose.

If surface water were to become contaminated (refer to **Section 6.1.2**), percolation of contaminated surface water could result in the mobilisation and transport of pollutants through the groundwater table. Groundwater quality could be impacted by the dissolution of heavy metals and pesticides, or compounds incidentally released during construction, such as hydrocarbons or the disruption of sulfuric acid from ASS (refer to **Section 6.6**). There are few operational groundwater bores within the vicinity of the subject land, with the nearest registered bore located

[1] **https://legislation.nsw.gov.au/view/pdf/asmade/sl-2023-328**

approximately 1.3 km upslope from the subject land. It is therefore unlikely that reductions in groundwater quality would impact on drinking water quality, health or agricultural production and business.

Operation

The proposed works would restore natural surface water and groundwater interactions at the subject land. This may involve a reduction in the volume of surface water percolating into groundwater due to the removal of Cambewarra dam. Due to the size of Cambewarra dam reservoir, and the localised nature of aquifers in the locality, any change in surface water and groundwater interaction at the site is likely to be negligible.

The proposed works may also reduce the likelihood of ongoing groundwater contamination through:

– removal of Cambewarra dam and associated standing water body, which would otherwise trap pollutants.
– excavation and removal of contaminated sediments, if present.

6.2.3 Mitigation

As demonstrated above, there is a relatively low risk of interaction with groundwater systems from undertaking the proposed works. Provided mitigation measures described in **Table 6.1** for surface water management and **Table 6.9** addressing the potential for contamination are implemented, there are no additional groundwater specific mitigation measures necessary.

6.3 Ecology

6.3.1 Existing environment

Ecological values have been identified from a combination of desktop assessment (**Appendix C**) and an ecological site inspection, undertaken by GHD on 1 February 2024 (refer to **Appendix D**).

The subject land is encircled to the north by Cambewarra Range Nature Reserve, which is located about 1.2 km away at its nearest point. The subject land is also encircled by the Budderoo Morton Illawarra-Shoalhaven Regional Biodiversity Corridor, which connects the Budderoo and Morton National Parks. This biodiversity corridor provides an important linkage of habitat for threatened species, including spotted-tail quoll (*Dasyurus maculatus*), eastern ground parrot (*Pezoporus wallicus wallicus*) and other woodland birds, arboreal mammals and plants.

The subject land does not include land mapped on the biodiversity values mapped as an area of outstanding biodiversity value (AOBV). However Good Dog Creek, which is located about 300 m downstream of Cambewarra dam, is mapped as biodiverse riparian land.

6.3.1.1 Vegetation communities and habitat

Plant community type (PCT) mapping identifies the likely plant species assemblages at a given location, based on common combinations of plant assemblages, and environmental conditions such as soil, temperature, moisture and other factors (NSW Environment and Heritage, 2023). PCTs identified as potentially occurring at the subject land are summarised in **Table 6.2**.

Upon inspection of the subject land (refer to **Appendix D**), it was determined that most of the PCTs were likely to be incorrectly mapped due to the history of disturbance, nature of regrowth and extent of weed infestation. However, plot-based surveys were not undertaken to conclusively identify which PCTs were present at the site.

Table 6.2 Vegetation communities potentially occurring on the subject land

Community	Description (DPE, 2022)
PCT 3013: Illawarra Lowland Subtropical Rainforest[2]	Tall to very tall, mid-dense to dense rainforest, or rarely very tall to extremely tall sclerophyll open forest with a dense rainforest sub-canopy. This PCT occurs mainly on the Illawarra lowlands between Helensburgh and Nowra.

[2] PCT 3013 was not identified in the desktop assessment as occurring on subject land but is mapped about 300 m upstream. The ecological site inspection (refer to Appendix D) identified that diagnostic species associated with the PCT were present on the subject land.

Community	Description (DPE, 2022)
	Overstorey composition is diverse and variable. The tallest rainforest trees very frequently include giant stinging tree (*Dendrocnide excelsa*), commonly with sassafras (*Doryphora sassafras*) and red cedar (*Toona ciliata*) (observed on subject land), each of which sometimes has locally high foliage cover. Eucalypts are rare, however when present coast white box (*Eucalyptus quadrangulata*) is the most frequent. Other rainforest trees in the canopy or sub-canopy very frequently include whalebone tree (*Streblus brunonianus*), black plum (*Diospyros australis*), common lilly pilly (*Acmena smithii*) (observed on subject land) and red olive plum (*Elaeodendron australi*); and are sometimes locally abundant. The cabbage palm (*Livistona australis*) was observed on subject land and is also very frequent and sometimes locally abundant in the understorey. The climbing epiphytic fern *Arthropteris tenella* and vines *Eustrephus latifolius*, *Marsdenia rostrata*, wonga wonga vine (*Pandorea pandorana*) (observed) and sweet morinda (*Gynochthodes jasminoides*) (observed) are all very frequent, usually with low abundance. The typically sparse ground cover very frequently includes the fern *Adiantum formosum* and tall forb *Gymnostachys anceps*.
PCT 3077: Illawarra Complex Dry Rainforest	Mid-high to tall, mid-dense to dense rainforest, or occasionally very tall, sclerophyll open forest with a dense rainforest mid-stratum. This PCT occurs on the coast and foothills of the Illawarra between Wollongong and Nowra. The canopy is typically dominated by whalebone tree and red olive plum, neither of which were recorded in the subject land. The community has a sparse to dense ground layer comprising forbs, grasses and ferns, in addition to some frequently occurring vine species, including wonga wonga vine, which was recorded in the subject land.
PCT 3078: Illawarra Lowland Wet Vine Forest	Very tall sclerophyll open forest with dense small tree, shrub and vine mid-stratum, or occasionally mid-high to tall, mid-dense to dense forest with eucalypt emergents, occurring on fertile soils of the Illawarra lowlands between Wollongong and Nowra. The canopy is typically dominated by forest red gum (*Eucalyptus tereticornis*) and/or coast white box, with the small tree (*Notelaea venosa*) very frequent. None of these species were observed during the site inspection. The community has a sparse to dense ground layer.
PCT 3191: South Coast Ranges Moist Gully Forest	A very tall moist sclerophyll open forest of gullies and sheltered slopes on coastal and hinterland foothills of the northern Southeast Corner and southern Sydney Basin bioregions. The tree canopy is generally moderately dense, with no single species dominating. Wollongong woollybutt (*Eucalyptus botryoides x saligna*) is a frequently occurring canopy species and was observed in the subject land during the site inspection. The community has a sparse small tree layer and moderately dense ground layer that is rich in vines, ferns, grasses, graminoids and soft forbs. Wonga wonga vine is a frequent vine species and weeping grass (*Microlaena stipoides*) a frequent grass species, both of which were recorded in the subject land during the site inspection.
PCT 3268: Shoalhaven Foothills Turpentine-Ironbark Moist Forest	A very tall moist shrubby sclerophyll open forest of moderately fertile sheltered slopes and plateaus of coastal foothills and hinterland valleys in the lower Shoalhaven and upper Clyde catchments. The PCT has a moderately dense tree canopy, sparse small tree and shrub stratum and sparse to moderately dense ground layers, frequently including wonga wonga vine, weeping grass and hard fern (*Blechnum neohollandicum*), all of which were observed during the site inspection.
PCT 3270: Shoalhaven Lowland Wet Gully Forest	A very tall sclerophyll open forest with a mid-stratum of mesophyll small trees, shrubs and palms and a ferny ground layer found in gullies and sheltered slopes of the Shoalhaven lowlands between Nowra and Batemans Bay. The tree canopy is variable in composition and the mid-stratum is layered with a sparse to mid-dense cover of smaller trees, commonly including the rough tree fern, which was observed during the site inspection. The ground layer almost always includes a high cover of rainbow fern (*Calochlaena dubia*) and commonly with hard fern, both of which were observed in the site inspection.
PCT 3654: Shoalhaven Lowland Bloodwood Shrub Forest	A tall to very tall dry shrubby sclerophyll open forest with a ground cover of grasses, graminoids and ferns mainly situated on Nowra sandstone lowlands and foothills in the Shoalhaven region between Kangaroo Valley, Nowra and Bawley Point. The mid-stratum very frequently includes several layers with a sparse taller canopy. A mid-dense shrub layer and ground layer is characterised by combinations of grasses and graminoid species, very frequently with weeping grass.

While all of the PCTs identified above comprise open sclerophyll forests or rainforest, the ecological site inspection described three dominant vegetation formations, these being cleared pasture, fringing vegetation and disturbed

moist forest, in addition to aquatic habitat. A description of these formations and their respective habitat values are summarised below.

Cleared / pasture

Historic aerial imagery demonstrates that the site has been subject to substantial clearing and pasture modification (see **Appendix F**). Cleared areas and pastures comprise various exotic and native grasses, dominated by kikuyu (*Pennisetum clandesinum*), paspalum (*Paspalum dilatatum*) and couch grass (*Cynodon dactylon*). The native weeping grass (*Microlaena stipoides*) is also relatively widespread across the subject land. A group of native overmature Australian blackwood trees (*Acacia melanoxylon*) are present growing on a stockpile of soil in the northeastern portion of the subject land and on the adjacent berm on the eastern bank of the reservoir.

Areas comprising the cleared / pasture community have limited ecological value and do not correspond to the definition of any listed communities. Notwithstanding, these areas may provide terrestrial foraging habitat for waterbirds, predatory birds and microchiropteran bats. Cleared / pasture areas may also provide occasional habitat for reptiles and amphibians.

Disturbed Moist Forest

Moist forest occurs along drainage lines above and below the dam wall, and along the western perimeter of the reservoir. Due to the extent of historical clearing at the site, moist forest at the subject land is regrowth forest and lacks diversity. The majority of moist forest at the subject land is highly disturbed and comprises a dense understorey of lantana (*lantana camara*). A variety of native ferns, vines, shrubs and small trees, are present in areas of moist forest not dominated by lantana. Areas of moist forest downstream of the dam wall comprise greater diversity and appear less disturbed, with a variety of epiphytic species and rough tree fern (*Cyathea australis*).

Areas comprising moist forest may provide a wide range of habitat opportunities for animals and plant species, including several threatened species. Moist forest at the subject land may provide refuge and foraging habitat for threatened woodland birds, owls, microchiropteran bats, grey-headed flying fox and marsupials, including the spot-tailed quoll and gliders. The site inspection also documented the presence of a wombat (*Vombatus ursinus*) on the western side of the dam wall, in addition to several wombat burrows.

Fringing vegetation

The eastern and northern perimeter of the reservoir comprises fringing vegetation, dominated by cumbungi (*Typha orientalis*), amongst several other emergent aquatic plants which were present to a depth of about one metre. Reed beds of cumbungi generally form a 2 m wide buffer around the eastern perimeter of the reservoir. A small number of introduced weeping willows (*Salix babylonica*) occur along the edge of the reservoir and in other moist parts of the subject land. Other damp areas surrounding the reservoir comprise native vegetation, including slender knotweed (*Persicaria decipens*) and various species of sedges (*Cyperus* spp.) and rushes (*Juncus* spp.).

Fringing vegetation at the subject land provides dense shelter for waterbirds, which may forage and breed in surrounding areas of aquatic and terrestrial habitat. Fringing vegetation may also provide important refuge and breeding habitat, for amphibians, small fish and other aquatic animals.

Subsequent to the ecological site inspection, SCC commenced active management of the reservoir water level. As a result, it is likely that the fringing vegetation as observed at that time would vary and may not be representative of what has been described.

Aquatic habitat

The subject land comprises a variety of aquatic habitat features and may provide habitat for a variety of species. The main feature of the subject land is the reservoir formed by Cambewarra dam, which provides a freshwater lacustrine body of water, with a surface area of 1.5 ha at full supply level. The reservoir is filled by Cambewarra Creek and two other small low order ephemeral creeks (refer to **Section 6.1.1**).

The reservoir may provide foraging and breeding habitat for a wide variety of aquatic species, including fish, amphibians, turtles, and insects, as well as foraging opportunities for microchiropteran bats and predatory birds. Due to the ephemeral nature of surrounding creeks, the reservoir may also provide important drought refuge for fish, turtles and amphibians. The banks of the reservoir are generally gently sloping and shallow and may therefore provide shallow foraging habitat and intermittent mud flats for a variety of wading birds and waterfowl.

The dam discharges into Cambewarra Creek, down a rocky rainforest gully. Downstream of the dam wall, Cambewarra Creek possesses natural cascades with alternating riffles and stepped pools, which may provide habitat for small fish, insects and other aquatic species and amphibians. However, fish passage is understood to be limited by the size (volume of flows) and morphology of Cambewarra Creek (stepped pools and cascades), in addition to Cambewarra dam, which does not possess a fishway. Cambewarra Creek may possess habitat for amphibians and reptiles, in addition to a variety of terrestrial animals and plants, which may rely on, or be associated with a water source.

With active management of the reservoir water level, the habitat potential on the subject land will vary from time to time according to the time since the most recent rainfall event. As such the aquatic habitat would be more equivalent to situations like a stormwater detention basin that is designed to capture peak flow and discharge it more slowly. This would be an ephemeral habitat that would provide opportunistic habitat for a more limited range of fauna.

6.3.1.2 Ecological Communities

A search of the DCCEWW PMST was undertaken on 14 February 2024 (refer to **Appendix B**) and identified eight EPBC Act listed TECs, as possibly occurring in the subject land, including four which were identified as likely to occur within the subject land or search area. These include:

– Illawarra–Shoalhaven subtropical rainforest of the Sydney Basin Bioregion (Critically Endangered)
– Illawarra and south coast lowland forest and woodland ecological community (Critically Endangered)
– River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria (Critically Endangered)
– Coastal swamp sclerophyll forest of New South Wales and southeast Queensland (Endangered).

Based upon the vegetation communities observed in the site inspection and a likelihood of occurrence undertaken in **Appendix E**, the following TECs (both collectively referred to herein as ‘subtropical rainforest’) may occur:

– Illawarra subtropical rainforest in the Sydney Basin Bioregion (NSW, Endangered)
– Illawarra–Shoalhaven subtropical rainforest of the Sydney Basin Bioregion (Commonwealth, Critically Endangered).

A specialist ecological assessment has not been undertaken to formerly identify whether vegetation communities present with the subject land meet the diagnostic criteria for classification as subtropical rainforest. However, diagnostic species were observed for both PCT 3013 and 3077 on the subject land. Both PCTs are considered to be components of the subtropical rainforest TEC, therefore indicating that the TEC may be present on subject land.

Due to the lack of structural complexity and level of degradation (lantana infestation) of the moist forest community observed during the ecological site inspection, vegetation on the subject land may not meet the diagnostic criteria for classification as the subtropical rainforest TEC. However, in application of the precautionary principle, the subtropical rainforest TEC has been considered present for the purpose of this assessment. The distribution of these communities may be along the eastern and southern fringes of the reservoir, including along the gully formed by Cambewarra Creek, immediately downstream of the dam wall (see restricted environmental area in **Figure 2.1**). There are no other Commonwealth or NSW listed TECs expected to occur in the subject land.

6.3.1.3 Threatened and Migratory Species

A list of species recorded in the site inspection is provided in **Appendix D**. The site inspection did not identify the presence of any threatened species in the subject land. However, various threatened species may occasionally occur in the subject land.

A search of the DCCEWW PMST was undertaken on 14 February 2024 (refer to **Appendix B**) and identified 111 EPBC Act listed threatened species and 57 migratory species as potentially occurring within the subject land, including 45 threatened species and 11 migratory species reported as likely or known to occur in the subject land.

Several species have been recorded on multiple occasions within the locality of the subject land, as mapped on the NSW Office of Environment and Heritage (OEH) BioNet Atlas (OEH, 2024)(refer to **Appendix C**). A likelihood of occurrence assessment was undertaken to assess the likelihood of threatened and migratory species occurring

in the subject land and is presented in **Appendix E**. Species considered as having a medium or high possibility of occurring at the subject land (on occasion) are shown in **Table 6.3**.

Table 6.3 Species potentially occurring in the subject land

Species	Commonwealth status	NSW status	Commonwealth Status
Animals - mammals			
Miniopterus australis	Little Bent-winged Bat	V[3]	-
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V	-
Pteropus poliocephalus	Grey-headed Flying-fox	V	V
Chalinolobus dwyeri	Large-eared Pied Bat	V	E[4]
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-
Myotis macropus	Southern Myotis	V	-
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-
Dasyurus maculatus	Spotted-tailed Quoll	V	E
Petaurus australis	Yellow-bellied Glider	V	V
Potorous tridactylus	Long-nosed Potoroo	V	V
Petauroides volans	Southern Greater Glider	E	E
Cercartetus nanus	Eastern Pygmy-possum	V	-
Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)	E	E
Animals - birds			
Circus assimilis	Spotted Harrier	V	-
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-
Lophoictinia isura	Square-tailed Kite	V	-
Hirundapus caudacutus	White-throated Needletail	V	V,C[5],J[6],K[7]
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-
Daphoenositta chrysoptera	Varied Sittella	V	-
Pachycephala olivacea	Olive Whistler	V	-
Petroica boodang	Scarlet Robin	V	-
Dasyornis brachypterus	Eastern Bristlebird	E	E
Pycnoptilus floccosus	Pilotbird	-	V
Callocephalon fimbriatum	Gang-gang Cockatoo	E	E
Calyptorhynchus lathami lathami	South-eastern Glossy Black-Cockatoo	V	V
Glossopsitta pusilla	Little Lorikeet	V	-
Lathamus discolor	Swift Parrot	E	CE[8]
Ninox strenua	Powerful Owl	V	-
Tyto novaehollandiae	Masked Owl	V	-

[3] V = Vulnerable
[4] E = Endangered
[5] C = China Australia Migratory Bird Agreement (CAMBA)
[6] J = Japan Australia Migratory Bird Agreement (JAMBA)
[7] K = Republic of Korea Australia Migratory Bird Agreement (ROKAMBA)
[8] CE = Critically Endangered

Species	Commonwealth status	NSW status	Commonwealth Status
Animals - mammals			
Tyto tenebricosa	Sooty Owl	V	-
Plants			
Rhodamnia rubescens	Scrub Turpentine	CE	CE
Zieria baeuerlenii	Bomaderry Zieria	E	E
Zieria tuberculata	Warty Zieria	V	V
Solanum celatum	-	E	-

6.3.2 Discussion

Construction

Terrestrial Vegetation

The proposed works would involve the disturbance and/or removal of up to 0.85 hectares of vegetation. Vegetation to be removed and/or disturbed would predominantly include exotic pastures and aquatic cumbungi but would also include the removal of up to 20 overmature (dead and senescent) blackwood (*Acacia melanoxylon*), from stockpiles in the northeast corner of the subject land (refer to **Figure 6.1**).

Figure 6.1 Dead and senescent Australian blackwood trees on a soil stockpile in the northeastern corner

In addition, four native trees would require removal from the edge of moist forest (potential subtropical rainforest) adjacent to the dam wall. Species affected include blackwood, cheese tree (*Glochidion ferdinandi*) and sweet pittosporum (*Pittosporum undulatum*). While these trees are not diagnostic of subtropical rainforest, they may contribute to the overall composition and integrity of the moist forest community. The site inspection did not identify any threatened plant species, or species diagnostic of subtropical rainforest, that would be impacted by the proposed works.

Clearing of native vegetation is recognised as a key threatening process under the NSW *Key threatening processes strategy* (OEH, 2018). Therefore, all efforts would be made in detailed design and construction to avoid unnecessary removal of native vegetation. This includes compliance with the limit of works presented in **Figure 2.1** which would prevent direct impacts to all areas of moist forest (except for four trees adjacent to the dam wall) and which may form part of the subtropical rainforest ecological community. Ground disturbance would

not be permitted outside of the limit of works, with the exception of one tree overlapping this boundary, which has been identified for potential removal. All trees identified for removal should be maintained if possible and should only be removed if required for safe access during construction works. Due to the proximity of works around the existing dam wall, there may be some construction works within the drip zone of other trees, including demolition of the dam wall and erosion control works.

A revegetation plan has been developed and is shown in **Figure 2.6**. The revegetation plan identifies areas subject to replanting and the plant species that will be used, in addition to areas of hydromulching. The intent of the revegetation plan is to facilitate the effective establishment of native vegetation, to prevent weed infestation, and to form a suitable buffer for protection and establishment of potential areas of subtropical rainforest. This plan adopts an approach of assisted natural regeneration for encouraging recovery of the natural vegetation communities along the drainage line. Assisted natural regeneration is a technique that involves active and passive approaches to vegetation recovery and includes limited replanting, weed control and protection from other threats such as grazing. Implementation will require a minimum six month period following conclusion of the proposed works and would be subject to a Landscape and Revegetation Management Plan that would form part of the CEMP.

The proposed works would only involve earthworks to natural ground level in the vicinity of moist forest. Therefore, direct impacts to native vegetation would be considered negligible. However, due to the sensitivity and critically endangered status of subtropical rainforest, the proposed works could potentially compromise the integrity of subtropical rainforest, if present, through edge effects.

Edge effects can include changes in the exposure of ecological communities to sunlight and winds (including damaging winds), and subsequent infiltration of weeds. Therefore, a significant impact assessment was undertaken for subtropical rainforest in accordance with the NSW 5-part test of significance and EPBC Act *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* (DEWHA, 2013) (refer to **Appendix E**). While there may be some indirect impacts to areas of potential subtropical rainforest, the proposed works are concluded as having a low likelihood of significantly impacting areas of potential subtropical rainforest.

Aquatic Habitat

In the event that there is a substantial volume of water retained at the commencement of proposed works, rapid draining of the reservoir could result in elevated velocities or flooding of downstream habitats. This could involve impacts such as displacement of animals, uprooting of plants, erosion of riparian banks and root systems, thermal shock (due to sudden changes in water temperature) to animals, or false breeding cues (due to elevated flows and discharge of comparatively warmer water) for species such as fish. Construction activities involving soil handling may also result in contamination of soils and waterways (refer to **Sections 6.1** and **6.6**), with potential on site and downstream toxicity impacts to flora and fauna. Contamination could result in temporary or long-term illness and injury or death for flora and fauna.

Owing to the volume retained by the dam and the relatively low rate of discharge (450mm pipe), the potential for downstream impacts to aquatic habitat and species from draining of the reservoir is considered very low. This is particularly the case given the active management of water levels currently in place to minimise the stored volume of water ahead of the commencement of proposed works.

Notwithstanding, the reservoir with fringing vegetation and surrounding moist forest provides an existing aquatic habitat that would be removed by the proposed works. This would result in the removal of aquatic habitat covering approximately 1.5 ha. It is expected to directly impact a range of common waterbirds in addition to amphibian, reptile and both terrestrial and flying mammals. However, the aquatic habitat provided by the subject land is not known to be used by any threatened or migratory species and is unlikely to provide habitat critical to the survival of any species.

Biosecurity

The proposed works have the potential to encourage proliferation of weed species and pathogens that are recognised as being detrimental to the populations and habitats of native animals and plants. Weed and pathogen dispersal could be facilitated by earthworks, movement of soil around site and attachment and transport of seeds and other vegetation matter via vehicles, plant and personnel. Several pathogens and parasites known in NSW have the potential to impact on biodiversity when introduced by construction activities. There are three key pathogens and parasites of key concern across NSW. There are listed as a key threatening process under either the EPBC Act and/or NSW *Key threatening processes strategy* (OEH, 2018) and include:

– dieback caused by *Phytophthora cinnamomi* (Root Rot) (EPBC Act and BC Act)
– infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis (EPBC Act and BC Act)
– introduction and establishment of exotic Rust Fungi on plants of the family Myrtaceae (BC Act).

These pathogens have not been observed or tested for in the subject land. However, lantana and exotic perennial grasses were identified in the site inspection and could be further established by the proposed works. Establishment of lantana and exotic perennial grasses are identified as key threatening processes under the NSW *Key threatening processes strategy* (OEH, 2018) and can rapidly smother native ground vegetation, resulting in reduced structural complexity and biodiversity.

The most likely causes of pathogen dispersal and importation associated with the proposed works could include earthworks, importation and movement of soil, and attachment of vegetation and soil matter to vehicles, plant machinery and footwear.

Fauna

During the construction phase of the proposed works, operation of plant, particularly during enabling works and subsequent earthworks, could disturb or injure animals sheltering in vegetation, living in burrows or moving across the subject land. Animals may also shelter or become trapped in machinery, which when operated may cause injury or mortality. Noise associated with construction plant may also temporarily disturb native fauna, potentially causing stress and/or movement out of the subject land.

Operation

The proposed works would result in the transformation of up to 1.5 ha of reservoir to a mixture of terrestrial vegetation and pasture, including reinstatement of Cambewarra Creek and its tributaries on the subject land. As a result, there would be direct changes in habitat quality and availability for different species, including abiotic modifications to the environment which could impact upon existing ecological communities.

The proposed works would also modify natural processes at and downstream of the subject land, which could modify the composition and distribution of plants and animals. These changes would include modifications to hydrological and nutrient cycles (refer to **Sections 6.1** and **6.6**) resulting from the removal of Cambewarra dam, which currently provides a barrier to the downstream transfer of water and nutrients. As a result, the proposed works would restore natural flows, which are expected to be steadier and more reliable throughout seasons. This is expected to improve habitat suitability and fish passage along Cambewarra Creek. The removal of the reservoir is also expected to influence water temperatures through removal of the reservoir, which is currently a shallow still water environment with high solar exposure. The naturalisation of water flows and temperatures is expected to be beneficial for species such as fish, which breed based on changes in environmental cues, and also to downstream ecological communities which favour wet or saturated environments.

Significant impact assessments were undertaken for threatened and migratory species listed in **Table 6.3**, as potentially occurring in the subject land. Assessments were undertaken in accordance with the NSW 5-part test of significance and EPBC Act *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* (DEWHA, 2013) (refer to **Appendix E**). While there may be some direct and possible indirect impacts to threatened and migratory species, the proposed works are unlikely to result in any significant impact to any threatened or migratory species or ecological communities protected under the BC Act or EPBC Act.

6.3.3 Mitigation

Mitigation measures provided in **Table 6.4** would be implemented to minimise potential impacts on ecology.

Table 6.4 Proposed mitigation measures – ecology

Impact	Mitigations and management	Timing	Responsibility
Removal of native vegetation	Before commencement of construction works, a vegetation clearing boundary is to be established and must prominently identify the physical limit of approved works. This would include clearly marking trees that have been designated for removal, including the four trees downstream of the dam wall. Vegetation disturbance and clearing must not take place on non-marked trees and outside of the boundary, which must include all areas of	Pre-Construction	Contractor

	moist forest (potentially threatened subtropical rainforest) except for trees specifically identified for removal. The delineation of such a boundary may include the use of temporary fencing, parawebbing or similar.		
	Works that are to be undertaken within five metres of the Tree Protection Zone (TPZ) of trees being retained, on the subject land or any adjoining property, must subject to tree management measures consistent with AS 4970-2009 *Protection of Trees on Development Sites*.	Pre-Construction	Contractor
	Removal of the four trees at the dam wall must not cause damage to any other adjacent vegetation that is to be retained, including damage to the root system within the TPZ as defined by AS 4970-2009.	Construction	Contractor
	Where possible, mature and hollow-bearing trees will be avoided. If any hollows need to be removed, a pre-clearance survey must be conducted by a suitably qualified ecologist prior to any vegetation disturbance.	Construction	Contractor
	Where possible, vegetation to be removed would be retained as habitat or mulched on-site and re-used to stabilise disturbed areas.	Construction	Contractor
Fauna disruption and injury	If threatened fauna species are discovered, works are to be stopped immediately and a suitably qualified ecologist contacted for advice.	Construction	Contractor
	Where any fauna are encountered within the construction area, stop work until the fauna moves off on their own accord (without physical or aggressive prompting). If the fauna does not move off, a fauna spotter catcher must be contacted to remove the animal(s) and relocate them nearby, or if necessary, deliver them to a veterinarian or wildlife carer for rehabilitation.	Construction	Contractor
	If any wombat burrows are likely to be impacted by the proposed works, a suitably qualified ecologist must be engaged to verify the burrow is not occupied prior to the commencement of any works that might damage it.	Construction	Contractor
	If any habitat trees (nest-bearing or hollow-bearing) are to be removed, an ecologist / fauna spotter catcher should be present to ensure no animals are injured.	Construction	Contractor
	Construction work should occur only during daylight hours to avoid impacts such as vehicle strikes.	Construction	Contractor
Contamination from leaks and spills, or soil handling impacting on woodland and aquatic habitat	Specific measures to prevent contamination from chemical spills and incorrect soil handling must be followed, as provided in **Section 6.6.3**.	Construction	Contractor
	Should the proposed works disturb acid sulfate soils, the works must adhere to the NSW Acid Sulfate Manual (Naylor et al. 1998), Acid Sulfate Soils Management Guidelines and the SLEP.	Construction	Contractor
Invasive species and pathogen incursion	The construction crew must be briefed on the identification of priority weeds that occur on site during inductions.	Construction	Contractor
	If declared priority weeds are identified during construction they must be managed according to the requirements of the *Biosecurity Act 2015*. Records of weed control activities must be kept.	Construction	Contractor
	Construction machinery (bulldozers, excavators, trucks, loaders and graders) will be cleaned in accordance with *Machinery Cleaning Guides and Checklists* published by the Australian Department of Agriculture Fisheries and	Construction	Contractor

	Forestry[9] (DAFF, 2024) before entering and exiting work sites.		
	Machinery must be inspected by designated personnel following cleaning to verify cleaning meets the DAFF (DAFF, 2024) requirements. Records of inspections must be maintained.	Construction	Contractor
	All pesticides must be used in accordance with the requirements on the label. Any person carrying out pesticide (including herbicide) application must be trained to do so and have the proper certificate of completion/competency or statement of attainment issued by a registered training organisation.	Construction	Contractor
	All food scraps and rubbish must be appropriately disposed of in sealed receptacles to prevent providing forage habitats for foxes, rats, dogs, and cats.	Construction	Contractor
Modification of hydrological and nutrient cycles	Drainage of the reservoir must be undertaken gradually to not exceed natural peak flow volumes.	Construction	SCC
	Soil and water management must be undertaken in accordance with the measures described in **Sections 6.1** and **6.6.**	Construction	Contractor

6.4 Aboriginal heritage

6.4.1 Discussion

There is limited documented in the publicly available literature that describes the Aboriginal cultural landscape of the Cambewarra area. A brief introduction in the context of the broader Shoalhaven local government area however is provided by Peter Freeman Pty Ltd (2003) as follows:

> The area between the Shoalhaven River and Jervis Bay was the boundary between two major linguistic groups of coastal Aboriginal people. To the north, as far as Botany Bay, were the Wodi-Wodi, speaking Tharuwal (also spelt Dharawal): to the south, down to Wallaga Lake, were the Wandandian, speaking Dhurga. These two linguistic areas both extended to the west beyond the present Shoalhaven Council boundaries.

Situated generally to the northwest of Jervis Bay, Cambewarra is located within the area that would have been occupied variously by members of the different linguistic groups. Despite the apparent lack of details to describe the heritage values of the area, this does not infer such values do not exist.

6.4.2 Assessment

An assessment of whether the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (Due Diligence Code of Practice) (DECCW, 2010) applies to the proposed works are shown in **Table 6.5**.

Table 6.5 Determination of whether the Due Diligence Code of Practice applies

Item	Reasoning	Response
Is the activity to be assessed under Division 4.7 (state significant development) or Division 5.2 (state significant infrastructure) of the EP&A Act?	The proposed works will be assessed under Division 5.1 of the EP&A Act.	No
Is the activity exempt from the NPW Act or NPW Regulation?	The proposed works are not exempt under the NPW Act and NPW Regulation.	No

[9] **https://www.agriculture.gov.au/biosecurity-trade/import/goods/vehicles-machinery/regulations/guides-checklists**

Item	Reasoning	Response
Do either or both apply: Is the activity in an Aboriginal place? Have previous investigations that meet the requirements of this Code identified Aboriginal objects?	The proposed works will not occur in an Aboriginal place. No previous investigations are known to have been undertaken at the subject land.	No
Is the activity a low impact one for which there is a defence in the NPW Regulation?	Erosion control works undertaken in the creek may be considered a low impact activity under Section 58 of the NPW Act. However, construction activities associated with demolition of the dam, earthworks, vegetation removal and construction of access tracks are not considered a low impact activity under section 58 of the NPW Act. The proposed works are not a low impact activity under section 58 of the NPW Regulation. However, erosion control works would be considered low impact activity under subclause 58(b)(v). Therefore, the due diligence process must be applied.	No
Is the activity occurring entirely within areas that are assessed as 'disturbed lands'?	Subclause 80B(4) states that "*For the purposes of this clause, land is disturbed if it has been the subject of human activity that has changed the land's surface, being changes that remain clear and observable*". Examples of disturbed land include construction of rural infrastructure (such as dams and fences), buildings and the erection of other structures, clearing of vegetation, and earthworks associated with the above activities. Historic aerial imagery (presented in **Appendix F**) demonstrates that historically, the subject land was subject to extensive land clearing, rural fencing and development, apparent grazing, and construction of Cambewarra dam and its associated reservoir. A cleared corridor has continued to be maintained along the eastern side of the subject land. Therefore, the subject land is regarded as disturbed land. Historic aerial imagery demonstrates that vegetation was cleared surrounding Cambewarra dam. Therefore, trees requiring removal as part of the proposed works, are unlikely to represent culturally modified trees.	Yes

The proposed works does not include an exempt activity so must follow the Due Diligence Code of Practice. The Due Diligence Code of Practice has been applied below:

Step 1. Will the activity disturb the ground surface or any culturally modified trees?

Yes, the proposed works will disturb the ground surface through excavation and the limited removal of regrowth vegetation.

The subject land and construction footprint has been subject to historical land clearing so is unlikely to contain any mature native trees which may have cultural modification. An ecological site inspection did not record any visible scars on any trees in the subject land.

Step 2a. Search the AHIMS database and use any other sources of information of which you are already aware.

There are no previously recorded sites within the study area.

A search of the Aboriginal Heritage Information Management System (AHIMS) was undertaken on 14 February 2024 in a search area bounded by latitude -34.8131, -34.7955 to longitude 150.5413, 150.5722 (refer to **Appendix G**). The search area represents an approximate one kilometre buffer around the subject land. No Aboriginal sites or places were identified within the search area.

There are no other sources of information known which may inform the presence, or likelihood, or Aboriginal sites at the subject land.

Step 2b. Activities in areas where landscape features indicate the presence of Aboriginal objects.

Yes, the subject land contains landforms with archaeological sensitivity.

The Due Diligence Code of Practice species that Aboriginal objects are often associated with particular landscape features. Landscape features which may indicate the existence of Aboriginal objects include proposed works:

– Within 200m of waters (any river, stream, lake, lagoon, swamp, wetlands, natural course or tidal waters)
– located within a sand dune system
– located on a ridge top, ridge line or headland
– located within 200m below or above a cliff face
– within 20m of or in a cave, rock shelter, or a cave mouth.

The subject land includes and is adjacent to waters. Waters within the subject land (except for current day Cambewarra dam reservoir) are limited to minor ephemeral creeks which are unlikely to have provided an important resource to Aboriginal people. Therefore, the adjacent waters are not considered to reliably indicate the likely presence of Aboriginal objects. No other landscape features are in or adjacent to the subject land.

Although, waters may indicate the existence of Aboriginal objects, the subject land is on disturbed land. That being land that "*has been the subject of human activity that has changed the land's surface, being changes that remain clear and observable*". Under clause 80B of the NPW Regulation, the subject land is considered disturbed land due to historic land clearing, grazing, construction of Cambewarra dam, and the construction of other rural infrastructure including fences.

Based on the absence of known Aboriginal objects at the subject land, the minor presence of indicative landscape features, and the highly disturbed state of the subject land, it is considered unlikely that Aboriginal objects would be encountered in the course of undertaking the proposed works. Therefore, steps 3 and 4 of the Due Diligence Code of Practice are not required and an AHIP is not required. The proposed works should proceed with caution and should be undertaken in accordance with an unexpected finds protocol (refer to Transport for NSW Unexpected heritage items procedure (Transport for NSW, 2022) as an example).

6.4.3 Mitigation

Mitigation measures provided in **Table 6.6** would be implemented to minimise potential impacts on Aboriginal heritage.

Table 6.6 Aboriginal heritage – mitigations summary

Impact	Mitigations and management	Timing	Responsibility
Unanticipated impacts to a heritage item or place	Site inductions must include an Aboriginal heritage awareness procedure to improve recognition of items of potential heritage significance and to make workers aware of the legislative protection of Aboriginal heritage items and places under the NPW Act.	Construction	Contractor
	If any item or place of potential Aboriginal heritage significance is observed, work must cease immediately, and a temporary exclusion zone established. Further action must be undertaken in accordance with an approved unexpected finds protocol.	Construction	Contractor
	All land and ground disturbance activities must be confined to within the limit of works described in this REF.	Construction	Contractor

6.5 Historical heritage

6.5.1 Existing environment

There are no heritage items of State, National or Commonwealth heritage significance in Cambewarra however there are three local heritage items listed under the SLEP (refer to Table 6.7). Bundanon Trust Property, a Commonwealth listed heritage place, is also located in the locality, approximately eight kilometres southwest of the subject land.

Cambewarra dam was constructed in 1910, so has inherent historic heritage value associated with the colonisation and development of the Nowra township. However, the dam is not recognised as a heritage item under the SLEP and has not been included within any heritage studies or conservation plans[10].

Table 6.7 Non-Aboriginal heritage near the subject land

Name	Address	Lot, DP	Distance from subject land
Colonial vertical timber slab cottage (Rose & Barn Country Cottages Cambewarra)	94 Barfield Road, Cambewarra	Lot 1 DP 573197	970 m south
Cambewarra Rainforest Reserve	Cambewarra Lookout Road	Reserve No 57023; Lot 7300, DP 1130978; Lot 7301, DP 1131110; Lot 7302, DP 1131111; Lots 7305 and 7306, DP 1154007; Part Lot 252, DP 720937; Part Lot 2, DP 223819; Lot 3, DP 221288; Lot 103, DP 739867; Lot 1, DP 1116520 (road reserve); Lots 5 and 6, DP 1117580 (road reserve)	1.2 km east
Evison's dairy farm complex	49 Hockeys Lane, Cambewarra	Lot 2 DP 621553	2.3 km south

6.5.2 Discussion

Construction

No heritage places would be accessed or impacted during delivery of the proposed works. The colonial vertical timber slab cottage at 94 Barfield Road, Cambewarra would be bypassed when travelling on Tannery's Road.

Decommissioning of Cambewarra dam would result in the removal of all above ground infrastructure associated with the dam. This would result in a loss of historic heritage value associated with the subject land and the broader region. However, the site is not a recognised heritage place, so the proposed works does not require development consent or any other approval. There is also no demonstratable community interest or appreciation of the heritage significance of the site. This is evidenced by an absence of online information or photographs of Cambewarra dam, including on the Shoalhaven Historical Society website. Therefore, although Cambewarra dam has historic value, the decommissioning and proposed works would not be considered significant.

Operation

While not listed as a heritage item, Cambewarra dam does represent a stage in the growth of Cambewarra village and a response to the need to provide a reliable source of fresh water in the early 20th century. As a result, it has inherent heritage value despite the lack of documented significance. With implementation of the proposed works in accordance with Option 3 (refer to **Section 3.2.3**), the footings of the dam wall would be retained allowing for future interpretation of the structure in situ. Accordingly, while the subject land lacks recognised heritage values, the proposed works would not remove the potential for future study and appreciation for infrastructure development of the early 20th century in support of growth in the Illawarra broadly and specifically in the Cambewarra locality.

6.5.3 Mitigation

Mitigations measures to prevent damage to non-Aboriginal heritage values are provided in **Table 6.8**.

Table 6.8 Proposed mitigation measures – historical heritage

Impact	Management measure	Timing	Responsibility
Unanticipated impacts to a	Site inductions must include a heritage awareness procedure to improve recognition of items of potential heritage significance and to make workers aware of the	Construction	Contractor

[10] **https://www.shoalhaven.nsw.gov.au/Planning-Development/Development-plans-and-policies/Heritage**

Impact	Management measure	Timing	Responsibility
heritage item or place	legislative protection of heritage items under the Heritage Act.		
	All land and ground disturbance activities must be confined to the limit of works described in this REF.	Construction	Contractor

6.6 Soils and geology

6.6.1 Existing environment

Topography and geology

The subject land is located in a gently sloping valley at the base of Cambewarra Range. The valley slopes fall towards the southeast towards Good Dog Creek. The valley forms a minor catchment, characterised by three small creeks which flow into Cambewarra dam. Cambewarra dam is generally shallow, with a maximum dam wall height of 8.4m. An earth embankment, up to 2.3 m high, surrounds the eastern perimeter of the reservoir.

The subject land is located within the Hawkesbury-Shoalhaven Plateaus and is characterised by the Jamberoo Sandstone and Berry Siltstone geologies of the Permian period. These geologies are characterised by colluvial (loose unconsolidated sediments, generally deposited at the base of hillslopes) benches on latite (an igneous volcanic) and Budgong Sandstone. Based on the Herbert (1983) *Sydney 1:100 000 Geological Sheet 9130, 1st edition. Geological Survey of New South Wales, Sydney*, the site is underlain by Pleistocene terrace, silt, clay, fluvial sand and gravel.

Soils and sediments

The site is underlain by Cambewarra and Wattamolla Road soil landscapes, which are typical of steep hills and side slopes. Generally, they are moderately deep (50 cm to over 150 cm) and include red and yellow podzolic soils (generally with a loamy upper layer underlain by a sodic clay rich lower layer) and krasnozems (red to brown, acid, strongly structured clay soils). Under the Australian soil classification, the subject land is characterised by kandosols, which are characterised by 'steep colluvial slump slopes beneath the sandstone scarp: chief soils are acid leached red earths'. Erodibility of soils at the subject land are likely to be high. Land use capability mapping on Geoscience Australia identifies the subject land as having severe erosion limitations.

Soils in the earth embankment and stockpile were assessed during a contamination assessment undertaken in February 2024. Soils in these areas were described as a low plasticity clay / silty clay and sandy silt/clay with gravel, respectively. Both soils were considered to be generally non-erodible. Sediments from the reservoir were also assessed and were described as silty clay with organic odour and organic matter (rootlets) present. Sediments in the reservoir are generally considered extremely to highly erodible.

Acid Sulfate Risk

A search of the Atlas of Australian Acid Sulfate Soils on the Geoscience Australia Portal[11] contained the site as having an 'extremely low' (1 – 5%) probability of occurrence for acid sulfate soils. Under the SLEP, the subject land is characterised by class 5 acid sulfate soils. The SLEP defines that a risk of acid sulfate soil exposure exists for class 5 soils if works are undertaken "*within 500 metres of adjacent Class 1, 2, 3, or 4 land that is below 5 metres [Australian height datum] AHD and by which the watertable is likely to be lowered below 1 metre AHD on adjacent*". The subject land is located at about 108 m AHD and is not within 500 m of land mapped as class 1 to 4.

During the supplementary contamination assessment in 2024, soil samples were screened for potential acid sulphate soils (PASS) and ASS. Strong variability was observed in the pH of soil samples (pH 5.2 to 8.8) taken from the earth embankment material. When exposed to hydrogen peroxide (H_2O_2), soils demonstrated a medium to extreme reaction and reduced to a pH range of 2.2 to 6.8. This demonstrates that reducible inorganic sulfur (acid generating material) and ASS may be present. However, it is possible that organic matter may also be responsible for the decrease in pH.

[11] **https://data.csiro.au/collection/csiro:6181**

To address the potential for acid generating soils, further testing should be undertake during excavation activities. The presence of ASS would mandate treatment to buffer the potential for acid generation and / or handling to reduce exposure to air.

Contamination

Sediments at the subject land were assessed during a preliminary site investigation (PSI) undertaken in November 2020 (refer to GHD, 2021b). The PSI was supported by a supplementary contamination assessment undertaken in February 2024, to establish the suitability of material contained in the earth embankment and stockpile for reuse as backfill, and to assess the condition of sediments in the dewatered dam which were not previously accessible during the PSI.

In total, the two sampling events involved the collection of 13 sediment samples and 10 soil samples. Sediment samples were taken from within the edge of the reservoir, close to the bank where access was possible. Soil samples were undertaken in the 2024 sampling program and included six samples of the earth embankment and four samples of the stockpile (locations presented in **Figure 6.2**).

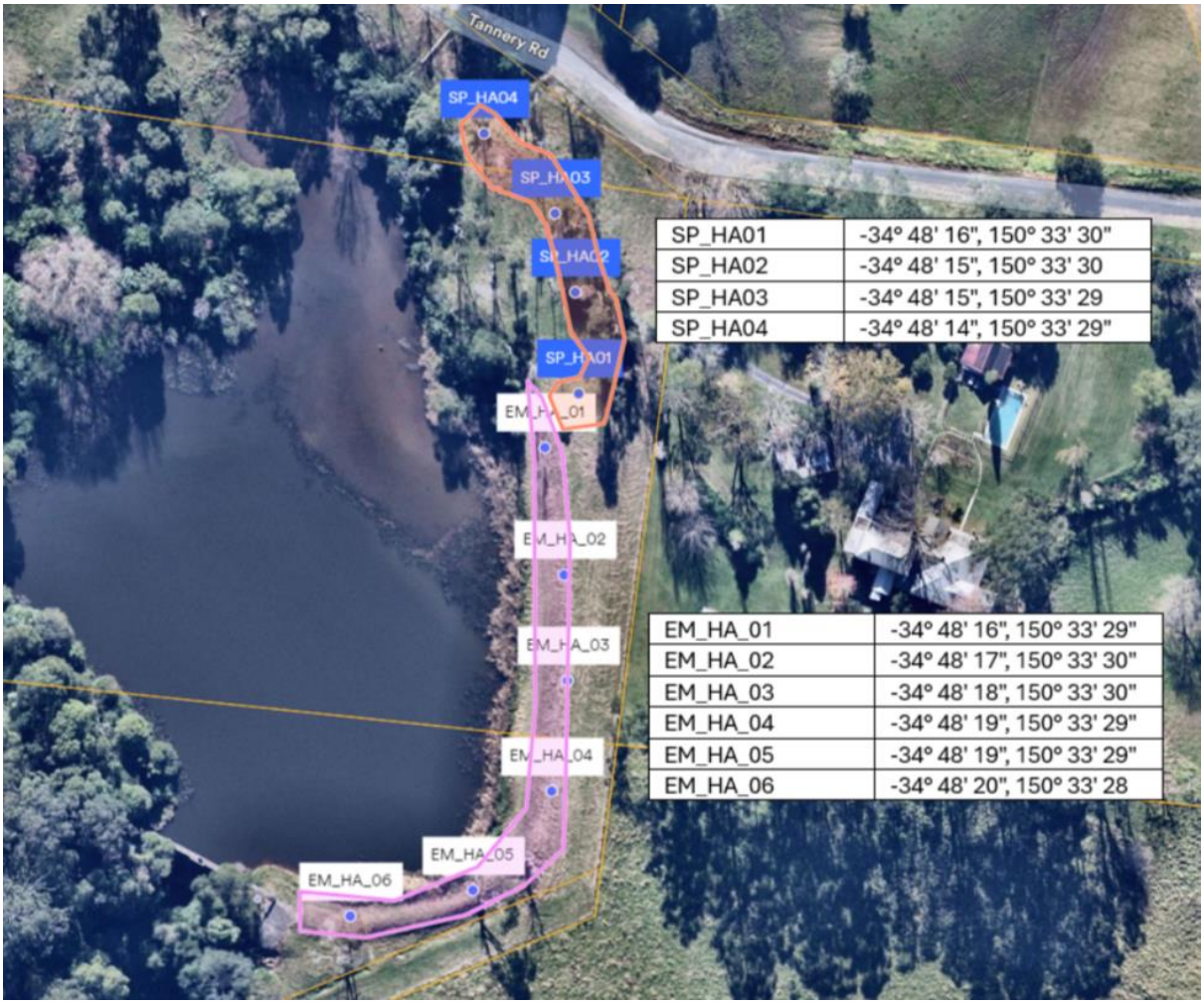


Figure 6.2 Soil sampling locations from 2024 contamination assessment

Contaminants identified in the PSI and supplementary sampling included:

Trace metals:

– 2020: Two out of 10 sediment samples recorded exceedances of ecological assessment criteria and investigation levels specified in the *Australian and New Zealand Guidelines for Fresh and Marine Water*

Quality (ANZG, 2018) and National Environment Protection Measures (NEPM) for copper and nickel[12]. No other trace metals were detected in any of the samples.

– 2024: None of the sediment or soil samples recorded exceedances of ecological assessment criteria and investigation levels specified in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018) and NEPM for trace metals.

Hydrocarbons:

– 2020: Total recoverable hydrocarbons (TRH) were recorded above the limit of reporting (LOR) in three sediment samples. One sediment sample exceeded the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (AZNG, 2018) sediment default guideline value of 280 mg/kg. When normalised[13], using the measured organic carbon content in each sample, the concentrations of TRH were below the default guideline value.
– 2024: TRH were reported above the LOR in all three sediment samples. The raw concentrations exceeded the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (AZNG, 2018) sediment default guideline value of 280 mg/kg, and the high value sediment guideline of 550 mg/kg. After normalisation using the measured organic carbon content in each sample, none of the samples exceeded the high value guidelines value. Only one sample retained an exceedance of the default guideline value, with a normalised concentration of 407 mg/kg.

No other contaminants were detected in any of the sediment or soil samples. There are not known to be any past or ongoing industries or activities that would contribute to elevated concentrations of contaminants in the subject land. There are no contaminated sites or contaminated land records in Cambewarra. The nearest place recorded on the National Pollutant Inventory is Bomaderry Main Line Valve and Meter Station, a gas supply facility located approximately four kilometres southeast at Pestells Lane, Bomaderry.

6.6.2 Discussion

Construction

Topography and geology

The proposed works would only involve earthworks down to natural ground level, including removal of the existing dam wall and excavation of a channel for Cambewarra Creek. The proposed works would also involve excavation of the earthen embankment and stockpile on the eastern portion of the subject land, and capping using this soil across the reclaimed reservoir site. This would involve minor modifications of the topography at the site, however, the modifications are intended to return the site to its natural (pre-dam) topography. Earthworks at the site would not interfere with the underlying geology.

Soils and sediments

The proposed works would involve earthworks as described in **Section 2.4**, in addition to stockpiling and the draining of Cambewarra dam reservoir which would expose 1.5 ha of unconsolidated sediments to weathering and erosion. If not adequately managed, this could have the following impacts:

– erosion of exposed sediments and stockpiled materials
– concrete particle and dust generation from onsite crushing of concrete
– dust generation from excavation, backfilling and vehicle movements over exposed soil
– an increase in sediment loads being eroded and entering receiving waterways area (refer to **Section 6.1**)

[12] Copper and Nickel occur naturally in soil and are derived from weathered rock and soils (El Naggar *et al.* 2021; Poggere *et al.* 2023). Both minerals are highly persistent in the environment and readily accumulate in soils. These minerals may also be derived from a variety of industries. For Copper these include mining, wood treatment sites, metal industries, and fungicides associated with agriculture (Poggere *et al.* 2023). For Nickel these include alloy industries, tannery and pigment manufacturing (El-Naggar *et al.* 2021).

[13] Sediments and other materials have different capacities and tendencies to absorb contaminants. Therefore, the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (AZNG, 2018) recommends averaging, or 'normalizing', the variability between samples based on observed sediment qualities.

– an increase in dust being suspended in the air (refer to **Section 6.7**).

Periods of heavy and frequent rainfall would increase the risk of surface water runoff and erosion. Overland flow and rainfall would be a primary cause of erosion with the creation of new channels in exposed sediment following draining of the reservoir. Unconsolidated and easily erodible sediments which have been deposited in the reservoir, would be easily eroded by flowing water. Other loose material, including stockpiled soil may also be eroded by runoff during rainfall events. As a result of increased runoff and erosion events, there would be an increased potential for soil transport and sedimentation of downstream waterways. This may in turn influence the vegetation and habitat of downstream areas by smothering groundcover vegetation or by modifying soil characteristics and nutrient load.

Spoil generation is not expected as part of the proposed works. However, spoil would be used as backfill where possible, or stockpiled in a suitable location prior to offsite disposal. Impacts associated with erosion of soils and sediments may be significant without the implementation of mitigation measures. However, with the implementation of mitigation measures outlined in **Section 6.6.3**, the risk of erosion can be effectively managed to avoid potentially significant impacts.

Acid Sulfate Soil Risk

Soil sampling has demonstrated that soils on the subject land may contain the potential for acid generation. Therefore, earthworks may interfere with ASS resulting in potential acid generation and increased solubility of heavy metals. Potential impacts from this may include:

– Damage to waterways and aquatic species: when washed downstream in waterways, immobile plants and animals may be damaged or killed, or survival and growth rates impacted. Sulfuric acid may also promote outbreaks of disease in fish.
– Damage to terrestrial plants: acidic soils may damage or kill plants growing in the impacted soil.
– Corrosion: sulfuric acid may corrode concrete or metal infrastructure if present within downstream waterways (e.g. weirs).
– Toxic water: acidified water can irritate the skin and eyes of people and animals. Drinking acidic water may make people or animals sick.

Contamination

Some contaminants, including copper and nickel, are already present at relatively low concentrations in soils of the subject land. These contaminants have the potential to contribute to more widespread off-site soil and groundwater contamination. Although naturally occurring and essential for plants, copper and nickel are toxic to all living organisms when at elevated concentrations, including plants, animals and humans. Common impacts to plants include reduced plant growth and death. Sufficient intake of copper and nickel from drinking water or food may cause poisoning, allergies, cancer and reduced lung function to human health (El-Naggar *et al.* 2021; Poggere *et al.* 2023). Contaminated soils also have the potential to affect surface water and groundwater quality through leaching and runoff from the subject land.

Construction plant and vehicles also have the potential to cause chemical and fuel spills, which could cause localised contamination of soils. However, this risk is considered to be low due to the small number of construction plant and vehicles which would be required on site. Therefore, the potential for contamination is low provided the mitigation measures outlined in **Section 6.6.3** are implemented.

Operation

Removal of the dam would prevent ongoing accumulation of contaminants due to the removal of the still-water reservoir environment, which may currently promote settling of suspended contaminants into the soil. Therefore, if there are any ongoing contamination sources, the proposed works would remove a ‘contaminant trap’ and allow downstream transport and diffusion of potential contaminants. Due to the relatively low concentration of soil contaminants at the site, it is unlikely that any significant contamination source is present. Contaminants are also in relatively low and unharmful concentrations, so would not present a hazard when diffused downstream (rather than accumulating in the reservoir). Copper and nickel are also essential trace metals, so in low concentrations would not be detrimental to downstream receivers. Therefore, ongoing impacts associated with operation of the proposed works are expected to be negligible.

6.6.3 Mitigation measures

Mitigation measures provided in **Table 6.9** would be implemented to minimise potential impacts on soils and geology.

Table 6.9 Proposed mitigation measures – soils and geology

ID	Mitigation measure	Timing	Responsibility
Erosion and sedimentation	A soil and water management plan (SWMP) and Erosion and Sediment Control Plan (ESCP) must be prepared in accordance with Blue Book – Managing Urban Stormwater: Soils and Construction (Landcom, 2004) and Volume 2A: Installation of Services.	Pre-construction, Construction	Contractor
	All erosion and sediment control measures, such as sediment fences, coir logs and silt curtains, must be established before ground disturbance work commences. These must stay in place until all surfaces have been restored and stabilised.	Pre-construction, Construction	Contractor
	Erosion and sediment controls must be regularly inspected and maintained (including clearing of sediment from behind barriers) to ensure effectiveness over the entire duration of the proposal.	Construction	Contractor
	Stockpiles must be located away from drainage lines and the dripline of trees. Stockpiles must be kept to a minimum height of one metre and must be covered, when possible, to prevent erosion, control runoff and prevent sedimentation.	Construction	Contractor
	Surface sediments are to be excavated or capped with suitable topsoil as soon as possible following dewatering of the reservoir, to prevent mobilisation of unconsolidated sediment and potential contaminants.	Construction	Contractor
	Work must cease during heavy rainfall events when there is a risk of sediment loss off-site or ground disturbance due to water logged conditions.	Construction	Contractor
	Dry street sweepers or hand-held brooms must be used to clean roads, in the event of tracked sediment.	Construction	Contractor
	Equipment, plant and materials must be parked in designated lay-down areas where they are least likely to cause erosion or damage to vegetation.	Construction	Contractor
	Final rehabilitation works should be undertaken within 10 days of the completion of earthworks, and should include a combination of geotechnical fabrics and/or coir matting, gravel and/or mulching, and native planting.	Post-construction, Construction	Contractor
Acid sulfate soil mobilisation	An Acid Sulfate Soils Management Plan (ASSMP) must be prepared as part of the Soil and Water Management Plan (SWMP), and in accordance with the *Waste Classification Guidelines - Part 4: Acid Sulfate Soils* (NSW EPA, 2014b). The plan must define the process and measures to manage actual and potential acid sulfate soil and sediment disturbed during construction including additional sampling and testing as appropriate. The plan must include a summary of available acid sulfate soil information relevant to the subject land and identify any further soil/water analysis required as a precursor to implementing the management plan.	Construction	Contractor
	If ASS is discovered during construction, soils must be managed and treated with lime in accordance with the *Waste Classification Guidelines - Part 4: Acid Sulfate Soils* (NSW EPA, 2014b).	Construction	Contractor
Accidental and unexpected contamination	The SWMP must include an unexpected finds/contaminated soils procedure. The procedure would include details of excavation, segregation, stockpiling, remediation, validation and disposal requirements for any contaminated matter.	Pre-construction	Contractor
	Should suspected soil contamination be found on-site, works must be stopped immediately and the unexpected finds/contaminated soils procedure implemented.	Construction	Contractor

ID	Mitigation measure	Timing	Responsibility
	An emergency spill plan must be prepared which includes procedures for the storage and handling of hazardous materials including fuel and chemicals.	Pre-construction	Contractor
	Storage of hazardous materials on-site to be kept to a minimum and would be in accordance with national guidelines and the safety data sheets relating to bunding, coverage, storage of incompatible materials, etc.	Construction	Contractor
	Refuelling is to occur off site where possible. If being undertaken on site, refuelling must be undertaken in a bunded area with spill kit readily accessible.	Construction	Contractor
	Construction workers must be trained in the correct use of spill kits.	Construction	Contractor

6.7 Air quality

6.7.1 Existing environment

The subject land is in a rural area, at the base of Cambewarra Range. The nearest sensitive receivers include scattered rural residences and the nearby township of Cambewarra Village, approximately 1.1 km to the south.

The subject land is located approximately 18 kilometres from the coast so may be influenced by coastal breezes. Existing air quality is likely to be influenced further by fugitive emissions associated with industry in Bomaderry and Nowra, low intensity agricultural activities, and bypassing road traffic, including along Moss Vale Road.

Cambewarra does not have any facilities listed on the National Pollutant Inventory. The nearest place recorded on the National Pollutant Inventory is Bomaderry Main Line Valve and Meter Station, a gas supply facility located approximately 4 km southeast at Pestells Lane, Bomaderry. Other facilities within 10 km of the subject land include:

– Bomaderry refuelling Facility (Sydney Trains)
– Bomaderry Wastewater Treatment Plant
– Shoalhaven Starches Bomaderry
– Nowra Sewage treatment Plant.

None of the facilities listed on the National Pollutant Inventory are expected to reliably influence air quality at the subject land.

Cambewarra does not have any air quality monitoring stations. The nearest station is located at Albion Park, approximately 30 km to the north. Average air quality at the station is good and is expected to be contiguous with Cambewarra due to its proximity and similarities in land setting.

6.7.2 Discussion

Construction

Potential impacts to air quality during construction would include dust generation, combustion engine emissions and odour emissions associated with draining of the reservoir.

Prevailing winds for Cambewarra can be inferred from the annual wind rose produced by the Bureau of Meteorology for the nearby town of Nowra[14]. While there would likely be some differences due to Cambewarra dam being located closer to the escarpment, **Figure 6.3** illustrates the average wind conditions experienced over a 12 month period for the nearby town of Nowra as measured at 9am between 1955 and 2000. This indicates prevailing winds at this time tend to come from a northwest to westerly direction. As the nearest sensitive receiver

[14] **http://www.bom.gov.au/cgi-bin/climate/cgi_bin_scripts/windrose_selector.cgi?period=Annual&type=9&location=68076**

is within 100 m east of the subject land, there is a high likelihood that any air quality impacts would be apparent, particularly given average morning conditions.

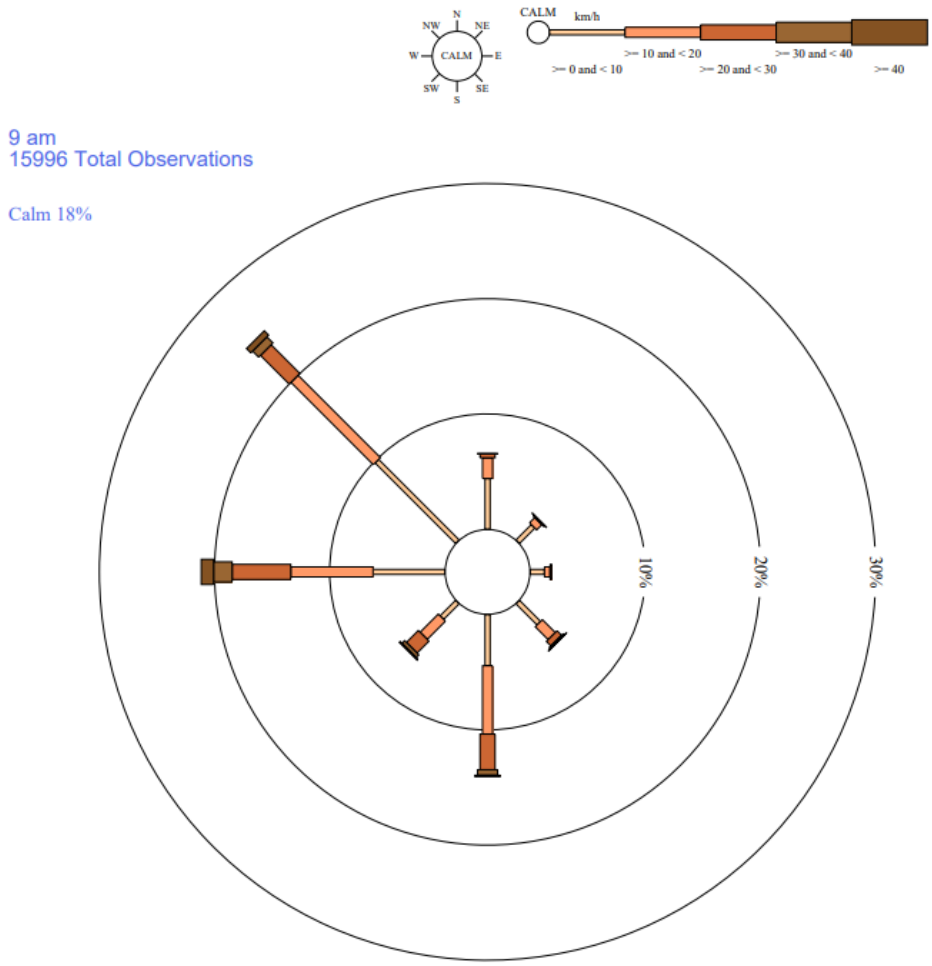


Figure 6.3 Annual wind rose for 9am at Nowra

Dust generation

Dust generating activities would include activities associated with vehicle and plant movement, on site crushing of concrete, and earthworks, including excavation, stockpiling of soil, and the removal and transport of excavated materials around the subject land (refer to **Section 6.6**). These activities would involve direct dust generation associated with mechanical disturbance, whereby soil and dust particles are loosened and separated during the operation of construction vehicles, plant and equipment. The activities would also include indirect dust generation associated with wind erosion of previously submerged and erodible sediments (refer to **Section 6.6**). Unconsolidated sediments and dust, whether directly or indirectly formed, would be susceptible to wind erosion, whereby dust particles are suspended into air circulation, particularly when left uncovered in dry and windy conditions.

The potential for dust generation and emissions would be dependent on the water content and water holding capacity of sediments and soils, the height and slope of stockpiles, and the length of time soils are exposed to drying and wind. The subject land would involve exposing a relatively large proportion of the subject land (1.5 ha) of exposed sediment to the potential for wind erosion. While the subject land is located in a rural environment proximity of several nearby residences would increase the potential for dust generation to adversely impact air quality for these locations. Despite this, it is expected that with soil management measures (refer to **Section 6.6.3**) being implemented, the impacts of potential dust generation are expected to be low.

Combustion fumes

Combustion emissions from construction vehicles and plant would contribute to local air pollution, comprising potential pollutants such as hydrocarbons, carbon monoxide, nitrogen oxide, smoke and particulate matter. Given

the small scale requirement for plant machinery, and the rural landscape, combustion emissions would have a negligible influence on local air quality.

Odour emissions

Minor odour emissions would likely occur during reclamation of the reservoir due to the drying of organic rich sediments and changes in biological activity (including degradation of organic matter). These odours would be associated with algae and the breakdown of organic matter by bacteria in the sediments of the dam. These impacts would likely occur soon after draining of the reservoir and potentially for several weeks after, including after earthworks which may upturn organically rich soil. Due to the locality of the subject land in a rural environment, odours are unlikely to remain in high concentrations for a prolonged period and are not expected to cause significant disturbance.

Operation

If the reservoir was drained and sediments left exposed, ongoing impacts associated with weathering of sediments and dust generation may be expected as the site becomes revegetated. However, the proposed works would involve measures to rehabilitate and stabilise the subject land during construction. Therefore, ongoing impacts associated with weathering of sediments and potential dust generation are likely to be negligible.

Following remediation of the subject land, the proposed works are not expected to have any other ongoing impacts associated with air quality.

6.7.3 Mitigation

Mitigations to manage air quality impacts are presented in **Table 6.10**.

Table 6.10 Proposed mitigation measures – air quality

Impact	Mitigations and management	Timing	Responsibility
Dust generation	Erosion and sediment controls must be implemented during construction in accordance with mitigation measures in **Section 6.6.3**.	Pre-construction, construction	Contractor
	Ongoing potential for dust generation must be minimised through site reclamation measures in **Section 6.6.3**, which include undertaking site rehabilitation of unvegetated soils and disturbed areas as soon as possible after dewatering of the reservoir, and immediately after construction works are completed.		
	Standard dust suppression measures must be incorporated in the ESCP including: – avoid undertaking excavation and earthmoving activities during high winds – limit the areas of clearing and ground disturbance to the minimum required – implement dust suppression using water carts or binder sprays – keep stockpiles covered and below one metre in height – minimise vehicle and plant movements – cover loads during transport.	Construction	Contractor
	Tannery Road must be swept as required to control dust generation and road utility.	Construction	Contractor
	Prevailing weather conditions must be monitored over the period when exposed soils have the potential to generate dust and impact neighbouring properties. Where dust generating winds are predicted or experienced, additional dust suppression activities,	Construction	Contractor

Impact	Mitigations and management	Timing	Responsibility
	such as water cart sprays and covering of stockpiles, must be undertaken.		
	Dust complaints must be investigated and corrective actions implemented as soon as practicable.	Construction	Contractor
Combustion fume emissions	Construction plant and machinery must be disengaged when not in use.	Construction	Contractor
	Plant and machinery must be fitted with emission control devils complying with Australian design standards.	Construction	Contractor
	Construction plant and equipment must be well maintained, serviced, and in good working condition. Equipment found to be emitting excessive exhaust emissions (such as excessive visible diesel smoke) must be stood down until repaired.	Construction	Contractor
Odour emissions	Reservoir sediments must be capped as soon as possible following dewatering, to create a buffer from odour emitting and oxidising sediments.	Construction	Contractor
	Any odour complaints must be managed in accordance with SCC requirements. Biological and chemical management controls should be considered for implementation.	Construction	Contractor, SCC

6.8 Noise and vibration

6.8.1 Methodology

The *Transport for NSW Construction and Maintenance Noise Estimator* (March 2017) was used to predict noise impacts during the proposed works. A distance-based construction scenario assessment was used to assess potential construction noise. The report outputs from the estimator are provided in **Appendix H**.

Assessments were based on a representative noise environment area (category R0) for 'undeveloped green fields and rural areas with isolated dwellings'. Construction scenarios considered to be the most relevant to the proposed works were selected and included:

– compound site establishment
– corridor clearing
– bulk earthworks
– structural demolition

Based on the distance based construction scenario assessment (refer to **Appendix H**), sensitive receivers were identified within the calculated clearly audible noise distance (1.01 km).

Criteria

Construction noise

Construction noise criteria are developed in accordance with the Interim Construction Noise Guideline (ICNG) (DECC, 2009). The ICNG states that the potential for construction noise impacts can be assessed by comparing the predicted noise at the assessment locations with the noise management levels provided by the ICNG. Construction is considered to have the potential to cause a noise impact if the predicted noise exceeds the noise management levels.

The construction noise estimator was used to identify an appropriate background noise level, referred to as the rating background level (RBL LA90), and noise management level (NML) for the proposal.

The construction noise estimator tool was used to identify the rating background level (RBL LA90) and noise management levels (NMLs) for the proposed works based on Australian Standard (AS) 1055.3-1997 *Acoustics - Description and measurement of environmental noise - Acquisition of data pertinent to land use.*

The adopted NMLs for RBL category R0 is shown in **Table 6.11**.

Table 6.11 Adopted noise management levels

RBL or LA90 rating background level (dB(A)) (RBL)	**Day**	30
	Evening	30
	Night	30
LAeq (15 minutes) noise management level (dB(A)) (NML)	**Day**	40
	Day (out of hours work (OOHW))	35
	Evening	35
	Night	35
	Highly affected	75

Construction vibration

Minimum working distances from sensitive receivers for typical construction plant are identified for cosmetic damage based on the requirements of British Standard (BS) 7385-2:1993 and for human response based on the OH&E vibration guideline. These are provided in **Table 6.12**.

Table 6.12 Recommended minimum working distances for vibration intensive plant (adapted from RMS, 2016)

Plant	Rating	Minimum working distance	
		Cosmetic damage (BS 7385)	Human response (OH&E Vibration guideline)
Vibratory Roller	< 50 kN (Typically 1 – 2 tonnes)	5	15 – 20
	< 100 kN (Typically 2 – 4 tonnes)	6	20
	< 200 kN (Typically 4 – 6 tonnes)	12	40
	< 300 kN (Typically 7 – 13 tonnes)	15	100
	> 300 kN (Typically 13 – 18 tonnes)	20	100
	> 300 kN (> 18 tonnes)	25	100
Hydraulics Hammer	300 kg (5 – 12 tonne excavator)	2	7
	900 kg (12 – 18 tonne excavator)	7	23
	1600 kg (18 – 34 tonne excavator)	22	73
Jackhammer	Hand held	4	-
Profiler	Wirtgen W210	1	-
Asphalt Paver	Vogele Super 1800-3	2	-
Steel Drum Roller	Hamm HD70	1	-

6.8.2 Existing environment

The subject land is located about 1.1 km north of Cambewarra Village and about 1.1 km west of Moss Vale Road, a State classified main road. The subject land is in a rural setting with no known agriculture that would contribute a significant noise source. The noise environment at the subject land is expected to be relatively quiet and dominated by natural sounds, with diffused noise associated with nearby rural residences, Cambewarra Village, Moss Vale Road, and occasional residential traffic on Tannery Road.

Sensitive receivers were identified within the clearly audible noise distance for the proposed works using aerial imagery and are listed in **Table 6.13**. The closest sensitive receivers include rural residences located on properties adjoining the subject land. The most common sensitive receivers are residences, of which there are 19. Only one commercial/recreational operation was identified in the clearly audible noise distance for the proposed works, that being Rose & Barn Country Cottages Cambewarra at 94 Barfield Road. Rose & Barn Country Cottages are located on a local heritage property (refer to **Section 6.5**) and operate as a holiday accommodation establishment. There are no community establishments or recreation facilities located within one kilometre of the subject land.

Table 6.13 Sensitive receivers within clearly audible noise distance

Type	Receiver – distance from subject land
Residential property	230 Tannery Road – 65 m 284 Tannery Road – 130 m 285 Tannery Road - 250 m 246 Tannery Road – 300 m 158 Reservoir Lane – 310 m 245 Tannery Road – 330 m 201 Tannery Road – 370 m 230B Tannery Road – 400 m 195 Tannery Road – 430 m 203 Tannery Road – 430 m 215 Tannery Road – 430 m 216 Tannery Road – 490 m 230A Tannery Road – 530 m 159 Tannery Road – 540 m

Type	Receiver – distance from subject land
	92 Reservoir Lane – 570 m 169 Tannery Road – 590 m 149 Tannery Road – 670 m 138 Tannery Road – 840 m 180 Tannery Road -840 m.
Commercial, industrial	Rose & Barn Country Cottages Cambewarra (accommodation), 94 Barfield Road – 990 m (also a heritage listed property – Colonial vertical timber slab cottage)

6.8.3 Discussion

Construction

Noise

The proposed works would generate substantial noise associated with compound site establishment, vegetation clearing, earthworks and concrete crushing, vehicle movements and structural demolition of the dam wall. The most notable noise emissions would likely be associated with earthworks, concrete crushing and demolition of the dam wall involving hydraulic hammering and acute rock-strike or dumping noises (e.g. dropping concrete rubble from an excavator into a dump truck). Accordingly, while notable, the most apparent noise emissions are expected to be relatively short term and irregular. Continuous ambient noise may be heard at nearby sensitive receivers, associated with the operation of diesel engines and plant machinery.

Construction would take place during standard work hours (Monday to Friday 7:00 AM to 6:00 PM) so would not involve disturbance to standard sleep periods.

Based on the Transport for NSW Construction and Maintenance Noise Estimator outputs, the proposed works would have the potential to impact sensitive receivers at distances shown in **Table 6.14**. Refer to **Appendix H** which provides the construction noise assessment tables. Based on all assessed construction scenarios, sensitive receivers would be expected to experience construction noise at the following distances from the subject land:

– clearly audible noise at 1010 m
– moderately intrusive noise at 485 m
– highly intrusive noise at 230 m
– highly affected noise at 60 m.

Assuming that the proposed works are undertaken only during the day, construction noise could be heard at up to 1.01 km. This would include clearly audible noise at up to 20 sensitive receivers as listed in **Table 6.13**. Of these, 11 residences would be within the moderately intrusive distance, including:

– 230 Tannery Road – 65 m
– 284 Tannery Road – 130 m
– 285 Tannery Road – 250 m
– 246 Tannery Road – 300 m
– 158 Reservoir Lane – 310 m
– 245 Tannery Road – 330 m
– 201 Tannery Road – 370 m
– 230B Tannery Road – 400 m
– 195 Tannery Road – 430 m
– 203 Tannery Road – 430 m
– 215 Tannery Road – 430 m.

Two of these residences would be located within the highly intrusive noise distance, including:

– 230 Tannery Road – 65 m
– 284 Tannery Road – 130 m.

Notable disruptions may also occur at Rose & Barn Country Cottages, on the corner of Barfield Road and Tannery Road. Heavy vehicle noise from construction vehicles would likely disrupt patrons and diminish the tranquil rural noise environment at the accommodation. However, due to the distance of the accommodation from the subject land, and the intermittent nature of vehicle movements throughout the day only, the Rose & Barn Country Cottages are unlikely to be significantly impacted.

Table 6.14 Potential construction noise impacts by distance (m)

Scenario	LAeq(15minute) noise level above nominal background (LA90) for a R0 representative environment				Highly affected distance (m)
	5 – 10 dB(A) Noticeable	10 – 20 dB(A) Clearly audible	20 – 30 dB(A) Moderately intrusive	>30 dB(A) Highly intrusive	LAeq(15min) 75 dB(A) or greater
Daytime					
Bulk earthworks	-	*1010*	*485*	*230*	*60*
Structural demolition	-	*940*	*450*	*215*	*50*
Corridor clearing	-	*875*	*420*	*200*	*45*
Compound site establishment	-	*755*	*360*	*170*	*35*
Day (OOHW), Evening, Night					
Bulk earthworks	*1430*	*1010*	*485*	*230*	*60*
Structural demolition	*1335*	*940*	*450*	*215*	*50*
Corridor clearing	*1250*	*875*	*420*	*200*	*45*
Compound site establishment	*1085*	*755*	*360*	*170*	*35*

There would be no sensitive receivers within the highly impacted noise distance. Therefore, if the proposed works are undertaken during standard hours only (refer to **Section 2.4.3**), impacts associated with construction noise are not considered to be significant.

However, if works were undertaken outside of standard hours, construction noise impacts could be substantial at the 11 residences within the moderate and highly intrusive noise distance. Works outside of standard work hours would require the implementation of several additional management measures in accordance with the ICNG (DECC, 2009) (refer to mitigation measures in **Section 6.8.4**). Provided these management measures are implemented, any out of hours work would be manageable and not significant due to the low number of sensitive receivers potentially being impacted by the proposed works.

Vibration

Construction activities would result in localised vibration associated with hydraulic hammering and other earthmoving activities. The proposal is unlikely to require high powered vibratory equipment near infrastructure so is unlikely to cause vibration capable of damaging property and infrastructure. One sensitive receiver at 230 Tannery Road may experience some vibration during hydraulic hammering that is capable of causing human discomfort according to the OH&E Vibration guideline. Due to the distance of the vibration intensive activities at the subject land from this residence, and the short duration of vibration intensive works, impacts associated with vibration are expected to be minimal.

There are no vibration impacts considered likely to be notable at the heritage listed property at 94 Barfield Road.

Operation

There is not expected to be any noise and vibration generated following conclusion of the proposed works.

6.8.4 Mitigation

Mitigation measures to manage noise and vibration impacts are shown in Table 6.15.

Table 6.15 Proposed mitigation measures – noise and vibration

Impact	Mitigations and management	Timing	Responsibility
Construction noise	All contractors must receive an environmental induction covering noise and vibration. The induction must include: – all relevant project specific and standard noise and vibration mitigation measures – relevant licence and approval conditions – permissible hours of work (including delivery receival).	Construction	Contractor
	Works must be undertaken during standard construction hours only and at the least sensitive time of day, as far as possible. Any works outside of these hours must obtain SCC approval through an Out of Hours Work Application and must include appropriate notification and respite offers to impacted receivers, in accordance with the Interim Construction Noise Guideline (DECC, 2009).	Construction	Contractor
	Plant used intermittently must be throttled down or shut off when not in use.	Construction	Contractor
	Noise and vibration complaints must be recorded, including suitable identification/ description of the source (e.g., continual/impulsive) and general location of the complaint. Any complaints must be investigated and actioned as required. Where necessary, attended noise and/or vibration monitoring will be undertaken following a complaint.	Construction	Contractor
	Residents that are within the clearly audible noise distance of noise intensive works must be notified prior to construction in accordance with the Interim Construction Noise Guideline (DECC, 2009). Notification must be made a minimum of five days prior to the start of construction and may consist of signage letterbox drops, and or/ website and social media publications. Notification information must include details of the works program and the timing of the works. Residents will also be provided with SCC's contact details.	Construction	Contractor
	Quieter and less powerful equipment must be used where possible, particularly when operating within minimum recommended distances.	Construction	Contractor
Construction vibration	Vibration intensive works must take place outside of minimum recommended distances for vibration intensive plant (refer to RMS, 2016). If this is not possible, the lowest power option is to be selected for vibration intensive equipment.	Construction	Contractor
	The resident at 230 Tannery Road is located within the minimum recommended distance for human response and must be notified prior to conducting vibration intensive works (demolition using hydraulic hammer).	Construction	Contractor

6.9 Traffic and access

6.9.1 Existing environment

The subject land is accessed from Tannery Road, Cambewarra, which is approximately two kilometres from the nearest town (Cambewarra Village). Tannery Road is a public road which provides access to a small number of rural residences. Tannery Road is sealed, but provides limited, or inadequate passing space in parts of the alignment, with road widths generally ranging from 3.5 m to 4.5 m. Tannery Road also has several tightly winding bends with poor visibility and steep descents, including a steep and sharply turning bend coming down into Good Dog Creek. The road is therefore not suited to heavy multi-combination vehicles and may provide restricted access to heavy combination (e.g. flatbed trailer or dump truck with dog trailer) and heavy rigid (e.g. heavy mobile crane) vehicles. A low hanging overhead communication line and associated power lines cross Tannery Road three times within 500 m of the subject land and may provide limited clearance for large vehicles (see **Figure 6.4**).

Figure 6.4 Overhead line crossing locations

Additional photographs illustrating the general configuration of overhead line crossings is presented below in **Figure 6.5**, **Figure 6.6** and **Figure 6.7**.

Figure 6.5 illustrates the overhead line crossing point number 1 in a photograph taken looking east from near the gated entrance to the subject land. The bridge over Good Dog Creek can be seen at the point where Tannery Road curves to the south (right), beyond the overhead line crossing point.

Figure 6.5 Overhead line crossing point 1

Figure 6.6 illustrates the overhead line crossing point number 2 in a photograph taken looking west, from the same location where the photograph in **Figure 6.7** was taken. Further to the west Tannery Road can be seen to fall away as it approaches Good Dog Creek.

Figure 6.6 Overhead line crossing point 2

Figure 6.7 illustrates the overhead line crossing point number 3 over a sharp 90-degree bend on Tannery Road in a photograph taken looking west, from the location where the photograph in **Figure 6.6** was taken

Figure 6.7 Overhead line crossing point 3

Moss Vale Road, a State classified main road connecting Nowra and Bomaderry to Moss Vale and Bowral, is located about 2.5 km from the subject land, via Barfield Road. Barfield Road can only be accessed from Moss Vale Road when travelling in a northbound direction.

The subject land is owned by SCC and is accessed by locked gate.

6.9.2 Discussion

Construction

The proposed works would involve heavy vehicle movements associated with transport of plant and other machinery, material transport, and daily site attendance. Access is anticipated to be predominantly from Moss Vale Road via Barfield Road. Traffic and access impacts associated with construction pertain to traffic management and road degradation.

Due to the width and navigability of Tannery Road, heavy vehicle access may require road closures and traffic management. Depending on vehicle dimensions, access requirements, an authorised temporary traffic management plan would be required which may involve the implementation of traffic management to:

– control vehicle movements through intersections
– establish one way traffic (as required) to prevent alternate vehicle movement through tight points
– establish designated stopping and passing points to allow passing
– establish reduced speed limits.

As a result of traffic management, there is expected to be potentially disruptive traffic delays for residents. However, given the length of the road that would require traffic management (about two kilometres) and the small number of local residents along Tannery Road, it is unlikely that traffic impacts would be significant. There is only one business that could be impacted by traffic management, that being Rose & Barn Country Cottages, on the corner of Barfield Road and Tannery Road. Due to its position on the intersection of Barfield Road, patrons could be subject to short delays associated with traffic management at the intersection with Tannery Road. However, due to the small numbers of patrons able to stay Rose & Barn Country Cottages, and the position of the accommodation along Tannery Road, it is likely that only a limited number patrons would potentially be affected. Any such impacts would be of short duration, limited to daylight hours and to a negligible extent only (with the possible exception of traffic noise, see **Section 6.8.3**).

Tannery Road is a minor rural access road, so is unlikely to be engineered to a standard designed for heavy vehicle traffic. Therefore, the road may be vulnerable to degradation, potentially causing a safety hazard to road users. Furthermore, road rehabilitation works, if required, would necessitate further capital expenditure and would give rise to further traffic management impacts, as described above.

Operation

Operation of the proposed works would not require ongoing access so would not present any impacts associated with traffic and access.

6.9.3 Mitigation

Mitigation measures to manage traffic and access impacts are shown in **Table 6.16**.

Table 6.16 Proposed management measures – traffic and access

Impact	Management measure	Timing	Responsibility
Access and navigability	Heavy multi-combination vehicles must not access the subject land and Tannery Road, unless authorised by SCC.	Construction	Contractor
Road degradation	Preliminary road condition assessments are to be undertaken, including photographic documentation. Ongoing monitoring of road condition must be undertaken on a monthly basis, or as required.	Pre-construction	SCC
	In the event of unsafe road degradation, road works must be undertaken as soon as practicable to restore damaged roads to an acceptable standard.	Construction	SCC
Disruption to local traffic	If traffic control is needed, a Traffic Management Plan (TMP) must be prepared by the contractor in consultation with SCC. The TMP would include a Traffic Control Plan / Temporary Traffic Management Plan with details of: – speed limits of the local road network – locations requiring traffic management – route selection to minimise noise, vibration and other potential disruptions to sensitive receivers and the community in general – timing of traffic movements, with consideration to traffic using local roads and tracks. The TMP, if required, must include a consultation strategy for management of construction traffic in relation to Rose & Barn Country Cottages Cambewarra and other impacted residences along Tannery Road.	Pre-construction, construction	Contractor
	Construction vehicle access should be scheduled for periods of reduced traffic and all traffic control devices must be in accordance with AS 1742.3-2009 Manual of uniform traffic control Devices: Traffic control for works on roads and the Transport for NSW Traffic control at worksites manual.	Pre-construction, construction	Contractor
	Surrounding residences and sensitive receivers directly affected by the works must be notified at least five days in advance of the proposed commencement of works, work methods and the duration of the construction period.	Pre-construction	Contractor

6.10 Waste

6.10.1 Existing environment

The subject land is located within a Council managed property with restricted access. There are no waste generating activities or sources that currently occur at the subject land. The subject land is surrounded by rural residential properties and is not located near any known waste generating sources. A residential waste collection service operates weekly in Cambewarra with recycling collected fortnightly.

6.10.2 Discussion

Construction

The proposed works would result in the generation of various construction wastes, including:

– Concrete and rock rubble

– Metal fences and handrails
– Metal pipes, valve and drainage infrastructure
– Erosion control material, including coir logs, mats and rubble.

These wastes are typically heavy so are unlikely to be transported by wind or water, and unintentionally spread beyond the subject land. Therefore, waste is likely to be well contained during the proposed works.

Waste produced during the proposed works would be managed in accordance with the waste management hierarchy. This provides that waste avoidance is a priority, followed by reuse and recycling/reprocessing, with disposal as a last resort. Most materials (except for contaminated soil if present) generated by the proposed works could be readily recycled or stockpiled for reuse and are therefore unlikely to contribute substantially to unrecoverable waste generation.

The proposed works would also result in some degree of general refuse, such as lunch containers and drink bottles. These types of wastes, if not suitably contained in waste receptacles, could contribute to local litter generation with impacts on local amenity and environmental degradation (e.g. Clogging waterways).

Where possible, excavated soil and soil in the earth embankment and stockpile would be reused on site for land reclamation works. Contaminated/excess spoil not used onsite would be classified in accordance with the NSW *Waste Classification Guidelines* (EPA, 2014) and disposed of at an appropriately licenced waste management facility. Existing rubble included along current erosion control structures would also be repurposed in updated erosion control structures. If suitably classified according to the NSW *Waste Classification Guidelines* (EPA, 2014), concrete from destruction of the dam wall would also be broken into rubble of nominal 300mm thickness (but ranging from 200-400 mm thick) on site and used as a bedding layer for rip-rap erosion protection lining the reconstructed channel (see **Figure 2.5**) of Cambewarra Creek (see **Figure 2.**).

Due to the volume and nature of waste material expected to be generated, and the ability to reuse and recycle most of the generated wastes, impacts associated with waste are expected to be insignificant.

Operation

There is no waste anticipated to be generated from operation of the proposal.

6.10.3 Mitigation

Mitigation measures to manage waste are shown in **Table 6.17**.

Table 6.17 Proposed mitigation measures – waste management

Impact	Measure	Timing	Responsibility
Waste generation and management	The resource management hierarchy principles must be followed as far as practicable: – avoid unnecessary resource consumption as a priority – re-use materials, reprocess, recycle and recover energy – dispose as a last resort (in accordance with the *Waste Avoidance and Resource Recovery Act* 2001).	Construction	Contractor
	All excavated soil, including soil within the earth dam embankment, should be reused on site, subject to compliance with the POEO Act and *Waste Classification Guidelines* (EPA 2014).	Construction	Contractor
	All waste material must be classified, managed and disposed of in accordance with the POEO Act and *Waste Classification Guidelines* (EPA 2014).	Construction	Contractor
	Acid sulfate soils, if present, must be managed in accordance with the *Waste Classification Guidelines - Part 4: Acid Sulfate Soils* (NSW EPA, 2014b) and measures identified in **Section 6.6.3**.	Construction	Contractor
	Labelled waste receptacles must be provided to promote the segregation of waste and recyclable materials.	Construction	Contractor
	Procurement of materials should preferentially select products with minimal packaging, or those where packaging is recyclable and/or able to be returned for re-use to the supplier.	Pre-construction/ construction	Contractor
	All working areas must be maintained by keeping free of rubbish and cleaning up at the end of each working day.	Construction	Contractor
	Portable toilets must be provided for construction workers and appropriate disposal of sewage undertaken (i.e. removed by a licensed supplier).	Construction	Contractor

6.11 Socioeconomic

6.11.1 Existing environment

The subject land is located at the end of Tannery Road, a quiet rural access road. The subject land is a locked gate private property so does not provide any practical amenity to the community. The Cambewarra dam is also not used as a water supply, so serves no useful purpose to the community, despite requiring ongoing maintenance costs and ownership levies (refer to **Section 3.1**).

The subject land may provide some visual amenity in the form of natural bush landscape for neighbouring residences and other locals during leisure and recreation, such as walking and cycling. But due to the earthen embankment and stockpile, the reservoir is not easily visible from Tannery Road. The dam wall is situated in a heavily vegetated forest gully so is not readily viewable from surrounding properties or any other vantage point. The subject land is not known to be readily visible from any other public place or vantage point in the locality, including Cambewarra Mountain lookout.

Applicable strategic plans applying to the subject land are summarised in **Section 4.3**.

6.11.2 Discussion

The proposed works are unlikely to have any substantial impact on socioeconomic factors due to the subject land being located on a relatively secluded private property, and because the existing reservoir is a redundant asset. Because of these reasons, there is unlikely to be any impacts to the practical amenity of the site and only minor impacts to visual amenity. The proposed works would not involve transforming the subject land from a natural condition into an artificial state. Therefore, in addition to the minimal number of visual receivers, there is only likely to be negligible impacts to visual amenity of the subject land.

As discussed in **Section 6.1**, removal of the dam wall may slightly reduce the likelihood and severity of flood risk downstream of the subject land. Therefore, the proposed works may reduce the likelihood of injury, death and property damage, associated with major floods.

Rehabilitation of the subject land would modify the capacity of the land to be used for other useful purposes by SCC. This may include selling the land for residential purposes or alternative council purposes.

6.11.3 Mitigation measures

Mitigation measures to manage socioeconomic impacts are shown in **Table 6.18**.

Table 6.18 Proposed mitigation measures – socioeconomic

Impact	Measure	Timing	Responsibility
Reduction of natural visual amenity	The size and frequency of waste/stockpiles on site must be minimised. Unnecessary plant and materials must be removed from the subject land as soon as practicable.	Construction	Contractor
	Plant and vehicles must remain within the subject land, where possible.	Construction	Contractor
	Street sweeping (if obvious sediment deposits are visible on Tannery Road adjacent to the access point of the subject land) and rubbish collection (in the event of any rubbish outside of the subject land, that originates for the proposed works) must be undertaken along Tannery Road to ensure that the proposed works are not impacting the visual amenity off site of the subject land.	Construction	Contractor
Public safety	Fencing and access arrangements must be maintained to prevent unauthorised access. Adequate signage must be erected notifying members of the public of site hazards.	Construction	Contractor
	Traffic management measures provided in **Section 6.9.3** must be complied with to prevent traffic hazards and delays.	Construction	Contractor
	Potential ASS must be managed in accordance with the measures identified in **Section 6.6.3**, to prevent potential health impacts associated with acidified soils and water.	Construction	Contractor

6.12 Cumulative impacts

6.12.1 Existing environment

Cumulative impacts have the potential to arise from the interaction of the proposed works and the added effects of other projects and trends across the environment, particularly with those identified as key threatening processes. SCC is required under Clause 228 (2) of the EP&A Act to consider potential cumulative impacts as a result of the proposed works.

Other activities currently occurring or seeking approval within the region, that are of a large scale or similar nature to the proposed works, include:

- **Lower Shoalhaven River – Flood Levee Repairs**: SCC is currently progressing works to repair the flood levee of the Shoalhaven River at several locations, which include Comerong Island, Numbaa and Terara. All work locations are downstream of the confluence of Bomaderry Creek with the Shoalhaven River. The works would involve repair of flood levees damaged by floods in 2022.
- **Nowra Bioenergy Project**: Innovating Energy is currently seeking approval for construction of a biogas generation facility, about nine kilometres southeast of the subject land, in Terara. The proposal would take place on cleared pasture and would involve generation of gas for energy generation, from cow manure and food waste.
- **Shoalhaven Hospital Redevelopment**: SCC is currently seeking approval for redevelopment of Shoalhaven Hospital, including construction of a seven-storey hospital, and revised access and parking. The proposal would involve demolition works, earthworks, subdivision, tree removal and landscaping across the existing hospital site. The hospital is located on the southern side of the Shoalhaven River.
- **Shoalhaven Hydro Expansion Project – Main Works**: Origin Energy is currently seeking approval to develop a new 235 MW underground pumped hydro power station, tunnels, underground and overground water pipelines, and ancillary infrastructure, between Fitzroy Falls Reservoir and Lake Yarrunga, about 11 km northwest of the subject land.

6.12.2 Discussion

Potential cumulative impacts may occur as a result of construction of the proposed works occurring simultaneously with the construction of other projects or by contributing to ongoing trends of environmental degradation (i.e. key threatening processes). Subject to the timing of construction it is possible that there could be temporary cumulative impacts that could relate to:

- erosion and sedimentation of waterways
- construction noise and vibration impacts
- construction traffic impacts
- dust generation and air quality impacts.

In the short term, the proposed works are expected to contribute to adverse cumulative impacts associated with erosion and sedimentation, construction noise, traffic, and air quality. These impacts would be temporary in nature and of a relatively low scale, so are not likely to contribute significantly to any cumulative impact or key threatening process. There are no known major projects expected to be happening at the same time that would significantly increase compound these impacts. Negative cumulative impacts would be minimised through the application of the environmental controls and management measures as summarised in **Section 7**.

There are few major projects occurring in the region, which are also largely dissimilar in nature compared to the proposed works. Therefore, there is unlikely to be any significant cumulative impact generate by the cooccurrence of other projects with the proposed works. However, all major projects occurring, or soon to be occurring, in the region are located in or adjacent to the Shoalhaven River. Therefore, it is possible that the proposed works in combination with other projects, if occurring at the same time, could contribute to reduced water quality in the Shoalhaven River, including increased turbidity, nutrient loads and sedimentation. The proposed works may also contribute, to a small degree, cumulative impacts associated with the clearing of native vegetation, including potentially threatened subtropical rainforest, which may be present in the subject land and in the footprint of the Shoalhaven Hydro Expansion Project.

While the proposed works would result in a net loss of aquatic habitat, loss of aquatic habitat is not specifically identified as a key threatening process under the NSW *Key threatening processes strategy* (OEH, 2018) and the current habitat formed by the reservoir is not considered important habitat for native species. In contrast, alteration to the natural flow regimes of rivers and streams and clearing of native vegetation are key threatening processes. The proposed works would result in restoration of natural flow regimes and regrowth of native vegetation so has potential to have a beneficial impact on the environment. However, invasion and establishment of exotic plants, including exotic perennial grasses, lantana, are identified as key threatening processes. Without implementation of the measures in **Section 7**, the proposed works has the potential to cumulatively contribute to identified key threatening processes, which could lead to further spread of invasive plants and degradation of native vegetation communities.

6.12.3 Mitigation measures

Mitigation measures to manage cumulative impacts would be undertaken consistent with the mitigation measures provided for other elements of the environment, which are summarised in **Section 7**.

7. Environmental controls and measures to minimise impacts

The proposed works must be undertaken in accordance with environmental mitigation measures and controls specified in **Section 7.1**, in addition to any required licences, permits and approvals (refer to **Section 4**). These measures would be documented and consolidated in a CEMP consistent with the AS/NZS ISO 14001:2016 Environmental Management Systems framework. The CEMP must be implemented as an integral part of delivery of the proposed works. Additional subplans would be required and should include the following:

- Erosion and Soil Control Plan (ESCP)
  - Soil and Water Management Plan (SWMP)
  - Flood Contingency Plan (FCP)
  - Acid Sulfate Soil Management Plan (ASSMP)
- Traffic Management Plan (TMP)
- Tree Management Plan
- Emergency Spill Plan (ESP)
- Landscape and Revegetation Management Plan.

The CEMP and associated subplans must be prepared prior to the commencement of construction and would be reviewed and endorsed by SCC. The CEMP would be a working document, subject to ongoing change and updated as necessary. The construction contractor would take on day to day operational responsibility for implementing the CEMP. The CEMP would identify the specific responsibilities of personnel, including key responsibilities of personnel overseeing the implementation of the CEMP.

7.1 Summary of measures

The CEMP would include controls and management measures identified in **Section 6** of the REF. The measures are summarised in **Table 7.1** below. This is a consolidated list of measures that includes only unique requirements noting that in many instances mitigation measures serve to manage potential environmental impacts across a range of environmental aspects.

Table 7.1 Summary of controls and management measures

No.	Management measures	Timing	Responsibility	Reference
1	All works would be undertaken in accordance with required approvals and permits, including but not limited to: – Part 7 FM Act permit for Dredging and/or Reclamation (refer section 200 of FM Act) – Part 7 FM Act permit for Obstruct Fish Passage (refer section 219 of FM Act) – Section 90 WM Act approval for Water Supply Work (refer section 91B of WM Act) – Section 90 WM Act approval for Drainage Work (refer to section 91C of WM Act)	Pre-construction	Contractor	Section 7
2	All works must be undertaken in accordance with a CEMP (and associated subplans) which must be endorsed by SCC prior to construction commencing and implemented during construction of the proposed works.	Pre-construction	Contractor	Section 7
3	A flood contingency plan must be in place so that any stockpiles, machinery, equipment, etc. are relocated in the event of a known upcoming large rainfall or flood event. This will include forecast monitoring at a minimum frequency of weekly.	Pre-construction	Contractor	Table 6.1
4	Surrounding residences and sensitive receivers directly affected by the works must be notified at least five days in advance of the proposed commencement of works, work methods and the duration of the construction period.	Pre-construction	Contractor	Table 6.16
5	Preliminary road condition assessments are to be undertaken, including photographic documentation. Ongoing monitoring of road condition must be undertaken on a monthly basis, or as required.	Pre-construction	SCC	Table 6.16
6	Before commencement of construction works, a vegetation clearing boundary is to be established and must prominently identify the physical limit of approved works. This would include clearly marking trees that have been designated for removal, including the four trees downstream of the dam wall. Vegetation disturbance and clearing must not take place on non-marked trees and outside of the boundary, which must include all areas of moist forest (potentially threatened subtropical rainforest) except for trees specifically identified for removal. The delineation of such a boundary may include the use of temporary fencing, parawebbing or similar.	Pre-Construction	Contractor	Table 6.4
7	Works that are to be undertaken within five metres of the Tree Protection Zone (TPZ) of trees being retained, on the subject land or any adjoining property, must subject to tree management measures consistent with AS 4970-2009 *Protection of Trees on Development Sites*.	Pre-Construction	Contractor	Table 6.4
8	The SWMP must include an unexpected finds/contaminated soils procedure. The procedure would include details of excavation, segregation, stockpiling, remediation, validation and disposal requirements for any contaminated matter.	Pre-construction	Contractor	Table 6.9
9	An emergency spill plan must be prepared which includes procedures for the storage and handling of hazardous materials including fuel and chemicals.	Pre-construction	Contractor	Table 6.9
10	Any changes to the proposed works arising during construction works must be subject to consultation with the project engineer and an appropriately experienced ecologist. and must not include any modification to the limit of works specified in this REF. Should modification of the limit of works be required, the extent and scope of the work must be approved by a qualified ecologist who may amend site limits based on: – avoiding removal of native vegetation, including trees mid-storey and ground layer plants – avoiding impacts to wombat burrows and other equivalent habitat (e.g. hollow bearing trees, fallen logs, etc.) – avoiding dispersal of weeds	Pre-construction, construction	Contractor, SCC	Section 2.4

No.	Management measures	Timing	Responsibility	Reference
	– avoiding fragmentation currently connected vegetation – minimising removal of vegetation that provides a buffering effect to rainforest species.			
11	An induction process would be implemented for the training of construction personnel to ensure: – awareness and understanding of management procedures detailed in this table and other management plans prepared for the proposed works – awareness and understanding of environmental values on the subject land – awareness and understanding of any unexpected finds procedures.	Pre-construction/ construction	Contractor	Section 7
12	If traffic control is needed, a Traffic Management Plan (TMP) must be prepared by the contractor in consultation with SCC. The TMP would include a Traffic Control Plan / Temporary Traffic Management Plan with details of: – speed limits of the local road network – locations requiring traffic management – route selection to minimise noise, vibration and other potential disruptions to sensitive receivers and the community in general – timing of traffic movements, with consideration to traffic using local roads and tracks. The TMP, if required, must include a consultation strategy for management of construction traffic in relation to Rose & Barn Country Cottages Cambewarra and other impacted residences along Tannery Road.	Pre-construction, construction	Contractor	Table 6.16
13	Procurement of materials should preferentially select products with minimal packaging, or those where packaging is recyclable and/or able to be returned for re-use to the supplier.	Pre-construction, construction	Contractor	Table 6.17
14	A soil and water management plan (SWMP) and Erosion and Sediment Control Plan (ESCP) must be prepared in accordance with B*lue Book – Managing Urban Stormwater: Soils and Construction (Landcom, 2004) and Volume 2A: Installation of Services*.	Pre-construction, construction	Contractor	Table 6.9
15	All erosion and sediment control measures, such as sediment fences, coir logs and silt curtains, must be established before ground disturbance work commences. These must stay in place until all surfaces have been restored and stabilised.	Pre-construction, construction	Contractor	Table 6.9
16	Erosion and sediment controls are to be maintained daily during construction. Additional inspections of sediment and erosion control measures must be undertaken prior to any predicted rainfall event reaching the site that would lead to surface water runoff. Inspections are to ensure control measures remain effective and can withstand the predicted weather conditions.	Construction	Contractor	Table 6.1
17	Rehabilitation will be undertaken as soon as possible, in all areas subject to reclamation and ground disturbance, including ground stabilization and provision of vegetative groundcover in all disturbed areas. Sediment and erosion controls (including dust) must be maintained until vegetation cover is established and self-sustaining.	Construction	Contractor	Table 6.1
18	Visual monitoring (i.e. turbidity, hydrocarbon spills/slicks, etc.) of Cambewarra Creek will be undertaken on a regular basis to identify any potential spills or deficient erosion and sediment controls. A record will be kept of these inspections.	Construction	Contractor	Table 6.1

No.	Management measures	Timing	Responsibility	Reference
19	Vehicle wash downs, refuelling, fuel decant and vehicle maintenance must occur offsite or in a designated bunded area more than 40 m from any drainage line.	Construction	Contractor	Table 6.1
20	All materials (e.g. Fuel, contaminated soil) that have the potential to contaminate surface water or groundwater must be stored at least 40 m away from any watercourses and on flat grades.	Construction	Contractor	Table 6.1
21	Earthworks, including demolition, capping and channel formation works, must not be undertaken within 20 m of Cambewarra Creek, during or immediately following (at least one day depending on extent of rain) rainfall events, when water levels are elevated or when ground conditions would result in bogging.	Construction	Contractor	Table 6.1
22	Drainage of the reservoir must be undertaken gradually, so as to not exceed natural peak flow volumes that may otherwise cause flooding.	Construction	SCC	Table 6.1
23	Standard dust suppression measures must be incorporated in the ESCP including: – avoid undertaking excavation and earthmoving activities during high winds – limit the areas of clearing and ground disturbance to the minimum required – implement dust suppression using water carts or binder sprays – keep stockpiles covered and below one metre in height – minimise vehicle and plant movements – cover loads during transport.	Construction	Contractor	Table 6.10
24	Tannery Road must be swept as required to control dust generation and road utility.	Construction	Contractor	Table 6.10
25	Prevailing weather conditions must be monitored over the period when exposed soils have the potential to generate dust and impact neighbouring properties. Where dust generating winds are predicted or experienced, additional dust suppression activities, such as water cart sprays and covering of stockpiles, must be undertaken.	Construction	Contractor	Table 6.10
26	Dust complaints must be investigated and corrective actions implemented as soon as practicable.	Construction	Contractor	Table 6.10
27	Plant and machinery must be fitted with emission control devils complying with Australian design standards.	Construction	Contractor	Table 6.10
28	Construction plant and equipment must be well maintained, serviced, and in good working condition. Equipment found to be emitting excessive exhaust emissions (such as excessive visible diesel smoke) must be stood down until repaired.	Construction	Contractor	Table 6.10
29	Reservoir sediments must be capped as soon as possible following dewatering, to create a buffer from odour emitting and oxidising sediments.	Construction	Contractor	Table 6.10
30	Any odour complaints must be managed in accordance with SCC requirements. Biological and chemical management controls should be considered for implementation.	Construction	Contractor, SCC	Table 6.10
31	All contractors must receive an environmental induction covering noise and vibration. The induction must include: – all relevant project specific and standard noise and vibration mitigation measures – relevant licence and approval conditions – permissible hours of work (including delivery receival).	Construction	Contractor	Table 6.15

No.	Management measures	Timing	Responsibility	Reference
32	Works must be undertaken during standard construction hours only and at the least sensitive time of day, as far as possible. Any works outside of these hours must obtain SCC approval through an Out of Hours Work Application and must include appropriate notification and respite offers to impacted receivers, in accordance with the *Interim Construction Noise Guideline* (DECC, 2009).	Construction	Contractor	Table 6.4, Table 6.15
33	Plant used intermittently must be throttled down or shut off when not in use.	Construction	Contractor	Table 6.15
34	Noise and vibration complaints must be recorded, including suitable identification/ description of the source (e.g., continual/impulsive) and general location of the complaint. Any complaints must be investigated and actioned as required. Where necessary, attended noise and/or vibration monitoring will be undertaken following a complaint.	Construction	Contractor	Table 6.15
35	Residents that are within the clearly audible noise distance of noise intensive works must be notified prior to construction in accordance with the *Interim Construction Noise Guideline* (DECC, 2009). Notification must be made a minimum of five days prior to the start of construction and may consist of signage letterbox drops, and or/ website and social media publications. Notification information must include details of the works program and the timing of the works. Residents will also be provided with SCC's contact details.	Construction	Contractor	Table 6.15
36	Quieter and less powerful equipment must be used where possible, particularly when operating within minimum recommended distances.	Construction	Contractor	Table 6.15
37	Vibration intensive works must take place outside of minimum recommended distances for vibration intensive plant (refer to RMS, 2016). If this is not possible, the lowest power option must be selected for vibration intensive equipment.	Construction	Contractor	Table 6.15
38	The resident at 230 Tannery Road is located within the minimum recommended distance for human response and must be notified prior to conducting vibration intensive works (demolition using hydraulic hammer).	Construction	Contractor	Table 6.15
39	Heavy multi-combination vehicles must not access the subject land and Tannery Road, unless authorised by SCC.	Construction	Contractor	Table 6.16
40	In the event of unsafe road degradation, road works must be undertaken as soon as practicable to restore damaged roads to an acceptable standard.	Construction	SCC	Table 6.16
41	Construction vehicle access should be scheduled for periods of reduced traffic and all traffic control devices must be in accordance with AS 1742.3-2009 *Manual of uniform traffic control Devices: Traffic control for works on roads and the Transport for NSW Traffic control at worksites manual*.	Construction		Table 6.16
42	The resource management hierarchy principles must be followed as far as practicable: – avoid unnecessary resource consumption as a priority – re-use materials, reprocess, recycle and recover energy – dispose as a last resort (in accordance with the *Waste Avoidance and Resource Recovery Act 2001*).	Construction	Contractor	Table 6.17
43	All excavated soil, including soil within the earth dam embankment, should be reused on site, subject to compliance with the POEO Act and *Waste Classification Guidelines* (EPA 2014).	Construction	Contractor	Table 6.17
44	All waste material must be classified, managed and disposed of in accordance with the POEO Act and *Waste Classification Guidelines* (EPA 2014).	Construction	Contractor	Table 6.17
45	Labelled waste receptacles must be provided to promote the segregation of waste and recyclable materials.	Construction	Contractor	Table 6.17

No.	Management measures	Timing	Responsibility	Reference
46	All working areas must be maintained by keeping free of rubbish and cleaning up at the end of each working day.	Construction	Contractor	Table 6.17
47	Portable toilets must be provided for construction workers and appropriate disposal of sewage undertaken (i.e. removed by a licensed supplier).	Construction	Contractor	Table 6.17
48	The size and frequency of waste/stockpiles on site must be minimised. Unnecessary plant and materials must be removed from the subject land as soon as practicable.	Construction	Contractor	Table 6.18
49	Plant and vehicles must remain within the subject land, where possible.	Construction	Contractor	Table 6.18
50	Street sweeping (if obvious sediment deposits are visible on Tannery Road adjacent to the access point of the subject land) and rubbish collection (in the event of any rubbish outside of the subject land, that originates for the proposed works) must be undertaken along Tannery Road to ensure that the proposed works are not impacting the visual amenity off site of the subject land.	Construction	Contractor	Table 6.9, Table 6.18
51	Fencing and access arrangements must be maintained to prevent unauthorised access. Adequate signage must be erected notifying members of the public of site hazards.	Construction	Contractor	Table 6.18
52	Removal of the four trees at the dam wall must not cause damage to any other adjacent vegetation that is to be retained, including damage to the root system within the TPZ as defined by AS 4970-2009.	Construction	Contractor	Table 6.4
53	Where possible, mature and hollow-bearing trees will be avoided. If any hollows need to be removed, a pre-clearance survey must be conducted by a suitably qualified ecologist prior to any vegetation disturbance.	Construction	Contractor	Table 6.4
54	Where possible, vegetation to be removed would be retained as habitat or mulched on-site and re-used to stabilise disturbed areas.	Construction	Contractor	Table 6.4
55	If threatened fauna species are discovered, works are to be stopped immediately and a suitably qualified ecologist contacted for advice.	Construction	Contractor	Table 6.4
56	Where any fauna are encountered within the construction area, stop work until the fauna moves off on their own accord (without physical or aggressive prompting). If the fauna does not move off, a fauna spotter catcher must be contacted to remove the animal(s) and relocate them nearby, or if necessary, deliver them to a veterinarian or wildlife carer for rehabilitation.	Construction	Contractor	Table 6.4
57	If any wombat burrows are likely to be impacted by the proposed works, a suitably qualified ecologist must be engaged to verify the burrow is not occupied prior to the commencement of any works that might damage it.	Construction	Contractor	Table 6.4
58	If any habitat trees (nest-bearing or hollow-bearing) are to be removed, an ecologist / fauna spotter catcher should be present to ensure no animals are injured.	Construction	Contractor	Table 6.4
59	Should the proposed works disturb acid sulfate soils, the works must adhere to the *NSW Acid Sulfate Manual* (Naylor et al. 1998), *Acid Sulfate Soils Management Guidelines*, Waste Classification Guidelines - Part 4: Acid Sulfate Soils (NSW EPA, 2014b), and the SLEP.	Construction	Contractor	Table 6.4, Table 6.17
60	The construction crew must be briefed on the identification of priority weeds that occur on site during inductions.	Construction	Contractor	Table 6.4
61	If declared priority weeds are identified during construction they must be managed according to the requirements of the *Biosecurity Act 2015*. Records of weed control activities must be kept.	Construction	Contractor	Table 6.4

No.	Management measures	Timing	Responsibility	Reference
62	Construction machinery (bulldozers, excavators, trucks, loaders and graders) must be cleaned in accordance with Machinery Cleaning Guides and Checklists published by the Australian Department of Agriculture Fisheries and Forestry[1] (DAFF, 2024) before entering and exiting work sites.	Construction	Contractor	Table 6.4
63	Machinery will be inspected by designated personnel following cleaning to verify cleaning meets the DAFF (DAFF, 2024) requirements. Records of inspections must be maintained.	Construction	Contractor	Table 6.4
64	All pesticides must be used in accordance with the requirements on the label. Any person carrying out pesticide (including herbicide) application must be trained to do so and have the proper certificate of completion/competency or statement of attainment issued by a registered training organisation.	Construction	Contractor	Table 6.4
65	All food scraps and rubbish must be appropriately disposed of in sealed receptacles to prevent providing forage habitats for foxes, rats, dogs, and cats.	Construction	Contractor	Table 6.4
66	Should there be an accumulation of water in the reservoir at the point of commencing the proposed works, drainage the reservoir must be undertaken gradually, to not exceed natural peak flow volumes that may otherwise cause flooding.	Construction	SCC	Table 6.4
67	Site inductions must include an Aboriginal heritage awareness procedure to improve recognition of items of potential heritage significance and to make workers aware of the legislative protection of Aboriginal heritage items and places under the NPW Act.	Construction	Contractor	Table 6.4
68	If any item or place of potential Aboriginal heritage significance is observed, work must cease immediately, and a temporary exclusion zone established. Further action must be undertaken in accordance with an approved unexpected finds protocol.	Construction	Contractor	Table 6.6
69	All land and ground disturbance activities must be confined to within the limit of works described in this REF.	Construction	Contractor	Table 6.6, Table 6.8
70	Site inductions must include a heritage awareness procedure to improve recognition of items of potential heritage significance and to make workers aware of the legislative protection of heritage items under the Heritage Act.	Construction	Contractor	Table 6.8
71	Stockpiles must be located away from drainage lines and the dripline of trees. Stockpiles must be kept to a minimum height of one metre and must be covered, when possible, to prevent erosion, control runoff and prevent sedimentation.	Construction	Contractor	Table 6.9
72	An Acid Sulfate Soils Management Plan (ASSMP) must be prepared as part of the Soil and Water Management Plan (SWMP), and in accordance with the *Waste Classification Guidelines - Part 4: Acid Sulfate Soils* (NSW EPA, 2014b).	Construction	Contractor	Table 6.9
73	Erosion and sediment controls must be regularly inspected and maintained (including clearing of sediment from behind barriers) to ensure effectiveness over the entire duration of the proposal.	Construction	Contractor	Table 6.9
74	Surface sediments are to be excavated or capped with suitable topsoil as soon as possible following dewatering of the reservoir, to prevent mobilisation of unconsolidated sediment and potential contaminants.	Construction	Contractor	Table 6.9
75	Work must cease during heavy rainfall events when there is a risk of sediment loss off-site or ground disturbance due to water logged conditions.	Construction	Contractor	Table 6.9

No.	Management measures	Timing	Responsibility	Reference
76	Equipment, plant and materials will be parked in designated lay-down areas where they are least likely to cause erosion or damage to vegetation.	Construction	Contractor	Table 6.9
77	If ASS is discovered during construction, soils must be managed and treated with lime in accordance with the *Waste Classification Guidelines - Part 4: Acid Sulfate Soils* (NSW EPA, 2014b).	Construction	Contractor	Table 6.9
78	Should suspected soil contamination be found on-site, works must be stopped immediately and the unexpected finds/contaminated soils procedure implemented.	Construction	Contractor	Table 6.9
79	Storage of hazardous materials on-site to be kept to a minimum and would be in accordance with national guidelines and the safety data sheets relating to bunding, coverage, storage of incompatible materials, etc.	Construction	Contractor	Table 6.9
80	Refuelling is to occur off site where possible. If being undertaken on site, refuelling must be undertaken in a bunded area with spill kit readily accessible.	Construction	Contractor	Table 6.9
81	Construction workers must be trained in the correct use of spill kits.	Construction	Contractor	Table 6.9
82	Final rehabilitation works should be undertaken within 10 days of the completion of earthworks and should include a combination of geotechnical fabrics and/or coir matting, gravel and/or mulching, and native planting.	Construction, Post-construction	Contractor	Table 6.9

8. Significance evaluation and conclusion

This REF has assessed all matters associated with the proposed works and has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed works. Appendix A provides an assessment of all environmental factors, required to be taken into account under clause 171(2) of the EP&A Regulation.

Key permanent environmental impacts from the proposed works would include modification of surface water flows and loss of aquatic habitat. Key temporary impacts would likely include erosion and sedimentation, dust generation, noise emissions, potential disruption of ASS, and potential traffic disruption. Environmental controls and management measures detailed in this REF would avoid or minimise these expected impacts. The proposed works would also involve rehabilitation of the subject land to a more natural condition, including restoration of the natural flow regime and terrestrial habitat. On balance, the proposed works are considered justified and the following conclusions are made:

– The proposed works would be unlikely to cause a significant impact on the environment, including significant impacts to threatened species, populations or ecological communities, or their habitats. Therefore, an EIS, SIS or BDAR is not required.
– The proposed works are not likely to have a significant impact on MNES or the environment of Commonwealth land within the meaning of the EPBC Act. A referral to the Commonwealth is not required.

While there would be some environmental impacts as a consequence of the proposed works, they have been avoided or minimised wherever possible through design and site-specific controls, as summarised in **Section 7.1**. The benefits of the proposed works are considered to outweigh the expected impact on the environment. The proposed works must be undertaken in accordance with the permits, approvals and notifications specified in **Section 4**.

8.1 Certification

I certify that I have reviewed and endorsed the contents of this REF document and, to the best of my knowledge, it is in accordance with the EP&A Act, the EP&A Regulation and the Guidelines approved under clause 170 of the EP&A Regulation, and the information it contains is neither false nor misleading.

Name: Peter Cowper

Position title: Technical Director – Environment

Company name: GHD

Date: 6 June 2024

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I have examined this REF and accept it on behalf of SCC.

Name: Robert Horner

Position title: Executive Manager - Shoalhaven Water

Authority: Shoalhaven City Council

Date: 25/06/2024

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Appendices

Appendix A

Clause 171(2) checklist

Clause 171(2) Checklist

Factor	Impact
Any environmental impact on a community? Construction of the proposed works would result in some short-term negative impacts, such as erosion and sedimentation, dust generation, noise emissions, potential disruption of ASS, and potential traffic disruption. These could impact negatively on the local community, however potential impacts would be temporary and minimised with the implementation of the controls detailed in this REF. Upon completion, the proposed work would have a positive environmental impact on the community in the long-term, through restoration of natural flow regimes and economic benefits associated with ongoing maintenance.	Short-term, minor, negative Long-term, minor, positive
Any transformation of a locality? The proposed works would involve transformation of Cambewarra Reservoir to reclaimed terrestrial land. The subject land is located in a low visibility rural area and is of a size which would not constitute a significant transformation of the locality.	Long-term, negligible
Any environmental impact on the ecosystems of the locality? Impacts to ecology have been assessed in **Section 6.3**, and in relation to abiotic factors in other sections of this REF. The most significant impact would be reclamation of Cambewarra Reservoir and restoration of the natural flow regime. The proposed works are unlikely to have a significant impact on the ecosystems of the locality and potential impacts would be minimised with the implementation of the controls detailed in this REF.	Long-term, minor, positive
Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality? During construction, the proposed works would have the potential to create a reduction in the overall aesthetic quality of the subject land and surrounds due to the presence of plant and equipment required for construction, dust and noise generation as well as potential traffic disruptions. However, impacts would be minimised as far as practicable through the implementation of controls detailed in this REF. The subject land is not publicly accessible, so any reduction in aesthetic or recreational quality would be negligible. The proposal would not notably reduce scientific or other environmental qualities of the locality.	Short-term, minor, negative Long-term, negligible, negative
Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations? The proposed works would not impact on any heritage places or values during construction or operation (refer to **Sections 6.4** and **6.5**).	Long-term, negligible, negative
Any impact on the habitat of protected fauna (within the meaning of the BC Act)? Impacts to ecology have been assessed in **Section 6.3**. The proposed works are unlikely to have a significant impact on the habitat of protected fauna and potential impacts would be minimised with the implementation of the controls detailed in this REF.	Long-term, minor, negative

Factor	Impact
Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air? Impacts to ecology have been assessed in **Section 6.3**. The proposed works are unlikely to endanger any species of animal, plant or other form of life and potential impacts would be minimised with the implementation of the controls given in **Section 6.3.3** of this REF. The proposed works may facilitate the regrowth of native vegetation, which may provide beneficial terrestrial vegetation for endangered species and communities.	Short-term, minor, negative Long-term, minor, positive
Any long-term effects on the environment? The proposed works would involve naturalisation of the subject land and downstream receivers through restoration of the flow regime and associated ecological processes. Due to the proposed works involving decommissioning of an asset and naturalisation, the proposed works are unlikely to present any negative long-term effects on the environment.	Long-term, minor, positive
Any degradation of the quality of the environment? The proposed works would result in temporary degradation of the environment on a localised scale, potentially including impacts to noise and air quality, and small scale vegetation clearing of mostly exotic vegetation. The proposed works would return a natural flow regime to the subject land and would likely facilitate beneficial regrowth of native vegetation, so long as exotic weeds are managed appropriately. Broader scale impacts may include temporary water quality impacts and sedimentation at downstream receivers due to erosion during construction and rehabilitation of the site.	Short-term, minor, negative Long-term, minor, positive
Any risk to the safety of the environment? The construction work has the potential to temporarily decrease safety within and adjacent to the subject land due to works within the road reserve and movement of construction plant, however the potential impacts would be minimised with the implementation of the controls given in this REF. Decomissioning of Cambewarra dam would remove an aging asset which may otherwise present a risk to site users and downstream receivers in flood prone land.	Short-term, minor, negative Long-term, minor, positive
Any reduction in the range of beneficial uses of the environment? The subject land was historically used as a water supply storage reservoir but has not been used for this purpose for over 40 years. Removal of Cambewarra dam would increase the range of possible uses of the subject land.	Short-term, minor, positive
Any pollution of the environment? The proposal would potentially cause pollution to the environment as a result of unmanaged erosion and sediment (including heavy metals and acid sulfate soils) polluting waterways or via the dust and construction plant emissions. However, any potential impacts would be minimised with the implementation of the controls provided in this REF.	Short-term, minor, negative
Any environmental problems associated with the disposal of waste? Waste will be generated by the proposed works during construction. It is likely that some quantities of construction waste and domestic waste will be generated. Waste associated with the proposed works would be managed in accordance with the *Waste Avoidance and Resource Recovery Act 2001* and will be repurposed on site and recycled where possible. This would include reusing soil maintained in the earth embankment dam on site, and if possible, reusing concrete rubble from the decommissioned dam wall for erosion protection. Issues associated with the disposal of waste are not expected.	Short-term, minor, negative
Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply? Relatively small amounts of materials would be required for the proposed works. The proposed works are unlikely to significantly increase demands on resources, which are, or are likely to become, in short supply.	Negligible
Any cumulative environmental effect with other existing or likely future activities? Cumulative impacts are discussed in **Section 6.12** and may include decreased water quality and sedimentation of Shoalhaven River. However, due to the scale and proximity of other activities, and the scale and management measures to be implemented as part of the proposed works, there are unlikely to be any significant cumulative impacts because of the proposed works.	Short-term, minor, negative.
Any impact on coastal processes and coastal hazards, including those under projected climate change conditions?	Nil

Factor	Impact
The proposed works are not located in a coastal area.	
Applicable local strategic planning statements, regional strategic plans or district strategic plans made under the Act, Division 3.1? Refer to **Section 4.3**.	Nil
Other relevant environmental factors? Other relevant factors have been addressed in **Section 6**.	Nil

Appendix B

PMST search report

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 14-Feb-2024

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	8
Listed Threatened Species:	111
Listed Migratory Species:	57

Other Matters Protected by the EPBC Act

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

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	155
Commonwealth Heritage Places:	1
Listed Marine Species:	68
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	10
Regional Forest Agreements:	1
Nationally Important Wetlands:	1
EPBC Act Referrals:	10
Key Ecological Features (Marine):	None
Biologically Important Areas:	3
Bioregional Assessments:	1
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community likely to occur within area	In buffer area only
Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland	Endangered	Community likely to occur within area	In feature area
Illawarra and south coast lowland forest and woodland ecological community	Critically Endangered	Community likely to occur within area	In feature area
Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion	Critically Endangered	Community likely to occur within area	In feature area
Natural Temperate Grassland of the South Eastern Highlands	Critically Endangered	Community may occur within area	In buffer area only
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria	Critically Endangered	Community likely to occur within area	In feature area
Robertson Rainforest in the Sydney Basin Bioregion	Critically Endangered	Community likely to occur within area	In buffer area only
Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion	Endangered	Community may occur within area	In buffer area only

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Anthochaera phrygia			
Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Aphelocephala leucopsis](#) Southern Whiteface [529]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Ardenna grisea](#) Sooty Shearwater [82651]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
[Arenaria interpres](#) Ruddy Turnstone [872]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
[Botaurus poiciloptilus](#) Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area	In feature area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
[Calidris tenuirostris](#) Great Knot [862]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
[Callocephalon fimbriatum](#) Gang-gang Cockatoo [768]	Endangered	Species or species habitat known to occur within area	In feature area
[Calyptorhynchus lathami lathami](#) South-eastern Glossy Black-Cockatoo [67036]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Charadrius leschenaultii](#) Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
[Charadrius mongolus](#) Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Climacteris picumnus victoriae Brown Treecreeper (south-eastern) [67062]	Vulnerable	Species or species habitat known to occur within area	In feature area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat known to occur within area	In feature area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea antipodensis gibsoni Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat may occur within area	In buffer area only
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In feature area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Endangered	Species or species habitat known to occur within area	In buffer area only
Limosa limosa Black-tailed Godwit [845]	Endangered	Species or species habitat known to occur within area	In buffer area only
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In buffer area only
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Melanodryas cucullata cucullata South-eastern Hooded Robin, Hooded Robin (south-eastern) [67093]	Endangered	Species or species habitat may occur within area	In feature area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat may occur within area	In buffer area only
Neophema chrysostoma Blue-winged Parrot [726]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Pycnoptilus floccosus Pilotbird [525]	Vulnerable	Species or species habitat known to occur within area	In feature area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area	In feature area
Stagonopleura guttata Diamond Firetail [59398]	Vulnerable	Species or species habitat known to occur within area	In feature area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour may occur within area	In buffer area only
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area	In buffer area only
FISH			
Epinephelus daemelii Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Macquaria australasica Macquarie Perch [66632]	Endangered	Species or species habitat may occur within area	In feature area
Prototroctes maraena Australian Grayling [26179]	Vulnerable	Species or species habitat known to occur within area	In feature area
FROG			
Heleioporus australiacus Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat known to occur within area	In feature area
Litoria littlejohni Northern Heath Frog, Littlejohn's Tree Frog [64733]	Endangered	Species or species habitat may occur within area	In buffer area only
Litoria watsoni Southern Heath Frog, Watson's Tree Frog [91509]	Endangered	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Mixophyes balbus](#)			
Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat known to occur within area	In feature area
INSECT			
[Keyacris scurra](#)			
Key's Matchstick Grasshopper [89739]	Endangered	Species or species habitat may occur within area	In buffer area only
MAMMAL			
[Chalinolobus dwyeri](#)			
Large-eared Pied Bat, Large Pied Bat [183]	Endangered	Species or species habitat known to occur within area	In feature area
[Dasyurus maculatus maculatus (SE mainland population)](#)			
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area	In feature area
[Isoodon obesulus obesulus](#)			
Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern) [68050]	Endangered	Species or species habitat known to occur within area	In feature area
[Notamacropus parma](#)			
Parma Wallaby [89289]	Vulnerable	Species or species habitat may occur within area	In feature area
[Petauroides volans](#)			
Greater Glider (southern and central) [254]	Endangered	Species or species habitat known to occur within area	In feature area
[Petaurus australis australis](#)			
Yellow-bellied Glider (south-eastern) [87600]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Petrogale penicillata](#)			
Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)](#)			
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Endangered	Species or species habitat known to occur within area	In feature area
[Potorous tridactylus trisulcatus](#)			
Long-nosed Potoroo (southern mainland) [86367]	Vulnerable	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Pseudomys novaehollandiae](#) New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Pteropus poliocephalus](#) Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area	In feature area
PLANT			
[Acacia bynoeana](#) Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat may occur within area	In feature area
[Boronia deanei](#) Deane's Boronia [8397]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Caladenia tessellata](#) Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Calochilus pulchellus](#) Pretty Beard Orchid, Pretty Beard-orchid [84677]	Endangered	Species or species habitat known to occur within area	In buffer area only
[Cryptostylis hunteriana](#) Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Cynanchum elegans](#) White-flowered Wax Plant [12533]	Endangered	Species or species habitat likely to occur within area	In feature area
[Daphnandra johnsonii](#) Illawarra Socketwood [67186]	Endangered	Species or species habitat may occur within area	In buffer area only
[Eucalyptus langleyi](#) Albatross Mallee, Green Mallee Ash [56224]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
[Genoplesium baueri](#) Yellow Gnat-orchid, Bauer's Midge Orchid, Brittle Midge Orchid [7528]	Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Grevillea parviflora subsp. parviflora Small-flower Grevillea [64910]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Haloragis exalata subsp. exalata Wingless Raspwort, Square Raspwort [24636]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Helichrysum calvertianum [5702]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Hibbertia acaulothrix [87409]	Endangered	Species or species habitat may occur within area	In buffer area only
Irenepharsus trypherus Delicate Cress, Illawarra Irene [14664]	Endangered	Species or species habitat known to occur within area	In feature area
Leucopogon exolasius Woronora Beard-heath [14251]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Melaleuca biconvexa Biconvex Paperbark [5583]	Vulnerable	Species or species habitat may occur within area	In feature area
Melaleuca deanei Deane's Melaleuca [5818]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Persoonia oxycoccoides [16114]	Endangered	Species or species habitat may occur within area	In buffer area only
Pimelea spicata Spiked Rice-flower [20834]	Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Pomaderris brunnea Rufous Pomaderris, Brown Pomaderris [16845]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Pomaderris cotoneaster Cotoneaster Pomaderris [2043]	Endangered	Species or species habitat known to occur within area	In feature area
Prasophyllum affine Jervis Bay Leek Orchid, Culburra Leek-orchid, Kinghorn Point Leek-orchid [2210]	Endangered	Species or species habitat known to occur within area	In feature area
Prasophyllum fuscum Tawny Leek-orchid, Slaty Leek-orchid [19455]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Prostanthera densa Villous Mintbush [12233]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Pterostylis gibbosa Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood [4562]	Endangered	Species or species habitat known to occur within area	In feature area
Pterostylis pulchella Pretty Greenhood [6448]	Vulnerable	Species or species habitat known to occur within area	In feature area
Pterostylis vernalis Halbury Rustyhood [84711]	Critically Endangered	Species or species habitat known to occur within area	In buffer area only
Pultenaea aristata [18062]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Rhizanthella slateri Eastern Underground Orchid [11768]	Endangered	Species or species habitat may occur within area	In feature area
Rhodamnia rubescens Scrub Turpentine, Brown Malletwood [15763]	Critically Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Rhodomyrtus psidioides Native Guava [19162]	Critically Endangered	Species or species habitat may occur within area	In feature area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Thelymitra kangaloonica Kangaloon Sun Orchid [81861]	Critically Endangered	Species or species habitat likely to occur within area	In buffer area only
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Triplarina nowraensis Nowra Heath-myrtle [64544]	Endangered	Species or species habitat known to occur within area	In buffer area only
Xerochrysum palustre Swamp Everlasting, Swamp Paper Daisy [76215]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Zieria baeuerlenii Bomaderry Zieria, Bomaderry Creek Zieria [56781]	Endangered	Species or species habitat known to occur within area	In buffer area only
REPTILE			
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area	In buffer area only
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Hoplocephalus bungaroides Broad-headed Snake [1182]	Endangered	Species or species habitat known to occur within area	In feature area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area	In buffer area only

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Ardenna grisea Sooty Shearwater [82651]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat may occur within area	In buffer area only
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat may occur within area	In buffer area only
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area	In buffer area only
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour may occur within area	In buffer area only
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Migratory Marine Species			
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area	In buffer area only
Dugong dugon Dugong [28]		Species or species habitat may occur within area	In buffer area only
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area	In buffer area only
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat may occur within area	In buffer area only
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Migratory Terrestrial Species			
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In feature area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Myiagra cyanoleuca](#) Satin Flycatcher [612]		Species or species habitat known to occur within area	In feature area
[Rhipidura rufifrons](#) Rufous Fantail [592]		Species or species habitat known to occur within area	In feature area
[Symposiachrus trivirgatus as Monarcha trivirgatus](#) Spectacled Monarch [83946]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
[Actitis hypoleucos](#) Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
[Arenaria interpres](#) Ruddy Turnstone [872]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Calidris alba](#) Sanderling [875]		Species or species habitat known to occur within area	In buffer area only
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat known to occur within area	In feature area
[Calidris ruficollis](#) Red-necked Stint [860]		Species or species habitat known to occur within area	In buffer area only
[Calidris tenuirostris](#) Great Knot [862]	Vulnerable	Species or species habitat known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Charadrius bicinctus Double-banded Plover [895]		Species or species habitat known to occur within area	In buffer area only
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area	In buffer area only
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat known to occur within area	In buffer area only
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Limicola falcinellus Broad-billed Sandpiper [842]		Species or species habitat known to occur within area	In buffer area only
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area	In buffer area only
Limosa limosa Black-tailed Godwit [845]	Endangered	Species or species habitat known to occur within area	In buffer area only
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Numenius phaeopus Whimbrel [849]		Species or species habitat known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area	In buffer area only
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat known to occur within area	In buffer area only
Tringa brevipes Grey-tailed Tattler [851]		Species or species habitat known to occur within area	In buffer area only
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area	In buffer area only
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area	In buffer area only
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area	In buffer area only

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

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

Commonwealth Land Name	State	Buffer Status
Communications, Information Technology and the Arts - Australian Postal Corporation		
Commonwealth Land - Australian Postal Commission [11865]	NSW	In buffer area only
Commonwealth Land - Australian Postal Corporation [16179]	NSW	In buffer area only
Communications, Information Technology and the Arts - Telstra Corporation Limited		
Commonwealth Land - Australian Telecommunications Commission [11866]	NSW	In buffer area only
Defence		
Commonwealth Land - Defence Service Homes Corporation [11867]	NSW	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [11860]	NSW	In buffer area only
Defence - DCO NOWRA [10109]	NSW	In buffer area only

Commonwealth Land Name	State	Buffer Status
Defence - PARACHUTE DROPPING ZONE (PARACHUTE TRAINING SCHOOL) ; NOWRA - PTS [10067]	NSW	In buffer area only
Defence - Shop 3 [10111]	NSW	In buffer area only
Defence - Suite 18, Holt Centre [10110]	NSW	In buffer area only
Defence - Defence Housing Authority		
Commonwealth Land - Defence Housing Authority [16042]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16043]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11913]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11912]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11911]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11910]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11916]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11917]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11914]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11915]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11938]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11939]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16399]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11922]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11934]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11935]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11992]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11925]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11997]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11924]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11996]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11927]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11991]	NSW	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - Defence Housing Authority [11926]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11990]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16040]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11859]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11994]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11995]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16041]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11920]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11923]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11921]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11928]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16398]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11929]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16402]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11904]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11905]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11906]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16403]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11907]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11993]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11998]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11909]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11908]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11999]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11858]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11950]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11951]	NSW	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - Defence Housing Authority [11952]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11953]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11954]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11955]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11956]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11957]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11958]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11983]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11959]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11984]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11982]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11903]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11902]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11901]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11900]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11987]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11986]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11985]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16351]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11857]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11856]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11918]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11919]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11973]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [15631]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11978]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11868]	NSW	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - Defence Housing Authority [11971]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11970]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11969]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11979]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11949]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11972]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11948]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [15633]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [15630]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [15632]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11976]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11977]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11974]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11975]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11963]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11960]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11965]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11962]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11968]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11961]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11964]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11967]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11966]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12003]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12002]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11933]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11931]	NSW	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - Defence Housing Authority [11930]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11980]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11981]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11988]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11989]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11936]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11937]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12005]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12006]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12000]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12001]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16031]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16033]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16032]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12004]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16404]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11899]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16401]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11898]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16407]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16400]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16405]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16406]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11943]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11942]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11862]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11863]	NSW	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - Defence Housing Authority [11944]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11945]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11946]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11947]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11940]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11941]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16036]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16037]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16034]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16039]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [11861]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16035]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16038]	NSW	In buffer area only
Unknown		
Commonwealth Land - [11932]	NSW	In buffer area only
Commonwealth Land - [11864]	NSW	In buffer area only

Commonwealth Heritage Places			[Resource Information]
Name	State	Status	Buffer Status
Historic			
Bundanon Trust Property	NSW	Listed place	In buffer area only

Listed Marine Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Ardenna grisea as Puffinus griseus Sooty Shearwater [82651]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Arenaria interpres Ruddy Turnstone [872]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat known to occur within area	In feature area
Calidris alba Sanderling [875]		Species or species habitat known to occur within area	In buffer area only
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area overfly marine area	In feature area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area overfly marine area	In buffer area only
Calidris tenuirostris Great Knot [862]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In buffer area only
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Charadrius bicinctus Double-banded Plover [895]		Species or species habitat known to occur within area overfly marine area	In buffer area only
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area	In buffer area only
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area overfly marine area	In buffer area only
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat known to occur within area overfly marine area	In buffer area only
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea antipodensis gibsoni as Diomedea gibsoni Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat likely to occur within area overfly marine area	In feature area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area	In feature area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Species or species habitat known to occur within area overfly marine area	In buffer area only
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In feature area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area overfly marine area	In feature area
Limicola falcinellus Broad-billed Sandpiper [842]		Species or species habitat known to occur within area overfly marine area	In buffer area only
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In buffer area only
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area	In buffer area only
Limosa limosa Black-tailed Godwit [845]	Endangered	Species or species habitat known to occur within area overfly marine area	In buffer area only
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area overfly marine area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In buffer area only
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area overfly marine area	In feature area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In buffer area only
Neophema chrysostoma Blue-winged Parrot [726]	Vulnerable	Species or species habitat likely to occur within area overfly marine area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Numenius phaeopus Whimbrel [849]		Species or species habitat known to occur within area	In buffer area only
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Pandion haliaetus](#) Osprey [952]		Species or species habitat known to occur within area	In buffer area only
[Phaethon lepturus](#) White-tailed Tropicbird [1014]		Species or species habitat may occur within area	In buffer area only
[Pluvialis fulva](#) Pacific Golden Plover [25545]		Species or species habitat known to occur within area	In buffer area only
[Pterodroma cervicalis](#) White-necked Petrel [59642]		Species or species habitat may occur within area	In feature area
[Rhipidura rufifrons](#) Rufous Fantail [592]		Species or species habitat known to occur within area overfly marine area	In feature area
[Rostratula australis as Rostratula benghalensis (sensu lato)](#) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
[Sterna striata](#) White-fronted Tern [799]		Migration route may occur within area	In feature area
[Symposiachrus trivirgatus as Monarcha trivirgatus](#) Spectacled Monarch [83946]		Species or species habitat may occur within area overfly marine area	In feature area
[Thalassarche bulleri](#) Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Thalassarche bulleri platei as Thalassarche sp. nov.](#) Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Thalassarche cauta](#) Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour may occur within area	In buffer area only
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Tringa brevipes as Heteroscelus brevipes Grey-tailed Tattler [851]		Species or species habitat known to occur within area	In buffer area only
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area overfly marine area	In buffer area only
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area overfly marine area	In buffer area only
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area overfly marine area	In buffer area only
Mammal			
Dugong dugon Dugong [28]		Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Reptile			
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area	In buffer area only
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area	In buffer area only

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Bamarang	Nature Reserve	NSW	In buffer area only
Bomaderry Creek	Regional Park	NSW	In buffer area only
Budderoo	National Park	NSW	In buffer area only
Bugong	National Park	NSW	In buffer area only
Cambewarra Range	Nature Reserve	NSW	In buffer area only
Kangaroo River	Nature Reserve	NSW	In buffer area only
Morton	National Park	NSW	In buffer area only
Tapitallee	Nature Reserve	NSW	In buffer area only
Triplarina	Nature Reserve	NSW	In buffer area only
Wogamia	Nature Reserve	NSW	In buffer area only

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included. Please see the associated resource information for specific caveats and use limitations associated with RFA boundary information.

RFA Name	State	Buffer Status
Southern RFA	New South Wales	In feature area

Nationally Important Wetlands [Resource Information]

Wetland Name	State	Buffer Status
Shoalhaven/Crookhaven Estuary	NSW	In buffer area only

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Action clearly unacceptable				
Construct and operate north Nowra link road	2008/4473	Action Clearly Unacceptable	Completed	In buffer area only
Controlled action				
North Nowra Link Road	2009/5238	Controlled Action	Completed	In buffer area only
Not controlled action				
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
INDIGO Central Submarine Telecommunications Cable	2017/8127	Not Controlled Action	Completed	In feature area
Residential Development Lot 3 and Lot 384	2012/6327	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manner)				
construction & operation of gas-fired power facility, installation of transmission lines & gas pipel	2006/3056	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval	In feature area
Princes Highway upgrade	2012/6233	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Proposed Residential Development at George Evans Road, Mundamia, NSW	2012/6470	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Residential Subdivision of Lot 1433 Bangalee	2011/6207	Not Controlled Action	Post-Approval	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action (particular manner)				
		(Particular Manner)		

Biologically Important Areas

Scientific Name	Behaviour	Presence	Buffer Status
Seabirds			
Ardenna pacifica			
Wedge-tailed Shearwater [84292]	Foraging	Likely to occur	In buffer area only
Ardenna tenuirostris			
Short-tailed Shearwater [82652]	Foraging	Likely to occur	In buffer area only
Pelagodroma marina			
White-faced Storm-petrel [1016]	Breeding	Known to occur	In buffer area only

Bioregional Assessments

SubRegion	BioRegion	Website	Buffer Status
Sydney	Sydney Basin	BA website	In feature area

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

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

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

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

Please feel free to provide feedback via the Contact us page.

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Appendix C

NSW BioNet search outputs

Data from the BioNet Atlas website, which holds records from a number of custodians. The data are only indicative and cannot be considered a comprehensive inventory, and may contain errors and omissions. Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1° C; ^^ rounded to 0.01° C. Copyright the State of NSW through the Department of Planning, Industry and Environment. Search criteria : Licensed Report of all Valid Records of Threatened (listed on BC Act 2016) ,Commonwealth listed ,CAMBA listed ,JAMBA listed or ROKAMBA listed Entities in selected area [North: -34.75 West: 150.51 East: 150.61 South: -34.85] returned a total of 759 records of 57 species.
Report generated on 18/04/2024 2:14 PM

Kingdom	Class	Family	Scientific Name	Common Name	NSW status	Comm. status	Records
Animalia	Amphibia	Limnodynastidae	*Heleioporus australiacus*	Giant Burrowing Frog	V,P	V	6
Animalia	Reptilia	Elapidae	^^*Hoplocephalus bungaroides*	Broad-headed Snake	E1,P,2	E	1
Animalia	Aves	Apodidae	*Hirundapus caudacutus*	White-throated Needletail	V,P	V,C,J,K	7
Animalia	Aves	Procellariidae	*Ardenna pacifica*	Wedge-tailed Shearwater	P	J	1
Animalia	Aves	Accipitridae	*Circus assimilis*	Spotted Harrier	V,P		1
Animalia	Aves	Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	V,P		2
Animalia	Aves	Accipitridae	*Hieraaetus morphnoides*	Little Eagle	V,P		1
Animalia	Aves	Accipitridae	*Lophoictinia isura*	Square-tailed Kite	V,P,3		5
Animalia	Aves	Burhinidae	*Burhinus grallarius*	Bush Stone-curlew	E1,P		1
Animalia	Aves	Cacatuidae	*Callocephalon fimbriatum*	Gang-gang Cockatoo	E1,P,3	E	18
Animalia	Aves	Cacatuidae	^^*Calyptorhynchus lathami lathami*	South-eastern Glossy Black-Cockatoo	V,P,2	V	132
Animalia	Aves	Cacatuidae	^^*Lophochroa leadbeateri*	Pink Cockatoo	V,P,2		1
Animalia	Aves	Psittacidae	*Glossopsitta pusilla*	Little Lorikeet	V,P		2
Animalia	Aves	Psittacidae	*Lathamus discolor*	Swift Parrot	E1,P	CE	1
Animalia	Aves	Strigidae	*Ninox strenua*	Powerful Owl	V,P,3		15
Animalia	Aves	Tytonidae	*Tyto novaehollandiae*	Masked Owl	V,P,3		2
Animalia	Aves	Tytonidae	*Tyto tenebricosa*	Sooty Owl	V,P,3		6
Animalia	Aves	Dasyornithidae	^^*Dasyornis brachypterus*	Eastern Bristlebird	E1,P,2	E	13
Animalia	Aves	Dasyornithidae	*Pycnoptilus floccosus*	Pilotbird	P	V	2
Animalia	Aves	Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	V,P		10
Animalia	Aves	Pachycephalidae	*Pachycephala olivacea*	Olive Whistler	V,P		6
Animalia	Aves	Artamidae	*Artamus cyanopterus cyanopterus*	Dusky Woodswallow	V,P		9
Animalia	Aves	Petroicidae	*Petroica boodang*	Scarlet Robin	V,P		2
Animalia	Mammalia	Dasyuridae	*Dasyurus maculatus*	Spotted-tailed Quoll	V,P	E	12
Animalia	Mammalia	Dasyuridae	*Sminthopsis leucopus*	White-footed Dunnart	V,P		1
Animalia	Mammalia	Peramelidae	*Isoodon obesulus obesulus*	Southern Brown Bandicoot (eastern)	E1,P	E	5
Animalia	Mammalia	Phascolarctidae	*Phascolarctos cinereus*	Koala	E1,P	E	2
Animalia	Mammalia	Burramyidae	*Cercartetus nanus*	Eastern Pygmy-possum	V,P		8
Animalia	Mammalia	Petauridae	*Petaurus australis*	Yellow-bellied Glider	V,P	V	44
Animalia	Mammalia	Pseudocheiridae	*Petauroides volans*	Southern Greater Glider	E1,P	E	3
Animalia	Mammalia	Potoroidae	*Potorous tridactylus*	Long-nosed Potoroo	V,P	V	15
Animalia	Mammalia	Macropodidae	*Notamacropus parma*	Parma Wallaby	V,P	V	1
Animalia	Mammalia	Macropodidae	*Petrogale penicillata*	Brush-tailed Rock-	E1,P	V	3
Animalia	Mammalia	Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-fox	V,P	V	162
Animalia	Mammalia	Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V,P		2
Animalia	Mammalia	Molossidae	*Micronomus norfolkensis*	Eastern Coastal Free-tailed Bat	V,P		5
Animalia	Mammalia	Vespertilionidae	*Chalinolobus dwyeri*	Large-eared Pied Bat	V,P	E	7
Animalia	Mammalia	Vespertilionidae	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V,P		3
Animalia	Mammalia	Vespertilionidae	*Myotis macropus*	Southern Myotis	V,P		5
Animalia	Mammalia	Vespertilionidae	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V,P		2
Animalia	Mammalia	Miniopteridae	*Miniopterus australis*	Little Bent-winged Bat	V,P		1
Animalia	Mammalia	Miniopteridae	*Miniopterus orianae oceanensis*	Large Bent-winged Bat	V,P		6
Plantae	Flora	Brassicaceae	*Irenepharsus trypherus*	Illawarra Irene	E1	E	1
Plantae	Flora	Dilleniaceae	*Hibbertia stricta subsp. furcatula*		E1		13
Plantae	Flora	Grammitidaceae	*Grammitis stenophylla*	Narrow-leaf Finger Fern	E1,3		1
Plantae	Flora	Myrtaceae	*Eucalyptus langleyi*	Albatross Mallee	V	V	31
Plantae	Flora	Myrtaceae	*Eucalyptus langleyi*	Eucalyptus langleyi population north of the Shoalhaven River in the Shoalhaven local government area	E2,V	V	31
Plantae	Flora	Myrtaceae	*Rhodamnia rubescens*	Scrub Turpentine	E4A	CE	10
Plantae	Flora	Myrtaceae	*Syzygium paniculatum*	Magenta Lilly Pilly	E1	V	1
Plantae	Flora	Orchidaceae	^^*Calochilus pulchellus*	Pretty Beard Orchid	E1,P,2	E	1
Plantae	Flora	Orchidaceae	^^*Cryptostylis hunteriana*	Leafless Tongue Orchid	V,P,2	V	4

Plantae	Flora	Orchidaceae	^^*Genoplesium baueri*	Bauer's Midge Orchid	E1,P,2	E	12
Plantae	Flora	Orchidaceae	^^*Pterostylis pulchella*	Waterfall Greenhood	V,P,2	V	1
Plantae	Flora	Orchidaceae	^^*Pterostylis ventricosa*		E4A,P,2		1
Plantae	Flora	Rutaceae	*Zieria baeuerlenii*	Bomaderry Zieria	E1	E	101
Plantae	Flora	Rutaceae	*Zieria tuberculata*	Warty Zieria	V	V	5
Plantae	Flora	Solanaceae	*Solanum celatum*		E1		15

Profile ID	Scientific Name	Common Name	PCT ID	PCT Name
10841	Anthochaera phrygia	Regent Honeyeater	3654	Shoalhaven Lowland Bloodwood Shrub Forest
20303	Artamus cyanopterus cyanopterus	Dusky Woodswallow	3077	Illawarra Complex Dry Rainforest
20303	Artamus cyanopterus cyanopterus	Dusky Woodswallow	3078	Illawarra Lowland Wet Vine Forest
20303	Artamus cyanopterus cyanopterus	Dusky Woodswallow	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
20303	Artamus cyanopterus cyanopterus	Dusky Woodswallow	3191	South Coast Ranges Moist Gully Forest
20303	Artamus cyanopterus cyanopterus	Dusky Woodswallow	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
20303	Artamus cyanopterus cyanopterus	Dusky Woodswallow	3270	Shoalhaven Lowland Wet Gully Forest
20303	Artamus cyanopterus cyanopterus	Dusky Woodswallow	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10067	Arthropteris palisotii	Lesser Creeping Fern	3077	Illawarra Complex Dry Rainforest
10113	Burhinus grallarius	Bush Stone-curlew	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10975	Callocephalon fimbriatum	Gang-gang Cockatoo	3077	Illawarra Complex Dry Rainforest
10975	Callocephalon fimbriatum	Gang-gang Cockatoo	3078	Illawarra Lowland Wet Vine Forest
10975	Callocephalon fimbriatum	Gang-gang Cockatoo	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
10975	Callocephalon fimbriatum	Gang-gang Cockatoo	3191	South Coast Ranges Moist Gully Forest
10975	Callocephalon fimbriatum	Gang-gang Cockatoo	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10975	Callocephalon fimbriatum	Gang-gang Cockatoo	3270	Shoalhaven Lowland Wet Gully Forest
10975	Callocephalon fimbriatum	Gang-gang Cockatoo	3654	Shoalhaven Lowland Bloodwood Shrub Forest
20106	Calomnion complanatum	Calomnion complanatum	3078	Illawarra Lowland Wet Vine Forest
10140	Calyptorhynchus lathami lathami	South-eastern Glossy Black-Cockatoo	3077	Illawarra Complex Dry Rainforest
10140	Calyptorhynchus lathami lathami	South-eastern Glossy Black-Cockatoo	3078	Illawarra Lowland Wet Vine Forest
10140	Calyptorhynchus lathami lathami	South-eastern Glossy Black-Cockatoo	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
10140	Calyptorhynchus lathami lathami	South-eastern Glossy Black-Cockatoo	3191	South Coast Ranges Moist Gully Forest
10140	Calyptorhynchus lathami lathami	South-eastern Glossy Black-Cockatoo	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10140	Calyptorhynchus lathami lathami	South-eastern Glossy Black-Cockatoo	3270	Shoalhaven Lowland Wet Gully Forest

10140	Calyptorhynchus lathami lathami	South-eastern Glossy Black-Cockatoo	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10155	Cercartetus nanus	Eastern Pygmy-possum	3077	Illawarra Complex Dry Rainforest
10155	Cercartetus nanus	Eastern Pygmy-possum	3078	Illawarra Lowland Wet Vine Forest
10155	Cercartetus nanus	Eastern Pygmy-possum	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
10155	Cercartetus nanus	Eastern Pygmy-possum	3191	South Coast Ranges Moist Gully Forest
10155	Cercartetus nanus	Eastern Pygmy-possum	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10155	Cercartetus nanus	Eastern Pygmy-possum	3270	Shoalhaven Lowland Wet Gully Forest
10155	Cercartetus nanus	Eastern Pygmy-possum	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10157	Chalinolobus dwyeri	Large-eared Pied Bat	3077	Illawarra Complex Dry Rainforest
10157	Chalinolobus dwyeri	Large-eared Pied Bat	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
10157	Chalinolobus dwyeri	Large-eared Pied Bat	3191	South Coast Ranges Moist Gully Forest
10157	Chalinolobus dwyeri	Large-eared Pied Bat	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10157	Chalinolobus dwyeri	Large-eared Pied Bat	3270	Shoalhaven Lowland Wet Gully Forest
10157	Chalinolobus dwyeri	Large-eared Pied Bat	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10187	Cryptostylis hunteriana	Leafless Tongue Orchid	3191	South Coast Ranges Moist Gully Forest
10187	Cryptostylis hunteriana	Leafless Tongue Orchid	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10196	Cynanchum elegans	White-flowered Wax Plant	3077	Illawarra Complex Dry Rainforest
10196	Cynanchum elegans	White-flowered Wax Plant	3078	Illawarra Lowland Wet Vine Forest
10201	Daphnandra johnsonii	Illawarra Socketwood	3077	Illawarra Complex Dry Rainforest
10201	Daphnandra johnsonii	Illawarra Socketwood	3078	Illawarra Lowland Wet Vine Forest
20135	Daphoenositta chrysoptera	Varied Sittella	3077	Illawarra Complex Dry Rainforest
20135	Daphoenositta chrysoptera	Varied Sittella	3078	Illawarra Lowland Wet Vine Forest
20135	Daphoenositta chrysoptera	Varied Sittella	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
20135	Daphoenositta chrysoptera	Varied Sittella	3191	South Coast Ranges Moist Gully Forest
20135	Daphoenositta chrysoptera	Varied Sittella	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
20135	Daphoenositta chrysoptera	Varied Sittella	3270	Shoalhaven Lowland Wet Gully Forest

20135	Daphoenositta chrysoptera	Varied Sittella	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10206	Dasyornis brachypterus	Eastern Bristlebird	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10207	Dasyurus maculatus	Spotted-tailed Quoll	3077	Illawarra Complex Dry Rainforest
10207	Dasyurus maculatus	Spotted-tailed Quoll	3078	Illawarra Lowland Wet Vine Forest
10207	Dasyurus maculatus	Spotted-tailed Quoll	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
10207	Dasyurus maculatus	Spotted-tailed Quoll	3191	South Coast Ranges Moist Gully Forest
10207	Dasyurus maculatus	Spotted-tailed Quoll	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10207	Dasyurus maculatus	Spotted-tailed Quoll	3270	Shoalhaven Lowland Wet Gully Forest
10207	Dasyurus maculatus	Spotted-tailed Quoll	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10275	Ephippiorhynchus asiaticus	Black-necked Stork	3077	Illawarra Complex Dry Rainforest
10275	Ephippiorhynchus asiaticus	Black-necked Stork	3078	Illawarra Lowland Wet Vine Forest
10275	Ephippiorhynchus asiaticus	Black-necked Stork	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
10275	Ephippiorhynchus asiaticus	Black-necked Stork	3191	South Coast Ranges Moist Gully Forest
10275	Ephippiorhynchus asiaticus	Black-necked Stork	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10275	Ephippiorhynchus asiaticus	Black-necked Stork	3270	Shoalhaven Lowland Wet Gully Forest
10275	Ephippiorhynchus asiaticus	Black-necked Stork	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10298	Eucalyptus langleyi	Albatross Mallee	3654	Shoalhaven Lowland Bloodwood Shrub Forest
20155	Eucalyptus langleyi - endangered population	Eucalyptus langleyi population north of the Shoalhaven River in the Shoalhaven local government area	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10331	Falsistrellus tasmaniensis	Eastern False Pipistrelle	3077	Illawarra Complex Dry Rainforest
10331	Falsistrellus tasmaniensis	Eastern False Pipistrelle	3078	Illawarra Lowland Wet Vine Forest
10331	Falsistrellus tasmaniensis	Eastern False Pipistrelle	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
10331	Falsistrellus tasmaniensis	Eastern False Pipistrelle	3191	South Coast Ranges Moist Gully Forest
10331	Falsistrellus tasmaniensis	Eastern False Pipistrelle	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest

10331	Falsistrellus tasmaniensis	Eastern False Pipistrelle	3270	Shoalhaven Lowland Wet Gully Forest
10331	Falsistrellus tasmaniensis	Eastern False Pipistrelle	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10875	Genoplesium baueri	Bauer's Midge Orchid	3654	Shoalhaven Lowland Bloodwood Shrub Forest
20111	Glossopsitta pusilla	Little Lorikeet	3077	Illawarra Complex Dry Rainforest
20111	Glossopsitta pusilla	Little Lorikeet	3078	Illawarra Lowland Wet Vine Forest
20111	Glossopsitta pusilla	Little Lorikeet	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
20111	Glossopsitta pusilla	Little Lorikeet	3191	South Coast Ranges Moist Gully Forest
20111	Glossopsitta pusilla	Little Lorikeet	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
20111	Glossopsitta pusilla	Little Lorikeet	3270	Shoalhaven Lowland Wet Gully Forest
20111	Glossopsitta pusilla	Little Lorikeet	3654	Shoalhaven Lowland Bloodwood Shrub Forest
20278	Gossia acmenoides - endangered population	Gossia acmenoides population in the Sydney Basin Bioregion south of the Georges River	3077	Illawarra Complex Dry Rainforest
10356	Grammitis stenophylla	Narrow-leaf Finger Fern	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
20322	Haliaeetus leucogaster	White-bellied Sea-Eagle	3077	Illawarra Complex Dry Rainforest
20322	Haliaeetus leucogaster	White-bellied Sea-Eagle	3078	Illawarra Lowland Wet Vine Forest
20322	Haliaeetus leucogaster	White-bellied Sea-Eagle	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
20322	Haliaeetus leucogaster	White-bellied Sea-Eagle	3191	South Coast Ranges Moist Gully Forest
20322	Haliaeetus leucogaster	White-bellied Sea-Eagle	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
20322	Haliaeetus leucogaster	White-bellied Sea-Eagle	3270	Shoalhaven Lowland Wet Gully Forest
20322	Haliaeetus leucogaster	White-bellied Sea-Eagle	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10398	Heleioporus australiacus	Giant Burrowing Frog	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
10398	Heleioporus australiacus	Giant Burrowing Frog	3191	South Coast Ranges Moist Gully Forest
10398	Heleioporus australiacus	Giant Burrowing Frog	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10398	Heleioporus australiacus	Giant Burrowing Frog	3270	Shoalhaven Lowland Wet Gully Forest

10398	Heleioporus australiacus	Giant Burrowing Frog	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10402	Hibbertia puberula	Hibbertia puberula	3654	Shoalhaven Lowland Bloodwood Shrub Forest
20078	Hibbertia stricta subsp. furcatula	Hibbertia stricta subsp. furcatula	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
20131	Hieraaetus morphnoides	Little Eagle	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
20131	Hieraaetus morphnoides	Little Eagle	3270	Shoalhaven Lowland Wet Gully Forest
20131	Hieraaetus morphnoides	Little Eagle	3654	Shoalhaven Lowland Bloodwood Shrub Forest
20354	Hirundapus caudacutus	White-throated Needletail	3077	Illawarra Complex Dry Rainforest
20354	Hirundapus caudacutus	White-throated Needletail	3078	Illawarra Lowland Wet Vine Forest
20354	Hirundapus caudacutus	White-throated Needletail	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
20354	Hirundapus caudacutus	White-throated Needletail	3191	South Coast Ranges Moist Gully Forest
20354	Hirundapus caudacutus	White-throated Needletail	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
20354	Hirundapus caudacutus	White-throated Needletail	3270	Shoalhaven Lowland Wet Gully Forest
20354	Hirundapus caudacutus	White-throated Needletail	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10413	Hoplocephalus bungaroides	Broad-headed Snake	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10413	Hoplocephalus bungaroides	Broad-headed Snake	3270	Shoalhaven Lowland Wet Gully Forest
10413	Hoplocephalus bungaroides	Broad-headed Snake	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10427	Illawarra Subtropical Rainforest in the Sydney Basin Bioregion	Illawarra Subtropical Rainforest in the Sydney Basin Bioregion	3077	Illawarra Complex Dry Rainforest
10427	Illawarra Subtropical Rainforest in the Sydney Basin Bioregion	Illawarra Subtropical Rainforest in the Sydney Basin Bioregion	3078	Illawarra Lowland Wet Vine Forest
20396	Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion	Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion	3077	Illawarra Complex Dry Rainforest
20396	Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion	Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion	3078	Illawarra Lowland Wet Vine Forest
10437	Irenepharsus trypherus	Illawarra Irene	3077	Illawarra Complex Dry Rainforest
10437	Irenepharsus trypherus	Illawarra Irene	3078	Illawarra Lowland Wet Vine Forest

10437	Irenepharsus trypherus	Illawarra Irene	3191	South Coast Ranges Moist Gully Forest
10439	Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)	3077	Illawarra Complex Dry Rainforest
10439	Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)	3078	Illawarra Lowland Wet Vine Forest
10439	Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
10439	Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)	3191	South Coast Ranges Moist Gully Forest
10439	Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10439	Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)	3270	Shoalhaven Lowland Wet Gully Forest
10439	Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10441	Ixobrychus flavicollis	Black Bittern	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
10441	Ixobrychus flavicollis	Black Bittern	3191	South Coast Ranges Moist Gully Forest
10441	Ixobrychus flavicollis	Black Bittern	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10441	Ixobrychus flavicollis	Black Bittern	3270	Shoalhaven Lowland Wet Gully Forest
10441	Ixobrychus flavicollis	Black Bittern	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10455	Lathamus discolor	Swift Parrot	3077	Illawarra Complex Dry Rainforest
10455	Lathamus discolor	Swift Parrot	3078	Illawarra Lowland Wet Vine Forest
10455	Lathamus discolor	Swift Parrot	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
10455	Lathamus discolor	Swift Parrot	3191	South Coast Ranges Moist Gully Forest
10455	Lathamus discolor	Swift Parrot	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10455	Lathamus discolor	Swift Parrot	3270	Shoalhaven Lowland Wet Gully Forest
10455	Lathamus discolor	Swift Parrot	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10483	Litoria aurea	Green and Golden Bell Frog	3077	Illawarra Complex Dry Rainforest
10483	Litoria aurea	Green and Golden Bell Frog	3078	Illawarra Lowland Wet Vine Forest
10483	Litoria aurea	Green and Golden Bell Frog	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
10483	Litoria aurea	Green and Golden Bell Frog	3191	South Coast Ranges Moist Gully Forest
10483	Litoria aurea	Green and Golden Bell Frog	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest

10483	Litoria aurea	Green and Golden Bell Frog	3270	Shoalhaven Lowland Wet Gully Forest
10483	Litoria aurea	Green and Golden Bell Frog	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10488	Litoria littlejohni	Littlejohn's Tree Frog	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10495	Lophoictinia isura	Square-tailed Kite	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
10495	Lophoictinia isura	Square-tailed Kite	3191	South Coast Ranges Moist Gully Forest
10495	Lophoictinia isura	Square-tailed Kite	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10495	Lophoictinia isura	Square-tailed Kite	3270	Shoalhaven Lowland Wet Gully Forest
10495	Lophoictinia isura	Square-tailed Kite	3654	Shoalhaven Lowland Bloodwood Shrub Forest
20073	Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	3077	Illawarra Complex Dry Rainforest
10544	Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	3077	Illawarra Complex Dry Rainforest
10544	Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	3270	Shoalhaven Lowland Wet Gully Forest
10544	Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10533	Miniopterus australis	Little Bent-winged Bat	3077	Illawarra Complex Dry Rainforest
10533	Miniopterus australis	Little Bent-winged Bat	3078	Illawarra Lowland Wet Vine Forest
10534	Miniopterus orianae oceanensis	Large Bent-winged Bat	3077	Illawarra Complex Dry Rainforest
10534	Miniopterus orianae oceanensis	Large Bent-winged Bat	3078	Illawarra Lowland Wet Vine Forest
10534	Miniopterus orianae oceanensis	Large Bent-winged Bat	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
10534	Miniopterus orianae oceanensis	Large Bent-winged Bat	3191	South Coast Ranges Moist Gully Forest
10534	Miniopterus orianae oceanensis	Large Bent-winged Bat	3270	Shoalhaven Lowland Wet Gully Forest
10534	Miniopterus orianae oceanensis	Large Bent-winged Bat	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10536	Mixophyes balbus	Stuttering Frog	3077	Illawarra Complex Dry Rainforest
10536	Mixophyes balbus	Stuttering Frog	3078	Illawarra Lowland Wet Vine Forest
10536	Mixophyes balbus	Stuttering Frog	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
10536	Mixophyes balbus	Stuttering Frog	3191	South Coast Ranges Moist Gully Forest
10536	Mixophyes balbus	Stuttering Frog	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest

10536	Mixophyes balbus	Stuttering Frog	3270	Shoalhaven Lowland Wet Gully Forest
10536	Mixophyes balbus	Stuttering Frog	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10549	Myotis macropus	Southern Myotis	3077	Illawarra Complex Dry Rainforest
10549	Myotis macropus	Southern Myotis	3078	Illawarra Lowland Wet Vine Forest
10549	Myotis macropus	Southern Myotis	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
10549	Myotis macropus	Southern Myotis	3191	South Coast Ranges Moist Gully Forest
10549	Myotis macropus	Southern Myotis	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10549	Myotis macropus	Southern Myotis	3270	Shoalhaven Lowland Wet Gully Forest
10549	Myotis macropus	Southern Myotis	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10561	Ninox connivens	Barking Owl	3077	Illawarra Complex Dry Rainforest
10561	Ninox connivens	Barking Owl	3078	Illawarra Lowland Wet Vine Forest
10561	Ninox connivens	Barking Owl	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
10561	Ninox connivens	Barking Owl	3191	South Coast Ranges Moist Gully Forest
10561	Ninox connivens	Barking Owl	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10561	Ninox connivens	Barking Owl	3270	Shoalhaven Lowland Wet Gully Forest
10561	Ninox connivens	Barking Owl	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10562	Ninox strenua	Powerful Owl	3077	Illawarra Complex Dry Rainforest
10562	Ninox strenua	Powerful Owl	3078	Illawarra Lowland Wet Vine Forest
10562	Ninox strenua	Powerful Owl	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
10562	Ninox strenua	Powerful Owl	3191	South Coast Ranges Moist Gully Forest
10562	Ninox strenua	Powerful Owl	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10562	Ninox strenua	Powerful Owl	3270	Shoalhaven Lowland Wet Gully Forest
10562	Ninox strenua	Powerful Owl	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10583	Pachycephala olivacea	Olive Whistler	3078	Illawarra Lowland Wet Vine Forest
10583	Pachycephala olivacea	Olive Whistler	3190	South Coast Hinterland Monkey Gum Wet Fern Forest

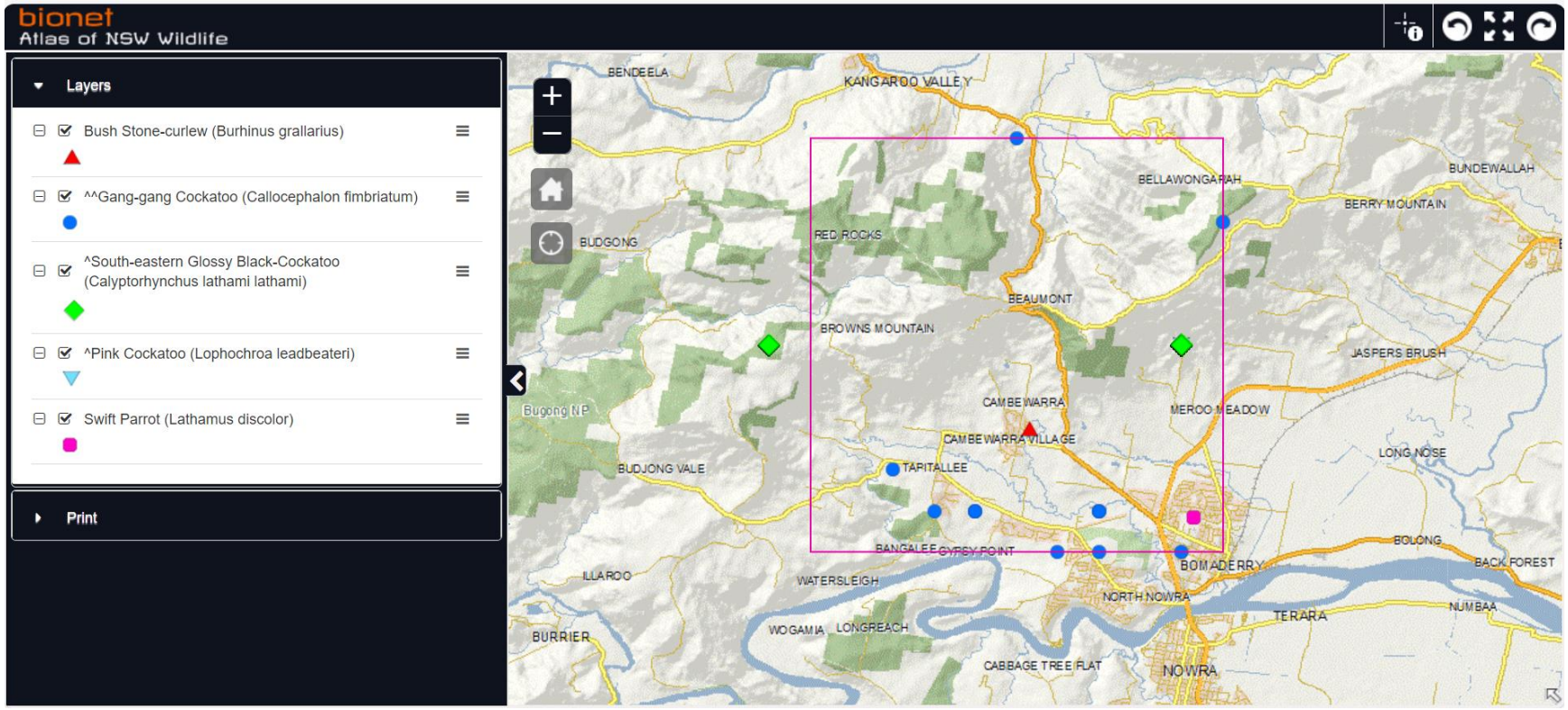
10583	Pachycephala olivacea	Olive Whistler	3191	South Coast Ranges Moist Gully Forest
10583	Pachycephala olivacea	Olive Whistler	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10583	Pachycephala olivacea	Olive Whistler	3270	Shoalhaven Lowland Wet Gully Forest
10583	Pachycephala olivacea	Olive Whistler	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10585	Pandion cristatus	Eastern Osprey	3077	Illawarra Complex Dry Rainforest
10585	Pandion cristatus	Eastern Osprey	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10585	Pandion cristatus	Eastern Osprey	3270	Shoalhaven Lowland Wet Gully Forest
10585	Pandion cristatus	Eastern Osprey	3654	Shoalhaven Lowland Bloodwood Shrub Forest
20306	Petauroides volans	Southern Greater Glider	3077	Illawarra Complex Dry Rainforest
20306	Petauroides volans	Southern Greater Glider	3078	Illawarra Lowland Wet Vine Forest
20306	Petauroides volans	Southern Greater Glider	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
20306	Petauroides volans	Southern Greater Glider	3191	South Coast Ranges Moist Gully Forest
20306	Petauroides volans	Southern Greater Glider	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
20306	Petauroides volans	Southern Greater Glider	3270	Shoalhaven Lowland Wet Gully Forest
20306	Petauroides volans	Southern Greater Glider	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10601	Petaurus australis	Yellow-bellied Glider	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
10601	Petaurus australis	Yellow-bellied Glider	3191	South Coast Ranges Moist Gully Forest
10601	Petaurus australis	Yellow-bellied Glider	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10601	Petaurus australis	Yellow-bellied Glider	3270	Shoalhaven Lowland Wet Gully Forest
10601	Petaurus australis	Yellow-bellied Glider	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10604	Petaurus norfolcensis	Squirrel Glider	3191	South Coast Ranges Moist Gully Forest
10604	Petaurus norfolcensis	Squirrel Glider	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10604	Petaurus norfolcensis	Squirrel Glider	3270	Shoalhaven Lowland Wet Gully Forest
10604	Petaurus norfolcensis	Squirrel Glider	3654	Shoalhaven Lowland Bloodwood Shrub Forest

10605	Petrogale penicillata	Brush-tailed Rock-wallaby	3077	Illawarra Complex Dry Rainforest
10605	Petrogale penicillata	Brush-tailed Rock-wallaby	3078	Illawarra Lowland Wet Vine Forest
10605	Petrogale penicillata	Brush-tailed Rock-wallaby	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
10605	Petrogale penicillata	Brush-tailed Rock-wallaby	3191	South Coast Ranges Moist Gully Forest
10605	Petrogale penicillata	Brush-tailed Rock-wallaby	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10605	Petrogale penicillata	Brush-tailed Rock-wallaby	3270	Shoalhaven Lowland Wet Gully Forest
20133	Petroica boodang	Scarlet Robin	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
20133	Petroica boodang	Scarlet Robin	3191	South Coast Ranges Moist Gully Forest
20133	Petroica boodang	Scarlet Robin	3654	Shoalhaven Lowland Bloodwood Shrub Forest
20129	Petroica phoenicea	Flame Robin	3077	Illawarra Complex Dry Rainforest
20129	Petroica phoenicea	Flame Robin	3078	Illawarra Lowland Wet Vine Forest
20129	Petroica phoenicea	Flame Robin	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
20129	Petroica phoenicea	Flame Robin	3191	South Coast Ranges Moist Gully Forest
20129	Petroica phoenicea	Flame Robin	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
20129	Petroica phoenicea	Flame Robin	3270	Shoalhaven Lowland Wet Gully Forest
20129	Petroica phoenicea	Flame Robin	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10613	Phascogale tapoatafa	Brush-tailed Phascogale	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
10613	Phascogale tapoatafa	Brush-tailed Phascogale	3191	South Coast Ranges Moist Gully Forest
10613	Phascogale tapoatafa	Brush-tailed Phascogale	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10613	Phascogale tapoatafa	Brush-tailed Phascogale	3270	Shoalhaven Lowland Wet Gully Forest
10613	Phascogale tapoatafa	Brush-tailed Phascogale	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10616	Phascolarctos cinereus	Koala	3078	Illawarra Lowland Wet Vine Forest
10616	Phascolarctos cinereus	Koala	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
10616	Phascolarctos cinereus	Koala	3191	South Coast Ranges Moist Gully Forest

10616	Phascolarctos cinereus	Koala	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10616	Phascolarctos cinereus	Koala	3270	Shoalhaven Lowland Wet Gully Forest
10616	Phascolarctos cinereus	Koala	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10444	Phoniscus papuensis	Golden-tipped Bat	3077	Illawarra Complex Dry Rainforest
10444	Phoniscus papuensis	Golden-tipped Bat	3078	Illawarra Lowland Wet Vine Forest
10444	Phoniscus papuensis	Golden-tipped Bat	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
10444	Phoniscus papuensis	Golden-tipped Bat	3191	South Coast Ranges Moist Gully Forest
10444	Phoniscus papuensis	Golden-tipped Bat	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10444	Phoniscus papuensis	Golden-tipped Bat	3270	Shoalhaven Lowland Wet Gully Forest
10444	Phoniscus papuensis	Golden-tipped Bat	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10629	Pimelea curviflora var. curviflora	Pimelea curviflora var. curviflora	3077	Illawarra Complex Dry Rainforest
10632	Pimelea spicata	Spiked Rice-flower	3077	Illawarra Complex Dry Rainforest
10632	Pimelea spicata	Spiked Rice-flower	3078	Illawarra Lowland Wet Vine Forest
10662	Potorous tridactylus	Long-nosed Potoroo	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
10662	Potorous tridactylus	Long-nosed Potoroo	3191	South Coast Ranges Moist Gully Forest
10662	Potorous tridactylus	Long-nosed Potoroo	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10662	Potorous tridactylus	Long-nosed Potoroo	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10697	Pteropus poliocephalus	Grey-headed Flying-fox	3077	Illawarra Complex Dry Rainforest
10697	Pteropus poliocephalus	Grey-headed Flying-fox	3078	Illawarra Lowland Wet Vine Forest
10697	Pteropus poliocephalus	Grey-headed Flying-fox	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
10697	Pteropus poliocephalus	Grey-headed Flying-fox	3191	South Coast Ranges Moist Gully Forest
10697	Pteropus poliocephalus	Grey-headed Flying-fox	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10697	Pteropus poliocephalus	Grey-headed Flying-fox	3270	Shoalhaven Lowland Wet Gully Forest
10697	Pteropus poliocephalus	Grey-headed Flying-fox	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10704	Pterostylis pulchella	Waterfall Greenhood	3191	South Coast Ranges Moist Gully Forest

10730	Rhizanthella slateri	Eastern Australian Underground Orchid	3191	South Coast Ranges Moist Gully Forest
10730	Rhizanthella slateri	Eastern Australian Underground Orchid	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10730	Rhizanthella slateri	Eastern Australian Underground Orchid	3270	Shoalhaven Lowland Wet Gully Forest
10730	Rhizanthella slateri	Eastern Australian Underground Orchid	3654	Shoalhaven Lowland Bloodwood Shrub Forest
20341	Rhodamnia rubescens	Scrub Turpentine	3077	Illawarra Complex Dry Rainforest
20341	Rhodamnia rubescens	Scrub Turpentine	3078	Illawarra Lowland Wet Vine Forest
20341	Rhodamnia rubescens	Scrub Turpentine	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
20341	Rhodamnia rubescens	Scrub Turpentine	3191	South Coast Ranges Moist Gully Forest
20341	Rhodamnia rubescens	Scrub Turpentine	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
20341	Rhodamnia rubescens	Scrub Turpentine	3270	Shoalhaven Lowland Wet Gully Forest
10741	Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	3077	Illawarra Complex Dry Rainforest
10741	Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	3191	South Coast Ranges Moist Gully Forest
10741	Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10741	Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10748	Scoteanax rueppellii	Greater Broad-nosed Bat	3077	Illawarra Complex Dry Rainforest
10748	Scoteanax rueppellii	Greater Broad-nosed Bat	3191	South Coast Ranges Moist Gully Forest
10748	Scoteanax rueppellii	Greater Broad-nosed Bat	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10758	Sminthopsis leucopus	White-footed Dunnart	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10758	Sminthopsis leucopus	White-footed Dunnart	3270	Shoalhaven Lowland Wet Gully Forest
10758	Sminthopsis leucopus	White-footed Dunnart	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10761	Solanum celatum	Solanum celatum	3077	Illawarra Complex Dry Rainforest
10761	Solanum celatum	Solanum celatum	3078	Illawarra Lowland Wet Vine Forest
10761	Solanum celatum	Solanum celatum	3191	South Coast Ranges Moist Gully Forest
10761	Solanum celatum	Solanum celatum	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10761	Solanum celatum	Solanum celatum	3270	Shoalhaven Lowland Wet Gully Forest
10794	Syzygium paniculatum	Magenta Lilly Pilly	3077	Illawarra Complex Dry Rainforest

10794	Syzygium paniculatum	Magenta Lilly Pilly	3078	Illawarra Lowland Wet Vine Forest
10813	Triplarina nowraensis	Nowra Heath Myrtle	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10820	Tyto novaehollandiae	Masked Owl	3077	Illawarra Complex Dry Rainforest
10820	Tyto novaehollandiae	Masked Owl	3078	Illawarra Lowland Wet Vine Forest
10820	Tyto novaehollandiae	Masked Owl	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
10820	Tyto novaehollandiae	Masked Owl	3191	South Coast Ranges Moist Gully Forest
10820	Tyto novaehollandiae	Masked Owl	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10820	Tyto novaehollandiae	Masked Owl	3270	Shoalhaven Lowland Wet Gully Forest
10820	Tyto novaehollandiae	Masked Owl	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10821	Tyto tenebricosa	Sooty Owl	3190	South Coast Hinterland Monkey Gum Wet Fern Forest
10821	Tyto tenebricosa	Sooty Owl	3191	South Coast Ranges Moist Gully Forest
10821	Tyto tenebricosa	Sooty Owl	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10821	Tyto tenebricosa	Sooty Owl	3270	Shoalhaven Lowland Wet Gully Forest
10821	Tyto tenebricosa	Sooty Owl	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10826	Varanus rosenbergi	Rosenberg's Goanna	3268	Shoalhaven Foothills Turpentine-Ironbark Moist Forest
10826	Varanus rosenbergi	Rosenberg's Goanna	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10850	Zieria baeuerlenii	Bomaderry Zieria	3654	Shoalhaven Lowland Bloodwood Shrub Forest
10856	Zieria granulata	Illawarra Zieria	3077	Illawarra Complex Dry Rainforest
10856	Zieria granulata	Illawarra Zieria	3078	Illawarra Lowland Wet Vine Forest
10865	Zieria tuberculata	Warty Zieria	3078	Illawarra Lowland Wet Vine Forest
10865	Zieria tuberculata	Warty Zieria	3190	South Coast Hinterland Monkey Gum Wet Fern Forest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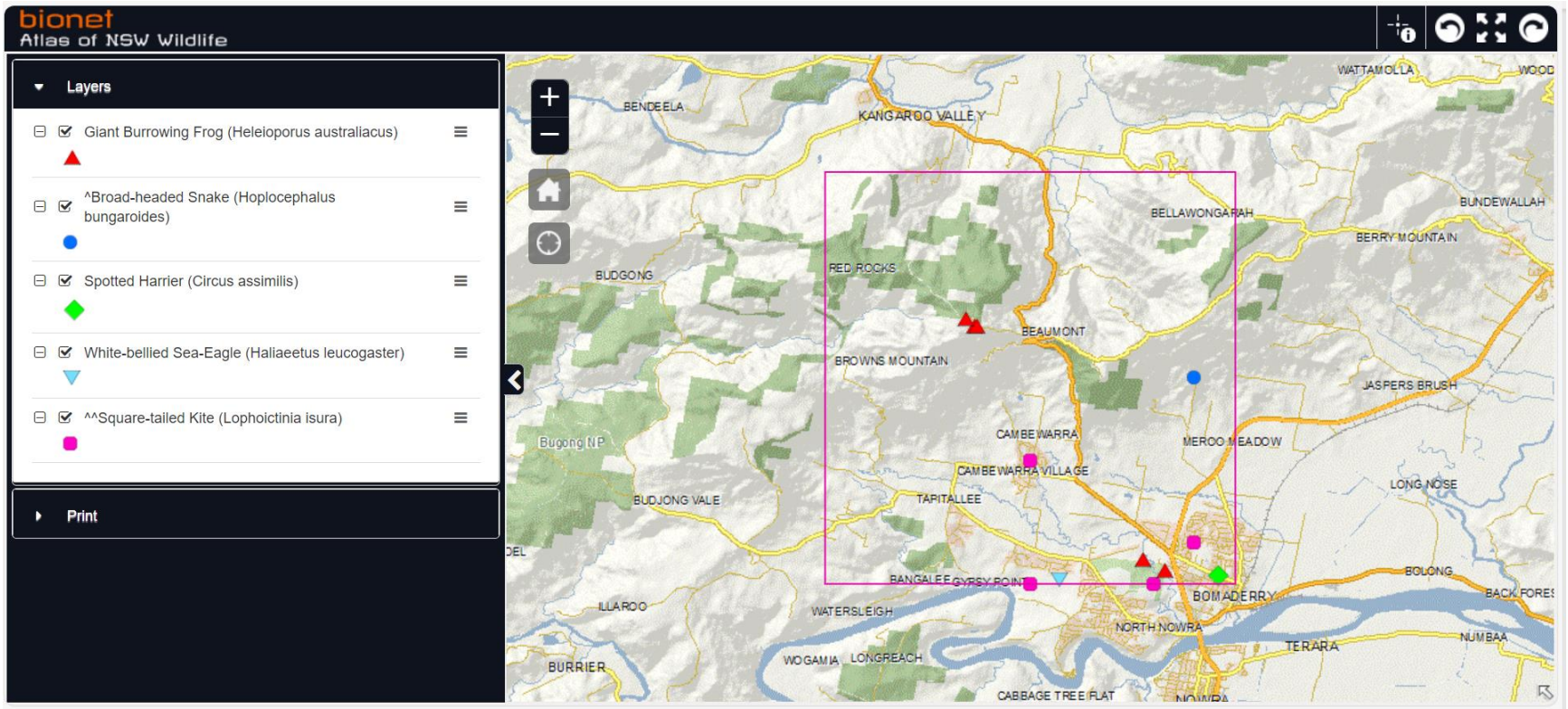
Atlas of NSW Wildlife
Layers
Bush Stone-curlew (Burhinus grallarius)
^^Gang-gang Cockatoo (Callocephalon fimbriatum)
^South-eastern Glossy Black-Cockatoo (Calyptorhynchus lathami lathami)
^Pink Cockatoo (Lophochroa leadbeateri)
Swift Parrot (Lathamus discolor)
Print
BENDEELA
KANGAROO VALLEY
BELLAWONGARAH
BUNDEWALLAH
BERRY MOUNTAIN
BUDGONG
RED ROCKS
BEAUMONT
BROWNS MOUNTAIN
JASPERS BRUSH
Bugong NP
CAMBEWARRA
MEROO MEADOW
CAMBEWARRA VILLAGE
LONG NOSE
BUDJONG VALE
TAPITALLEE
BANGALEE
GYPSY POINT
BOMADERRY
BOLONG
BACK FOREST
ILLAROO
WATERSLEIGH
NORTH NOWRA
TERARA
NUMBAA
WOGAMIA
LONGREACH
BURRIER
CABBAGE TREE FLAT
NOWRA


bionet
Atlas of NSW Wildlife
Layers
Giant Burrowing Frog (Heleioporus australiacus)
^Broad-headed Snake (Hoplocephalus bungaroides)
Spotted Harrier (Circus assimilis)
White-bellied Sea-Eagle (Haliaeetus leucogaster)
^^Square-tailed Kite (Lophoictinia isura)
Print
BENDEELA
KANGAROO VALLEY
WATTAMOLLA
BELLAWONGARAH
BUNDEWALLAH
BERRY MOUNTAIN
BUDGONG
RED ROCKS
BEAUMONT
BROWNS MOUNTAIN
JASPERS BRUSH
Bugong NP
CAMBEWARRA
MEROO MEADOW
CAMBEWARRA VILLAGE
LONG NOSE
BUDJONG VALE
TAPITALLEE
BANGALEE
GYPSY POINT
BOMADERRY
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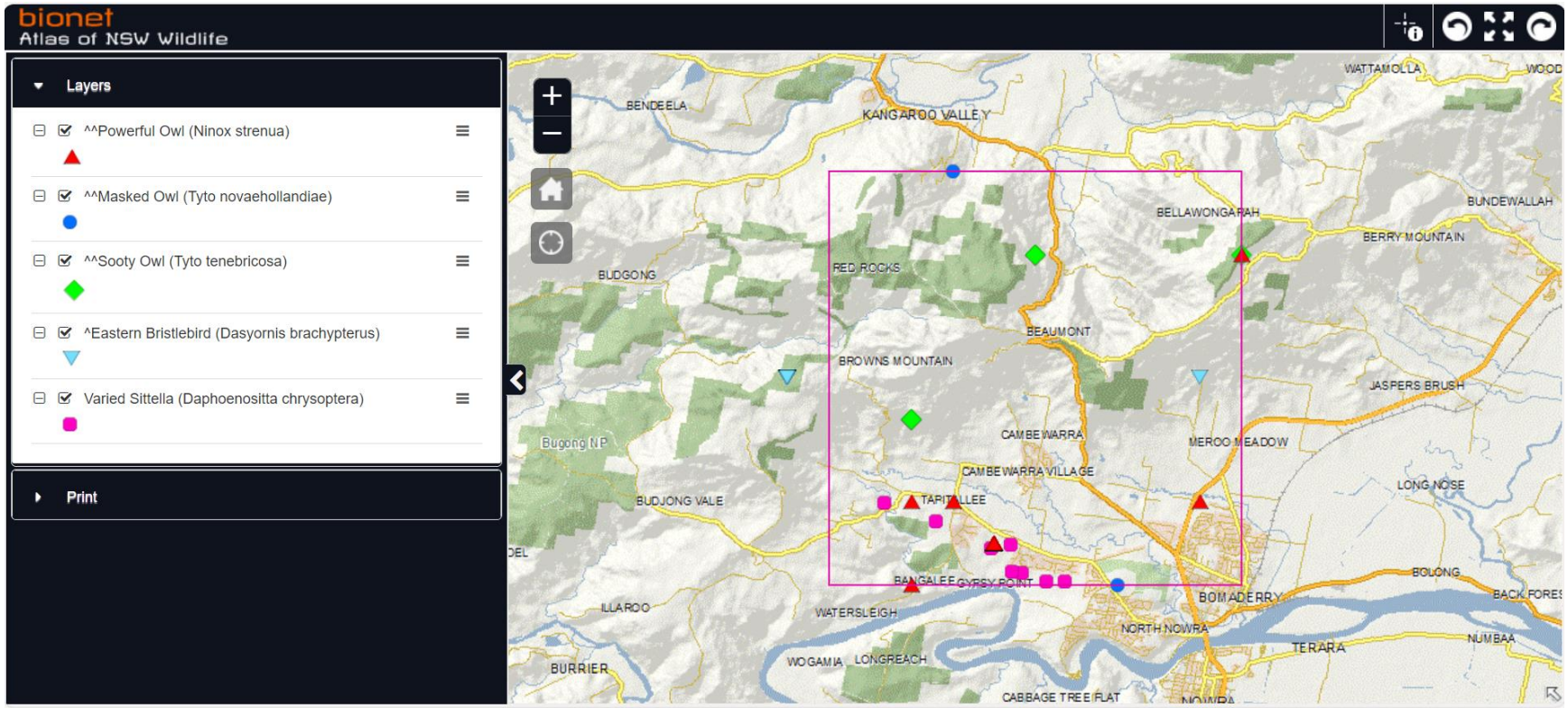
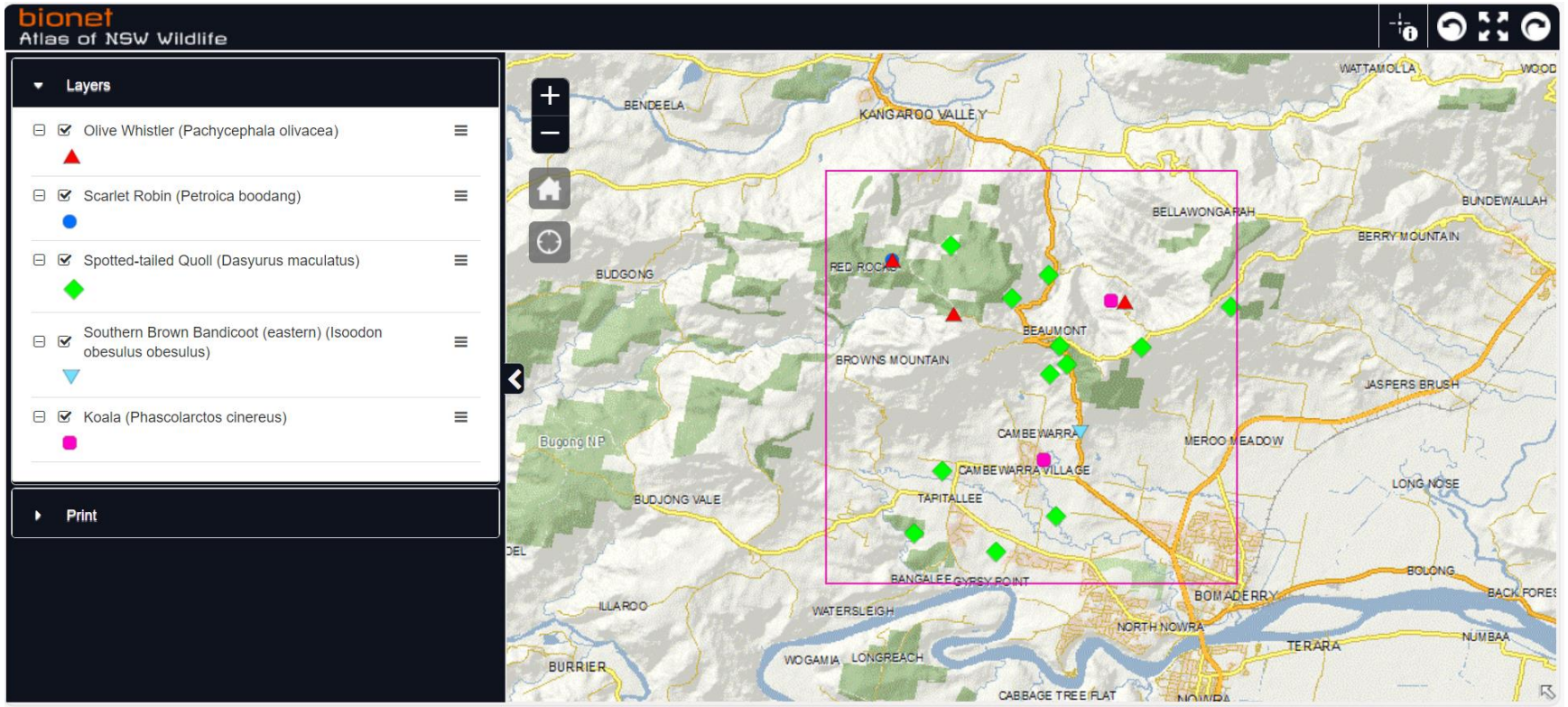
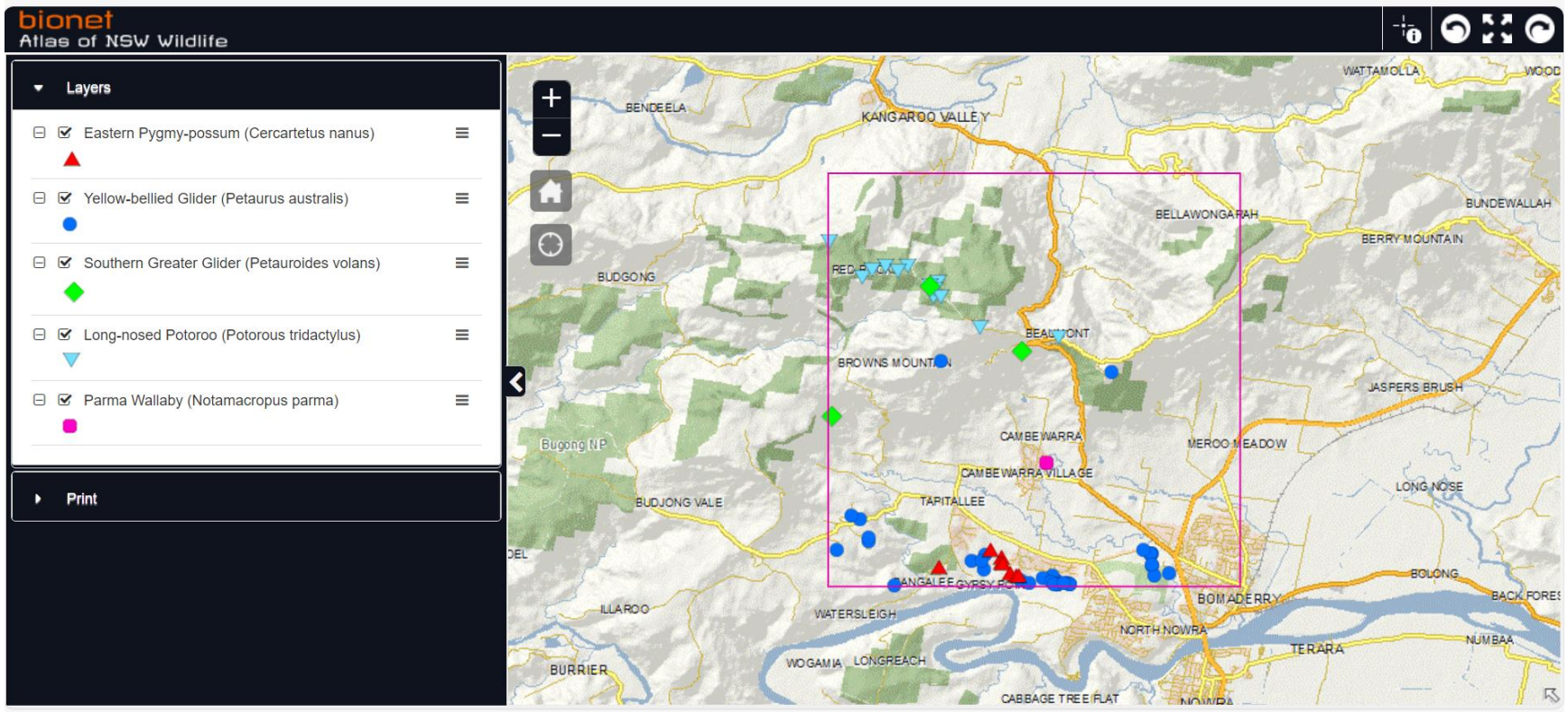
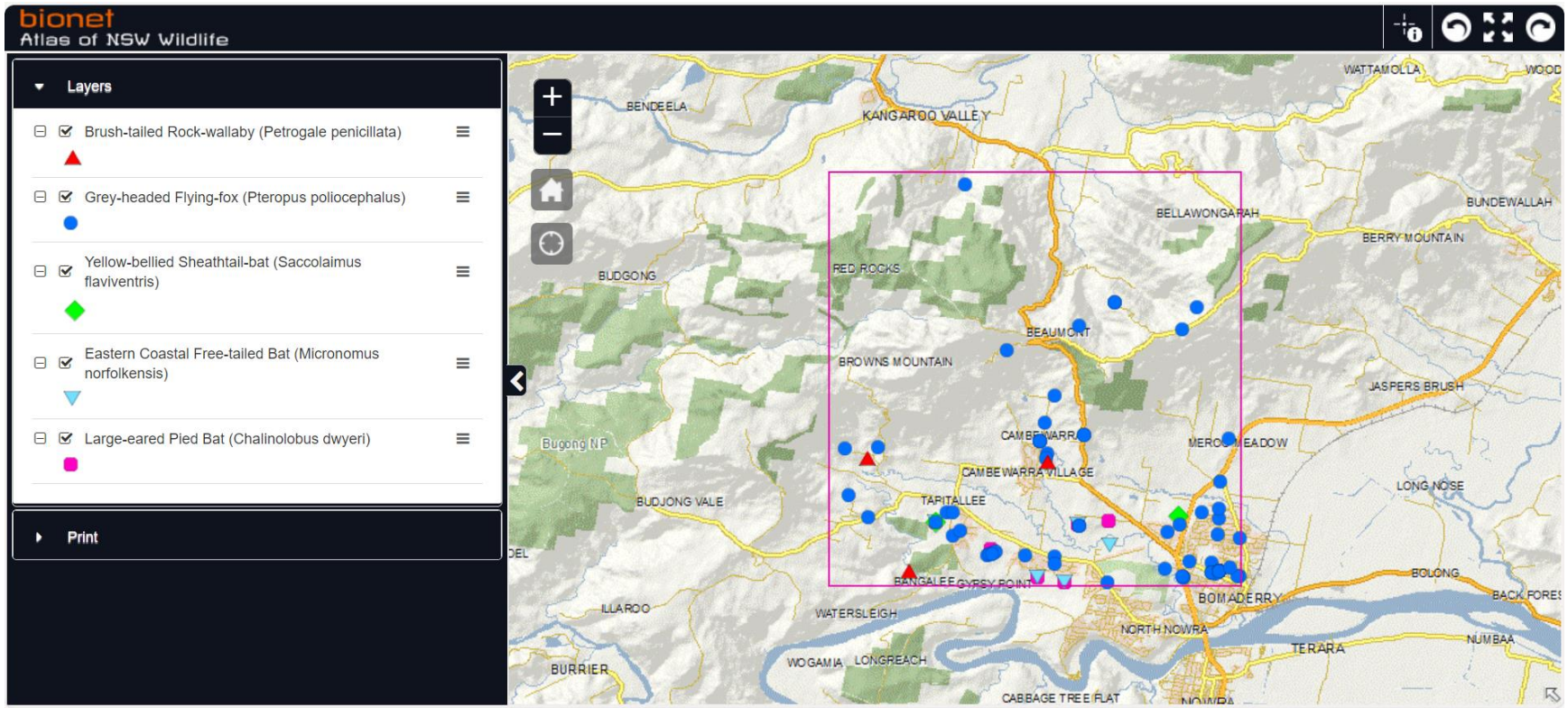
TERARA
NUMBAA
WOGAMIA
LONGREACH
BURRIER
CABBAGE TREE FLAT


bionet
Atlas of NSW Wildlife
Layers
^^Powerful Owl (Ninox strenua)
^^Masked Owl (Tyto novaehollandiae)
^^Sooty Owl (Tyto tenebricosa)
^Eastern Bristlebird (Dasyornis brachypterus)
Varied Sittella (Daphoenositta chrysoptera)
Print
BENDEELA
KANGAROO VALLEY
WATTAMOLLA
BUNDEWALLAH
BELLAWONGARAH
BERRY MOUNTAIN
BUDGONG
RED ROCKS
BEAUMONT
BROWNS MOUNTAIN
JASPERS BRUSH
Bugong NP
CAMBEWARRA
MEROO MEADOW
CAMBEWARRA VILLAGE
LONG NOSE
BUDJONG VALE
TAPITALLEE
BANGALEE
GYPSY POINT
BOMADERRY
BOLONG
ILLAROO
WATERSLEIGH
NORTH NOWRA
TERARA
NUMBAA
WOGAMIA
LONGREACH
BURRIER
CABBAGE TREE FLAT


bionet
Atlas of NSW Wildlife
Layers
Olive Whistler (Pachycephala olivacea)
Scarlet Robin (Petroica boodang)
Spotted-tailed Quoll (Dasyurus maculatus)
Southern Brown Bandicoot (eastern) (Isoodon obesulus obesulus)
Koala (Phascolarctos cinereus)
Print
BENDEELA
KANGAROO VALLEY
WATTAMOLLA
BUNDEWALLAH
BELLAWONGARAH
BERRY MOUNTAIN
BUDGONG
RED ROCKS
BEAUMONT
BROWNS MOUNTAIN
JASPERS BRUSH
Bugong NP
CAMBEWARRA
MEROO MEADOW
CAMBEWARRA VILLAGE
LONG NOSE
BUDJONG VALE
TAPITALLEE
BANGALEE
GYPSY POINT
BOLONG
BOMADERRY
ILLAROO
WATERSLEIGH
NORTH NOWRA
TERARA
NUMBAA
WOGAMIA
LONGREACH
BURRIER
CABBAGE TREE FLAT


bionet
Atlas of NSW Wildlife
Layers
Eastern Pygmy-possum (Cercartetus nanus)
Yellow-bellied Glider (Petaurus australis)
Southern Greater Glider (Petauroides volans)
Long-nosed Potoroo (Potorous tridactylus)
Parma Wallaby (Notamacropus parma)
Print
BENDEELA
KANGAROO VALLEY
WATTAMOLLA
WOOD
BUNDEWALLAH
BELLAWONGARAH
BERRY MOUNTAIN
BUDGONG
BEAUMONT
BROWNS MOUNTAIN
JASPERS BRUSH
Bugong NP
CAMBEWARRA
MEROO MEADOW
CAMBEWARRA VILLAGE
LONG NOSE
BUDJONG VALE
TAPITALLEE
BOLONG
BOMADERRY
ILLAROO
WATERSLEIGH
NORTH NOWRA
TERARA
NUMBAA
WOGAMIA
LONGREACH
BURRIER
CABBAGE TREE FLAT


bionet
Atlas of NSW Wildlife
Layers
Brush-tailed Rock-wallaby (Petrogale penicillata)
Grey-headed Flying-fox (Pteropus poliocephalus)
Yellow-bellied Sheathtail-bat (Saccolaimus flaviventris)
Eastern Coastal Free-tailed Bat (Micronomus norfolkensis)
Large-eared Pied Bat (Chalinolobus dwyeri)
Print
BENDEELA
KANGAROO VALLEY
WATTAMOLLA
BELLAWONGARAH
BUNDEWALLAH
BERRY MOUNTAIN
BUDGONG
RED ROCKS
BEAUMONT
BROWNS MOUNTAIN
JASPERS BRUSH
Bugong NP
CAMBEWARRA
CAMBEWARRA VILLAGE
MEROO MEADOW
LONG NOSE
BUDJONG VALE
TAPITALLEE
BANGALEE
GYPSY POINT
BOMADERRY
BOLONG
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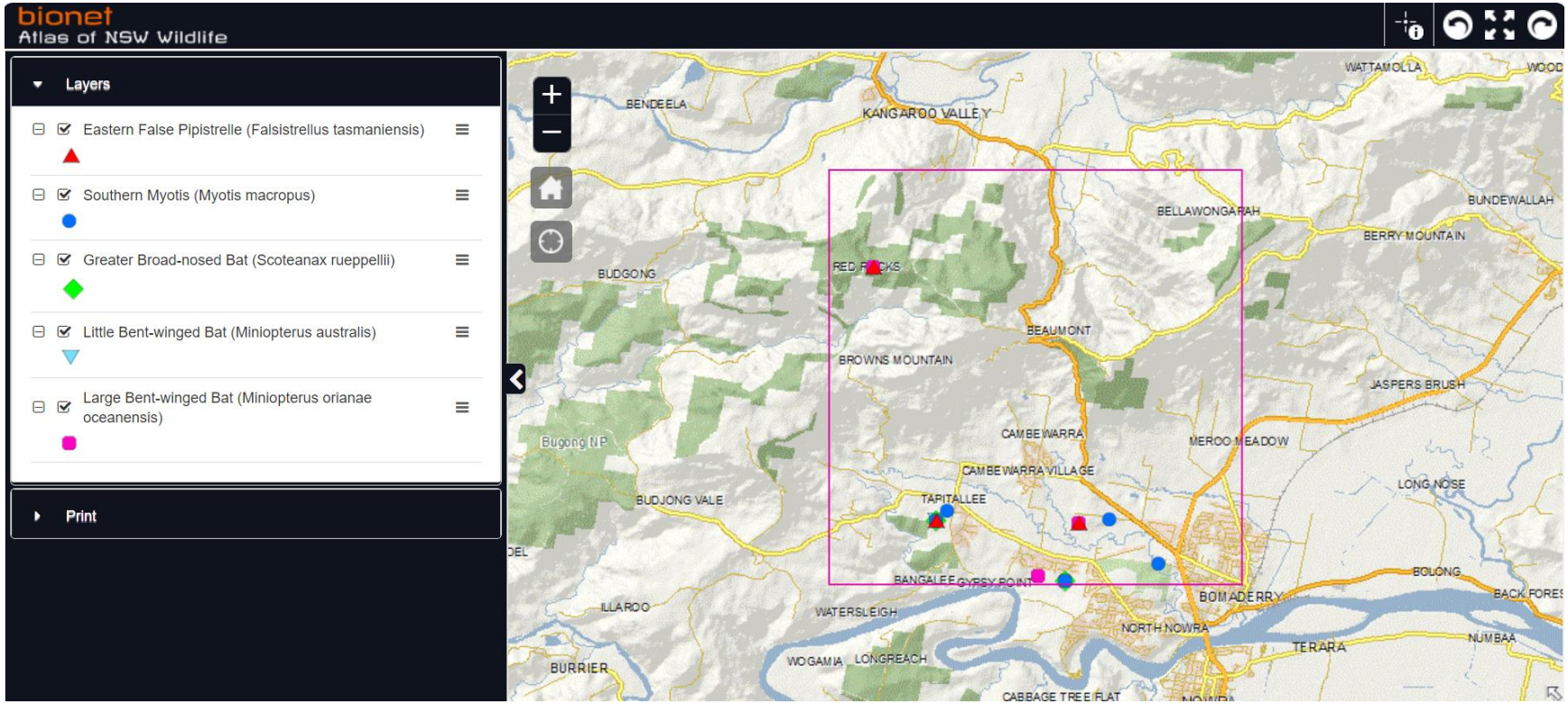
TERARA
NUMBAA
WOGAMIA
LONGREACH
BURRIER
CABBAGE TREE FLAT


bionet
Atlas of NSW Wildlife
Layers
Eastern False Pipistrelle (Falsistrellus tasmaniensis)
Southern Myotis (Myotis macropus)
Greater Broad-nosed Bat (Scoteanax rueppellii)
Little Bent-winged Bat (Miniopterus australis)
Large Bent-winged Bat (Miniopterus orianae oceanensis)
Print
BENDEELA
KANGAROO VALLEY
WATTAMOLLA
BUNDEWALLAH
BELLAWONGARAH
BERRY MOUNTAIN
BUDGONG
BEAUMONT
BROWNS MOUNTAIN
JASPERS BRUSH
Bugong NP
CAMBEWARRA
MEROO MEADOW
CAMBEWARRA VILLAGE
LONG NOSE
BUDJONG VALE
TAPITALLEE
BANGALEE
GYPSY POINT
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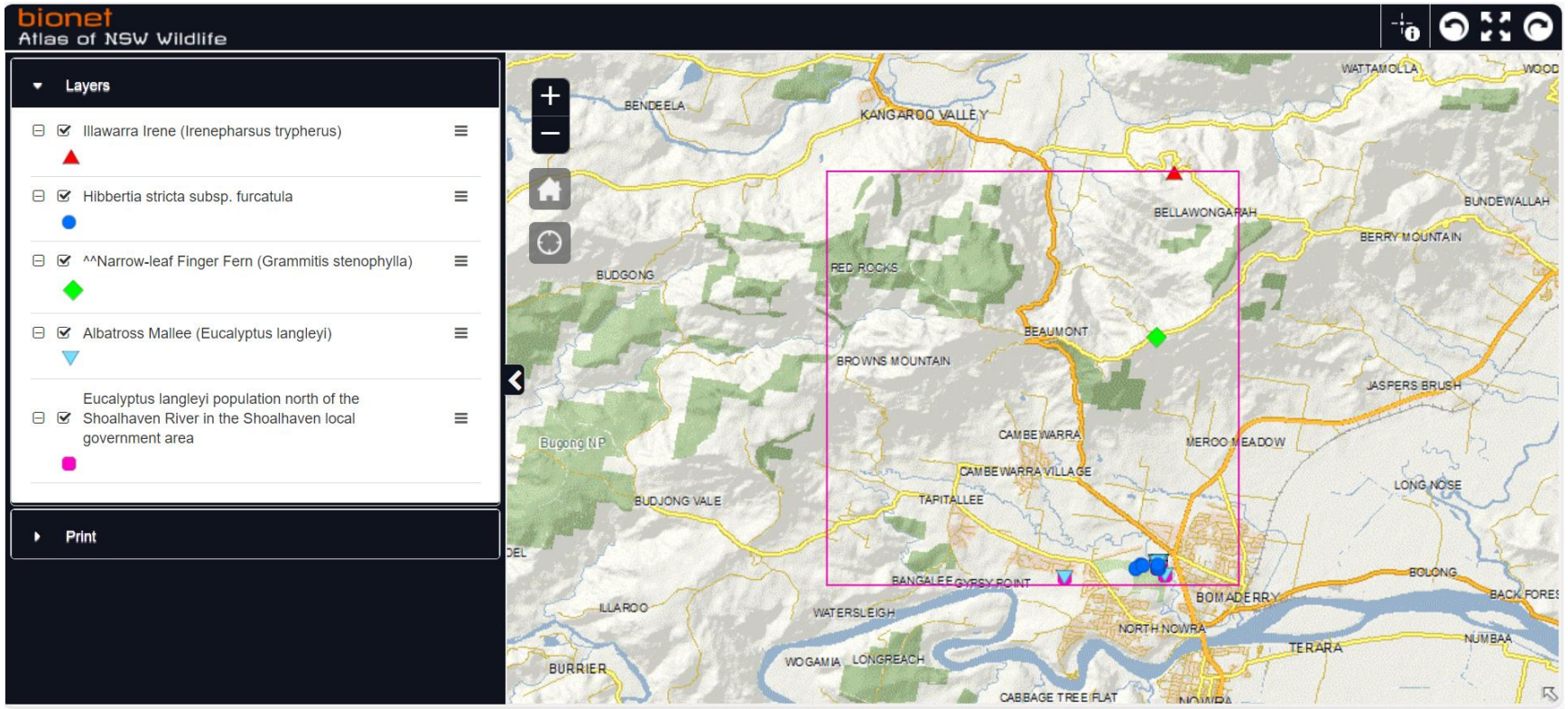
BURRIER
CABBAGE TREE FLAT


bionet
Atlas of NSW Wildlife
Layers
Illawarra Irene (Irenepharsus trypherus)
Hibbertia stricta subsp. furcatula
^^Narrow-leaf Finger Fern (Grammitis stenophylla)
Albatross Mallee (Eucalyptus langleyi)
Eucalyptus langleyi population north of the Shoalhaven River in the Shoalhaven local government area
Print
BENDEELA
KANGAROO VALLEY
WATTAMOLLA
BELLAWONGARAH
BUNDEWALLAH
BERRY MOUNTAIN
BUDGONG
RED ROCKS
BEAUMONT
BROWNS MOUNTAIN
JASPERS BRUSH
Bugong NP
CAMBEWARRA
MEROO MEADOW
CAMBEWARRA VILLAGE
LONG NOSE
BUDJONG VALE
TAPITALLEE
BANGALEE
GYPSY POINT
BOMADERRY
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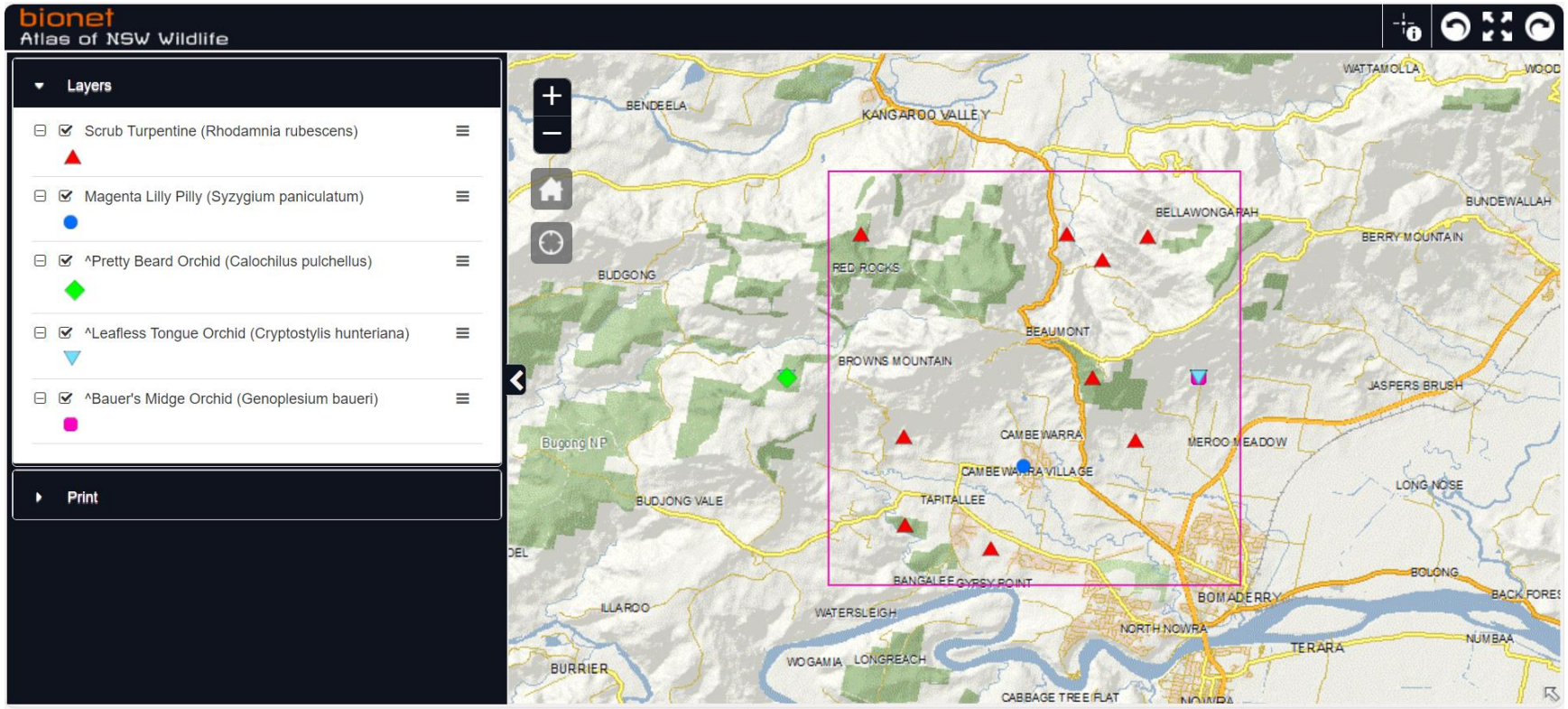
LONGREACH
BURRIER
CABBAGE TREE FLAT


bionet
Atlas of NSW Wildlife
Layers
Scrub Turpentine (Rhodamnia rubescens)
Magenta Lilly Pilly (Syzygium paniculatum)
^Pretty Beard Orchid (Calochilus pulchellus)
^Leafless Tongue Orchid (Cryptostylis hunteriana)
^Bauer's Midge Orchid (Genoplesium baueri)
Print
BENDEELA
KANGAROO VALLEY
WATTAMOLLA
BUNDEWALLAH
BELLAWONGARAH
BERRY MOUNTAIN
BUDGONG
RED ROCKS
BEAUMONT
BROWNS MOUNTAIN
JASPERS BRUSH
Bugong NP
CAMBEWARRA
MEROO MEADOW
CAMBEWARRA VILLAGE
LONG NOSE
BUDJONG VALE
TAPITALLEE
BANGALEE
GYPSY POINT
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LONGREACH
BURRIER
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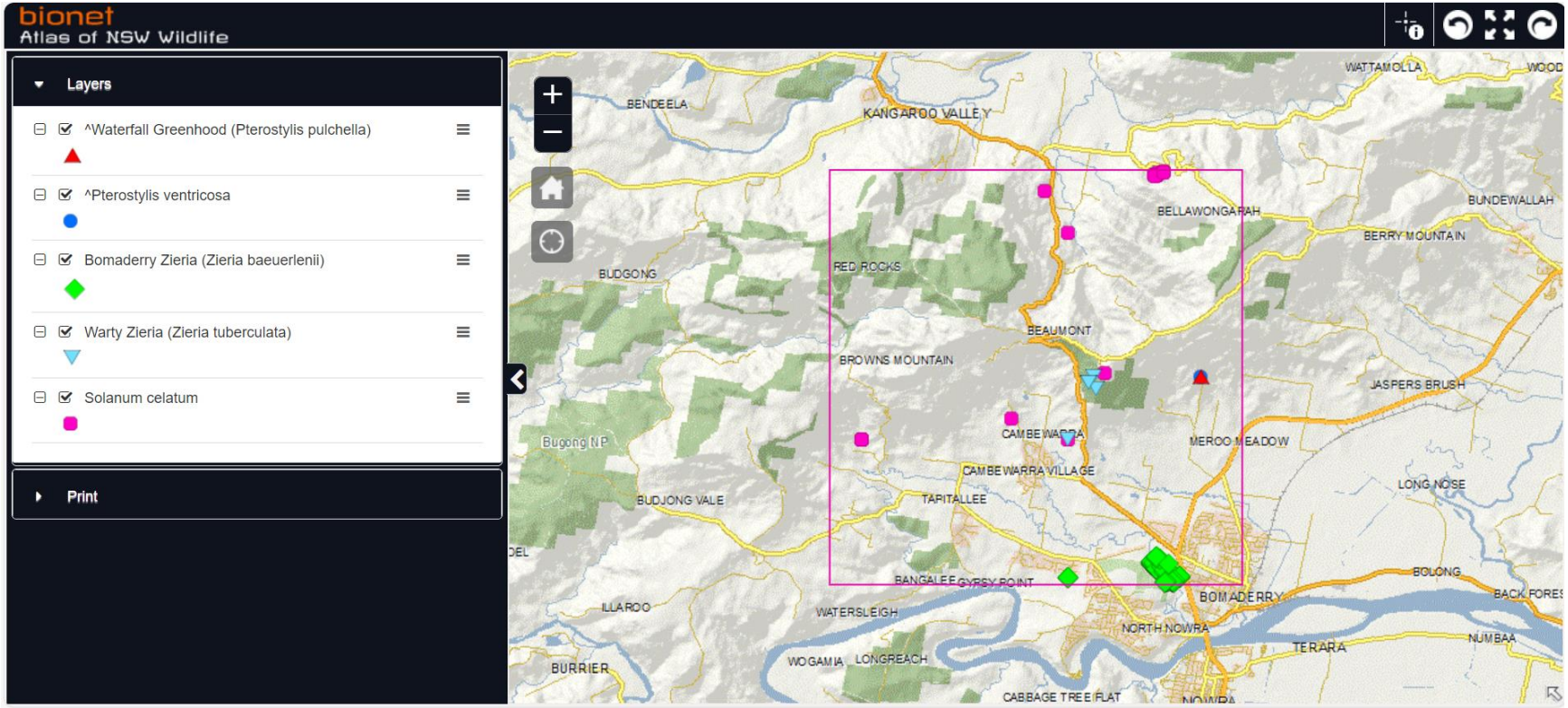
bionet
Atlas of NSW Wildlife
Layers
^Waterfall Greenhood (Pterostylis pulchella)
^Pterostylis ventricosa
Bomaderry Zieria (Zieria baeuerlenii)
Warty Zieria (Zieria tuberculata)
Solanum celatum
Print
WATTAMOLLA
BENDEELA
KANGAROO VALLEY
BELLAWONGARAH
BERRY MOUNTAIN
BUNDEWALLAH
BUDGONG
RED ROCKS
BEAUMONT
BROWNS MOUNTAIN
JASPERS BRUSH
Bugong NP
CAMBEWARRA
MEROO MEADOW
CAMBEWARRA VILLAGE
LONG NOSE
BUDJONG VALE
TARITALLEE
BOLONG
BOMADERRY
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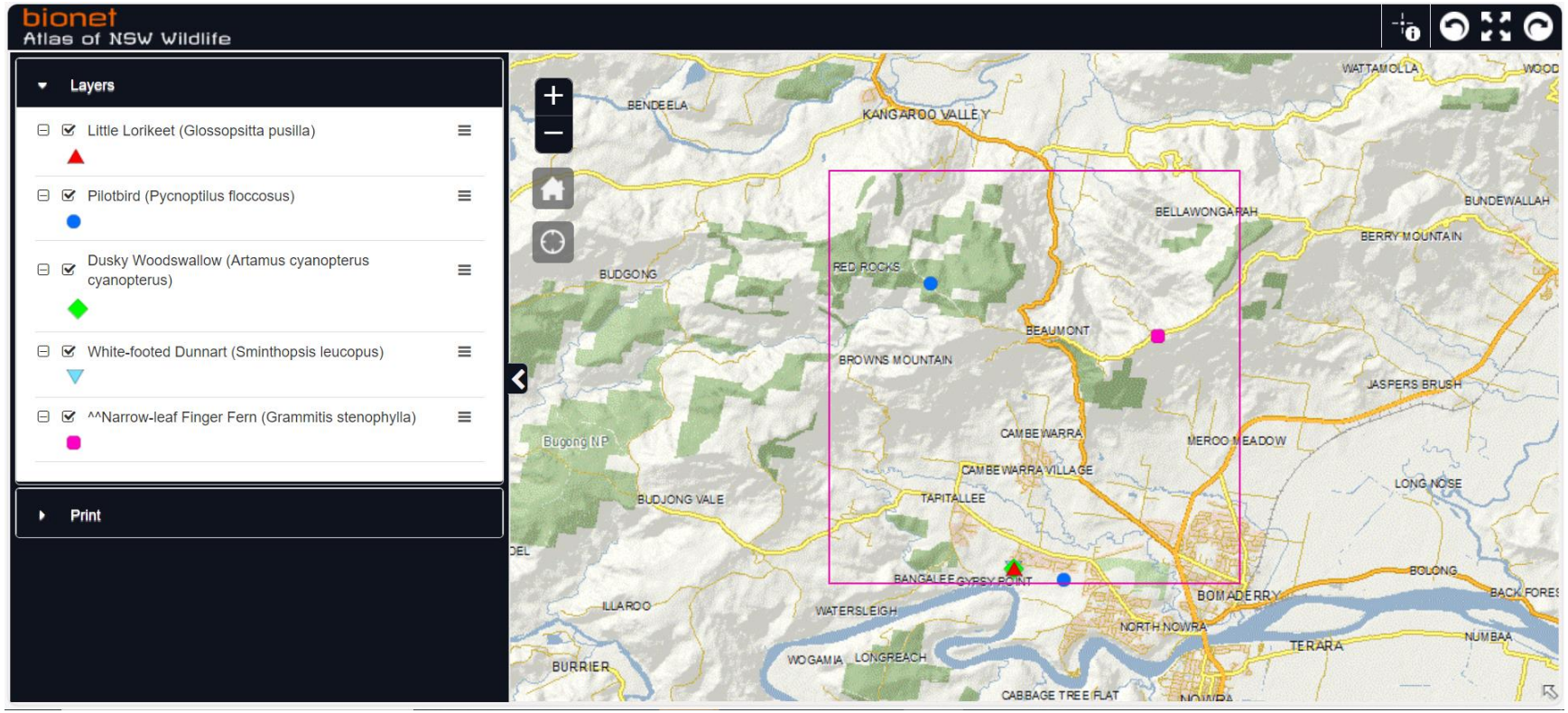
LONGREACH
BURRIER
CABBAGE TREE FLAT
NOWRA


bionet
Atlas of NSW Wildlife
Layers
Little Lorikeet (Glossopsitta pusilla)
Pilotbird (Pycnoptilus floccosus)
Dusky Woodswallow (Artamus cyanopterus cyanopterus)
White-footed Dunnart (Sminthopsis leucopus)
^^Narrow-leaf Finger Fern (Grammitis stenophylla)
Print
BENDEELA
KANGAROO VALLEY
WATTAMOLLA
BUNDEWALLAH
BELLAWONGARAH
BERRY MOUNTAIN
BUDGONG
RED ROCKS
BEAUMONT
BROWNS MOUNTAIN
JASPERS BRUSH
Bugong NP
CAMBEWARRA
MEROO MEADOW
CAMBEWARRA VILLAGE
LONG NOSE
BUDJONG VALE
TAPITALLEE
BANGALEE
GYPSY POINT
BOMADERRY
BOLONG
ILLAROO
WATERSLEIGH
NORTH NOWRA
TERARA
NUMBAA
WOGAMIA
LONGREACH
BURRIER
CABBAGE TREE FLAT

Appendix D

Ecological Site Inspection

Report

7 February 2024

To	Shoalhaven City Council	**Contact No.**	
Copy to	Jake Gallup	**Email**	
From	Peter Cowper	**Project No.**	12628715
Project Name	Detailed Design – Cambewarra Dam Decommissioning		
Subject	Ecological site inspection		

1. Introduction

GHD was engaged by Shoalhaven City Council to undertake the detailed design for the proposed decommissioning of Cambewarra Dam. A component of this project includes the preparation of a Review of Environmental Factors (REF) that was to be informed by an ecological site inspection. This report provides a summary of that site inspection and presents conclusions as to the apparent ecological values and considerations for the design process.

1.1 Purpose of this report

Prior to the conduct of the site inspection, review of desktop information identified numerous threatened species and communities were identified as potentially occurring within close proximity of the site. Sources for this desktop review included the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool[1] (PMST) and the NSW government's online SEED portal[2].

The purpose of this report is to describe the findings of the ecological site inspection. This report provides a description of:

– observable flora species present within the project area,
– Plant Community Types (PCT) present based on the extant vegetation community,
– habitat potential for listed flora and fauna species, in particular amphibians and microbats,
– likelihood of occurrence for species and communities listed under NSW and Commonwealth environmental legislation,
– any additional investigations necessary to inform the REF,
– guidance around species selection and other ecological considerations in support of the design development process.

[1] https://pmst.awe.gov.au/
[2] https://www.seed.nsw.gov.au/

2. Scope and limitations

2.1 Scope of work

The ecological site inspection was limited to land parcels comprising SCC land adjoining Cambewarra Dam and was undertaken to provide an indication of potential ecological constraints. The scope did not include detailed or targeted surveys.

2.2 Limitations

This report: has been prepared by GHD for Shoalhaven City Council and may only be used and relied on by Shoalhaven City Council for the purpose agreed between GHD and Shoalhaven City Council as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Shoalhaven City Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) [00] of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

Accessibility of documents

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.

3. Findings

3.1 Desktop Review

The following **Table 1** summarises the vegetation communities identified in desktop reviews. While the reviews were completed prior to the site inspection, online searches were completed again prior to finalisation of the report to account for any changes in regulatory status or new listings. It is also noted that the PCT communities are often components of the nationally listed threatened ecological communities (TEC) and this detail is generally captured in the published conservation advice or listing advice associated with each TEC.

Table 1 Vegetation communities identified in desktop reviews

Community
SEED: NSW Plant Community Types
PCT 3077: Illawarra Complex Dry Rainforest (associated with State and EPBC Act listed TEC)
PCT 3078: Illawarra Lowland Wet Vine Forest (associated with State and EPBC Act listed TEC)
PCT 3191: South Coast Ranges Moist Gully Forest
PCT 3268: Shoalhaven Foothills Turpentine-Ironbark Moist Forest
PCT 3270: Shoalhaven Lowland Wet Gully Forest

Community
PCT 3654: Shoalhaven Lowland Bloodwood Shrub Forest
PMST: EPBC Act listed TEC, modelled as likely to occur or mapped on site
Illawarra–Shoalhaven subtropical rainforest of the Sydney Basin Bioregion
Illawarra and south coast lowland forest and woodland ecological community
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria
Coastal swamp sclerophyll forest of New South Wales and southeast Queensland

While the list of communities returned from the desktop review is indicative only, further communities were also identified in the PMST report. The communities not listed in **Table 1** which were also identified in the PMST report are unlikely to have been present in the area of interest and as such have not been included.

Illustrated in **Figure 1** are the plant community types mapped in the online SEED[3] resource managed by the NSW Government. It indicates a diverse collection of vegetation communities however due to the methods used in creating the PCT maps should not be considered authoritative particularly where no site-based plots have been undertaken to verify the mapping.

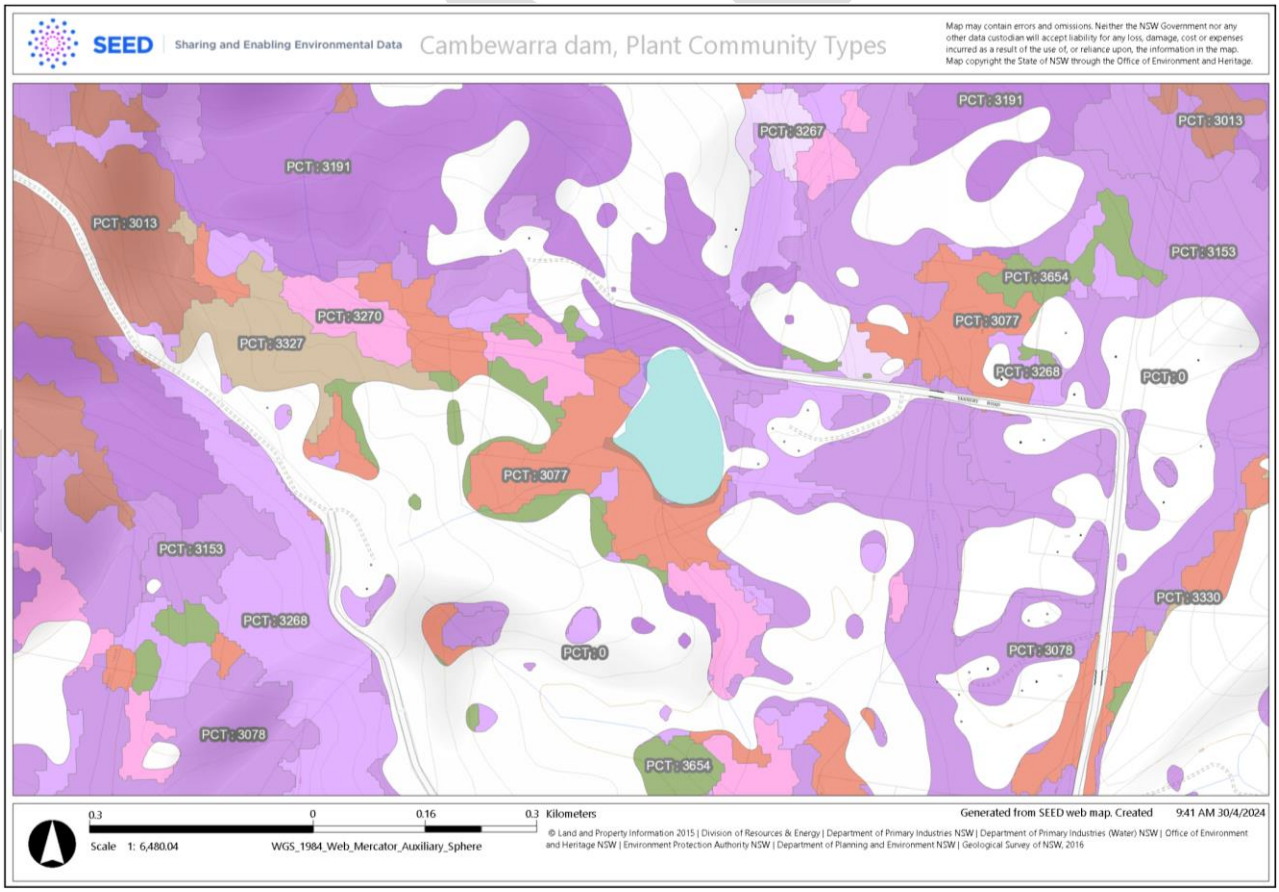


Figure 1 NSW SEED, Plant Community Types

[3] SEED = Sharing and Enabling Environmental Data, **https://www.seed.nsw.gov.au/**

The most prominent feature of the PCT mapping as illustrated in **Figure 1** is the apparent high level of variation in vegetation communities over a relatively small area. This is likely a consequence of the aerial photograph interpretation method applied in creating the PCT map which is reliant on feature recognition software as one of the main inputs to the vegetation modelling. In situations where there are no additional information sources that the PCT mapping process has relied upon, including reference sites where ground-based survey plots have been completed, it is likely there will be a higher potential for deviation from the mapped PCT.

The PCT which aligns to the extent of existing vegetation on the property is mapped as PCT 3077: Illawarra Complex Dry Rainforest. This is described by the Bionet PCT data (NSW Government 2022) as follows:

> Mid-high to tall, mid-dense to dense rainforest, or occasionally very tall, sclerophyll open forest with a dense rainforest mid-stratum. This PCT occurs on the coast and foothills in the Illawarra area between Wollongong and Nowra, with a limited disjunct occurrence near Milton. The rainforest stratum almost always includes trees *Streblus brunonianus* and very frequently *Elaeodendron australe*, either or both of which often have high cover. Tree species which only sometimes have a high cover very frequently include *Notelaea venosa* and commonly *Alectryon subcinereus*, *Pittosporum undulatum*, *Alphitonia excelsa* and *Diospyros australis*. Rarely, where a eucalypt canopy is present, the most frequent species are *Eucalyptus quadrangulata* and *Eucalyptus tereticornis*. Among the vines, *Eustrephus latifolius* is almost always present, very frequently with *Pandorea pandorana* and *Geitonoplesium cymosum* as well as the shrub *Pittosporum multiflorum*, all of which have low abundance. The sparse to dense ground layer is comprised of forbs, grasses and ferns, very frequently including *Pseuderanthemum variabile*, *Oplismenus imbecillis* and *Pellaea falcata*, occasionally with *Adiantum formosum*.
>
> This PCT occurs mainly in mild, wet locations receiving 1200-1510 mm mean annual rainfall, at low to mid elevations of 40-220 metres asl. In the Illawarra area it occurs on clay-rich sandstone or shale, while the disjunct occurrence at Milton is on monzonite. It occurs in a mosaic with wet sclerophyll PCT 3078, which occupies more exposed sites or those subject to periodic fire.

3.2 Site Inspection

On Thursday 1 February 2024, Cambewarra Dam and the associated Shoalhaven City Council (SCC) land was inspected for the purpose of determining the general ecological attributes and potential for threatened species and communities. The inspection commenced at 11:00am and was concluded on site by 1:20pm. Access to the property was provided by a SCC officer at commencement with all gates returned to a locked state upon conclusion of the inspection.

At the time of the inspection, the dam was at full supply level with a steady flow over the causeway.

The site inspection involved walking around the impoundment area and compiling a list of flora observed including any fauna observed or heard calling. The inspection included no plot-based survey, as a result all species recorded were through opportunistic means.

Attachment 1 includes the species lists of flora and fauna recorded during the inspection.

3.2.1 Fauna

During the site inspection a total of 19 bird species were observed or heard calling. Species recorded are typical of environments associated with rural areas including farm dams and mixed structure vegetation with a range of understorey and canopy plants.

Observed throughout the property were many wombat burrows. One wombat (*Vombatus ursinus*) was also observed on the western side of the dam wall under a dense layer of lantana. All species listed during the site inspection are relatively common and occur widely throughout eastern Australia.

The property may also provide potential habitat for further avifauna given the characteristics of the canopy in parts which would provide roosting habitat for forest owls and other threatened species known to occur in the general vicinity. Similarly, the structured vegetation with adjacent open spaces and the impoundment created by the dam provides foraging opportunities for various microchiropteran bat and some other bird species.

As the intent of the inspection was to consider the potential for fauna presence and did not include detailed surveys, the species list should be considered indicative only. With this limitation it is noted:

– it is probable several amphibian and reptile species would occur in and around the dam, detection of these species would require appropriately timed seasonal survey effort,
– arboreal and flying mammals are also potentially present and would require a range of survey methods to verify presence,
– as the site inspection did not commence until late morning, it is likely additional birds would be present as bird activity is typically concentrated in the early mornings.

3.2.2 Vegetation Communities

Vegetation surrounding the dam is highly disturbed and broadly divided into cleared land/pasture and a remnant weedy moist forest community dominated in the understorey by lantana (*Lantana camara*). The following sections provide a summary of the main species observed through each of the areas.

Cleared / pasture

Dominated by various exotic and native grasses including; kikuyu (*Pennisetum clandesinum*); paspalum (*Paspalum dilatatum*); couch grass (*Cynodon dactylon*); and in places the native weeping grass (*Microlaena stipoides*) occurred. Accessible parts of the property had been slashed recently prior to the conduct of the site inspection. As a result, the full diversity of species in the cleared/pasture areas was not apparent. However, there were numerous other exotic species which were observed including: flax-leaf fleabane (*Conyza bonariensis*); spear thistle (*Cirsum vulgare*); cobblers pegs (*Bidens pilosa*); fireweed (*Senecio madagascariensis*); Crofton weed (*Ageratina adenophora*); purple-top (*Verbena bonariensis*); and paddy's lucerne (*Sida rhombifolia*).

Near the northeastern corner of the property and main access from Tannery Road is a group of overmature and senescent Australian blackwood (*Acacia melanoxylon*) which had become established on a stockpile of soil and the adjacent berm along the eastern bank of the dam.

Areas comprising the cleared/pasture community have limited ecological value and do not correspond to the definition of any listed communities. Notwithstanding, these areas likely provide terrestrial forage areas for species such as purple swamp hen *(Porphryio porphryio*) and aerial hawking for small birds and microchiropteran bats. Occasional predation from diurnal and nocturnal raptors is also likely. At different times, it is also likely that the cleared/pasture areas provide shelter and foraging habitat for a range of reptile and amphibian species such as common eastern froglet (*Crinia signifiera*) which was heard calling from grassy areas during the inspection.

Fringing vegetation

Around the periphery to the dam there is a reed bed dominated by cumbungi (*Typha orientalis*) with several other emergent aquatic plants occupying ground to within a depth of one metre (1m) of the full supply level. The fringing vegetation is relatively narrow, generally up to about two metres wide. A small number of weeping willows (*Salix babylonica*) occur along the edge of the dam and in other parts of the property where the ground conditions are damp. Also associated with damp areas close to the limit of inundation was slender knotweed (*Persicaria decipens*) and various *Cyperus* spp. and *Juncus* spp.

The fringing vegetation provides dense shelter for waterbirds as observed with numerous black ducks (*Anas superciliosa*) and coot (*Fulica fuliginosa*) being flushed from cover during the inspection. The emergent vegetation provides good shelter for a range of amphibian species however at the time of the inspection, there were no amphibians calling from emergent vegetation.

Disturbed Moist Forest

The moist forest community occurs along the drainage lines above and below the dam wall with a mostly consistent dense layer of lantana dominating the understorey. In some locations, where there are gaps in the lantana, a number of native species occur including a range of ferns and other species associated with rainforest communities.

Due to the extent of historical clearing, the majority of vegetation within these areas is regrowth and lacks the structural elements of less disturbed sites. However, key species observed during the inspection included:

Trees: Australian blackwood (*Acacia melanoxylon*); Australian red cedar (*Toona ciliata*); Blackwattle (*Callicoma serratafolia*); and black apple (*Planchonella australis*). Limited eucalypts are present on the property however several trees tentatively identified as Wollongong woolybutt (*Eucalyptus saligna* x *botryoides*) are present upstream of the dam and also on the drier slopes above the western side of the creek, downstream of the dam.

Small trees: cheese tree (*Glochidion ferdinandi*); sweet pittosporum (*Pittosporum undulatum*); sandpaper fig (*Ficus coronata*); common lilly pilly (*Acmena smithii*); and brush cherry (*Syzygium australe*). The exotic tobacco bush (*Solanum marituanum*) was present in a few locations around the edges of the moist forest.

Shrubs: lantana (*Lantana camara*); orange thorn (*Pittosporum multiflorum*), bleeding heart (*Homolanthus populifolius*)

Vines and climbers: wonga wonga vine (*Pandorea pandorana*); sweet morninda (*Gynochthodes jasminoides*; native raspberry (*Rubus parvifolia*); and climbing guinea flower (*Hibbertia scandens*).

Ground layer: basket grass (*Osplismenus aemulus*); scurvy weed (*Commelina cyanea*); small rasp fern (*Doodia caudata*); prickly rasp fern (*Doodia aspera*); sickle fern (*Pellaea falcata*)

All vegetation that was not part of the cleared/pasture areas or fringing vegetation to the dam is included in the disturbed moist forest description. However, it was apparent that downstream of the dam wall the vegetation retained more characteristics of the original vegetation community. This included the presence of epiphytic species such as birds nest fern (*Asplenium australsicum*) and rock felt fern (*Pyrrosia rupestris*) in addition to rough tree fern (*Cyathea australis*). Understorey vegetation in areas that lacked a tree canopy were typically dominated by lantana.

4. Discussion

Plant community types depicted in **Figure 1**, indicate a high level of variation in the modelled vegetation. Following inspection of the property this is considered to be a consequence of the high weed load and extent of regrowth which would create a highly variable canopy. This is likely to have resulted in the false-positive identification of several PCT, particularly where no manual revision of the mapping or reference sites have been described.

The existence of false-positives is not unanticipated in the PCT mapping where the objective has been to exceed a 70% accuracy (Roff *et al.* 2023). Additionally, Roff *et al.* (2023) indicate that non-native

vegetation was aggregated across all types and in creating the PCT map through translation of pre-existing vegetation map products, all non-native vegetation. Accordingly, while it is noted that some PCT have a prevalence for invasion by exotic species, novel communities that are predominantly exotic are not described. These factors likely contribute to the high variability in mapped PCT as discussed in association with **Figure 1**.

The extent of regrowth can be illustrated through historical imagery sourced by GHD (2021). It shows that vegetation adjacent to and in the area surrounding Cambewarra Dam is largely regrowth. The earliest image available, taken in 1949 shows a landscape significantly devoid of vegetation across much of the area and in the drainage lines which feed into and drain from the dam, vegetation appears to be relatively small indicating most is regrowth. By comparison, the 2018 imagery which is more reflective of the current extent of vegetation shows substantial regrowth through most drainage lines and some associated slopes and includes numerous examples of planted vegetation associated with dwellings, roads and property boundaries (refer to **Figure 2**).

Figure 2 ***Side-by-side comparison of aerial imagery from 1949 (left) and 2018 (right) [source: GHD 2021]***

Due to the large component of vegetation that is regrowth or planted since 1949, it is probable in areas that are not landscape planting, that while the species assemblage is reflective of the original communities that pre-dated European occupation, the floristic diversity and structure is much simplified. The original vegetation communities are likely to have a included a mixture of gallery rainforest along the drainage lines and on protected slopes, while in more exposed areas a range of drier sclerophyll communities would have prevailed.

Many of the PCT that would have originally occurred throughout the Cambewarra area now form part of listed ecological communities as indicated previously in Table 1. Notably among these is the critically endangered ecological community (CEEC) 'Illawarra Lowland Subtropical Rainforest'. While the PCT mapping does not identify the associated PCT 3013 as occurring on the Cambewarra dam site, it is mapped as occurring less than 300 metres upstream of the western edge of the property. The Bionet PCT data describes PCT 3013 as follows:

> Tall to very tall, mid-dense to dense rainforest, or rarely very tall to extremely tall sclerophyll open forest with a dense rainforest sub-canopy. This PCT occurs mainly on the Illawarra lowlands between Helensburgh and Nowra, with disjunct and restricted occurrences near Milton and on the lower slopes of Mount Dromedary. Overstorey composition is diverse and variable. The tallest rainforest trees very frequently include *Dendrocnide excelsa*, commonly with *Doryphora sassafras* and *Toona ciliata*, each of which sometimes has locally high foliage cover. Eucalypts are rare, however when present *Eucalyptus quadrangulata* is the most frequent. Other rainforest trees in the canopy or sub-canopy very frequently include *Streblus brunonianus*, *Diospyros australis*, *Acmena smithii* and *Elaeodendron australe*; and are sometimes locally abundant. The palm *Livistona australis* is also very frequent and sometimes locally abundant in the understorey. The climbing epiphytic fern *Arthropteris tenella* and vines *Eustrephus latifolius*, *Marsdenia rostrata*, *Pandorea pandorana* and *Gynochthodes jasminoides* are all very frequent, usually with low abundance. The typically sparse ground cover very frequently includes the fern *Adiantum formosum* and tall forb *Gymnostachys anceps*.
>
> This PCT occurs mainly in mild, wet locations receiving 1200-1770 mm mean annual rainfall, at low to mid elevations of 60-300 metres asl. In its main area of occurrence on the Illawarra Lowlands, it occurs on or close to basalt or in sheltered sites on clay-rich sediments. In the two disjunct southerly localities, it occurs on monzonite. This community has been extensively cleared, which likely obscures its relationships with other PCTs. The most southerly occurrence at Mount Dromedary is at the fringe of cleared areas and near the dry end of the gradient for this PCT. It grades into PCT 3036 at higher elevations on the mountain.

The site inspection determined the presence of several plant species that are identified in the Bionet PCT data as being associated with PCT 3013 including red cedar and common lilly pilly. However, some species associated with PCT 3077 were also present such as orange thorn, sweet pittosporum, sickle fern and wonga wonga vine.

Given the presence of diagnostic species for both PCT 3013 and 3077 it is likely the Cambewarra dam property is associated with an ecotonal area where characteristics of both PCT are exhibited as one grades into the other with variation in terrain such as aspect, soil, elevation and access to water. To assess which PCT the site most closely aligns with, plot-based survey would be required to build a more comprehensive species list and consider the vegetation characteristics both upstream and downstream of the dam and impoundment area. Any additional survey would also need to consider the extent of disturbance and weed level to determine alignment with the listed TEC descriptions.

Regardless, both PCT are considered components of the State listed TEC '*Illawarra Subtropical Rainforest in the Sydney Basin Bioregion*' and would also likely align with the EPBC Act listed TEC '*Illawarra–Shoalhaven subtropical rainforest of the Sydney Basin Bioregion*'.

The final determination of the NSW Scientific Committee in listing the State TEC[4] identifies threats to the community as including:

– having been extensively cleared in the past for agriculture,
– being present mainly on private land with little representation in the conservation reserve network,

[4] **https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations/2011-2012/illawarra-subtropical-rainforest-in-the-sydney-basin-bioregion-minor-amendment-determination**

– remnants are typically small and fragmented with long term viability threatened,
– weed invasion by a range of species including several noted as present at Cambewarra dam including crofton weed, lantana and tobacco bush, and
– ongoing threats from further clearing, quarrying, grazing, inappropriate fire regimes, rubbish dumping and hobby farm developments.

5. Conclusion

It is understood with the proposed decommissioning works that a potential for vegetation disturbance exists given the dam wall would be removed. It is anticipated with would include the need to provide a safe working area and access for plant and equipment. In the absence of further, more detailed investigations into the ecological characteristics and alignment with listed TEC, removal of native vegetation should be avoided based on the *Precautionary Principle*. This would also limit the potential for unnecessary impacts to potential fauna habitat.

Subsequent restoration of the landform following the proposed works should also consider an approach to stabilisation and revegetation which minimises the potential for continued weed invasion and creates an environment where natural or assisted regeneration of the native vegetation communities (comprising either PCT 3013 or 3077) can occur.

References

GHD (2021) *Cambewarra Dam Decommissioning Preliminary Site Investigation (March 2021)* unpublished report to Shoalhaven City Council

NSW Government (2022) *BioNet Plant Community Type data*, Department of Planning and Environment (4 July 2022) [online: **https://www.environment.nsw.gov.au/research-and-publications/publications-search/bionet-plant-community-type-data**]

Roff A, Day M, Thonell J & Denholm B (2023) *NSW State Vegetation Type Map: Technical Notes*, Department of Planning and Environment (18 December 2023) [online: **https://www.environment.nsw.gov.au/research-and-publications/publications-search/nsw-state-vegetation-type-map-2023**]

Attachment 1

Species lists

Species List: avifauna

Purple swamphen, *Porphyrio porphyrio*

Brown thornbill*, Acanthiza pusilla*

Australian Magpie, *Gymnorhina tibicen*

Australian Raven, *Corvus coronoides*

Whipbird, *Psophodes olivaceus*

Grey butcherbird, *Cracticus torquatus*

Pacific black duck, *Anas superciliosa*

Little pied cormorant, *Microcarbo melanoleucos*

Australian wood duck, *Chenonetta jubata*

Hard head, *Aythya australis*

Hoary headed grebe, *Poliocephalus poliocephalus*

Coot, *Fulica fuliginosa*

Red browed firetail, *Neochmia temporalis*

White-browed scrub-wren, *Sericornis frontalis*

Superb fairywren, *Malurus cyaneus*

Grey fantail, *Rhipidura albiscapa*

White-eared honeyeater, *Lichenostomus leucotis*

Great pied cormorant, *Phalacrocorax varius*

Pied mudlark, *Grallina cyanoleuca*

Species List: other vertebrates

Common wombat, *Vombatus ursinus*

Common eastern froglet; *Crinia signifera*

Species List: plants

(* indicates exotic species)

ASPLENIACEAE

Birds nest fern, *Asplenium australasicum*

ASTERACEAE

Crofton weed, *Ageratina adenophora**

Cobblers pegs, *Bidens pilosa**

Spear thistle, *Cirsium vulgare**

Flaxleaf fleabane, *Conyza bonariensis**

Fireweed, *Senecio madagascariensis**

BIGNONIACEAE

Wonga wonga vine, *Pandorea pandorana*

BLECHNACEAE

Hard fern, *Blechnum* sp.

Prickly rasp fern, *Doodia aspera*

Small rasp fern, *Doodia caudata*

COMMELINACEAE

Scurvy weed, *Commelina cyanea*

CUNIONACEAE

Black wattle, *Callicoma serratifolia*

CYATHEACEAE

Rough tree fern, *Cyathea australis*

CYPERACEAE

Cyperus spp.

DICKSONIACEAE

Rainbow fern, C*alochlaena dubia*

DILLENACEAE

Climbing guinea flower, *Hibbertia scandens*

EUPHORBIACEAE

Bleeding heart, *Homalanthus populifolius*

FABACEAE

Mimosoideae

Australian blackwood, *Acacia melanoxylon*

JUNACEAE

Juncus spp.

MALVACEAE

Paddys lucerne, *Sida rhombifolia**

MELIACEAE

Australian redcedar, *Toona ciliata*

MORACEAE

Sandpaper fig, *Ficus coronata*

MYRTACEAE

(?) Wollongong woollybutt, *Eucalyptus saligna x botryoides*

Brush cherry, *Syzygium australe*

Common lilly pilly*, Acmena smithii*

PITTOSPORACEAE

Orange thorn, *Pittosporum multiflorum*

Sweet pittosporum, *Pittosporum undulatum*

PHYLLANTHACEAE

Cheese tree, *Glochidion ferdinandi*

POLYPODIACEAE

Fragrant fern, *Microsorum scandens*

Rock felt fern, *Pyrrosia rupestris*

POACEAE

Couch grass. *Cynodon dactylon*

Weeping grass, *Microlaena stipoides*

Basket grass, O*plismenus aemulus*

Paspalum, *Paspalum dilatatum**

Kikuyu grass*, Pennisetum clandestinum**

POLYGONACEAE

Slender knotweed, *Persicaria decipens*

PTERIDACEAE

Rough maidenhair fern, *Adiantum hispidulum*

Sickle fern, *Pellaea falcata*

ROSACEAE

Native raspberry, *Rubus parvifolius*

RUBIACEAE

Sweet morinda*, Gynochthodes jasminoides*

SALIACEAE

Weeping willow, *Salix babylonica**

SAPOTACEAE

Black apple, *Planchonella australis*

SOLANACEAE

Tobacco bush, *Solanum marituanum**

TYPHACEAE

Bulrush, cumbungi, *Typha orientalis*

VERBENACEAE

Lantana, *Lantana camara**

Purple-top, *Verbena bonariensis**

Appendix E

Threatened species and ecological communities – likelihood of occurrence and significant impact assessment

Likelihood of occurrence

A list of threatened and migratory species known to occur within the locality (<10 km) of the proposal site was generated from NSW BioNet Atlas (see Table 1) (refer to appendix xx of the REF). To determine the likelihood of species occurring in the proposal site, an additional list of threatened and migratory species was generated by conducting an NSW BioNet Atlas threatened biodiversity vegetation associations report filtered by subregion (Sydney Basin -Illawarra) and plant community types that occur in the proposal site (refer to appendix xx of the REF). This data, and other information was used to assess the likelihood of threatened and migratory species, and ecological communities, occurring within the proposal site, based on:

– Proximity and frequency of sighting records / known distributions
– Habitat and other ecological requirements of the species / community
– Known vegetations associations of the species / community
– Availability and quality of habitat and vegetation associations.

These features were considered and used to assign a likelihood of occurrence in the proposal site, according to the following descriptions:

– High – a medium to high probability that a species uses the site, based on nearby records and suitable habitat being present.
– Moderate – suitable habitat for a species occurs on the site, but the species has not been observed or previously recorded at the site.
– Low – a very low likelihood that the species uses the site, based on lack of the preferred type and size of habitat.
– Absent – habitat on-site and in the vicinity is unsuitable for the species.

The likelihood of occurrence for species to occur within the proposal site, is presented in Table 1.

Species which have been identified as possibly occurring in the proposal site, based on the DCCEWW PMST search (see search report in Appendix B of the REF) and NSW BioNet Atlas threatened biodiversity vegetation associations report, but were not identified in NSW BioNet records as occurring within the locality of the proposal site, are inferred to have an ‘absent’ or ‘low’ likelihood of occurrence.

Ecological assessments

Table 1 Likelihood of occurrence

Kingdom / Class / Order / scientific name	Common Name	NSW status	Cwth status	Records <10 km	PCT associations (ID)	Habitat description	Likelihood of occurrence
Threatened Ecological Communities							
Illawarra Subtropical Rainforest in the Sydney Basin Bioregion		E	-	Known	3077, 3078.	Illawarra Subtropical Rainforest is generally synonymous with the Commonwealth listed Illawarra-Shoalhaven Subtropical Rainforest. The community includes Subtropical Rainforest, Moist Subtropical Rainforest and Dry Subtropical Rainforests of the Illawarra Region. The community is closely associated with topographically sheltered sites and occurs on the coastal plain, low-lying foothills and slopes, benches and drainage lines (gullies) of the eastern coastal escarpment (and of some coastal mountains). The community occurs on fertile soils with good water-holding capacity. The community is typically a dense, complex rainforest with a dense mixed canopy layer and sparse shrub layer with an abundance of vines and epiphytes. Characteristic tree species are *Baloghia inophylla, Brachychiton acerifolius, Dendrocnide excelsa, Diploglottis australis, Ficus* spp., *Pennantia cunninghamii* and *Toona ciliata.* Stands may have species of *Eucalyptus*, *Syncarpia* and *Acacia* as emergents or incorporated into the dense canopy. Stands of the community are present in Cambewarra Range Nature Reserve.	High
Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion		-	CE	Known	3077, 3078.		High
Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions		E	-	Known	3077.	Lowland Rainforest is a structurally complex subtropical rainforest or dry rainforest, spanning widely across NSW. Lowland Rainforest may be associated with a range of high-nutrient geological substrates, notably basalts and fine-grained sedimentary rocks, on coastal plains and plateaux, foot slopes and foothills. In the Sydney Basin bioregion, it is limited to elevations below 350 m.	Medium

Kingdom / Class / Order / scientific name	Common Name	NSW status	Cwth status	Records <10 km	PCT associations (ID)	Habitat description	Likelihood of occurrence
						Lowland Rainforest has a closed canopy, characterised by a high diversity of trees with varying shapes and sizes which form three major strata: emergents, canopy and sub-canopy. The trees are taxonomically diverse at the genus and family levels and a range of plant growth forms are present in Lowland Rainforest, including palms, vines, and vascular epiphytes.	
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria		-	CE	Known	None	River flat eucalypt forest is found on the floodplains of the eastern and southern watershed of the Great Dividing Range from central and southern New South Wales to eastern Victoria. The ecological community occurs on alluvial landforms related to coastal river floodplains and associated sites where transient water accumulates, including floodplains, riverbanks, riparian zones, lake foreshores, creek lines (including the floors of tributary gullies), floodplain pockets, depressions, alluvial flats, fans, terraces, and localised colluvial fans. River flat eucalypt forest is a tall forest or woodland with a canopy dominated by eucalypts and an understorey of small trees, shrubs, grasses, other herbs and climbers. The canopy is dominated by eucalypt species, often with several species present, forming a typical crown cover of 40 to 60 percent. A mid-layer of small trees or sub-canopy may be present with scattered to dense shrubs. The ecological community often has climbers and vines extending into the mid-storey and canopy. The ecological community generally has a more diverse and abundant groundcover than locally adjoining slopes and typically includes grasses, forbs, ferns, sedges and scramblers. The ecological community occurs widely along the tributaries of the Shoalhaven River watershed.	Low
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community		-	E	Known	None	The ecological community occurs in coastal catchments, on coastal flats, floodplains, drainage lines, lake margins, wetlands and estuarine fringes where soils are at least occasionally saturated, water-logged or inundated. The community occurs on unconsolidated soils, including alluvium, which are often saturated and loamy or peaty. The ecological community is typically found where groundwater is saline or brackish and is characterized by a dominant cover of Coastal Swamp Oak.	Absent

Kingdom / Class / Order / scientific name	Common Name	NSW status	Cwth status	Records <10 km	PCT associations (ID)	Habitat description	Likelihood of occurrence
Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland		-	E	Known	None	Coastal Swamp Sclerophyll Forest is a forested marsh wetland or swamp forest, found in the temperate to subtropical coastal valleys of Australia's east coast. The community typically occurs in low-lying coastal alluvial areas with minimal relief, such as swamps, floodplain pockets, depressions, alluvial flats, back-barrier flats, fans, terraces, and behind fore-dunes. The community often has a layered canopy, dominated by melaleucas and/or Swamp Mahogany (*Eucalyptus robusta*).	Absent
Animals							
Amphibians							
Anura (tailless frogs)							
Heleioporus australiacus	Giant Burrowing Frog	V	V	6	3190, 3191, 3268, 3270, 3654.	The Giant Burrowing Frog is distributed in southeastern NSW and Victoria. Habitat includes heath, woodland and open dry sclerophyll forest, often on sandstone scarps, but also in a variety of soil types except those that are clay based. More than 95% of its time is spent in non-breeding habitat (areas up to 300 m from breeding sites) where it burrows below the soil surface or in leaf litter. Sightings in the locality of the proposal site are restricted to sandstone plateaus in Cambewarra Range Nature Reserve and west of Bomaderry.	Low
Birds							
Procellariiformes (petrels)							
Ardenna pacifica	Wedge-tailed Shearwater	-	J	1	-	The Wedge-tailed Shearwater is a pelagic (open ocean) seabird, which nests on (generally tropical) offshore islands and feeds pelagically on fish.	Absent
Accipitriformes (hawks and relatives)							
Circus assimilis	Spotted Harrier	V	-	1-	-	The Spotted Harrier occurs widely across the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges. Habitat is usually grassy open woodland including Acacia and mallee scrub, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also in	Moderate

Kingdom / Class / Order / scientific name	Common Name	NSW status	Cwth status	Records <10 km	PCT associations (ID)	Habitat description	Likelihood of occurrence
						agricultural land, foraging over open habitats including the edges of inland wetlands.	
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	2	3077, 3078, 3190, 3191, 3268, 3270, 3654.	The White-bellied Sea-eagle occurs widely across the Australian coastline, and along inland rivers and wetlands of the Murray Darling Basin. Habitat includes large areas of open water including rivers, swamps, lakes, and the sea. Breeding habitat is typically large emergent eucalypts for nesting within tall open forest, tall woodland, or swamp sclerophyll forest close to foraging habitat. Feeding items include fish and freshwater turtles, but also waterbirds, reptiles, mammals and carrion.	Moderate
Hieraaetus morphnoides	Little Eagle	V	-	1	3268, 3270, 3654.	The Little Eagle is found across the Australian mainland in open eucalypt forest, woodland or open woodland. They generally don't occur in dense forest but may occur in in sheoak or acacia woodlands and riparian woodlands. Large trees in the riparian zone are favoured for nesting.	Low
Lophoictinia isura	Square-tailed Kite	V	-	5	3190, 3191, 3268, 3270, 3654.	The Square-tailed Kite ranges along coastal and subcoastal areas across southern and eastern Australia. It is a summer breeding migrant to the south-east of Australia, generally arriving in September and leaving by March. Habitat includes a variety of timbered habitats including dry woodlands and open forests, particularly along watercourses.	Moderate
Apodiformes (swifts)							
Hirundapus caudacutus	White-throated Needletail	V	V,C,J,K	7	3077, 3078, 3190, 3191, 3268, 3270, 3654.	The White-throated Needletail is widespread in coastal regions of eastern and south-eastern Australia, and extends inland to the western slopes of the Great Dividing Range. They are an aerial insectivore spending most of their time in the air, generally above, but sometimes within, the canopy of woodland and forest.	Moderate
Charadriiformes (waders and relatives)							
Burhinus grallarius	Bush Stone-curlew	E	-	1	3268.	The Bush Stone-curlew is found widely across Australia. Habitat includes open forests and woodlands with a sparse grassy ground layer and fallen timber. They are largely nocturnal and are most active on moonlit nights, where they feed on insects and small vertebrates, such	Low

Kingdom / Class / Order / scientific name	Common Name	NSW status	Cwth status	Records <10 km	PCT associations (ID)	Habitat description	Likelihood of occurrence
						as frogs, lizards and snakes. Nests are built on the ground in a scrape or small bare patch.	
Passeriformes (passerines / perching birds)							
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	9	3077, 3078, 3190, 3268, 3270, 3654.	Dusky Woodswallows are widespread across southeastern Australia. Primary habitat includes dry open eucalypt forests and woodlands, in addition to shrublands, heathlands and very occasionally in moist forest or rainforest. They are also found in farmland, usually at the edges of forest or woodland. Most breeding activity occurs on the western slopes of the Great Dividing Range.	High
Daphoenositta chrysoptera	Varied Sittella	V	-	10	3077, 3078, 3190, 3191, 3268, 3270, 3654.	The Varied Sittella inhabits most of mainland Australia except for treeless deserts and open grasslands. Habitat includes eucalypt forests and woodlands, especially those containing suitable foraging habitat, including rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Several recorded sightings have been made in woodland adjacent to the Shoalhaven River, south of the proposal site.	Moderate
Pachycephala olivacea	Olive Whistler	V	-	6	3078, 3190, 3191, 3268, 3270, 3654.	The Olive Whistler inhabits wet forests on the ranges of the east coast of Australia. It has a disjunct distribution in NSW chiefly occupying the beech forests around Barrington Tops and the MacPherson Ranges in the north and wet forests from Illawarra south to Victoria. Habitat is mostly wet forests above 500m, tending to be lower during winter months. They forage in trees and shrubs and on the ground, feeding on berries and insects.	Moderate
Petroica boodang	Scarlet Robin	V	-	2	3190, 3191, 3654.	The Scarlet Robin is widespread across eastern Australia, along the coast and inland slopes of the Great Dividing Range. After breeding, some Scarlet Robins disperse to the lower valleys and plains of the tablelands and slopes. The Scarlet Robin inhabits eucalypt forests and woodlands with an open and grassy understorey, and occasionally in mallee or wet forest communities, or in wetlands and tea-tree swamps. Scarlet Robin habitat usually contains abundant logs and fallen timber, which are important for foraging.	Moderate

Kingdom / Class / Order / scientific name	Common Name	NSW status	Cwth status	Records <10 km	PCT associations (ID)	Habitat description	Likelihood of occurrence
^^*Dasyornis brachypterus*	Eastern Bristlebird	E	E	13	3654.	The Eastern Bristlebird has three disjunct populations across eastern Australia, including its most major population in the Illawarra/Jervis Bay area (most importantly including Booderee National Park). The Eastern Bristlelbird has limited flight capabilities so spends most of its time foraging on the ground in dense grassland, and sometimes in coastal heath, shrubland and other woodland with a dense understorey.	Low
Pycnoptilus floccosus	Pilotbird	-	V	2	-	Pilotbirds are endemic to south-east Australia and occupy temperate forests, especially wet temperate forests. The bird has poor flight and spends most of its time foraging on the ground in dense undergrowth and debris.	Moderate
Psittaciformes (parrots)							
Callocephalon fimbriatum	Gang-gang Cockatoo	E	E	18	3077, 3078, 3190, 3191, 3268, 3270, 3654.	The Gang-gang Cockatoo is distributed across south-eastern Australia. In spring and summer, they are generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. However, their distribution broadens in colder months. Several recorded sightings have been made in woodland adjacent to the Shoalhaven River, south of the proposal site.	Moderate
^^*Calyptorhynchus lathami lathami*	South-eastern Glossy Black-Cockatoo	V	V	132	3077, 3078, 3190, 3191, 3268, 3270, 3654.	The species is uncommon but widespread across eastern Australia throughout suitable forest and woodland habitats. Habitat includes open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (*Allocasuarina littoralis*) and Forest Sheoak (*A. torulosa*) are important feed trees. Inland populations feed on a wide range of sheoaks, including Drooping Sheoak.	Moderate
^^*Lophochroa leadbeateri*	Pink Cockatoo	V	-	1	-	The Pink Cockatoo, commonly referred to as the Major Mitchell Cockatoo, occupies inland arid and semi-arid woodlands where it forages preferably on conifers (*Callitris* spp.), sheoak (*Allocasuarina* spp.) and eucalypts.	Absent
Glossopsitta pusilla	Little Lorikeet	V	-	2	3077, 3078, 3190, 3191,	The Little Lorikeet is distributed widely across the coast and Great Dividing Range of eastern Australia. Foraging	Moderate

Kingdom / Class / Order / scientific name	Common Name	NSW status	Cwth status	Records <10 km	PCT associations (ID)	Habitat description	Likelihood of occurrence
					3268, 3270, 3654.	occurs primarily in the canopy of open eucalyptus forest and woodlands, which may also include Angophora, Melaleuca and other tree species. Riparian habitats are generally favoured due to higher food availability.	
Lathamus discolor	Swift Parrot	E	CE	1	3077, 3078, 3190, 3191, 3268, 3270, 3654.	The Swift Parrot breeds in Tasmania during spring and summer and migrates to south-eastern Australia in the autumn and winter months. In NSW, they mostly occur on the coast and southwest slopes of the Great Dividing Range. Habitat includes eucalypt forests and woodlands that 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 (*Eucalyptus robusta*), Spotted Gum (*Corymbia maculate*), Red Bloodwood (*C. gummifera*), Forest Red Gum (*E. tereticornis*), Mugga Ironbark (*E. sideroxylon*), and White Box (*E. albens*).	Moderate
Strigiformes (owls)							
Ninox strenua	Powerful Owl	V	-	15	3077, 3078, 3190, 3191, 3268, 3270, 3654.	The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range. The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large areas of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine (*Syncarpia glomulifera*), Black She-oak (*Allocasuarina littoralis*), Blackwood (*Acacia melanoxylon*), Rough-barked Apple (*Angophora floribunda*), Cherry Ballart (*Exocarpus cupressiformis*) and a number of eucalypt species. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm). Several recorded sightings have been made in woodland adjacent to the Shoalhaven River, south of the proposal site.	High
Tyto novaehollandiae	Masked Owl	V	-	2	3077, 3078, 3190, 3191,	The Masked Owl is distributed from the eastern coast of Australia where it is most abundant to the western plains.	Moderate

Kingdom / Class / Order / scientific name	Common Name	NSW status	Cwth status	Records <10 km	PCT associations (ID)	Habitat description	Likelihood of occurrence
					3268, 3270, 3654.	Habitat is typically dry eucalypt forests and woodlands from sea level up to 1100 m. Foraging occurs in forests, and along the edges of forests, including roadsides.	
Tyto tenebricosa	Sooty Owl	V	-	6	3190, 3191, 3268, 3270, 3654.	Greater sooty owls occur widely across eastern Australia, typically in wet forests containing smooth-barked gum trees, tree ferns and a wet forest understorey. Roosting occurs in large tree hollows, caves and in dense foliage during daylight hours. Hunting occurs at night, with mammals the main source of food.	Moderate
Mammals							
Chiroptera (bats)							
Miniopterus australis	Little Bent-winged Bat	V	-	1	3077, 3078.	Found along the east coast and ranges of Australia in moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas, Little Bent-winged Bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day. At night they forage for small insects beneath the canopy of densely vegetated habitats.	Moderate
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	6	3077, 3078, 3190, 3191, 3270, 3654.	Eastern Bentwing-bats occur along the east and north-west coasts of Australia. Roosting occurs in caves and sometimes derelict mines, storm-water tunnels, buildings and other man-made structures. Hunting takes place in forested areas, where they catch moths and other flying insects above the tree canopy.	Moderate
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V	-	5	3077, 3270, 3654.	The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW. Habitat includes dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roosting takes place mainly in tree hollows but also under bark or in man-made structures. Hunting takes place in forested areas, where they catch moths and other flying insects above the tree canopy.	Moderate
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	162	3077, 3078, 3190, 3191,	Grey-headed Flying-foxes are widespread across the eastern coast of Australia. Habitat includes subtropical and temperate rainforests, tall sclerophyll forests and	High

Kingdom / Class / Order / scientific name	Common Name	NSW status	Cwth status	Records <10 km	PCT associations (ID)	Habitat description	Likelihood of occurrence
					3268, 3270, 3654.	woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies or riparian forests with a dense canopy. Foraging is undertaken in forested areas where they feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines. They may also forage on fruits in growing in gardens and orchids. Sighting records are widespread in the locality of the proposal site.	
Chalinolobus dwyeri	Large-eared Pied Bat	V	E	7	3077, 3190, 3191, 3268, 3270, 3654.	The Large-eared Pied Bat is patchily distributed across eastern Australia in areas with extensive cliffs and caves. Roosting takes place in caves, crevices and overhangs in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*). Habitat is usually low to mid-elevation dry open forest and woodland with suitable roosting habitat.	Moderate
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	3	3077, 3078, 3190, 3191, 3268, 3270, 3654.	The Eastern False Pipistrelle is found across the south-east coast and ranges of Australia, generally in moist forest with tall trees. Roosting occurs in eucalypt hollows and under loose bark on trees or in buildings.	Moderate
Myotis macropus	Southern Myotis	V	-	5	3077, 3078, 3190, 3191, 3268, 3270, 3654.	The Southern Myotis is found in coastal areas across eastern Australia and is rarely found more than 100 km inland, except along major rivers. Roosting occurs close to water, in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Foraging takes place over streams and pools where they catch insects and small fish by raking their feet across the water surface.	High
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	2	3077, 3191, 3654.	The Greater Broad-nosed Bat is found broadly across the slopes and coastal side of the Great Dividing Range. Habitats include woodland, moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest and near valleys and waterways. Roosting occurs in tree hollows and foraging occurs after sunset, which involves flying slowly and directly along creek and river corridors at low altitude.	Moderate

Kingdom / Class / Order / scientific name	Common Name	NSW status	Cwth status	Records <10 km	PCT associations (ID)	Habitat description	Likelihood of occurrence
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	2	3077, 3191, 3268, 3654.	The Yellow-bellied Sheathtail-bat is widespread across eastern Australia in various woodland habitats, including open woodland and grassland. Roosting occurs in tree hollows, buildings and sometimes mammal burrows. Foraging for insects takes place above the forest canopy with quick bursts of speed. Although predominantly insectivorous, the Yellow-bellied Sheathtail-bat sometimes consumes fruits.	Moderate
Dasyuromorphia (carnivorous marsupials)							
Dasyurus maculatus	Spotted-tailed Quoll	V	E	12	3077, 3078, 3190, 3191, 3268, 3270, 3654.	The Spotted-tailed Quoll is found in eastern NSW, eastern Victoria, south-east and north-eastern Queensland, and Tasmania. Habitat types are broad and include 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 outcrops and rocky-cliff faces as den sites. Several recorded sightings have been made in the locality of the proposal site, including in Cambewarra Range Nature Reserve and Tapitallee Nature Reserve.	Moderate
Sminthopsis leucopus	White-footed Dunnart	V	-	1	3268, 3270, 3654.	The White-footed Dunnart occurs in Tasmania and along the Victorian and southern NSW coast. The Shoalhaven area is the species' northern-most limit. The White-footed Dunnart is found in a range of different habitats, including coastal dune vegetation, coastal forest, tussock grassland and sedgeland, heathland, woodland and forest.	Low
Diprotodontia (herbivorous marsupials)							
Petaurus australis	Yellow-bellied Glider	V	V	44	3190, 3191, 3268, 3270, 3654.	The Yellow-bellied Glider is found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria. Habitat includes tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Recorded sightings are common in woodland adjacent to the Shoalhaven River, south of the proposal site.	Low
Phascolarctos cinereus	Koala	E	E	2	3078, 3190, 3191, 3268, 3270, 3654.	The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. Koalas inhabit eucalypt	Low

Kingdom / Class / Order / scientific name	Common Name	NSW status	Cwth status	Records <10 km	PCT associations (ID)	Habitat description	Likelihood of occurrence
						woodlands and forests, in which they forage on the leaves of feed trees, including eucalyptus, corymbia and angophora.	
Potorous tridactylus	Long-nosed Potoroo	V	V	15	3190, 3191, 3268, 3654.	The long-nosed potoroo is found on the south-eastern coast of Australia, from Queensland to eastern Victoria. Habitat is generally restricted to coastal heaths and dry and wet forests east of the Great Dividing Range. A 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. A sandy loam soil is also a common feature. The fruit-bodies of hypogeous (underground-fruiting) fungi are a large component of the diet of the Long-nosed Potoroo. They also eat roots, tubers, insects and their larvae and other soft-bodied animals that are present in the soil. Several recorded sightings have been made in Cambewarra Range Nature Reserve, to the north of the proposal site.	Moderate
Petauroides volans	Southern Greater Glider	E	E	3	3077, 3078, 3190, 3191, 3268, 3270, 3654.	The Southern Greater Glider has a broad distribution across eastern Australia. Habitat includes eucalypt forests and woodlands with an abundance of hollow bearing trees. A few isolated records of the Southern Greater Glider have been made in the Cambewarra Range Nature Reserve.	Low
Cercartetus nanus	Eastern Pygmy-possum	V	-	8	3077, 3078, 3190, 3191, 3268, 3270, 3654.	The Eastern Pygmy-possum is found in south-eastern Australia, from southern Queensland to eastern South Australia and Tasmania. Habitat selection is broad and includes rainforest, sclerophyll forest, woodland, and heath. Breeding hollows are required for nesting. Several recorded sightings have been made in woodland adjacent to the Shoalhaven River, south of the proposal site.	Moderate
Notamacropus parma	Parma Wallaby	V	V	1	-	The Parma Wallaby is found in northern NSW and patchily across southeastern NSW. The Illawarra population is thought to be extinct. Habitat includes densely vegetated wet-sclerophyll forests and	Absent

Kingdom / Class / Order / scientific name	Common Name	NSW status	Cwth status	Records <10 km	PCT associations (ID)	Habitat description	Likelihood of occurrence
						occasionally rainforest or dry sclerophyll forests. The Parma Wallaby hides amongst thick groundcover during the day and emerges at night to feed on grasses and herbs.	
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	3	3077, 3078, 3190, 3191, 3268, 3270.	The Brush-tailed Rock-wallaby is distributed along the Great Dividing Range from south-east Queensland to the Grampians in western Victoria. Habitat comprised rocky escarpments, outcrops and cliffs with fissures, caves and ledges. Foraging occurs at night where they forage on grasses, forbs, fruits and the foliage of shrubs and trees. Mobs are highly territorial and have strong site fidelity with an average home range size of about 15 ha.	Low
Peramelemorphia (bandicoots and bilbies)							
Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)	E	E	5	3077, 3078, 3190, 3191, 3268, 3270, 3654.	The Southern Brown Bandicoot has a patchy distribution across south-eastern Australia, east of the Great Dividing Range. The Southern Brown Bandicoot prefers scrubby habitats with plenty of low ground cover and shelter. They are nocturnal, emerging at night to feed on a variety of insects, earthworms and plants.	Moderate
Reptiles							
Squamata (lizards and snakes)							
^^Hoplocephalus bungaroides	Broad-headed Snake	E	E	1	3268, 3270, 3654.	The Broad-headed Snake is confined to sandstone habitats, including sandstone heaths, within 250 km of Sydney. Reptiles and frogs form an important component of the diet.	Low
Plants							
Brassicales							
Irenepharsus trypherus	Illawarra Irene	E	E	1	3077, 3078, 3191.	Illawarra Irene has a localized population that occurs between Wollongong and Morton National Park. Illawarra Irene is a perennial herb that occurs in moist sclerophyll forest, Ironwood (*Backhousia myrtifolia*) thicket, and rainforest. Habitat generally includes the upper slopes of ridge systems, and on rocky cliff lines and gorges.	Low
Dilleniales							

Kingdom / Class / Order / scientific name	Common Name	NSW status	Cwth status	Records <10 km	PCT associations (ID)	Habitat description	Likelihood of occurrence
Hibbertia stricta subsp. furcatula		E	-	13	3268.	The species is a small shrub known from two populations: one on the southern outskirts of Sydney, and one near Nowra. Habitat includes dry sclerophyll forest and woodland, on sandy soils derived from sandstone. Some individuals have been recorded on the sandstone plateau between Nowra and Bomaderry.	Low
Polypodiales (polypod ferns)							
Grammitis stenophylla	Narrow-leaf Finger Fern	E	-	1	3190.	The Narrow-leaf Finger Fern is distributed broadly across wet areas of NSW and southern Queensland. Habitat includes rainforest and wet sclerophyll forest, where it grows amongst rocks.	Low
Myrtales							
Myrtaceae (myrtles)							
Eucalyptus langleyi	Albatross Mallee / Eucalyptus langleyi population north of the Shoalhaven River in the Shoalhaven local government area (species and population)	E2,V	V	31	3654.	Albatross Mallee is known only from two stands south-west of Nowra. Habitat includes shrubland in sandy soil over sandstone. Some individuals have been recorded on the sandstone plateau between Nowra and Bomaderry.	Absent
Rhodamnia rubescens	Scrub Turpentine	CE	CE	10	3077, 3078, 3190, 3191, 3268, 3270.	The Scrub Turpentine occurs in coastal districts north from southern NSW and across Queensland. Populations of Scrub Turpentine typically occur in coastal regions but may also occur on escarpments in high rainfall areas. Habitat includes littoral forest, warm temperate and subtropical rainforest and wet sclerophyll forest, usually on volcanic and sedimentary soils. The species is highly susceptible to infection by Myrtle Rust. Scrub Turpentine records are patchy but widespread in the locality of the proposal site.	Moderate
Syzygium paniculatum	Magenta Lilly Pilly	E	V	1	3077, 3078.	The Magenta Lilly Pilly occurs patchily along a 400 kilometre stretch of coastal NSW. It is a rainforest tree, with bright pink edible fruit that is dispersed by flying foxes and rainforest birds. One population grows in Booderee National Park at Jervis Bay.	Moderate

Kingdom / Class / Order / scientific name	Common Name	NSW status	Cwth status	Records <10 km	PCT associations (ID)	Habitat description	Likelihood of occurrence
Asparagales							
Orchidaceae (orchids)							
^^*Calochilus pulchellus*	Pretty Beard Orchid	E	E	1	-	The Pretty Beard Orchid is restricted to three areas in southeastern NSW and northeastern Victoria. The species has a stronghold in the Shoalhaven district, with six subpopulations over a range of approximately 60 km, including Cambewarra Nature Reserve. The species occurs in wet heathy habitats, swamps and woodland with deep leaf litter. The species depends upon symbiotic interactions with mycorrhizal fungi.	Low
^^*Cryptostylis hunteriana*	Leafless Tongue Orchid	V	V	4	3191, 3654.	The Leafless Tongue Orchid has as broad range across eastern Australia, with a stronghold between Batemans Bay and Nowra. The orchid does not appear to have well defined habitat preferences but is known to occur in heathlands, heathy woodlands, sedgelands, *Xanthorrheoa* 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.	Low
^^*Genoplesium baueri*	Bauer's Midge Orchid	E	E	12	3654.	Bauer's Middle Orchid is distributed between Ulladulla and Port Stephens in NSW. Habitat includes dry sclerophyll forest, heath, and moss gardens over sandstone.	Low
^^*Pterostylis pulchella*	Waterfall Greenhood	V	V	1	3191.	The Waterfall Greenhood is only known to occur at Fitzroy Falls, Belmore Falls, upper Bundanoon Creek (Meryla) and Minnamurra Falls, where it grows on cliff faces close to waterfalls and creek banks and mossy rocks alongside running water.	Low
^^*Pterostylis ventricosa*		CE		1	-	*Pterostylis ventricosa* is known from four populations at St Georges Basin and Sussex Inlet, south of Nowra on the NSW south coast. Habitat includes open areas within tall eucalypt forest and a dense heathy understorey.	Low
Sapindales							
Zieria baeuerlenii	Bomaderry Zieria	E	E	101	3654.	Bomaderry Zieria has an extremely localized distribution and is only known to occur in between Bomaderry and Nowra, NSW. Bomaderry Zieria occurs in eucalypt open	Moderate

Kingdom / Class / Order / scientific name	Common Name	NSW status	Cwth status	Records <10 km	PCT associations (ID)	Habitat description	Likelihood of occurrence
						forest and sclerophyll woodlands with shrubby understory and closed scrub. Plants occur on well drained sandy soils and amongst sandstone outcrops.	
Zieria tuberculata	Warty Zieria	V	V	5	3078, 3190.	Warty Zieria grows in the Mt Dromedary and Tilba Tilba area of NSW. A population at Cambewarra Mountain is now referred to as a separate species. Habitat includes shrublands fringed by temperate rainforest or eucalypt open forest. The species occasionally extends into the eucalypt forest understorey. Several plants have been recorded on Cambewarra Mountain.	Moderate
Solanales (nightshades)							
Solanum celatum		E	-	15	3077, 3078, 3191, 3268, 3270.	*Solanum celatum* is known only from Wollongong to just south of Nowra, and west to Bungonia. Habitat includes hills and slopes in eucalypt woodland. The species is vulnerable to habitat degradation by lantana. Several records are located around Cambewarra, including at SCC's reservoir site on Reservoir Lane, about 500 m south of the site.	High

Tests of significance

Tests of significance were undertaken for threatened and migratory species and ecological communities, that were assessed as having a medium or high likelihood of occurrence in the proposal site. Tests were undertaken in accordance with the tests of significance under:

– Section 7.3 of the *Biodiversity Conservation Act 2016* (the '5-part test')

– The EPBC Act *Significant Impact Guidelines 1.1* (DoE, 2013) for matters of national environmental significance.

Section 7.3 of the *Biodiversity Conservation Act 2016* states the 5-part test as follows:

> *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:*
>
> *(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,*
>
> *(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,*
>
> *(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,*
>
> *(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),*
>
> *(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.*

For the purpose of undertaking significant impact assessment, species were grouped together based on taxonomic relationships and similarities in behaviour and habitat requirements. The following significant impact assessments were undertaken:

– Table 2 5-part test for Biodiversity Conservation Act 2016 protected matters

- Illawarra Subtropical Rainforest in the Sydney Basin Bioregion

Bats

– Chiroptera

Marsupials

- Dasyuromorphia
- Diprotodontia
- Peramelemorphia

Aerial / predatory birds:

- Accipitriformes
- Strigiformes
- Apodiformes

Woodland birds / foragers:

- Passeriformes
- Psittaciformes

- Scrub Turpentine

Sapindales

- Bomaderry Zieria
- Warty Zieria

*Solanum celatum*Woodland birds / foragers:

- Table 3 EPBC Significant Impact Assessment – Subtropical Rainforest
- Table 4 EPBC Significant Impact Assessment – Animals
- Table 5 EPBC Significant Impact Assessment – White-throated Needletail
- Table 6 EPBC Significant Impact Assessment – Plants

Table 2 5-part test for Biodiversity Conservation Act 2016 protected matters

TEC/ Species grouping	a	b	c	d	e	Likelihood of significant impact
Threatened ecological communities						
Illawarra Subtropical Rainforest in the Sydney Basin Bioregion	NA	Four non-diagnostic trees would be removed from the edge of moist forest (potential Subtropical Rainforest), in addition to removal of the dam wall and other construction activities on the edge of moist forest. While these works would not directly modify and/or result in a reduction of the extent of the Subtropical Rainforest ecological community, they may do so indirectly through increased vulnerability to edge effects. Moist forest in the proposal site, while considered to be the Subtropical Rainforest ecological community through application of the precautionary principal, for the	Subtropical Rainforest is closely associated with topographically sheltered sites on fertile soils with good water-holding capacity. Therefore, the ecological community, if present, may be sensitive to changes in abiotic habitat associated with the proposed activity. Section 4 of the *Conservation Advice (incorporating listing advice) for Illawarra-Shoalhaven subtropical rainforest of the Sydney Basin Bioregion* (Subtropical Rainforest Conservation Advice) (DDE, 2019) identifies that altered hydrology is a key threat to the Subtropical Rainforest ecological community. The proposed activity would involve modification of the hydrological cycle at the proposal site, including decreased water saturation of soils adjacent to the current reservoir. The Subtropical Rainforest	The proposed activity is located at least 300 m upstream from Good Dog Creek, the nearest area of outstanding biodiversity value (AOBV). Therefore, there would be no direct impacts on AOBV. Minor downstream impacts on AOBV may be possible during construction, if inappropriately managed, including impacts pertaining to sedimentation and contamination. However, with the implementation of management measures, construction impacts on downstream AOBV are not anticipated to be significant. Following completion of the proposed activity, restoration of natural hydrological and nutrient cycles are anticipated to	Potential key threatening processes (KTPs) associated with the proposed activity could include: – Clearing of native vegetation – Invasion and establishment of exotic vines and scramblers – Introduction and establishment of Exotic Rust Fungi of the order Puccinaiales pathogenic on plants of the family Myrtaceaea. The proposed activity would involve the removal of several native trees which are common and not diagnostic to classification as part of the Subtropical Rainforest ecological	Low

TEC/ Species grouping	a	b	c	d	e	Likelihood of significant impact
		purposes of this assessment, is heavily infested with lantana and demonstrates limited structural complexity and diversity. Therefore, the proposed activity is unlikely to significantly modify the composition of the ecological community further, and following rehabilitation of the site, is unlikely to cause a reduction in the extent of the ecological community.	ecological community is associated with sheltered gullies, rather than open water bodies. As the tributaries in the proposal site would be retained, modifications to hydrology at the proposal site are not expected to impact negatively upon patches of moist forest (potential Subtropical Rainforest ecological community). Rather, a reduction in edge effects would be expected through the removal of Cambewarra Dam reservoir, which currently exposes areas of moist forest to edge effects. Section 5.1.2 of the Subtropical Rainforest Conservation Advice details that the community is threatened by edge effects, associated with: – Grazing (including trampling and destruction of vegetation and seedlings). – Light intrusion (including increased lateral solar exposure through removal of protective/buffering trees) – Wind (including increased storm damage and enhanced vulnerability to further light intrusion and wind due to broken trees)	benefit downstream AOBV.	community. These trees would be replaced with new plantings during rehabilitation of the site. Therefore, impacts associated with clearing of native vegetation is considered negligible. While it is possible for weeds and pathogens to be introduced and spread across the proposal site, soil infill and organic materials are not required to be imported to site. Therefore, there would be limited potential for introduction of weeds and pathogens to the site. Vehicles would be washed down prior to accessing the site to prevent the potential for spread of weeds and pathogens to the site.	

TEC/ Species grouping	a	b	c	d	e	Likelihood of significant impact
			– Weed invasion (including smothering of ground vegetation and inhibition of seedling establishment by dense weeds such as lantana) Section 3.3.1 of the Subtropical Rainforest Conservation Advice recommends maintaining a minimum 100 m buffer around the edge of Subtropical Rainforest patches to aid in buffering against edge effects. The proposed activity would involve the removal of four (non-diagnostic) trees and ground disturbance from the edge of moist forest (potential Subtropical Rainforest) in the proposal site and would therefore compromise the integrity of the moist forest community. This would be through the increased potential for wind and light penetration, and also through potential weed infiltration if not managed appropriately. Wind and light incursion would be greatest immediately after the removal of trees and the dam wall. However, following establishment of vegetation on the reclaimed reservoir site, vulnerability of the moist forest to wind and light incursion would be reduced. This would be through the introduction of wind barriers and buffering			

TEC/ Species grouping	a	b	c	d	e	Likelihood of significant impact
			canopy vegetation on what is currently an exposed edge on the perimeter of the reservoir. While there would be substantial changes to the abiotic environment surrounding the edges of moist forest in the proposal site, the proposed activity is unlikely to significantly impact patches of potential Subtropical Rainforest, and edge impacts would be temporary, during the establishment of buffering vegetation.			
Threatened species						
Mammals						
Bats – Chiroptera	Bats require suitable caves, hollows or similar structures throughout their whole life cycle, including for roosting, hibernation and rearing of offspring. Moist forest at the proposal site was historically cleared so comprises relatively young growth forest with limited availability of mature trees which may contain hollows. The proposal site does not contain any caves or other features that would comprise important habitat for the lifecycle of chiropterans.	NA	Most bats which may occur in the proposal site forage for insects or fruits amongst or above the canopy of forest communities. As the proposal would involve minor vegetation removal, reduction in foraging opportunities for these species would be negligible. However, some species, such as the Southern Myotis may forage intensely over waterbodies and may therefore be impacted by the reclamation of Cambewarra Dam reservoir. While this would result in reduced foraging opportunities, the proposal site is unlikely to be an important foraging site, particularly in consideration of the abundance of nearby waterways and waterbodies.	As above.	The proposed activity would contribute negligibly to the clearing of native vegetation KTP but would result in an increase in the extent of native vegetation following reclamation and rehabilitation of the site. Alteration to the natural flow regimes of rivers and streams is also a KTP. The proposed activity would return a natural flow regime to the proposal site and downstream receivers so would contribute positively to this KTP.	Low

TEC/ Species grouping	a	b	c	d	e	Likelihood of significant impact
	Construction works would only take place during the day, so would not disturb the activity of bats, which are nocturnal.		There were no roosting features, including caves or hollow-bearing trees that were observed during the site inspection that would be impacted by the proposed activity.		Invasion of exotic plants, including exotic perennial grasses and lantana, are also KTPs which could be exacerbated during the proposed activity. However, the potential for the introduction and spread of exotic vegetation would be mitigated and managed, and site rehabilitation would include planting with native species.	
Marsupials – Dasyuromorphia – Diprotodontia – Peramelemorphia	Marsupials require suitable caves, hollows or large woody debris for shelter and rearing offspring. Moist forest at the proposal site was historically cleared so comprises relatively young growth forest with limited availability of mature trees or large woody debris. As a result, the proposal site does not contain any features that would comprise important refuge habitat for the lifecycle of marsupials. Construction works would only take place during the day, so would not disturb the	NA	Marsupials which may occur in the proposal site generally forage amongst forest, which offers suitable cover and foraging opportunities. The proposed activity would only involve the removal of a few trees from the edge of the moist forest community and several scattered non-habitat trees from the north-eastern corner of the proposal site. While these trees could potentially provide future habitat opportunities for marsupials, they are unlikely to provide high quality refuge habitat due to their size and position on the edges of forest communities. There were no refuge habitat features, including caves or hollow-bearing trees that were observed during the site	As above.	As above.	Low

TEC/ Species grouping	a	b	c	d	e	Likelihood of significant impact
	nocturnal activity of marsupials.		inspection that would be impacted by the proposed activity. The proposed activity is unlikely to significantly modify the quality or extent of foraging or refuge habitat available to marsupials.			
Birds						
Aerial / predatory birds: – Accipitriformes – Strigiformes – Apodiformes	All birds require nests for the laying of eggs and rearing of offspring. Preferences for nest locations differ between species, but in general includes a preference for mature trees, which may offer hollows (in the case of owls) or a position emerging over the canopy (in the case of hawks and relatives). Forest at the proposal site was historically cleared so comprises relatively young growth forest with limited availability of suitable nesting habitat. There were no nest-bearing or hollow-bearing trees that were observed during the site inspection that would be impacted by the proposed activity. Given the lack of suitable habitat in the	NA	The proposed activity would involve a negligible reduction in the extent of forest, which would not substantially reduce foraging opportunities for aerial birds and predators, particularly in the context of the extent of high quality habitat which surrounds the proposal site. While the reservoir may provide occasional foraging habitat for some species of predatory birds, the reservoir would provide unimportant habitat which is negligible in comparison to nearby foraging opportunities provided by Shoalhaven River and larger nearby rivers and wetlands. Therefore, the proposed activity is unlikely to substantially modify the composition or extent of habitat available to threatened aerial and predatory birds.	As above.	As above.	Low

TEC/ Species grouping	a	b	c	d	e	Likelihood of significant impact
	proposal site, the proposed activity is unlikely to have an adverse effect on the life cycle of aerial and predatory birds.					
Woodland birds / foragers: – Passeriformes – Psittaciformes	All birds require nests for the laying of eggs and rearing of offspring. Preferences for nest locations differ between species, but in general require locations that are protected from exposure to weather and predation. Trees being removed as part of the proposed activity are relatively exposed, due to their position on the edge of areas of closed forest. Therefore, the proposed activity is unlikely to substantially reduce the availability or quality of nesting habitat available to woodland birds. The proposed activity may cause temporary disturbance due to noise and vibration impacts which may interfere with breeding or foraging behaviour, potentially resulting in abandonment of occupied nests.	NA	The proposed activity would involve a negligible reduction in the extent of forest, which would not substantially reduce foraging opportunities for woodland birds, particularly in the context of the extent of high quality habitat which surrounds the proposal site. Therefore, the proposed activity is unlikely to substantially modify the composition or extent of habitat available to threatened woodland birds.	As above.	As above.	Low

TEC/ Species grouping	a	b	c	d	e	Likelihood of significant impact
	However, there were no nest-bearing or hollow-bearing trees that were observed during the site inspection that would be impacted by the proposed activity.					
Plants						
Scrub Turpentine	Scrub Turpentine is not known to be present at the proposal site so would not be directly impacted by the proposed activity. The proposed activity has the potential to introduce weeds and pathogens, including myrtle rust, which could potentially spread and inhibit the establishment of seedlings and survival of saplings and established trees. However, these impacts would be avoided through mitigation and management measures. The proposed activity is therefore unlikely to have any direct or indirect impact upon the lifecycle of Scrub Turpentine, such that it would put a viable	NA	Scrub Turpentine is not known to be present at the proposal site so is unlikely to be directly or indirectly impacted by the proposed activity. While there would be some vegetation removal from the edges of moist forest, this is unlikely to modify the habitat to an extent that would impact on the potential for Scrub Turpentine to become established at the proposal site. Furthermore, restoration of natural hydrological and nutrient cycles is expected to improve habitat at and downstream of the proposal site.	As above.	As above.	Low

TEC/ Species grouping	a	b	c	d	e	Likelihood of significant impact
	population at risk of extinction.					
Sapindales – Bomaderry Zieria – Warty Zieria	Zieria is not known to be present at the proposal site so is unlikely to be directly impacted by the proposed activity.	NA	Zieria is not known to be present at the proposal site so is unlikely to be directly or indirectly impacted by the proposed activity. While there would be some vegetation removal from the edges of moist forest, this is unlikely to modify habitat to an extent that would impact on the potential for Zieria to become established at the proposal site.	As above.	As above.	Low
Solanum celatum	*Solanum celatum* is not known to be present at the proposal site so is unlikely to be directly impacted by the proposed activity. *Solanum celatum* is highly vulnerable to lantana which can smother and inhibit growth and reproduction. As lantana is already present in the proposal site, incidental spreading and facilitation of lantana could disturb existing populations and prevent further establishment. However, management measures and	NA	*Solanum celatum* is not known to be present at the proposal site so is unlikely to be directly or indirectly impacted by the proposed activity. However, infestation of weeds has the potential to prevent further establishment of the species (refer to column A). As the proposed activity would involve only small scale vegetation clearing, followed by site reclamation and rehabilitation, habitat available to the species is unlikely to be reduced, fragmented or modified, such that it would impact the long-term survival of the species in the locality.	As above.	As above.	Low

TEC/ Species grouping	a	b	c	d	e	Likelihood of significant impact
	mitigations to manage weeds would be incorporated to prevent the facilitation and spread of weeds.					

Table 3 EPBC Significant Impact Assessment – Subtropical Rainforest

Factor	Assessment
An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:	
Reduce the extent of an ecological community	Four non-diagnostic trees would be removed from the edge of moist forest (potential Subtropical Rainforest), in addition to removal of the dam wall and other construction activities on the edge of the moist forest community. While these works would not directly reduce the extent of the Subtropical Rainforest ecological community, they may do so indirectly through increased vulnerability of potential Subtropical Rainforest to edge effects.
Fragment or increase fragmentation of an ecological community	The proposed activity would involve minor vegetation removal from the edge of moist forest (potential Subtropical Rainforest). While this would not directly fragment the existing community, ongoing degradation by edge effects could potentially result in fragmentation (refer to below cell). However, rehabilitation of the proposal site could also result in reduced edge effects and potential distribution expansion of moist forest communities.
Modify or destroy abiotic factors necessary for an ecological community's survival, including groundwater levels, or substantial alteration of surface water drainage patters	Subtropical Rainforest is closely associated with topographically sheltered sites on fertile soils with good water-holding capacity. Therefore, the ecological community, if present, may be sensitive to changes in abiotic habitat associated with the proposed activity. Section 4 of the *Conservation Advice (incorporating listing advice) for Illawarra-Shoalhaven subtropical rainforest of the Sydney Basin Bioregion* (Subtropical Rainforest Conservation Advice) (DDE, 2019) identifies that altered hydrology is a key threat to the Subtropical Rainforest ecological community. The proposed activity would involve modification of the hydrological cycle at the proposal site, including decreased water saturation of soils adjacent to the current reservoir. The Subtropical Rainforest ecological community is associated with sheltered gullies, rather than open water bodies. As the tributaries in the proposal site would be retained, modifications to hydrology at the proposal site are not expected to impact negatively upon patches of moist forest (potential Subtropical Rainforest ecological community). Rather, a reduction in edge effects would be expected through the removal of Cambewarra Dam reservoir, which currently exposes areas of moist forest to edge effects. Section 5.1.2 of the Subtropical Rainforest Conservation Advice details that the community is threatened by edge effects, associated with: – Grazing (including trampling and destruction of vegetation and seedlings) – Light intrusion (including increased lateral solar exposure through removal of protective/buffering trees) – Wind (including increased storm damage and enhanced vulnerability to further light intrusion and wind due to broken trees) – Weed invasion (including smothering of ground vegetation and inhibition of seedling establishment by dense weeds such as lantana). Section 3.3.1 of the Subtropical Rainforest Conservation Advice recommends maintaining a minimum 100 m buffer around the edge of Subtropical Rainforest patches to aid in buffering against edge effects. The proposed activity would involve the removal of four (non-diagnostic) trees and ground disturbance from the edge of moist forest (potential Subtropical Rainforest) in the proposal site and would therefore compromise the integrity of the moist forest community. This would be through increased potential for wind and light penetration, and through potential weed infiltration, if not managed appropriately. Wind and light incursion would be greatest immediately after the removal of trees and the dam wall. However, following establishment of vegetation on the reclaimed reservoir site, vulnerability of the moist forest to wind and light incursion would be reduced. This would be through the introduction of wind barriers and buffering canopy vegetation on what is currently an exposed edge on the perimeter of the reservoir.

Factor	Assessment
	While there would be substantial changes to the abiotic environment surrounding the edges of moist forest in the proposal site, the proposed activity is unlikely to significantly impact patches of potential Subtropical Rainforest, and edge impacts would be temporary, during the establishment of buffering vegetation.
Adversely affect habitat critical to the survival of an ecological community	Moist forest in the proposal site has not been confirmed as the Subtropical Rainforest ecological community, but in application of the precautionary principle. has been considered as such for the purpose of this assessment. If moist forest in the proposal site is diagnostic of the Subtropical Rainforest ecological community, it would be considered disturbed and low quality, due to the extent of lantana infestations across the community. In contrast, several other patches of high quality Subtropical Rainforest are present in surrounding nature reserves and national parks. Therefore, the proposal site is unlikely to possess habitat critical to the survival of Subtropical Rainforest ecological community.
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	Moist forest in the proposal site, while considered to be the Subtropical Rainforest ecological community through application of the precautionary principal, for the purposes of this assessment, is heavily infested with lantana and demonstrates limited structural complexity and diversity. Therefore, while increased edge effects may negatively impact upon moist forest, the proposed activity is unlikely to significantly modify the composition of the ecological community further, and following rehabilitation of the site, is unlikely to cause a reduction in the extent of the ecological community.
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: – assisting invasive species, that are harmful to the listed ecological community, to become established, or– causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community,	The proposed activity has the potential to introduce weeds and pathogens, including myrtle rust and lantana, which could potentially be spread and inhibit the establishment of seedlings and survival of saplings and mature plants. Occurrences of lantana and other sprawling weeds would smother groundcover vegetation and would prevent the establishment of seedlings and other groundcover vegetation. Occurrences of rust fungus could be detrimental to canopy trees, causing degradation or death, which would further reduce the canopy and vulnerability of the community to increased light and wind penetration. Together, these impacts could result in a significantly loss in localised biodiversity but could also be spread beyond the proposal site. These impacts would be avoided and managed through the implementation of mitigation and management measures.
Interfere with the recovery of an ecological community.	As per the above responses, the proposed activity is unlikely to significantly impact Subtropical Rainforest, or its habitats, and is therefore unlikely to interfere with the recovery of the ecological community.
Conclusion	The proposed activity would not have a significant impact on any threatened ecological communities.

Table 4 EPBC Significant Impact Assessment – Animals

Factor	Assessment
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:	
Lead to a long-term decrease in the size of a population	The proposed activity would not involve any direct impacts to a threatened animal or any areas of important habitat. The proposed activity is unlikely to introduce any threats that would threaten the integrity of a population of threatened animal. Therefore, the proposed activity is unlikely to lead to a long-term decrease in the size of a population of threatened animals.
Reduce the area of occupancy of the species	The proposed activity would involve minor vegetation removal from the edges of forest but would not reduce the area of occupancy of threatened animals. Following reclamation of Cambewarra Dam reservoir, rehabilitation of terrestrial vegetation may increase the availability of potential habitat and may therefore increase the area of occupancy of threatened animals.
Fragment an existing population into two or more populations	The proposed activity would involve minor vegetation removal from the edges of forest but would not fragment any areas of available habitat. Threatened animals occurring in the proposal site are expected to be mobile and only transient visitors which would not be fragmented or inhibited by the proposed activity.
Adversely affect habitat critical to the survival of a species	The proposal site is unlikely to provide quality habitat for threatened fauna due to weed incursion by lantana and historic land clearing which would have removed potential nesting, roosting and denning sites (e.g. hollow-bearing trees, large woody debris). The proposal site is relatively disturbed and fragmented, including being situated in a rural residential area. In contrast, extensive high quality habitat is available in the Budderoo Morton Illawarra-Shoalhaven Regional Biodiversity Corridor which captures several nearby nature reserves and national parks. Therefore, habitat available in the proposal site is likely to be unimportant, especially in the context of habitat available in the locality.
Disrupt the breeding cycle of a population	The proposed activity is unlikely to possess any areas of habitat that are important to the breeding cycle of threatened animals, such as hollow-bearing trees, large woody debris or caves. Therefore, there is unlikely to be any work involving a reduction in breeding habitat or works that would disturb offspring (such as removal of hollow-bearing trees). Threatened animals which may occur in the proposal site, are generally nocturnal. Construction would only take place during the day, so noise and vibration related impacts are unlikely to negatively impact upon breeding of threatened animals.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The proposed activity would involve a minor temporary reduction in available habitat through the removal of trees, which may provide some foraging opportunities. Due to the removal of trees from the edges of forest patches, these are unlikely to provide any refuge value and would only provide limited foraging value. Following construction, the site would be rehabilitated and may provide additional habitat opportunities for threatened animals.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	The proposed activity has the potential to introduce or spread existing weeds and pathogens, which could smother native habitat and inhibit the establishment and survival of native species. As a result, the availability or quality of habitat available for foraging animals could be reduced. However, the proposal site would only represent a very small extent of (low quality) habitat compared to the surrounding Budderoo Morton Illawarra-Shoalhaven Regional Biodiversity Corridor and associated national parks, so is unlikely to represent important or reliable habitat. Potential impacts associated with weed and pathogen establishment would be avoided through mitigation and management measures.
Introduce disease that may cause the species to decline, or	The proposed activity is unlikely to introduce diseases that would cause the decline of any animal populations.

Factor	Assessment
Interfere with the recovery of the species.	As per the above responses, the proposed activity is unlikely to significantly impact populations of threatened species, or their habitats, and is therefore unlikely to interfere with the recovery of the species.
Conclusion	The proposed activity would not have a significant impact on any threatened animal species.

Table 5 EPBC Significant Impact Assessment – White-throated Needletail

Factor	Assessment
An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:	
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	While the proposal site may provide occasional and transient habitat for the white-throated needletail, it is not considered important habitat. White-throated needletail are infrequently recorded in the locality and have not been recorded at the proposal site. The proposal site does not provided unique habitat, that is critical to any life-stage, or at the limit of the species range.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	The proposal site does not comprise important habitat.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	The proposal site does not support an ecologically significant proportion of the population of white-throated needletail. White-throated needletail are infrequently recorded in the locality and have not previously been recorded at the proposal site.
Conclusion	The proposed activity would not have a significant impact on the white-throated needletail.

Table 6 EPBC Significant Impact Assessment – Plants

Factor	Assessment
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:	
Lead to a long-term decrease in the size of a population	Scrub Turpentine, Bomaderry Zieria and Warty Zieria are not known to be present at the proposal site so are unlikely to be directly impacted by the proposed activity. The proposed activity is therefore unlikely to have any direct or indirect impact upon the lifecycle of Scrub Turpentine, such that it would put a viable population at risk of extinction. NA Scrub Turpentine is not known to be present at the proposal site so is unlikely to be directly or indirectly impacted by the proposed activity. While there would be some vegetation removal from the edges of moist forest, this is unlikely to modify the habitat to an extent that would impact on the potential for Scrub Turpentine to become established at the proposal site. Furthermore, restoration of natural hydrological and nutrient cycles is expected to improve habitat at and downstream of the proposal site.
Reduce the area of occupancy of the species	The proposal would not reduce the actual area of occupancy of any threatened plant species and is unlikely to modify available habitat to a degree that would reduce the area of potential occupancy for threatened plant species.
Fragment an existing population into two or more populations	The proposal site is not known to possess any species of threatened plants that could be fragmented by the proposed activity. The proposal site is in a partially fragmented environment surrounded by vast areas of undisturbed habitat. Vegetation disturbance required for the proposed activity would involve minor disturbance around the edges of moist forest but would not create fragmentation or barriers to the dispersal of threatened plant species.
Adversely affect habitat critical to the survival of a species	The proposal site is not known to possess any species of threatened plants or any habitat critical to the survival of a threatened plant species.
Disrupt the breeding cycle of a population	The proposed activity is unlikely to directly impact upon any threatened plants, or any processes which may facilitate the breeding cycle of threatened plants, whether in the proposal site or downstream.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The proposed activity would not involve modification of habitat to the extent that threatened plant species are likely to decline. Small scale tree removal and vegetation disturbance could potentially increase the vulnerability of moist forest communities to degradation by edge effects, therefore degrading possible habitat for threatened plant species. However, in the long-term reclamation of the Cambewarra Dam reservoir would likely reduce edge effects on native moist forest habitats and could potentially provide additional habitat that could be established by native plants. In summary, the proposed activity would not directly impact upon the availability or quality of habitat available to threatened plants but could potentially result in increased availability and quality of habitat. However, the provision of additional habitat would be dependent on the management and exclusion of invasive weeds and pathogens (see below).
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	The proposed activity has the potential to introduce weeds and pathogens, including myrtle rust and lantana, which could potentially be spread and inhibit the establishment of seedlings and survival of saplings and mature plants. However, these impacts would be avoided through mitigation and management measures.
Introduce disease that may cause the species to decline, or	As above.

Factor	Assessment
Interfere with the recovery of the species.	The proposal site is not known to comprise any threatened plants species. It is therefore unlikely that the proposed activity would interfere with the recovery of the species. However, facilitation of weed and pathogen dispersal and establishment could prevent ongoing recovery of threatened plant species.
Conclusion	The proposed activity would not have a significant impact on any threatened plant species.

References

Department of the Environment and Energy (2019). *Conservation Advice (incorporating listing advice) for the Illawarra-Shoalhaven subtropical rainforest of the Sydney Basin Bioregion*. Canberra: Department of the Environment and Energy. In effect under the EPBC Act from 05-Sep-2019 [online: **http://www.environment.gov.au/biodiversity/threatened/communities/pubs/148-conservation-advice.pdf**]

Appendix F

Lotsearch Aerial Imagery

Aerial Imagery 2018

Cambewarra Dam, Cambewarra, NSW 2540

Scale: 0 40 80 120 160 Meters	Data Source Aerial Imagery: © 2020 Google Inc, used with permission. Google and the Google logo are registered trademarks of Google Inc.	Coordinate System: GDA 1994 MGA Zone 56	Date: 03 November 2020

Aerial Imagery 2016

Cambewarra Dam, Cambewarra, NSW 2540

Aerial Imagery 2012

Cambewarra Dam, Cambewarra, NSW 2540

Data Source Aerial Imagery: © 2020 Google Inc, used with permission. Google and the Google logo are registered trademarks of Google Inc.

Coordinate System: GDA 1994 MGA Zone 56

Date: 03 November 2020

Aerial Imagery 2006

Cambewarra Dam, Cambewarra, NSW 2540

Aerial Imagery 1997

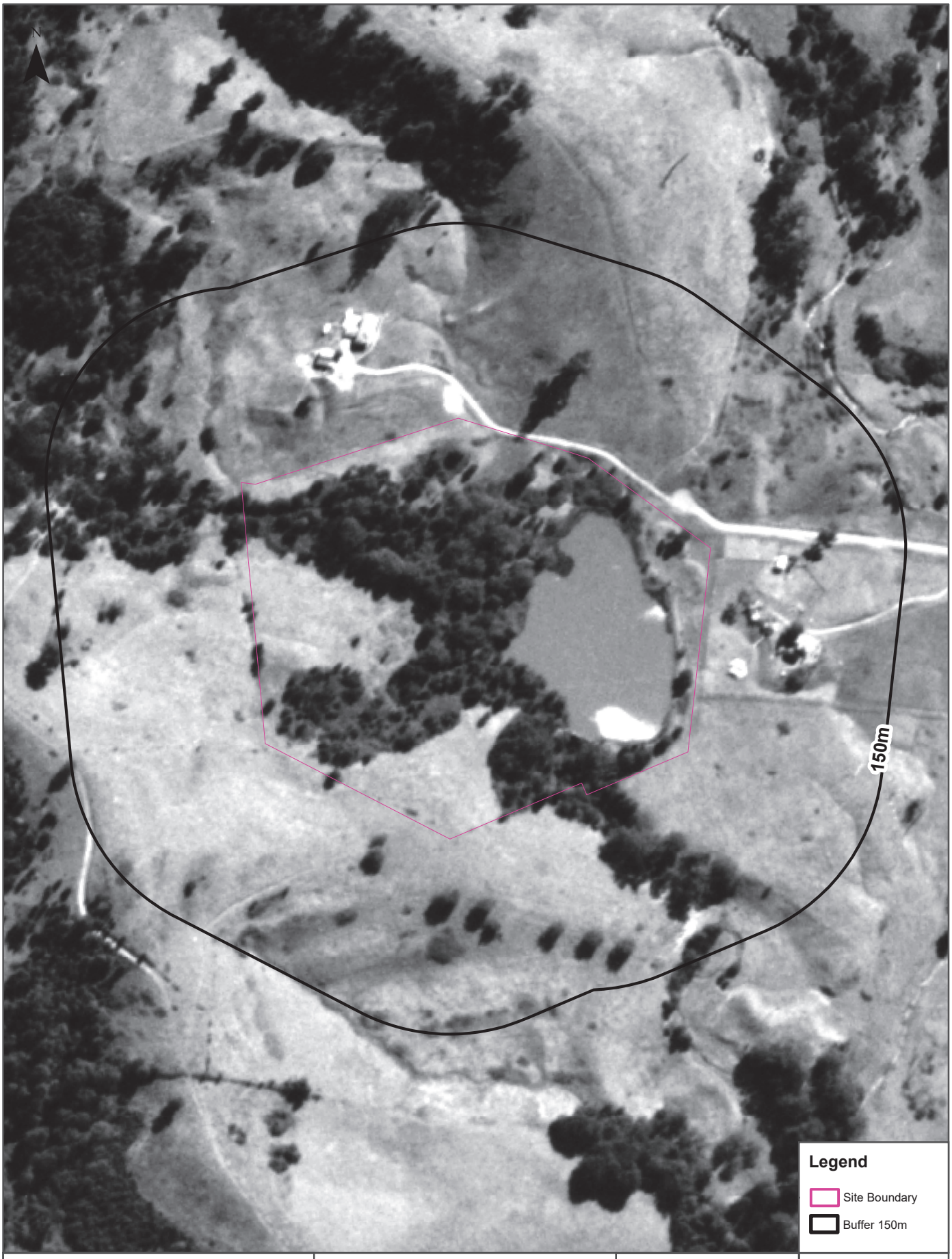
Cambewarra Dam, Cambewarra, NSW 2540

Aerial Imagery 1993

Cambewarra Dam, Cambewarra, NSW 2540

Aerial Imagery 1984

Cambewarra Dam, Cambewarra, NSW 2540

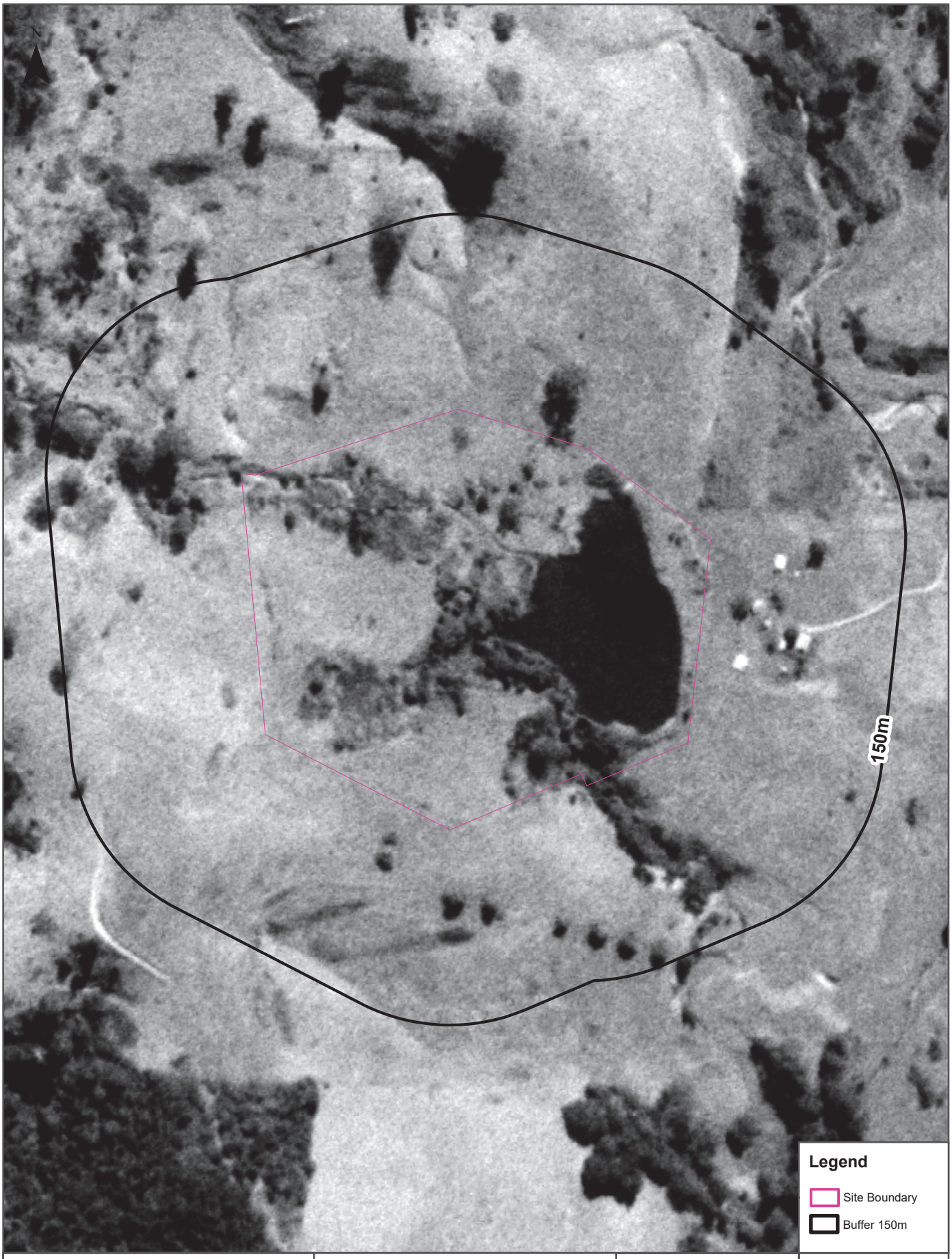


Aerial Imagery 1974

Cambewarra Dam, Cambewarra, NSW 2540

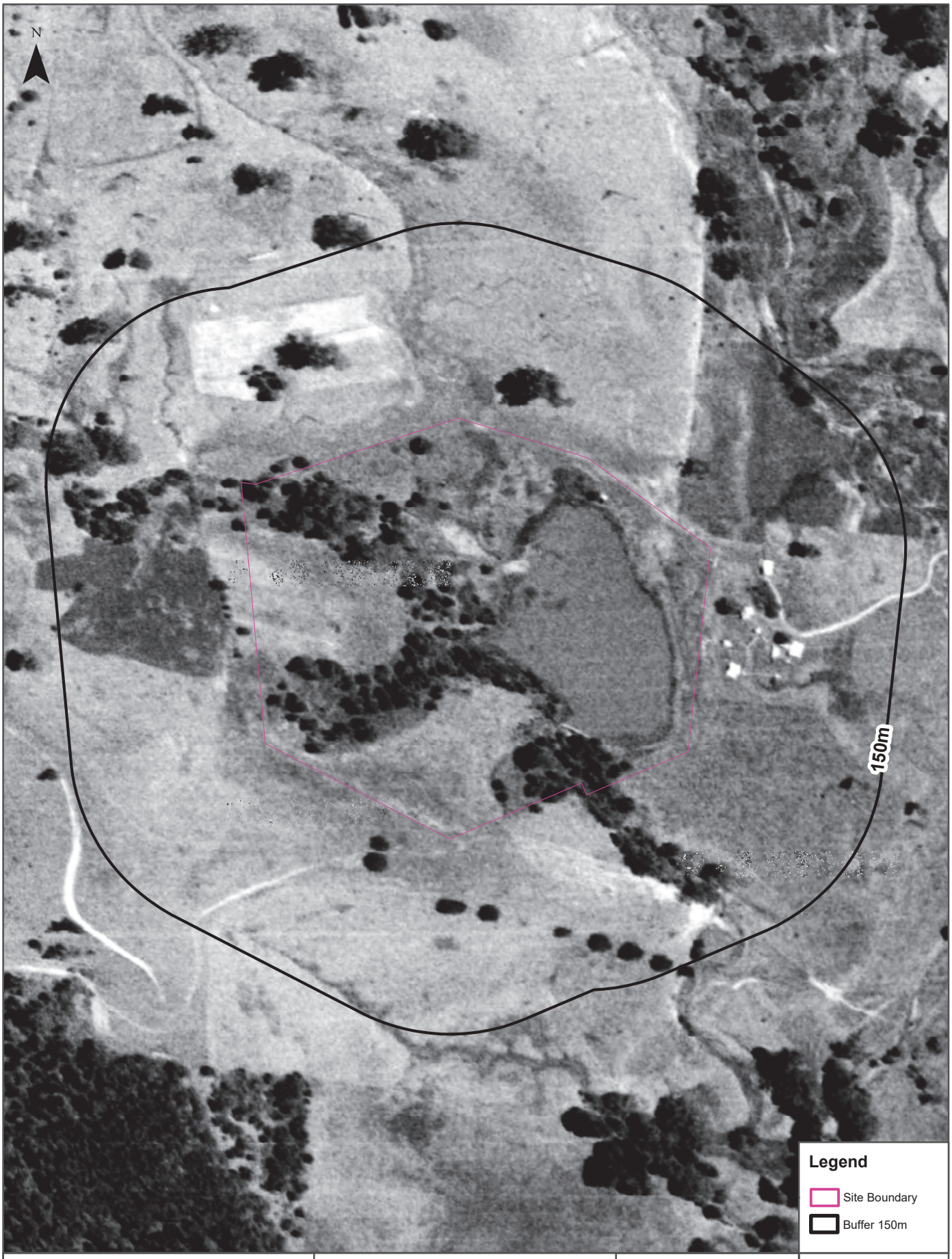
Aerial Imagery 1971

Cambewarra Dam, Cambewarra, NSW 2540



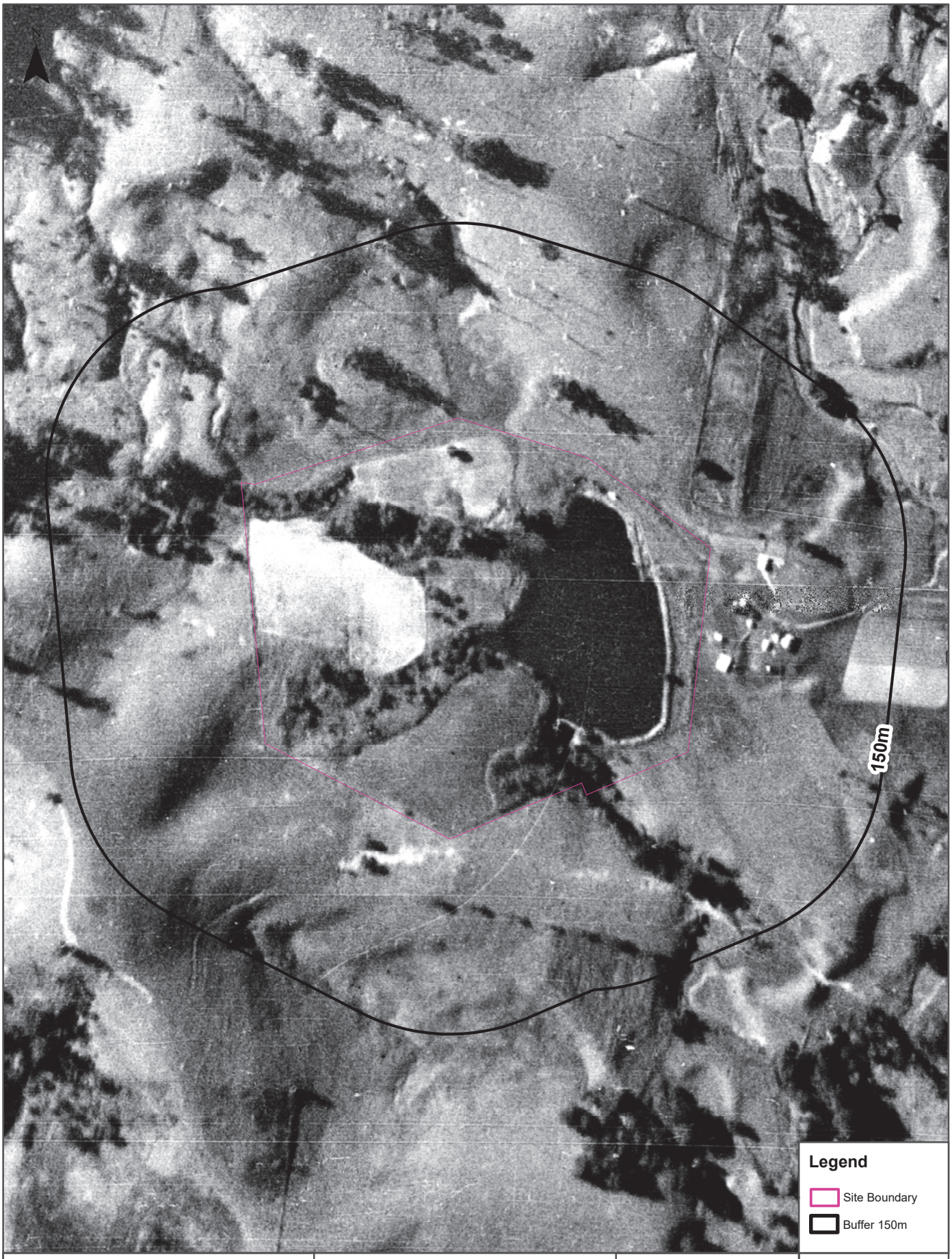
Aerial Imagery 1963

Cambewarra Dam, Cambewarra, NSW 2540



Aerial Imagery 1949

Cambewarra Dam, Cambewarra, NSW 2540



Appendix G

Aboriginal Heritage Information Management System

AHIMS Web Services (AWS)
Search Result

Your Ref/PO Number : Cambewarra Dam

Client Service ID : 864282

GHD

Date: 14 February 2024

7/16 Marcus Clarke Street
Canberra Australian Capital Territory 2601

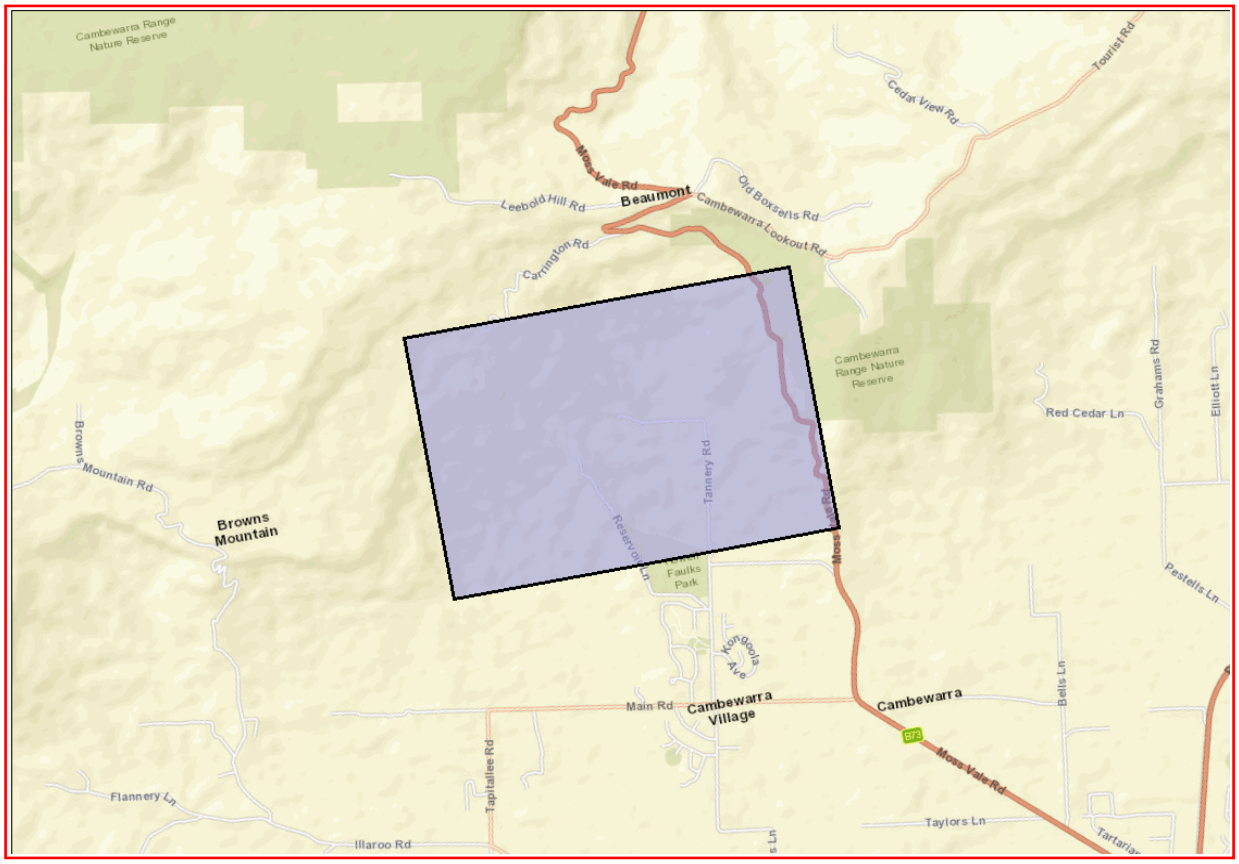
Attention: Adrian Plummer

Email: adrian.plummer@ghd.com

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lat, Long From : -34.8131, 150.5413 - Lat, Long To : -34.7955, 150.5722, conducted by Adrian Plummer on 14 February 2024.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of Heritage NSW AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

0	**Aboriginal sites are recorded in or near the above location.**
0	**Aboriginal places have been declared in or near the above location. ***

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (https://www.legislation.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Heritage NSW upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Heritage NSW and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date. Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

Level 6, 10 Valentine Ave, Parramatta 2150
Locked Bag 5020 Parramatta NSW 2124
Tel: (02) 9585 6345

ABN 34 945 244 274
Email: ahims@environment.nsw.gov.au
Web: www.heritage.nsw.gov.au

AHIMS Web Services (AWS)
Search Result

Your Ref/PO Number : Cambewarra Dam enlarged

Client Service ID : 864285

GHD

Date: 14 February 2024

7/16 Marcus Clarke Street
Canberra Australian Capital Territory 2601

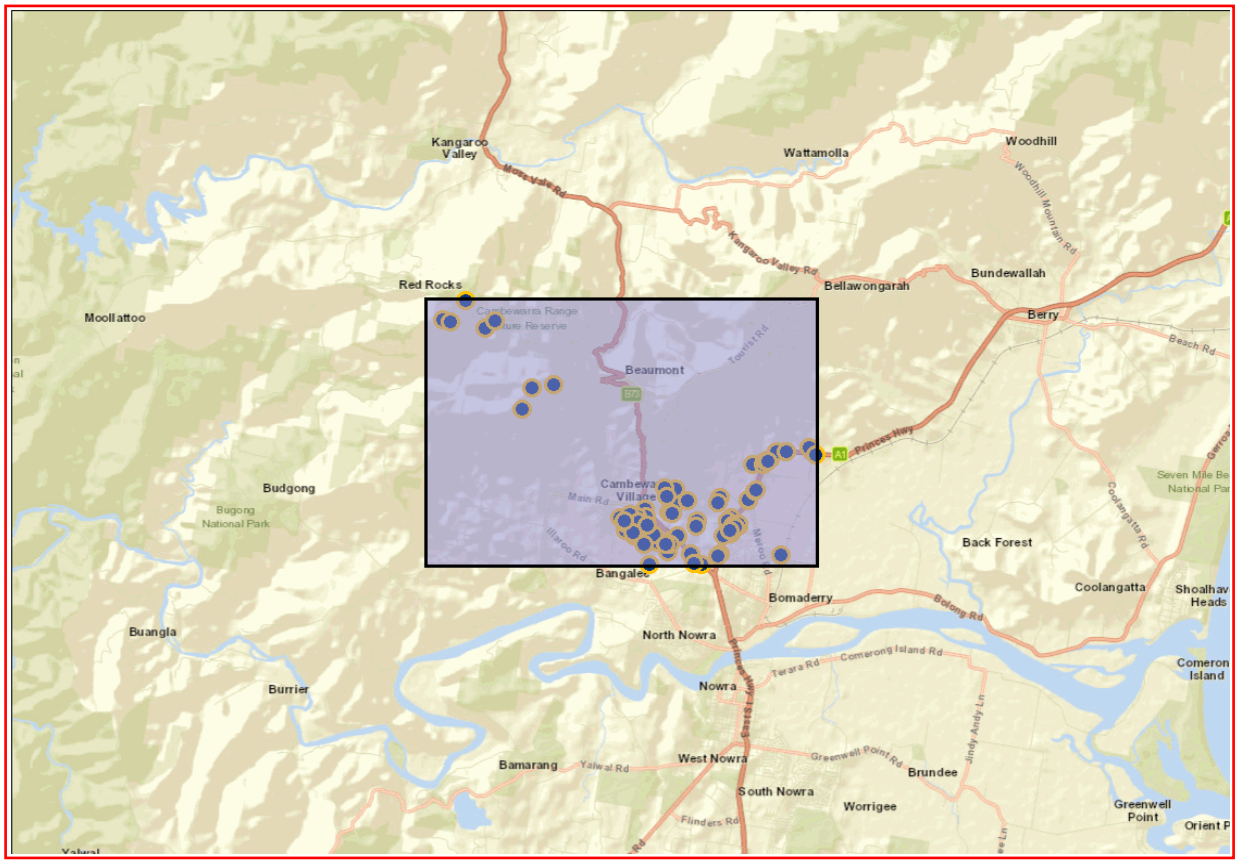
Attention: Adrian Plummer

Email: adrian.plummer@ghd.com

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lat, Long From : -34.84, 150.5029 - Lat, Long To : -34.7695, 150.6265, conducted by Adrian Plummer on 14 February 2024.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of Heritage NSW AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

83	**Aboriginal sites are recorded in or near the above location.**
0	**Aboriginal places have been declared in or near the above location. ***

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (https://www.legislation.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Heritage NSW upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Heritage NSW and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date. Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

Level 6, 10 Valentine Ave, Parramatta 2150
Locked Bag 5020 Parramatta NSW 2124
Tel: (02) 9585 6345

ABN 34 945 244 274
Email: ahims@environment.nsw.gov.au
Web: www.heritage.nsw.gov.au

Appendix H

Transport for NSW Construction noise assessment

Distanced Based Assessment (Construction Scenario)

Please pick from drop-down list in orange cells

Noise area category		R0
RBL or L_{A90} Background level (dB(A))	**Day**	30
	Evening	30
	Night	30
$L_{Aeq(15minute)}$ Noise Mangement Level (dB(A))	**Day**	40
	Day (OOHW)	35
	Evening	35
	Night	35
Scenario		Compound site establishment
Is there line of sight to receiver?		Yes

Steps for Screening Assessment:

1. Schedule noisy works to occur in standard hours where possible or before 11pm and implement Standard Measures.
2. Select the representative noise area category. The worksheet titled "Representative Noise Environ," provides a number of examples to help select the noise area category.
3. Select the scenario. If not found in drop-down list, refer to 'Source List' and select a representative scenario with similar plant combination.
4. Is there line of sight to receiver? Select the appropriate scenario from the drop down list .

Identify and implement standard mitigation measures where feasible and reasonable. Include any shielding implemented as part of the standard mitigation measures by changing the selection in the 'Is there line of sight to receiver' drop-down list. Solid barrier can be in the form of road cutting, solid construction hoarding, acoustic curtain, timber lapped and capped fence, shipping container, site office, etc. Please note that vegetation and trees are not considered to be a form of solid barrier and any gaps would compromise the acoustic integrity of the solid barrier.

6. Determine if there are any receivers (both residential and non-residential receivers) within the affected distance for each relevant time period . Consider background noise measurements to check assumption in Step #2 if:

(a) there are many affected receivers and the impact duration at any one receiver is more than 3 weeks; or

(b) there are a few affected receivers and the impact duration at any one receiver is more than 6 weeks.

Note that consideration need to be given to the construction staging plan when determining impact duration.

7. Identify if there are any receivers within the additional mitigation measures distances and identify feasible and reasonable measures at each receiver
8. Where night works are involved, identify sleep disturbance affected distance.
9. Document the outcomes of these steps.

(Note that suitable noise management levels for other noise-sensitive businesses not identified in the Construction Noise Estimator should be investigated on a project-by-project basis. Please contact a

Abbreviation	Measure
N	Notification
SN	Specific notifications
PC	Phone calls
IB	Individual briefings
RO	Respite offer
R1	Respite period 1
R2	Respite period 2
DR	Duration respite
AA	Alternative accommodation
V	Verification

Note that spot check verification of noise levels and individual briefings are not required for projects with less than 3 weeks impact duration

Residential receiver

			$L_{Aeq(15minute)}$ noise level above background (L_{A90})											$L_{Aeq(15minute)}$ 75 dB(A) or greater (Highly affected)			Sleep disutrbance L_{Amax} 65 dB(A)
			5 to 10 dB(A)			10 to 20 dB(A)			20 to 30 dB(A)			> 30 dB(A)					
			Noticeable			Clearly audible			Moderately intrusive			Highly intrusive					
		Affected distance (m)	Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Affected distance (m)
Undeveloped green fields, rural areas with isolated dwellings	Day	755							N	360	50	N	170	60	N, PC, RO	35	75	
	Day (OOHW)	1085				N, R1, DR	755	40	N, R1, DR	360	50	N, R1, DR, PC, SN	170	60	N, PC, RO	35	75	
	Evening	1085				N, R1, DR	755	40	N, R1, DR	360	50	N, R1, DR, PC, SN	170	60	N, PC, RO	35	75	
	Night	1085	N	1085	35	N, R2, DR	755	40	N, PC, SN, R2, DR	360	50	AA, N, PC, SN, R2, DR	170	60	N, PC, RO	35	75	115
	Highly Affected	35													N, PC, RO	35	75	
Developed settlements (urban and suburban)	Day	1010							N	460	50	N	200	60	N, PC, RO	40	75	
	Day (OOHW)	1455				N, R1, DR	1010	40	N, R1, DR	460	50	N, R1, DR, PC, SN	200	60	N, PC, RO	35	75	
	Evening	1455				N, R1, DR	1010	40	N, R1, DR	460	50	N, R1, DR, PC, SN	200	60	N, PC, RO	40	75	
	Night	1455	N	1455	35	N, R2, DR	1010	40	N, PC, SN, R2, DR	460	50	AA, N, PC, SN, R2, DR	200	60	N, PC, RO	40	75	130
	Highly Affected	40													N, PC, RO	40	75	
Propagation across a valley / over water	Day	1415							N	630	50	N	250	60	N, PC, RO	40	75	
	Day (OOHW)	2005				N, R1, DR	1415	40	N, R1, DR	630	50	N, R1, DR, PC, SN	250	60	N, PC, RO	40	75	
	Evening	2005				N, R1, DR	1415	40	N, R1, DR	630	50	N, R1, DR, PC, SN	250	60	N, PC, RO	40	75	
	Night	2005	N	2005	35	N, R2, DR	1415	40	N, PC, SN, R2, DR	630	50	AA, N, PC, SN, R2, DR	250	60	N, PC, RO	40	75	155
	Highly Affected	40													N, PC, RO	40	75	

Non-residential receiver
Undeveloped green fields, rural areas with isolated dwellings

				$L_{Aeq(15minute)}$ noise level above NML						LAeq(15minute) 75 dB(A) or greater (Highly affected)		
				<10 dB(A)			10 to 20 dB(A)					
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Classroom at schools and other educational institutions	Day	55	250				N	115	65	N, PC, RO	35	75
Hospital wards and operating theatres	Day	65	115							N, PC, RO	35	75
Place of worship	Day	55	250				N	115	65	N, PC, RO	35	75
Active recreation	Day	65	115							N, PC, RO	35	75
Passive recreation	Day	60	170				N	65	70	N, PC, RO	35	75
Industrial premise	Day	75	35							N, PC, RO	35	75
Offices, retail outlets	Day	70	65							N, PC, RO	35	75

				$L_{Aeq(15minute)}$ noise level above NML											
				< 5 dB(A)			5 to 15 dB(A)			15 to 25 dB(A)			> 25 dB(A)		
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Hospital wards and operating theatres	Evening	65	115				N, R1, DR	65	70	N, R1, DR	20	80	N, R1, DR, PC, SN	6	90
	Night	65	115	N	115	65	N, R2, NR	65	70	N, PC, SN, R2, DR	20	80	AA, N, PC, SN, R2, DR	6	90
Place of worship	Evening	55	250				N, R1, DR	170	60	N, R1, DR	65	70	N, R1, DR, PC, SN	20	80
	Night	55	250	N	250	55	N, R2, NR	170	60	N, PC, SN, R2, DR	65	70	AA, N, PC, SN, R2, DR	20	80
Active recreation	Evening	65	115				N, R1, DR	65	70	N, R1, DR	20	80	N, R1, DR, PC, SN	6	90
Passive recreation	Evening	60	170				N, R1, DR	115	65	N, R1, DR	35	75	N, R1, DR, PC, SN	11	85
Industrial premise	Evening	75	35				N, R1, DR	20	80	N, R1, DR	6	90	N, R1, DR, PC, SN	2	100
	Night	75	35	N	35	75	N, R2, NR	20	80	N, PC, SN, R2, DR	6	90	AA, N, PC, SN, R2, DR	2	100
Offices, retail outlets	Evening	70	65				N, R1, DR	35	75	N, R1, DR	11	85	N, R1, DR, PC, SN	4	95
	Night	70	65	N	65	70	N, R2, NR	35	75	N, PC, SN, R2, DR	11	85	AA, N, PC, SN, R2, DR	4	95

Non-residential receiver
Developed settlements (urban and suburban)

				$L_{Aeq(15minute)}$ noise level above NML						LAeq(15minute) 75 dB(A) or greater (Highly affected)		
				<10 dB(A)			10 to 20 dB(A)					
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Classroom at schools and other educational institutions	Day	55	305				N	130	65	N, PC, RO	40	75
Hospital wards and operating theatres	Day	65	130							N, PC, RO	40	75
Place of worship	Day	55	305				N	130	65	N, PC, RO	40	75
Active recreation	Day	65	130							N, PC, RO	40	75
Passive recreation	Day	60	200				N	75	70	N, PC, RO	40	75
Industrial premise	Day	75	40							N, PC, RO	40	75
Offices, retail outlets	Day	70	75							N, PC, RO	40	75

				$L_{Aeq(15minute)}$ noise level above NML											
				< 5 dB(A)			5 to 15 dB(A)			15 to 25 dB(A)			> 25 dB(A)		
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Hospital wards and operating theatres	Evening	65	130				N, R1, DR	75	70	N, R1, DR	22	80	N, R1, DR, PC, SN	7	90
	Night	65	130	N	130	65	N, R2, NR	75	70	N, PC, SN, R2, DR	22	80	AA, N, PC, SN, R2, DR	7	90
Place of worship	Evening	55	305				N, R1, DR	200	60	N, R1, DR	75	70	N, R1, DR, PC, SN	22	80
	Night	55	305	N	305	55	N, R2, NR	200	60	N, PC, SN, R2, DR	75	70	AA, N, PC, SN, R2, DR	22	80
Active recreation	Evening	65	130				N, R1, DR	75	70	N, R1, DR	22	80	N, R1, DR, PC, SN	7	90
Passive recreation	Evening	60	200				N, R1, DR	130	65	N, R1, DR	40	75	N, R1, DR, PC, SN	13	85
Industrial premise	Evening	75	40				N, R1, DR	22	80	N, R1, DR	7	90	N, R1, DR, PC, SN	2	100
	Night	75	40	N	40	75	N, R2, NR	22	80	N, PC, SN, R2, DR	7	90	AA, N, PC, SN, R2, DR	2	100
Offices, retail outlets	Evening	70	75				N, R1, DR	40	75	N, R1, DR	13	85	N, R1, DR, PC, SN	4	95
	Night	70	75	N	75	70	N, R2, NR	40	75	N, PC, SN, R2, DR	13	85	AA, N, PC, SN, R2, DR	4	95

Non-residential receiver
Propagation across a valley / over water

				$L_{Aeq(15minute)}$ noise level above NML						LAeq(15minute) 75 dB(A) or greater (Highly affected)		
				<10 dB(A)			10 to 20 dB(A)					
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Classroom at schools and other educational institutions	Day	55	405				N	130	65	N, PC, RO	40	75
Hospital wards and operating theatres	Day	65	150							N, PC, RO	40	75
Place of worship	Day	55	405				N	130	65	N, PC, RO	40	75
Active recreation	Day	65	150							N, PC, RO	40	75
Passive recreation	Day	60	250				N	75	70	N, PC, RO	40	75
Industrial premise	Day	75	40							N, PC, RO	40	75
Offices, retail outlets	Day	70	90							N, PC, RO	40	75

				$L_{Aeq(15minute)}$ noise level above NML											
				< 5 dB(A)			5 to 15 dB(A)			15 to 25 dB(A)			> 25 dB(A)		
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Hospital wards and operating theatres	Evening	65	150				N, R1, DR	90	70	N, R1, DR	22	80	N, R1, DR, PC, SN	7	90
	Night	65	150	N	150	65	N, R2, NR	90	70	N, PC, SN, R2, DR	22	80	AA, N, PC, SN, R2, DR	7	90
Place of worship	Evening	55	405				N, R1, DR	250	60	N, R1, DR	75	70	N, R1, DR, PC, SN	22	80
	Night	55	405	N	405	55	N, R2, NR	250	60	N, PC, SN, R2, DR	75	70	AA, N, PC, SN, R2, DR	22	80
Active recreation	Evening	65	150				N, R1, DR	90	70	N, R1, DR	22	80	N, R1, DR, PC, SN	7	90
Passive recreation	Evening	60	250				N, R1, DR	150	65	N, R1, DR	40	75	N, R1, DR, PC, SN	13	85
Industrial premise	Evening	75	40				N, R1, DR	25	80	N, R1, DR	7	90	N, R1, DR, PC, SN	2	100
	Night	75	40	N	40	75	N, R2, NR	25	80	N, PC, SN, R2, DR	7	90	AA, N, PC, SN, R2, DR	2	100
Offices, retail outlets	Evening	70	90				N, R1, DR	40	75	N, R1, DR	13	85	N, R1, DR, PC, SN	4	95
	Night	70	90	N	90	70	N, R2, NR	40	75	N, PC, SN, R2, DR	13	85	AA, N, PC, SN, R2, DR	4	95

Distanced Based Assessment (Construction Scenario)

Please pick from drop-down list in orange cells

Noise area category		R0
RBL or L_{A90} Background level (dB(A))	**Day**	30
	Evening	30
	Night	30
$L_{Aeq(15minute)}$ Noise Mangement Level (dB(A))	**Day**	40
	Day (OOHW)	35
	Evening	35
	Night	35
Scenario		Bulk earthworks
Is there line of sight to receiver?		Yes

Steps for Screening Assessment:

1. Schedule noisy works to occur in standard hours where possible or before 11pm and implement Standard Measures.
2. Select the representative noise area category. The worksheet titled "Representative Noise Environ," provides a number of examples to help select the noise area category.
3. Select the scenario. If not found in drop-down list, refer to 'Source List' and select a representative scenario with similar plant combination.
4. Is there line of sight to receiver? Select the appropriate scenario from the drop down list .

Identify and implement standard mitigation measures where feasible and reasonable. Include any shielding implemented as part of the standard mitigation measures by changing the selection in the 'Is there line of sight to receiver' drop-down list. Solid barrier can be in the form of road cutting, solid construction hoarding, acoustic curtain, timber lapped and capped fence, shipping container, site office, etc. Please note that vegetation and trees are not considered to be a form of solid barrier and any gaps would compromise the acoustic integrity of the solid barrier.

6. Determine if there are any receivers (both residential and non-residential receivers) within the affected distance for each relevant time period . Consider background noise measurements to check assumption in Step #2 if:

(a) there are many affected receivers and the impact duration at any one receiver is more than 3 weeks; or

(b) there are a few affected receivers and the impact duration at any one receiver is more than 6 weeks.

Note that consideration need to be given to the construction staging plan when determining impact duration.

7. Identify if there are any receivers within the additional mitigation measures distances and identify feasible and reasonable measures at each receiver
8. Where night works are involved, identify sleep disturbance affected distance.
9. Document the outcomes of these steps.

(Note that suitable noise management levels for other noise-sensitive businesses not identified in the Construction Noise Estimator should be investigated on a project-by-project basis. Please contact a

Abbreviation	Measure
N	Notification
SN	Specific notifications
PC	Phone calls
IB	Individual briefings
RO	Respite offer
R1	Respite period 1
R2	Respite period 2
DR	Duration respite
AA	Alternative accommodation
V	Verification

Note that spot check verification of noise levels and individual briefings are not required for projects with less than 3 weeks impact duration

Residential receiver

			$L_{Aeq(15minute)}$ noise level above background (L_{A90})											$L_{Aeq(15minute)}$ 75 dB(A) or greater (Highly affected)			Sleep disutrbance L_{Amax} 65 dB(A)
			5 to 10 dB(A)			10 to 20 dB(A)			20 to 30 dB(A)			> 30 dB(A)					
			Noticeable			Clearly audible			Moderately intrusive			Highly intrusive					
		Affected distance (m)	Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Affected distance (m)
Undeveloped green fields, rural areas with isolated dwellings	Day	1010							N	485	50	N	230	60	N, PC, RO	60	75	
	Day (OOHW)	1430				N, R1, DR	1010	40	N, R1, DR	485	50	N, R1, DR, PC, SN	230	60	N, PC, RO	60	75	
	Evening	1430				N, R1, DR	1010	40	N, R1, DR	485	50	N, R1, DR, PC, SN	230	60	N, PC, RO	60	75	
	Night	1430	N	1430	35	N, R2, DR	1010	40	N, PC, SN, R2, DR	485	50	AA, N, PC, SN, R2, DR	230	60	N, PC, RO	60	75	230
	Highly Affected	60													N, PC, RO	60	75	
Developed settlements (urban and suburban)	Day	1355							N	635	50	N	280	60	N, PC, RO	70	75	
	Day (OOHW)	1910				N, R1, DR	1355	40	N, R1, DR	635	50	N, R1, DR, PC, SN	280	60	N, PC, RO	60	75	
	Evening	1910				N, R1, DR	1355	40	N, R1, DR	635	50	N, R1, DR, PC, SN	280	60	N, PC, RO	70	75	
	Night	1910	N	1910	35	N, R2, DR	1355	40	N, PC, SN, R2, DR	635	50	AA, N, PC, SN, R2, DR	280	60	N, PC, RO	70	75	280
	Highly Affected	70													N, PC, RO	70	75	
Propagation across a valley / over water	Day	1900							N	880	50	N	370	60	N, PC, RO	70	75	
	Day (OOHW)	2005				N, R1, DR	1900	40	N, R1, DR	880	50	N, R1, DR, PC, SN	370	60	N, PC, RO	70	75	
	Evening	2005				N, R1, DR	1900	40	N, R1, DR	880	50	N, R1, DR, PC, SN	370	60	N, PC, RO	70	75	
	Night	2005	N	2005	35	N, R2, DR	1900	40	N, PC, SN, R2, DR	880	50	AA, N, PC, SN, R2, DR	370	60	N, PC, RO	70	75	370
	Highly Affected	70													N, PC, RO	70	75	

Non-residential receiver
Undeveloped green fields, rural areas with isolated dwellings

				$L_{Aeq(15minute)}$ noise level above NML						LAeq(15minute) 75 dB(A) or greater (Highly affected)		
				<10 dB(A)			10 to 20 dB(A)					
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Classroom at schools and other educational institutions	Day	55	335				N	155	65	N, PC, RO	60	75
Hospital wards and operating theatres	Day	65	155							N, PC, RO	60	75
Place of worship	Day	55	335				N	155	65	N, PC, RO	60	75
Active recreation	Day	65	155							N, PC, RO	60	75
Passive recreation	Day	60	230				N	105	70	N, PC, RO	60	75
Industrial premise	Day	75	60							N, PC, RO	60	75
Offices, retail outlets	Day	70	105							N, PC, RO	60	75

				$L_{Aeq(15minute)}$ noise level above NML											
				< 5 dB(A)			5 to 15 dB(A)			15 to 25 dB(A)			> 25 dB(A)		
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Hospital wards and operating theatres	Evening	65	155				N, R1, DR	105	70	N, R1, DR	34	80	N, R1, DR, PC, SN	11	90
	Night	65	155	N	155	65	N, R2, NR	105	70	N, PC, SN, R2, DR	34	80	AA, N, PC, SN, R2, DR	11	90
Place of worship	Evening	55	335				N, R1, DR	230	60	N, R1, DR	105	70	N, R1, DR, PC, SN	34	80
	Night	55	335	N	335	55	N, R2, NR	230	60	N, PC, SN, R2, DR	105	70	AA, N, PC, SN, R2, DR	34	80
Active recreation	Evening	65	155				N, R1, DR	105	70	N, R1, DR	34	80	N, R1, DR, PC, SN	11	90
Passive recreation	Evening	60	230				N, R1, DR	155	65	N, R1, DR	60	75	N, R1, DR, PC, SN	19	85
Industrial premise	Evening	75	60				N, R1, DR	34	80	N, R1, DR	11	90	N, R1, DR, PC, SN	3	100
	Night	75	60	N	60	75	N, R2, NR	34	80	N, PC, SN, R2, DR	11	90	AA, N, PC, SN, R2, DR	3	100
Offices, retail outlets	Evening	70	105				N, R1, DR	60	75	N, R1, DR	19	85	N, R1, DR, PC, SN	6	95
	Night	70	105	N	105	70	N, R2, NR	60	75	N, PC, SN, R2, DR	19	85	AA, N, PC, SN, R2, DR	6	95

Non-residential receiver
Developed settlements (urban and suburban)

				$L_{Aeq(15minute)}$ noise level above NML						LAeq(15minute) 75 dB(A) or greater (Highly affected)		
				<10 dB(A)			10 to 20 dB(A)					
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Classroom at schools and other educational institutions	Day	55	425				N	180	65	N, PC, RO	70	75
Hospital wards and operating theatres	Day	65	180							N, PC, RO	70	75
Place of worship	Day	55	425				N	180	65	N, PC, RO	70	75
Active recreation	Day	65	180							N, PC, RO	70	75
Passive recreation	Day	60	280				N	115	70	N, PC, RO	70	75
Industrial premise	Day	75	70							N, PC, RO	70	75
Offices, retail outlets	Day	70	115							N, PC, RO	70	75

				$L_{Aeq(15minute)}$ noise level above NML											
				< 5 dB(A)			5 to 15 dB(A)			15 to 25 dB(A)			> 25 dB(A)		
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Hospital wards and operating theatres	Evening	65	180				N, R1, DR	115	70	N, R1, DR	39	80	N, R1, DR, PC, SN	12	90
	Night	65	180	N	180	65	N, R2, NR	115	70	N, PC, SN, R2, DR	39	80	AA, N, PC, SN, R2, DR	12	90
Place of worship	Evening	55	425				N, R1, DR	280	60	N, R1, DR	115	70	N, R1, DR, PC, SN	39	80
	Night	55	425	N	425	55	N, R2, NR	280	60	N, PC, SN, R2, DR	115	70	AA, N, PC, SN, R2, DR	39	80
Active recreation	Evening	65	180				N, R1, DR	115	70	N, R1, DR	39	80	N, R1, DR, PC, SN	12	90
Passive recreation	Evening	60	280				N, R1, DR	180	65	N, R1, DR	70	75	N, R1, DR, PC, SN	22	85
Industrial premise	Evening	75	70				N, R1, DR	39	80	N, R1, DR	12	90	N, R1, DR, PC, SN	4	100
	Night	75	70	N	70	75	N, R2, NR	39	80	N, PC, SN, R2, DR	12	90	AA, N, PC, SN, R2, DR	4	100
Offices, retail outlets	Evening	70	115				N, R1, DR	70	75	N, R1, DR	22	85	N, R1, DR, PC, SN	7	95
	Night	70	115	N	115	70	N, R2, NR	70	75	N, PC, SN, R2, DR	22	85	AA, N, PC, SN, R2, DR	7	95

Non-residential receiver
Propagation across a valley / over water

				$L_{Aeq(15minute)}$ noise level above NML						LAeq(15minute) 75 dB(A) or greater (Highly affected)		
				<10 dB(A)			10 to 20 dB(A)					
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Classroom at schools and other educational institutions	Day	55	575				N	180	65	N, PC, RO	70	75
Hospital wards and operating theatres	Day	65	230							N, PC, RO	70	75
Place of worship	Day	55	575				N	180	65	N, PC, RO	70	75
Active recreation	Day	65	230							N, PC, RO	70	75
Passive recreation	Day	60	370				N	115	70	N, PC, RO	70	75
Industrial premise	Day	75	70							N, PC, RO	70	75
Offices, retail outlets	Day	70	140							N, PC, RO	70	75

				$L_{Aeq(15minute)}$ noise level above NML											
				< 5 dB(A)			5 to 15 dB(A)			15 to 25 dB(A)			> 25 dB(A)		
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Hospital wards and operating theatres	Evening	65	230				N, R1, DR	140	70	N, R1, DR	39	80	N, R1, DR, PC, SN	12	90
	Night	65	230	N	230	65	N, R2, NR	140	70	N, PC, SN, R2, DR	39	80	AA, N, PC, SN, R2, DR	12	90
Place of worship	Evening	55	575				N, R1, DR	370	60	N, R1, DR	115	70	N, R1, DR, PC, SN	39	80
	Night	55	575	N	575	55	N, R2, NR	370	60	N, PC, SN, R2, DR	115	70	AA, N, PC, SN, R2, DR	39	80
Active recreation	Evening	65	230				N, R1, DR	140	70	N, R1, DR	39	80	N, R1, DR, PC, SN	12	90
Passive recreation	Evening	60	370				N, R1, DR	230	65	N, R1, DR	70	75	N, R1, DR, PC, SN	22	85
Industrial premise	Evening	75	70				N, R1, DR	40	80	N, R1, DR	12	90	N, R1, DR, PC, SN	4	100
	Night	75	70	N	70	75	N, R2, NR	40	80	N, PC, SN, R2, DR	12	90	AA, N, PC, SN, R2, DR	4	100
Offices, retail outlets	Evening	70	140				N, R1, DR	70	75	N, R1, DR	22	85	N, R1, DR, PC, SN	7	95
	Night	70	140	N	140	70	N, R2, NR	70	75	N, PC, SN, R2, DR	22	85	AA, N, PC, SN, R2, DR	7	95

Distanced Based Assessment (Construction Scenario)

Please pick from drop-down list in orange cells

Noise area category		R0
RBL or L_{A90} Background level (dB(A))	**Day**	30
	Evening	30
	Night	30
$L_{Aeq(15minute)}$ Noise Mangement Level (dB(A))	**Day**	40
	Day (OOHW)	35
	Evening	35
	Night	35
Scenario		Corridor clearing
Is there line of sight to receiver?		Yes

Steps for Screening Assessment:

1. Schedule noisy works to occur in standard hours where possible or before 11pm and implement Standard Measures.
2. Select the representative noise area category. The worksheet titled "Representative Noise Environ," provides a number of examples to help select the noise area category.
3. Select the scenario. If not found in drop-down list, refer to 'Source List' and select a representative scenario with similar plant combination.
4. Is there line of sight to receiver? Select the appropriate scenario from the drop down list .

Identify and implement standard mitigation measures where feasible and reasonable. Include any shielding implemented as part of the standard mitigation measures by changing the selection in the 'Is there line of sight to receiver' drop-down list. Solid barrier can be in the form of road cutting, solid construction hoarding, acoustic curtain, timber lapped and capped fence, shipping container, site office, etc. Please note that vegetation and trees are not considered to be a form of solid barrier and any gaps would compromise the acoustic integrity of the solid barrier.

6. Determine if there are any receivers (both residential and non-residential receivers) within the affected distance for each relevant time period . Consider background noise measurements to check assumption in Step #2 if:

(a) there are many affected receivers and the impact duration at any one receiver is more than 3 weeks; or

(b) there are a few affected receivers and the impact duration at any one receiver is more than 6 weeks.

Note that consideration need to be given to the construction staging plan when determining impact duration.

7. Identify if there are any receivers within the additional mitigation measures distances and identify feasible and reasonable measures at each receiver
8. Where night works are involved, identify sleep disturbance affected distance.
9. Document the outcomes of these steps.

(Note that suitable noise management levels for other noise-sensitive businesses not identified in the Construction Noise Estimator should be investigated on a project-by-project basis. Please contact a

Abbreviation	Measure
N	Notification
SN	Specific notifications
PC	Phone calls
IB	Individual briefings
RO	Respite offer
R1	Respite period 1
R2	Respite period 2
DR	Duration respite
AA	Alternative accommodation
V	Verification

Note that spot check verification of noise levels and individual briefings are not required for projects with less than 3 weeks impact duration

Residential receiver

			$L_{Aeq(15minute)}$ noise level above background (L_{A90})												$L_{Aeq(15minute)}$ 75 dB(A) or greater (Highly affected)			Sleep disutrbance L_{Amax} 65 dB(A)
			5 to 10 dB(A)			10 to 20 dB(A)			20 to 30 dB(A)			> 30 dB(A)						
			Noticeable			Clearly audible			Moderately intrusive			Highly intrusive						
		Affected distance (m)	Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Affected distance (m)
Undeveloped green fields, rural areas with isolated dwellings	Day	875							N	420	50	N	200	60	N, PC, RO	45	75	
	Day (OOHW)	1250				N, R1, DR	875	40	N, R1, DR	420	50	N, R1, DR, PC, SN	200	60	N, PC, RO	45	75	
	Evening	1250				N, R1, DR	875	40	N, R1, DR	420	50	N, R1, DR, PC, SN	200	60	N, PC, RO	45	75	
	Night	1250	N	1250	35	N, R2, DR	875	40	N, PC, SN, R2, DR	420	50	AA, N, PC, SN, R2, DR	200	60	N, PC, RO	45	75	230
	Highly Affected	45													N, PC, RO	45	75	
Developed settlements (urban and suburban)	Day	1170							N	540	50	N	235	60	N, PC, RO	50	75	
	Day (OOHW)	1670				N, R1, DR	1170	40	N, R1, DR	540	50	N, R1, DR, PC, SN	235	60	N, PC, RO	45	75	
	Evening	1670				N, R1, DR	1170	40	N, R1, DR	540	50	N, R1, DR, PC, SN	235	60	N, PC, RO	50	75	
	Night	1670	N	1670	35	N, R2, DR	1170	40	N, PC, SN, R2, DR	540	50	AA, N, PC, SN, R2, DR	235	60	N, PC, RO	50	75	280
	Highly Affected	50													N, PC, RO	50	75	
Propagation across a valley / over water	Day	1645							N	745	50	N	305	60	N, PC, RO	50	75	
	Day (OOHW)	2005				N, R1, DR	1645	40	N, R1, DR	745	50	N, R1, DR, PC, SN	305	60	N, PC, RO	50	75	
	Evening	2005				N, R1, DR	1645	40	N, R1, DR	745	50	N, R1, DR, PC, SN	305	60	N, PC, RO	50	75	
	Night	2005	N	2005	35	N, R2, DR	1645	40	N, PC, SN, R2, DR	745	50	AA, N, PC, SN, R2, DR	305	60	N, PC, RO	50	75	370
	Highly Affected	50													N, PC, RO	50	75	

Non-residential receiver
Undeveloped green fields, rural areas with isolated dwellings

				$L_{Aeq(15minute)}$ noise level above NML						LAeq(15minute) 75 dB(A) or greater (Highly affected)		
				<10 dB(A)			10 to 20 dB(A)					
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Classroom at schools and other educational institutions	Day	55	290				N	135	65	N, PC, RO	45	75
Hospital wards and operating theatres	Day	65	135							N, PC, RO	45	75
Place of worship	Day	55	290				N	135	65	N, PC, RO	45	75
Active recreation	Day	65	135							N, PC, RO	45	75
Passive recreation	Day	60	200				N	85	70	N, PC, RO	45	75
Industrial premise	Day	75	45							N, PC, RO	45	75
Offices, retail outlets	Day	70	85							N, PC, RO	45	75

				$L_{Aeq(15minute)}$ noise level above NML											
				< 5 dB(A)			5 to 15 dB(A)			15 to 25 dB(A)			> 25 dB(A)		
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Hospital wards and operating theatres	Evening	65	135				N, R1, DR	85	70	N, R1, DR	25	80	N, R1, DR, PC, SN	8	90
	Night	65	135	N	135	65	N, R2, NR	85	70	N, PC, SN, R2, DR	25	80	AA, N, PC, SN, R2, DR	8	90
Place of worship	Evening	55	290				N, R1, DR	200	60	N, R1, DR	85	70	N, R1, DR, PC, SN	25	80
	Night	55	290	N	290	55	N, R2, NR	200	60	N, PC, SN, R2, DR	85	70	AA, N, PC, SN, R2, DR	25	80
Active recreation	Evening	65	135				N, R1, DR	85	70	N, R1, DR	25	80	N, R1, DR, PC, SN	8	90
Passive recreation	Evening	60	200				N, R1, DR	135	65	N, R1, DR	45	75	N, R1, DR, PC, SN	14	85
Industrial premise	Evening	75	45				N, R1, DR	25	80	N, R1, DR	8	90	N, R1, DR, PC, SN	3	100
	Night	75	45	N	45	75	N, R2, NR	25	80	N, PC, SN, R2, DR	8	90	AA, N, PC, SN, R2, DR	3	100
Offices, retail outlets	Evening	70	85				N, R1, DR	45	75	N, R1, DR	14	85	N, R1, DR, PC, SN	5	95
	Night	70	85	N	85	70	N, R2, NR	45	75	N, PC, SN, R2, DR	14	85	AA, N, PC, SN, R2, DR	5	95

Non-residential receiver
Developed settlements (urban and suburban)

				$L_{Aeq(15minute)}$ noise level above NML						LAeq(15minute) 75 dB(A) or greater (Highly affected)		
				<10 dB(A)			10 to 20 dB(A)					
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Classroom at schools and other educational institutions	Day	55	360				N	155	65	N, PC, RO	50	75
Hospital wards and operating theatres	Day	65	155							N, PC, RO	50	75
Place of worship	Day	55	360				N	155	65	N, PC, RO	50	75
Active recreation	Day	65	155							N, PC, RO	50	75
Passive recreation	Day	60	235				N	95	70	N, PC, RO	50	75
Industrial premise	Day	75	50							N, PC, RO	50	75
Offices, retail outlets	Day	70	95							N, PC, RO	50	75

				$L_{Aeq(15minute)}$ noise level above NML											
				< 5 dB(A)			5 to 15 dB(A)			15 to 25 dB(A)			> 25 dB(A)		
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Hospital wards and operating theatres	Evening	65	155				N, R1, DR	95	70	N, R1, DR	28	80	N, R1, DR, PC, SN	9	90
	Night	65	155	N	155	65	N, R2, NR	95	70	N, PC, SN, R2, DR	28	80	AA, N, PC, SN, R2, DR	9	90
Place of worship	Evening	55	360				N, R1, DR	235	60	N, R1, DR	95	70	N, R1, DR, PC, SN	28	80
	Night	55	360	N	360	55	N, R2, NR	235	60	N, PC, SN, R2, DR	95	70	AA, N, PC, SN, R2, DR	28	80
Active recreation	Evening	65	155				N, R1, DR	95	70	N, R1, DR	28	80	N, R1, DR, PC, SN	9	90
Passive recreation	Evening	60	235				N, R1, DR	155	65	N, R1, DR	50	75	N, R1, DR, PC, SN	16	85
Industrial premise	Evening	75	50				N, R1, DR	28	80	N, R1, DR	9	90	N, R1, DR, PC, SN	3	100
	Night	75	50	N	50	75	N, R2, NR	28	80	N, PC, SN, R2, DR	9	90	AA, N, PC, SN, R2, DR	3	100
Offices, retail outlets	Evening	70	95				N, R1, DR	50	75	N, R1, DR	16	85	N, R1, DR, PC, SN	5	95
	Night	70	95	N	95	70	N, R2, NR	50	75	N, PC, SN, R2, DR	16	85	AA, N, PC, SN, R2, DR	5	95

Non-residential receiver
Propagation across a valley / over water

				$L_{Aeq(15minute)}$ noise level above NML						LAeq(15minute) 75 dB(A) or greater (Highly affected)		
				<10 dB(A)			10 to 20 dB(A)					
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Classroom at schools and other educational institutions	Day	55	485				N	155	65	N, PC, RO	50	75
Hospital wards and operating theatres	Day	65	185							N, PC, RO	50	75
Place of worship	Day	55	485				N	155	65	N, PC, RO	50	75
Active recreation	Day	65	185							N, PC, RO	50	75
Passive recreation	Day	60	305				N	95	70	N, PC, RO	50	75
Industrial premise	Day	75	50							N, PC, RO	50	75
Offices, retail outlets	Day	70	110							N, PC, RO	50	75

				$L_{Aeq(15minute)}$ noise level above NML											
				< 5 dB(A)			5 to 15 dB(A)			15 to 25 dB(A)			> 25 dB(A)		
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Hospital wards and operating theatres	Evening	65	185				N, R1, DR	110	70	N, R1, DR	28	80	N, R1, DR, PC, SN	9	90
	Night	65	185	N	185	65	N, R2, NR	110	70	N, PC, SN, R2, DR	28	80	AA, N, PC, SN, R2, DR	9	90
Place of worship	Evening	55	485				N, R1, DR	305	60	N, R1, DR	95	70	N, R1, DR, PC, SN	28	80
	Night	55	485	N	485	55	N, R2, NR	305	60	N, PC, SN, R2, DR	95	70	AA, N, PC, SN, R2, DR	28	80
Active recreation	Evening	65	185				N, R1, DR	110	70	N, R1, DR	28	80	N, R1, DR, PC, SN	9	90
Passive recreation	Evening	60	305				N, R1, DR	185	65	N, R1, DR	50	75	N, R1, DR, PC, SN	16	85
Industrial premise	Evening	75	50				N, R1, DR	30	80	N, R1, DR	9	90	N, R1, DR, PC, SN	3	100
	Night	75	50	N	50	75	N, R2, NR	30	80	N, PC, SN, R2, DR	9	90	AA, N, PC, SN, R2, DR	3	100
Offices, retail outlets	Evening	70	110				N, R1, DR	50	75	N, R1, DR	16	85	N, R1, DR, PC, SN	5	95
	Night	70	110	N	110	70	N, R2, NR	50	75	N, PC, SN, R2, DR	16	85	AA, N, PC, SN, R2, DR	5	95

Distanced Based Assessment (Construction Scenario)

Please pick from drop-down list in orange cells

Noise area category		R0
RBL or L_{A90} Background level (dB(A))	**Day**	30
	Evening	30
	Night	30
$L_{Aeq(15minute)}$ Noise Mangement Level (dB(A))	**Day**	40
	Day (OOHW)	35
	Evening	35
	Night	35
Scenario		Structural demolition
Is there line of sight to receiver?		Yes

Steps for Screening Assessment:

1. Schedule noisy works to occur in standard hours where possible or before 11pm and implement Standard Measures.
2. Select the representative noise area category. The worksheet titled "Representative Noise Environ," provides a number of examples to help select the noise area category.
3. Select the scenario. If not found in drop-down list, refer to 'Source List' and select a representative scenario with similar plant combination.
4. Is there line of sight to receiver? Select the appropriate scenario from the drop down list .

Identify and implement standard mitigation measures where feasible and reasonable. Include any shielding implemented as part of the standard mitigation measures by changing the selection in the 'Is there line of sight to receiver' drop-down list. Solid barrier can be in the form of road cutting, solid construction hoarding, acoustic curtain, timber lapped and capped fence, shipping container, site office, etc. Please note that vegetation and trees are not considered to be a form of solid barrier and any gaps would compromise the acoustic integrity of the solid barrier.

6. Determine if there are any receivers (both residential and non-residential receivers) within the affected distance for each relevant time period . Consider background noise measurements to check assumption in Step #2 if:

(a) there are many affected receivers and the impact duration at any one receiver is more than 3 weeks; or

(b) there are a few affected receivers and the impact duration at any one receiver is more than 6 weeks.

Note that consideration need to be given to the construction staging plan when determining impact duration.

7. Identify if there are any receivers within the additional mitigation measures distances and identify feasible and reasonable measures at each receiver
8. Where night works are involved, identify sleep disturbance affected distance.
9. Document the outcomes of these steps.

(Note that suitable noise management levels for other noise-sensitive businesses not identified in the Construction Noise Estimator should be investigated on a project-by-project basis. Please contact a

Abbreviation	Measure
N	Notification
SN	Specific notifications
PC	Phone calls
IB	Individual briefings
RO	Respite offer
R1	Respite period 1
R2	Respite period 2
DR	Duration respite
AA	Alternative accommodation
V	Verification

Note that spot check verification of noise levels and individual briefings are not required for projects with less than 3 weeks impact duration

Residential receiver

			$L_{Aeq(15minute)}$ noise level above background (L_{A90})											$L_{Aeq(15minute)}$ 75 dB(A) or greater (Highly affected)			Sleep disutrbance L_{Amax} 65 dB(A)
			5 to 10 dB(A)			10 to 20 dB(A)			20 to 30 dB(A)			> 30 dB(A)					
			Noticeable			Clearly audible			Moderately intrusive			Highly intrusive					
		Affected distance (m)	Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Affected distance (m)
Undeveloped green fields, rural areas with isolated dwellings	**Day**	940							N	450	50	N	215	60	N, PC, RO	50	75	
	Day (OOHW)	1335				N, R1, DR	940	40	N, R1, DR	450	50	N, R1, DR, PC, SN	215	60	N, PC, RO	50	75	
	Evening	1335				N, R1, DR	940	40	N, R1, DR	450	50	N, R1, DR, PC, SN	215	60	N, PC, RO	50	75	
	Night	1335	N	1335	35	N, R2, DR	940	40	N, PC, SN, R2, DR	450	50	AA, N, PC, SN, R2, DR	215	60	N, PC, RO	50	75	170
	Highly Affected	50													N, PC, RO	50	75	
Developed settlements (urban and suburban)	**Day**	1260							N	585	50	N	255	60	N, PC, RO	60	75	
	Day (OOHW)	1790				N, R1, DR	1260	40	N, R1, DR	585	50	N, R1, DR, PC, SN	255	60	N, PC, RO	50	75	
	Evening	1790				N, R1, DR	1260	40	N, R1, DR	585	50	N, R1, DR, PC, SN	255	60	N, PC, RO	60	75	
	Night	1790	N	1790	35	N, R2, DR	1260	40	N, PC, SN, R2, DR	585	50	AA, N, PC, SN, R2, DR	255	60	N, PC, RO	60	75	200
	Highly Affected	60													N, PC, RO	60	75	
Propagation across a valley / over water	**Day**	1770							N	810	50	N	335	60	N, PC, RO	60	75	
	Day (OOHW)	2005				N, R1, DR	1770	40	N, R1, DR	810	50	N, R1, DR, PC, SN	335	60	N, PC, RO	60	75	
	Evening	2005				N, R1, DR	1770	40	N, R1, DR	810	50	N, R1, DR, PC, SN	335	60	N, PC, RO	60	75	
	Night	2005	N	2005	35	N, R2, DR	1770	40	N, PC, SN, R2, DR	810	50	AA, N, PC, SN, R2, DR	335	60	N, PC, RO	60	75	250
	Highly Affected	60													N, PC, RO	60	75	

Non-residential receiver
Undeveloped green fields, rural areas with isolated dwellings

			$L_{Aeq(15minute)}$ noise level above NML						LAeq(15minute) 75 dB(A) or greater (Highly affected)		
			<10 dB(A)			10 to 20 dB(A)					
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Classroom at schools and other educational institutions	**Day**	55	310				N	145	65	N, PC, RO	50	75
Hospital wards and operating theatres	**Day**	65	145							N, PC, RO	50	75
Place of worship	**Day**	55	310				N	145	65	N, PC, RO	50	75
Active recreation	**Day**	65	145							N, PC, RO	50	75
Passive recreation	**Day**	60	215				N	95	70	N, PC, RO	50	75
Industrial premise	**Day**	75	50							N, PC, RO	50	75
Offices, retail outlets	**Day**	70	95							N, PC, RO	50	75

				$L_{Aeq(15minute)}$ noise level above NML											
				< 5 dB(A)			5 to 15 dB(A)			15 to 25 dB(A)			> 25 dB(A)		
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Hospital wards and operating theatres	**Evening**	65	145				N, R1, DR	95	70	N, R1, DR	28	80	N, R1, DR, PC, SN	9	90
	Night	65	145	N	145	65	N, R2, NR	95	70	N, PC, SN, R2, DR	28	80	AA, N, PC, SN, R2, DR	9	90
Place of worship	**Evening**	55	310				N, R1, DR	215	60	N, R1, DR	95	70	N, R1, DR, PC, SN	28	80
	Night	55	310	N	310	55	N, R2, NR	215	60	N, PC, SN, R2, DR	95	70	AA, N, PC, SN, R2, DR	28	80
Active recreation	**Evening**	65	145				N, R1, DR	95	70	N, R1, DR	28	80	N, R1, DR, PC, SN	9	90
Passive recreation	**Evening**	60	215				N, R1, DR	145	65	N, R1, DR	50	75	N, R1, DR, PC, SN	16	85
Industrial premise	**Evening**	75	50				N, R1, DR	28	80	N, R1, DR	9	90	N, R1, DR, PC, SN	3	100
	Night	75	50	N	50	75	N, R2, NR	28	80	N, PC, SN, R2, DR	9	90	AA, N, PC, SN, R2, DR	3	100
Offices, retail outlets	**Evening**	70	95				N, R1, DR	50	75	N, R1, DR	16	85	N, R1, DR, PC, SN	5	95
	Night	70	95	N	95	70	N, R2, NR	50	75	N, PC, SN, R2, DR	16	85	AA, N, PC, SN, R2, DR	5	95

Non-residential receiver
Developed settlements (urban and suburban)

			$L_{Aeq(15minute)}$ noise level above NML						LAeq(15minute) 75 dB(A) or greater (Highly affected)		
			<10 dB(A)			10 to 20 dB(A)					
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Classroom at schools and other educational institutions	**Day**	55	390				N	165	65	N, PC, RO	60	75
Hospital wards and operating theatres	**Day**	65	165							N, PC, RO	60	75
Place of worship	**Day**	55	390				N	165	65	N, PC, RO	60	75
Active recreation	**Day**	65	165							N, PC, RO	60	75
Passive recreation	**Day**	60	255				N	105	70	N, PC, RO	60	75
Industrial premise	**Day**	75	60							N, PC, RO	60	75
Offices, retail outlets	**Day**	70	105							N, PC, RO	60	75

				$L_{Aeq(15minute)}$ noise level above NML											
				< 5 dB(A)			5 to 15 dB(A)			15 to 25 dB(A)			> 25 dB(A)		
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Hospital wards and operating theatres	**Evening**	65	165				N, R1, DR	105	70	N, R1, DR	34	80	N, R1, DR, PC, SN	11	90
	Night	65	165	N	165	65	N, R2, NR	105	70	N, PC, SN, R2, DR	34	80	AA, N, PC, SN, R2, DR	11	90
Place of worship	**Evening**	55	390				N, R1, DR	255	60	N, R1, DR	105	70	N, R1, DR, PC, SN	34	80
	Night	55	390	N	390	55	N, R2, NR	255	60	N, PC, SN, R2, DR	105	70	AA, N, PC, SN, R2, DR	34	80
Active recreation	**Evening**	65	165				N, R1, DR	105	70	N, R1, DR	34	80	N, R1, DR, PC, SN	11	90
Passive recreation	**Evening**	60	255				N, R1, DR	165	65	N, R1, DR	60	75	N, R1, DR, PC, SN	19	85
Industrial premise	**Evening**	75	60				N, R1, DR	34	80	N, R1, DR	11	90	N, R1, DR, PC, SN	3	100
	Night	75	60	N	60	75	N, R2, NR	34	80	N, PC, SN, R2, DR	11	90	AA, N, PC, SN, R2, DR	3	100
Offices, retail outlets	**Evening**	70	105				N, R1, DR	60	75	N, R1, DR	19	85	N, R1, DR, PC, SN	6	95
	Night	70	105	N	105	70	N, R2, NR	60	75	N, PC, SN, R2, DR	19	85	AA, N, PC, SN, R2, DR	6	95

Non-residential receiver
Propagation across a valley / over water

			$L_{Aeq(15minute)}$ noise level above NML						LAeq(15minute) 75 dB(A) or greater (Highly affected)		
			<10 dB(A)			10 to 20 dB(A)					
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Classroom at schools and other educational institutions	**Day**	55	530				N	165	65	N, PC, RO	60	75
Hospital wards and operating theatres	**Day**	65	205							N, PC, RO	60	75
Place of worship	**Day**	55	530				N	165	65	N, PC, RO	60	75
Active recreation	**Day**	65	205							N, PC, RO	60	75
Passive recreation	**Day**	60	335				N	105	70	N, PC, RO	60	75
Industrial premise	**Day**	75	60							N, PC, RO	60	75
Offices, retail outlets	**Day**	70	125							N, PC, RO	60	75

				$L_{Aeq(15minute)}$ noise level above NML											
				< 5 dB(A)			5 to 15 dB(A)			15 to 25 dB(A)			> 25 dB(A)		
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Hospital wards and operating theatres	**Evening**	65	205				N, R1, DR	125	70	N, R1, DR	34	80	N, R1, DR, PC, SN	11	90
	Night	65	205	N	205	65	N, R2, NR	125	70	N, PC, SN, R2, DR	34	80	AA, N, PC, SN, R2, DR	11	90
Place of worship	**Evening**	55	530				N, R1, DR	335	60	N, R1, DR	105	70	N, R1, DR, PC, SN	34	80
	Night	55	530	N	530	55	N, R2, NR	335	60	N, PC, SN, R2, DR	105	70	AA, N, PC, SN, R2, DR	34	80
Active recreation	**Evening**	65	205				N, R1, DR	125	70	N, R1, DR	34	80	N, R1, DR, PC, SN	11	90
Passive recreation	**Evening**	60	335				N, R1, DR	205	65	N, R1, DR	60	75	N, R1, DR, PC, SN	19	85
Industrial premise	**Evening**	75	60				N, R1, DR	35	80	N, R1, DR	11	90	N, R1, DR, PC, SN	3	100
	Night	75	60	N	60	75	N, R2, NR	35	80	N, PC, SN, R2, DR	11	90	AA, N, PC, SN, R2, DR	3	100
Offices, retail outlets	**Evening**	70	125				N, R1, DR	60	75	N, R1, DR	19	85	N, R1, DR, PC, SN	6	95
	Night	70	125	N	125	70	N, R2, NR	60	75	N, PC, SN, R2, DR	19	85	AA, N, PC, SN, R2, DR	6	95

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