NSW NATIONAL PARKS & WILDLIFE SERVICE

Wombeyan Karst Conservation Reserve

Review of environmental factors for visitor precinct upgrade

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Cover photo: Lookout view Wombeyan Caves. Stephen Babka/DPE

All other photos in the report: Ecological Australia

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Abbreviations

Abbreviation	Term
ACHA	Aboriginal cultural heritage assessment
AHIP	Aboriginal heritage impact permit
BC Act	*Biodiversity Conservation Act 2016* (NSW)
CEMP	Construction environmental management plan
ELA	Eco Logical Australia
EPA	Environmental Protection Agency
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
FM Act	*Fisheries Management Act 1994* (NSW)
LEP	Local environmental plan
LGA	Local government area
MNES	Matters of national environmental significance
N/A	Not applicable
NP	National Park
NPW Act	*National Parks and Wildlife Act 1974* (NSW)
NPWS	National Parks and Wildlife Service
NSW	New South Wales
PAD	Potential archaeological deposits
PCT	Plant community types
PoM	*Wombeyan Karst Conservation Reserve plan of management* (NPWS 1999)
REF	Review of environmental factors
SEPP	State environmental planning policy
TEC	Threatened ecological community
WIRES	Wildlife Information, Rescue and Education Service

1. Brief description of the proposed activity

Proposal name	Wombeyan Caves Visitor Precinct Upgrade
Lands within proposal	Wombeyan Karst Conservation Reserve
NPWS Area	Kanangra Area
Location of activity	Wombeyan Karst Conservation Reserve (the reserve) covers an area of 417 ha and is located 190 km south-west of Sydney, 77 km north of Goulburn and 63 km west of Mittagong. The Wombeyan Caves visitor precinct (see Figure 1), also referred to as the 'study area', is located within the eastern side of the Wombeyan Karst Conservation Reserve, at 24 Wombeyan Caves Road.
Council area	Upper Lachlan Shire Council Wingecarribee Shire Council
NSW State electorate	Wollondilly
Proposed commencement date	June 2022
Proposed completion date	January 2023
Estimated duration of proposal	8 months for construction phase (weather dependant); ongoing operational phase.

2. Proponent's details

Proponent	Angela Lonergan, Manager, Kanangra Area
Contact name	Matthew McNeil
Position	Senior Project Officer, Blue Mountains Branch
Street address	33–39 Acacia St, Katoomba NSW 2780
Postal address	As above

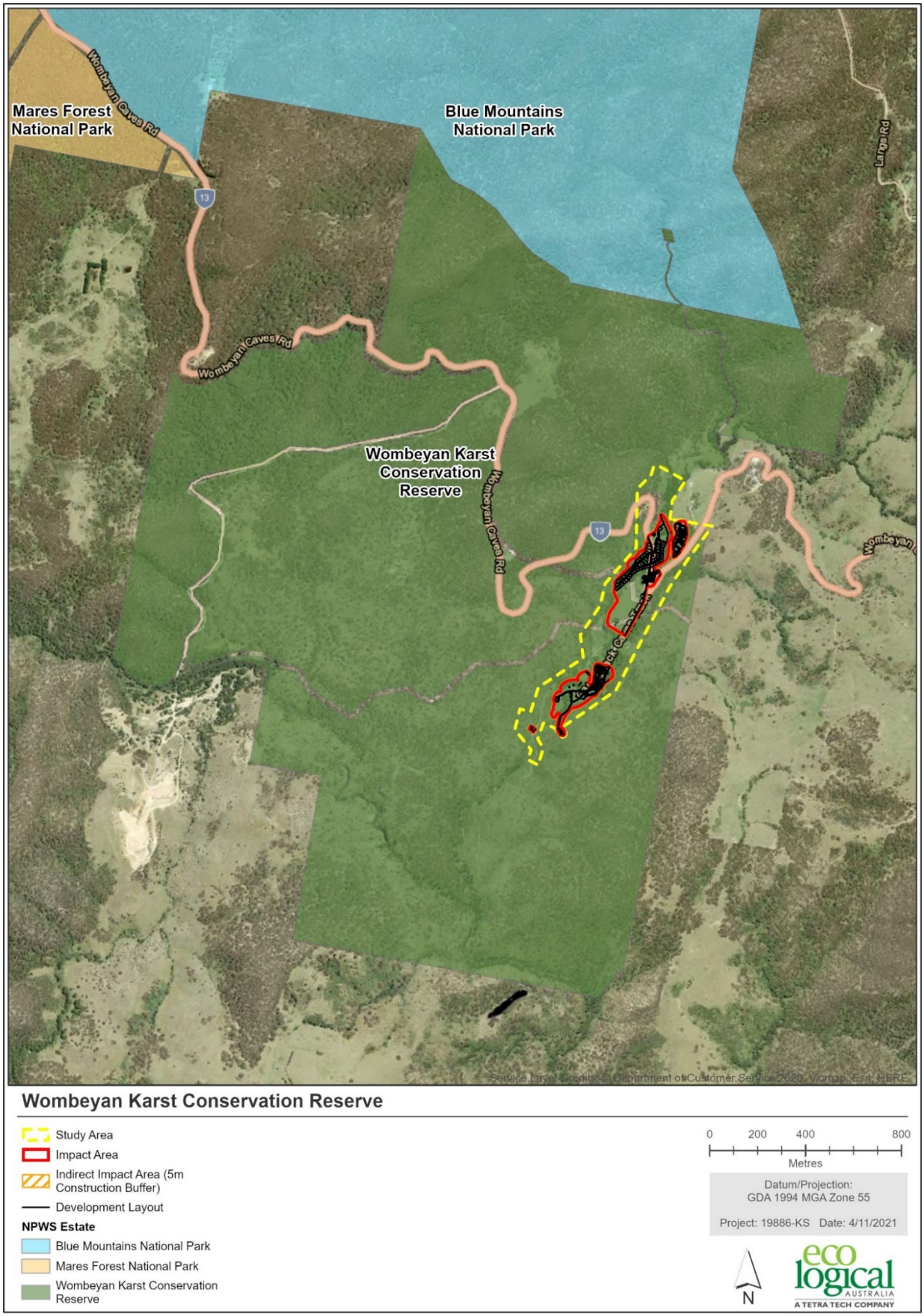

Figure 1 Wombeyan Karst Conservation Reserve showing location of visitor precinct (study area)

3. Permissibility and assessment pathway

3.1 Permissibility under NSW legislation

3.1.1 National Parks and Wildlife Act 1974

Objects of the National Parks and Wildlife Act (s 2A)

The *National Parks and Wildlife Act 1974* (NPW Act) establishes the National Parks and Wildlife Service (NPWS), which is responsible for the control and management of all national parks, historic sites, nature reserves, karst conservation reserves and Aboriginal areas (among others). The main aim of the Act is to conserve the natural and cultural heritage of New South Wales.

The objects of this Act (section 2A.1) are as follows:

a. the conservation of nature, including, but not limited to, the conservation of:
    i. habitat, ecosystems and ecosystem processes
    ii. biological diversity at the community, species and genetic levels
    iii. landforms of significance, including geological features and processes
    iv. landscapes and natural features of significance including wilderness and wild rivers
b. the conservation of objects, places or features (including biological diversity) of cultural value within the landscape, including, but not limited to:
    i. places, objects and features of significance to Aboriginal people
    ii. places of social value to the people of New South Wales
    iii. places of historic, architectural or scientific significance
c. fostering public appreciation, understanding and enjoyment of nature and cultural heritage and their conservation
d. providing for the management of land reserved under this Act in accordance with the management principles applicable for each type of reservation.

NPWS has identified that the Wombeyan Caves visitor precinct is an under-performing precinct, when compared to other regional tourism destinations. Furthermore, the precinct's ageing infrastructure is considered to no longer meet users' and NPWS's expectations. Therefore, NPWS is proposing to upgrade the precinct. The proposed upgrades are in accordance with section s 2A.1.c and s 2A.1.d, to comply with land management principles and allow for public appreciation, understanding and enjoyment of nature and cultural heritage through offering increased amenity to visitors.

The proposed works support s 2A.1.a as they seek to aid the conservation objectives by better management of human uses in the precinct through the provision of upgraded facilities, including toilets, and improved management of the riparian zone.

To address s 2A.1.b, an archaeological survey, test excavations and preparation of an Aboriginal cultural heritage assessment (Jackson Ward Archaeology 2022) have been undertaken; and an Aboriginal heritage impact permit has been sought to minimise impacts and conserve places, objects and features of significance to Aboriginal people. In addition, a statement of heritage impact (ELA 2022) has also been prepared to assess impacts to historic heritage.

The proposed works are therefore in accordance with the objects of this Act.

Reserve management principles (s 30I)

A karst conservation reserve is to be managed in accordance with the following principles:

Section 30I.2 Karst conservation areas	Relevance to project
a. the conservation of the karst environment, including the protection of catchment values, such as hydrological processes and water quality	The proposed works will not have a significant impact on the catchment values, hydrological process, and water quality of the reserve, subject to implementation of mitigation measures provided in Section 9.
b. the conservation of cultural values	The proposed works will not have a significant impact on Aboriginal cultural values. To ensure appropriate management of Aboriginal cultural values, an Aboriginal heritage impact permit has been sought for the upgrade works. In addition, a statement of heritage impact (ELA 2022) has been prepared and determined that the proposal is unlikely to have a significant impact on listed heritage items.
c. the protection of natural water movement and air movement regimes and processes within the karst environment	The proposed works will impact the natural flow of water through the construction of in-stream crossings (stepping stones), however, this is not considered significant, and the recommended revegetation of the riparian corridor is likely to increase water quality and improve natural flows in the reserve. There is no impact on the movement of air in the karst environment associated with the proposed works.
d. the conservation of biodiversity, the maintenance of ecosystem function, the protection of the geological and geomorphological features and natural phenomena and the maintenance of natural landscapes, cave formations and fossil deposits	The proposed works are primarily being undertaken on land that has already been cleared and is currently being used for visitor infrastructure. There are works located in the Victoria Arch, however, this area is already accessed by the public and the provision of visitor infrastructure will reduce the impacts of visitors by providing a formalised and equitable access/viewing point. Additionally, the works are located on rubble and are within the photic (i.e. bathed in sunshine) zone of the cave system, neither of which are considered a sensitive karst environment as they have either been disturbed or are exposed to elements outside of the karst system (such as wind and sunlight).
e. provision for research and monitoring	The proposed works will not reduce the ability for research and monitoring to be undertaken. The provision of upgraded visitor infrastructure will provide researchers a better base to undertake studies and monitoring in the area.
f. the promotion of public appreciation and understanding of the karst conservation reserve's natural and cultural values	The proposed works include the provision of signage to inform and educate visitors on the beauty and importance of the karstic landscape. Additionally, the works are proposing to provide accessible access to Victoria Arch, this will allow public appreciation of the reserve for all users.
g. provision for sustainable visitor or tourist use and enjoyment that is compatible with	The proposed upgrades will allow for sustainable visitor and tourist use, in particular the amenities upgrade, by improving waste

Section 30I.2 Karst conservation areas	Relevance to project
the karst conservation reserve's natural and cultural values	management. The works will have a minimal impact on the reserve's natural values as minimal vegetation and landscape disturbance is proposed to meet the objectives of the works. In addition, one aim of the proposed works is to better manage human waste which benefits land management and conservation objectives.
h. provision for sustainable use (including adaptive reuse) of any buildings or structures or modified natural areas having regard to the conservation of the karst conservation reserve's natural and cultural values	The construction of the proposed works will utilise existing areas of cleared and disturbed terrain, however, some additional vegetation clearing is required to facilitate the works. Existing building and facilities are to be retained and upgraded where appropriate.
i. provision for the carrying out of development in any part of a special area (within the meaning of the *Hunter Water Act 1991*) in the karst conservation reserve that is permitted under section 185A having regard to the conservation of the karst conservation reserve's natural and cultural values	The works will not be undertaken within a 'special area' within the meaning of the Hunter Water Act.

Consistency with plan of management

Due consideration has been taken for the provisions of the *Wombeyan Karst Conservation Reserve plan of management* (NPWS 1999) (the PoM). The proposed works do not compromise the objectives of the PoM and are considered consistent with the following objectives:

- protection of the karst system and associated features
- protection of water quality in the reserve
- maintenance of the scenic values of the naturally vegetated ridges and hillslopes, and of the valley as a contrasting cultural landscape
- provision of facilities and services which enhance visitor enjoyment and understanding of the reserve, including a range of guided and self-guided tours, accommodation and recreational facilities and activities
- education of visitors as to the value of the reserve and the natural and cultural processes which led to Wombeyan's formation and use.

The proposed upgrades to the visitor precinct are primarily aligned with the last 2 objectives listed above, whilst not comprising on the first 3 objectives. The upgrades to study area will enable visitors of the reserve to gain more appreciation for the cultural and natural values of the reserve and allow visitors to have a more comfortable stay. Furthermore, the design of the upgrades will be sympathetic to the existing infrastructure on site and has been designed to reduce impacts on the natural and historic values of the study area. The improved visitor infrastructure will incentivise increased visitation and enable the study area to be more readily used for accommodation, tourism and recreational purposes.

Within the PoM, the following management strategies and activities are relevant to the proposed works:

- The reserve will be promoted as a place which provides opportunities for appreciation and understanding of the natural and cultural heritage of the reserve and surrounding area through a range of tours, recreational and adventure activities as well as opportunities for reflection and relaxation.

- The cave infrastructure including walkways, handrails and steps will be maintained, and upgraded where necessary to meet safety standards in a manner which does not damage the caves.
- Where appropriate, facilities in the reserve will be designed to permit use by visitors with a disability.
- The existing carpark will be redesigned to provide better circulation patterns and to cater for all vehicles including buses.
- Investigate relocation of visitor centre and office into kiosk building.
- Prepare interpretation plan and review directional and interpretation signs and brochures.

The proposed works are consistent with the above management strategies and the PoM overall.

The PoM indicates that the Kui Kiosk is to be investigated to be upgraded, in order to house the visitor centre and NPWS offices. The upgrade of the Kui Kiosk is included in the scope of works of this proposal. The proposed development is permitted under the PoM.

3.1.2 Biodiversity Conservation Act 2016

The activity is consistent with the biodiversity conservation objectives of the *Biodiversity Conservation Act 2016* (BC Act).

The BC Act seeks to:

- conserve biological diversity at bioregional and state scales
- maintain the diversity and quality of ecosystems and enhance their capacity to adapt to change and provide for the needs of future generations
- assess the extinction risk of species and ecological communities and identify key threatening processes through an independent and rigorous scientific process
- establish a framework to avoid, minimise and offset the impacts of proposed development and land use change on biodiversity.

Section 7.3 of the Act requires proponents of activities subject to Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to determine whether they will have a significant impact on threatened species. The test for significant impact is described in s 7.3 of the Act. A significant impact also occurs if the activity is carried out in an area of outstanding biodiversity value.

If a significant impact is likely to occur, the proponent of the activity must prepare a species impact statement in accordance with s 7.20 or a biodiversity development assessment report, if the proponent so elects.

It was determined that the proposed works will not have a significant impact on any threatened entities. Therefore, the preparation of a species impact statement or biodiversity development assessment report is not required.

3.1.3 Rural Fires Act 1997

The proposed works are consistent with the provisions of the *Rural Fires Act 1997*. Under this Act, NPWS is a prescribed fire authority and is responsible for the control and suppression of all fires on lands that it manages.

The objectives of the Rural Fires Act are to provide for:

- the prevention, mitigation and suppression of fires
- coordination of bushfire fighting and prevention

- protection of people and property from fires
- protection of the environment.

The Rural Fires Act outlines the responsibilities of landowners to manage their land for bushfire protection and provides a mechanism for the approval of hazard reduction works, through the issue of a bushfire hazard reduction certificate. Section 63 specifies that it is the duty of the owner or occupier of land to take the notified steps (such as any listed in a bushfire management plan) and any other practicable steps to prevent the occurrence of bushfires on, and to minimise the danger of the spread of bushfires on or from, that land.

The proposed works will not have any impact on matters outlined under the Act. The reserve is managed by NPWS as set out in the reserve fire management plan.

3.2 Assessment pathways

3.2.1 Environmental Planning and Assessment Act 1979

The activity may be undertaken without development consent under the provisions of s 2.73(1)(a) of *State Environmental Planning Policy (Transport and Infrastructure) 2021* ('Transport and Infrastructure SEPP') because:

- it is on land reserved under the NPW Act or acquired under Part 11 of the NPW Act
- it is for a purpose authorised under the NPW Act.

The activity is not designated development under Schedule 3 of the Environmental Planning and Assessment Regulation 2001.

The activity is not 'state significant infrastructure' under Schedule 3(7) of the *SEPP (Planning Systems) 2021*, and is not of a similar kind to such an activity.

The activity is not designated development under s 2.7(2) of the *SEPP* (*Resilience and Hazards) 2021*.

The study area is located in local government areas (LGAs) in which the *SEPP (Koala Habitat Protection) 2021* applies (Upper Lachlan and Wingecarribee LGAs), however, as the proposed activity is being assessed under Part 5 of the EP&A Act, the SEPP does not apply. The *SEPP (Koala Habitat Protection) 2021* only applies to local development under Part 4 of the EP&A Act.

3.2.2 Heritage Act 1977

The activity is on land that contains:

- an item listed on the NPWS Heritage and Conservation Register under s 170 of the *Heritage Act 1977* (contained in the Historic Heritage Information Management System)
- a place, building, landscape feature or moveable heritage item older than 25 years.

Searches of the Australian Heritage Database, the NSW State Heritage Register and the *Upper Lachlan Local Government Area Local Environmental Plan 2010* (Upper Lachlan LEP) were undertaken to identify the location of any historical heritage items within the study area of the proposed works.

The Wombeyan Caves Area is a listed item of local heritage significance (landscape) on the Upper Lachlan LEP (item number I171). The listing curtilage does not cover the entire reserve. See Section 8.2.2 for more information on historic heritage.

The Blacksmith Shed, two quarries and the timber slab building are listed as potential heritage items on NPWS Historic Heritage Information Management System which means

they have not been assessed for heritage significance. These items will not be impacted by the proposed upgrade works.

The Power House Building and the Barmah timber and stone buildings are both older than 25 years. The statement of heritage impact (ELA 2022) found that proposed changes to these buildings will not impact views to and from these buildings and will improve their functionality.

3.2.3 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) provides for the protection, conservation and recovery of threatened species defined under the Act. It also makes provision for the management of threats to threatened species, populations and ecological communities defined under the Act, as well as the protection of fish and fish habitat in general. In particular, the FM Act has mechanisms to permit dredging and reclamation and obstruction of fish passage.

The activity involves the excavation of or deposition in 'water land', that is, land submerged by water (whether permanently or intermittently).

Under s 199 of the FM Act, a public authority must, before it carries out or authorises the carrying out of dredging work or reclamation work, give the Minister written notice of the proposed work, and consider any matters raised by the Minister.

Dredging includes works that involve excavating water land, and moving or removing material onto or from water land. Reclamation works means using materials, for example, sand, soil, gravel, timber or rocks to fill in or reclaim water land; or depositing such material on water land to construct something (e.g. a bridge) over water land; or draining water from water land for the purposes of reclamation.

As shown in Figure 2, the proposed development layout includes work within Wombeyan Creek, mapped as key fish habitat. The works will include the construction of a stepping-stone crossing across the creek line, which will require completing works on the creek bed to secure the stones. This is defined as dredging and reclamation, and therefore requires consultation with DPI Fisheries under s 199 of the FM Act before works commence. If the creek is to be dewatered to allow the stepping stones to be constructed, temporary obstruction of fish passage may be required, which will require a permit under s 219 of the FM Act.

Due to the significant amount of work under the scope of the *Wombeyan Karst Conservation Reserve: Wombeyan Caves visitor precinct plan* (NPWS 2021) (visitor precinct plan) some aspects may be undertaken at a later stage. Therefore, applications for permits under the FM Act should only be completed when the in-stream works are confirmed.

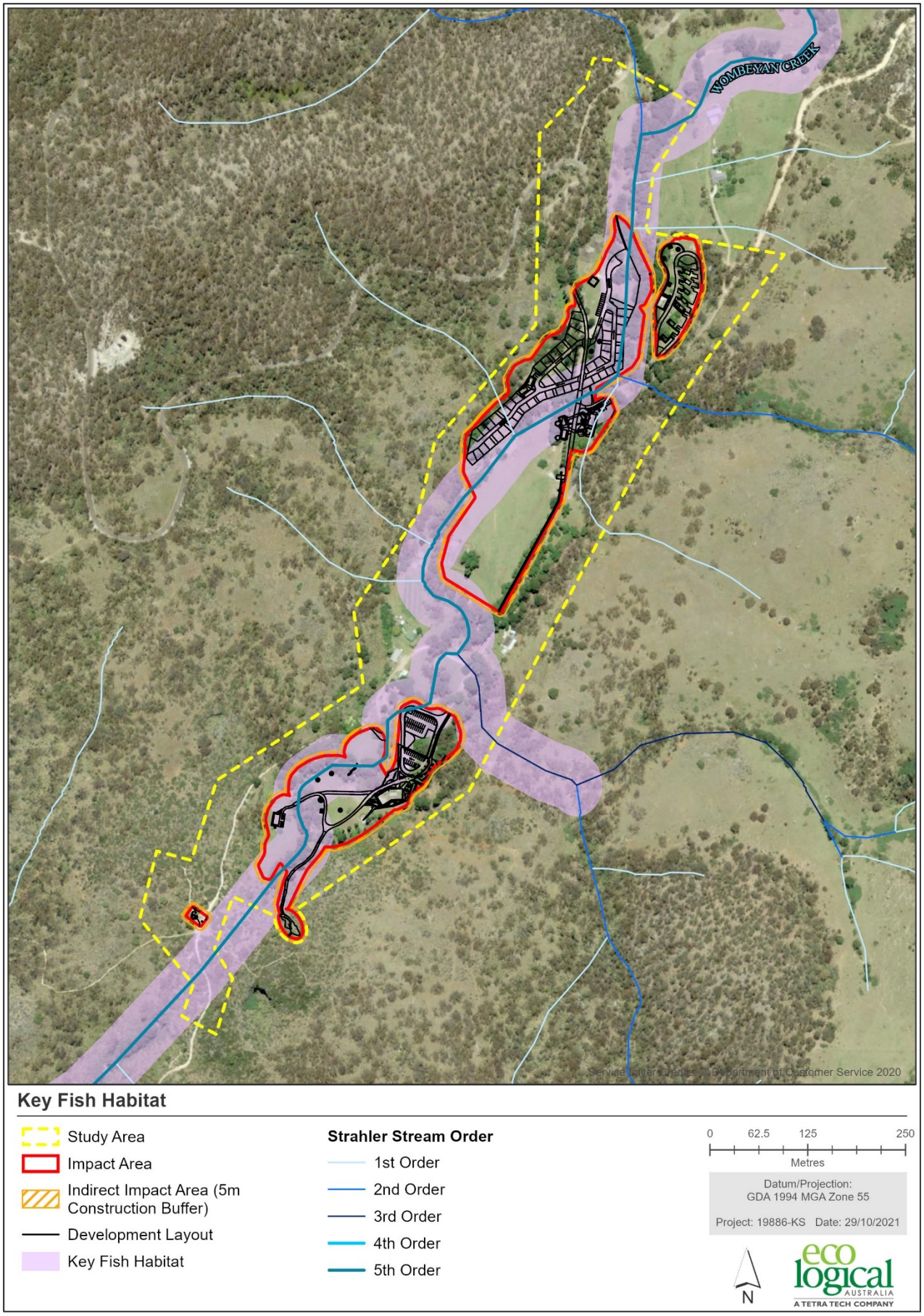

Figure 2 Mapped key fish habitat within the study area

3.2.4 Environment Protection and Biodiversity Conservation Act 1999

The activity is on land that contains the following, or the activity may affect:

- nationally listed threatened species and ecological communities, or listed migratory species.

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) protects matters of national environmental significance, such as threatened species and ecological communities, migratory species (protected under international agreements), and World Heritage and national heritage places (among others). Any actions that will or are likely to have a significant impact on the matters of national environmental significance require referral and approval from the Australian Government Environment Minister. Significant impacts for matters of national environmental significance are defined by the Australian Government's guidelines (DEWHA 2013) for matters of national environmental significance.

The protected matters search identified that one fish species – *Macquaria australasica* (Macquarie perch) – listed as endangered under the EPBC Act may occur or have habitat within the search area. The nearest record of this species is located approximately 20 km downstream of the study area in the Wollondilly River, therefore it is unlikely that it would be impacted by the proposed works.

The protected matters search also identified that the works lie close to the Greater Blue Mountains Area, which is a World Heritage property that is also listed as a national heritage place. It is unlikely that the World Heritage or national heritage values of this property would be impacted by the proposed works.

It was concluded that the proposed works are unlikely to have a significant impact on any threatened entity.

3.3 Consistency with NPWS policy

The activity is consistent with NPWS policies as described below.

Policy name	How proposal is consistent
Walking tracks policy	In accordance with the *Walking tracks policy*, tracks must be appropriately located, designed to minimise environmental impacts, and appropriate to the setting. The planning, development and management of walking tracks should also take into account public safety issues, how the track fits within other walking opportunities, such as off-park tracks, opportunities to provide access for people with disabilities, and resources needed to keep the track maintained. The proposed works are improving access for people with disabilities to enjoy the amenity of the area. Additionally, the works will improve facilities for people using the walking tracks. The design of the proposed works was developed in order to have a minimal environmental impact.
Neighbour relations policy	The *Neighbour relations policy* provides principles for NPWS to build and maintain good relationships with the people and groups who live on or manage land next door to national parks. There are 2 dwellings adjacent to the proposed works; one to the east of the proposed activity and the other to the north. Both of these properties are residential dwellings. NPWS will notify neighbouring residences of the proposed works and develop a complaints log to record and appropriately address any issues associated with the construction works.

Policy name	How proposal is consistent
No smoking in parks policy	Smoking is prohibited in all NSW national parks to make them safer and cleaner for the community. On-the-spot fines apply.
Vehicle access policy	NPWS manages vehicle access to parks to keep staff and visitors safe and limit impacts on the park environment. Vehicle access must not cause unacceptable impacts on natural and cultural heritage. The purpose of vehicle access is to supply opportunities for visitors to understand, enjoy and appreciate parks, and take maximum advantage of interpretive opportunities and scenic values. The proposed works provide a carpark within the study area to allow pedestrian access to walking tracks and other facilities. The proposal is in accordance with the policy as it does not provide unacceptable vehicle access but enables opportunities for visitors to enjoy the park.
Caves access policy	NPWS manages more than 40 areas containing karst caves of outstanding natural, cultural, scientific and recreational value, including Wombeyan Karst Conservation Reserve. NPWS may allow access to caves for appropriate recreational, cultural and scientific activities subject to conditions and the granting of consent. In determining what kinds of cave access it should grant, NPWS relies on the information provided by speleologists and researchers about cave-formation processes and cave contents (such as fauna, formations and fossils). The proposed works are in accordance with policy as they are not expected to significantly impact the cave systems and mitigation measures are provided in Section 9 to further mitigate impacts.
Visitor accommodation policy	The NPW Act permits accommodation in parks for some purposes. Visitor accommodation can help increase visitation to parks, enhance visitor experiences of parks, and support the appropriate dispersal of visitation throughout the reserve system. It can take many forms including, but not limited to, camping facilities, historic or contemporary buildings, moveable structures or caravans, and tourist parks. The Wombeyan Caves visitor precinct has existing accommodation. The project is proposing to update the existing accommodation in order increase visitation to the park. The existing facilities are not up to visitors' standards or those of NPWS.
Events, functions and venues policy	NPWS allows events and functions in parks (except wilderness areas) if the criteria under this policy are met. In accordance with the *Events, functions and venues policy*, the facilities associated with the proposed works will be consistent with the provisions of the PoM. The works are proposed to upgrade existing visitor facilities, which will have minimal additional environmental impact on the reserve. Construction of new facilities, including structured, powered and pre-pitch camping areas, Kui Kiosk Hub, wayfinding and pathways are designed to support visitor access and tourism. Pursuant to paragraph 6 of the policy, the works will provide recreational and financial benefits to the community by improving access to and appreciation of an important environmental asset, potentially generating new revenue and tourism for the region.
Commercial tour operator policy	The works aim to support a new tourism strategy for visitation to a multi-day, nature-based tourism experience. The *Commercial tour operator policy* will inform how this experience is implemented and managed. The tours will be guided by the NPW Act, NSW

Policy name	How proposal is consistent
	Government policy, departmental policies and strategic planning processes. Commercial tour operators must be appropriately licensed according to the Eco Pass program, and the tour must align with the park management values, including sustainability and respect of the Aboriginal and historic heritage values identified in this REF. Adherence to this policy will support the objectives of the works, encouraging visitor appreciation and enjoyment of the reserve. Visitor safety is an important aspect of commercial tours. Visitor safety is discussed below.
Visitor safety policy	NPWS has a duty of care to park visitors. Construction of new facilities, including structured, powered and pre-pitch camping areas, Kui Kiosk Hub, wayfinding and pathways are designed to improve visitor navigation and safety. These proposed new facilities also provide visitors with opportunities to charge electronic devices and use them for emergency contacts within the reserve, or to access upgraded or new signage and paths for improved reserve navigation. Communication is an important aspect of visitor safety. Upgrades to existing signage and construction of new signage and wayfinding will contribute to effective communication that helps visitors understand their own personal responsibility in the reserve. The NPWS *Park signage manual* (NPWS 2016b) will be used as best practice for design of safety signage.

3.4 Type of approval sought

Internal NPWS approval or authorisation, including expenditure, is required. There are no existing approvals, such as permits, leases, licences or easements, which apply to part or all of the proposed activity.

Other approvals required include an Aboriginal heritage impact permit from Heritage NSW and, potentially, a permit under the Fisheries Management Act for blocking fish passage should that component of the works proceed.

4. Consultation – general

The creation of the Wombeyan Caves visitor precinct plan (NPWS 2021) has included ongoing engagement with a project control group including area and strategic management, site management and site operational staff.

In addition, further engagement was undertaken with:

- First Nations stakeholders to understand site values and establish ongoing collaboration
- event specialists, to understand events' potential and capacities of the site
- local community – a community engagement session was held in December 2021
- the visitor precinct plan was published on the community engagement webpage for the proposal and comments have been included in project planning.

In addition, an Aboriginal cultural heritage assessment has been completed, and an Aboriginal heritage impact permit application has been prepared with consultation and guidance from registered Aboriginal parties.

A site inspection was undertaken by Eco Logical Australia (ELA), accompanied by some NPWS staff on the 29 September 2021. This site visit allowed the environmental constraints present at each site to be identified and confirmed toilet locations based on such constraints.

4.1 Consultation required under Transport and Infrastructure SEPP

4.1.1 Local council (s 2.10, 2.11, 2.12 and 2.14)

The activity is on land that contains:

- heritage items listed under the local environmental plan (LEP).

Consultation with Upper Lachlan Shire Council

Consultation with Upper Lachlan Shire Council has been undertaken. Consultation was recommended in order to mitigate any potential impacts the works may have within the heritage curtilage of Wombeyan Caves. Section 2.11.2 of the *Transport and Infrastructure SEPP 2021* states that a public authority, or a person acting on behalf of a public authority must not carry out development to which this clause applies unless the authority or the person has:

a. had an assessment of the impact prepared
b. given written notice of the intention to carry out the development, with a copy of the assessment and a scope of works, to the council for the area in which the heritage item or heritage conservation area (or relevant part of such an area) is located
c. taken into consideration any response to the notice that is received from the council within 21 days after the notice is given.

Wombeyan Caves is a listed item of local heritage significance (landscape) on the Upper Lachlan LEP 2010 (item number I171), however, the works are not expected to impact this listing. ELA has prepared a statement of heritage impact to support this finding (ELA 2022). Upper Lachlan Shire Council will be notified of the proposed works.

4.1.2 Roads or maritime (s 2.15(2)(c) or Schedule 3)

Is the activity:

- a fixed or floating structure in navigable waters
- traffic-generating development on main roads?

Not applicable.

4.1.3 Siding Spring Observatory (s 2.15(2)(d))

The activity will increase the amount of artificial light in the dark night sky within 200 km of the Siding Spring Observatory.

Not applicable.

4.1.4 Mine subsidence area (s 2.15(2)(f))

Not applicable. The land is not in a mine subsidence district within the meaning of the *Coal Mine Subsidence Compensation Act 2017*.

4.2 Consultation requirements under Fisheries Management Act (s 199)

The works will affect submerged land such as creeks, streams and rivers (including intermittently submerged areas, such as wetlands and non-perennial creeks) that involve excavation, removing material, depositing material or draining water.

The proposed works will include works on the bed of Wombeyan Creek and potential obstruction of fish passage. As the creek is mapped as key fish habitat, consultation with DPI Fisheries under s 199 of the FM Act (and potentially a permit under s 219) would be required before that component of the works can be approved or carried out.

4.3 Consultation requirements under NPW Act for leases and licences

Not applicable. No leases or licences under the NPW Act are required as part of the proposed activity.

5. Consultation – Aboriginal communities

5.1 Native title consultation requirements

The land is subject to an Indigenous land use agreement. *Gundungurra Indigenous land use agreement 2014* (OEH 2014) establishes the framework for all consultation with the Aboriginal community.

As required by the *Gundungurra Indigenous land use agreement*, a notification of a Class 2 Post Registration Act was sent to the Gundungurra parties to the agreement.

6. Proposed activity (or activities)

6.1 Location of activity

Lands within proposal	Wombeyan Karst Conservation Reserve
Description of location	Wombeyan Karst Conservation Reserve covers an area of 417 ha and is located 190 km south-west of Sydney, 77 km north of Goulburn and 63 km west of Mittagong. The visitor precinct is located within the eastern border of the reserve, at 24 Wombeyan Caves Road. See Figure 3. The reserve is in the mapped area of the Gundungurra Indigenous land use agreement 2014.
Site commonly known as	Wombeyan Caves
Lot/DP	Multiple
Street address	24 Wombeyan Caves Road, Wombeyan Caves
Site reference	Easting: 3418142 Northing: 14958174 AMG zone: 56 Reference system: GDA 94

6.2 Description of the proposed activity

NPWS proposes to undertake upgrade works to the Wombeyan Caves visitor precinct. The key objectives of the project include:

1. to revitalise and activate an iconic tourism asset
2. to create an outstanding experience for Wombeyan Caves to act as a demand driver for the region
3. to increase visitation and length of dwell and stay in the region by:
   a. revitalising and activating an iconic tourism asset
   b. supporting a new tourism strategy that links Wombeyan Caves visitation to a 2- to 3-day nature-based tourism experience
   c. developing improved event, recreational and accommodation infrastructure including improved accessibility.

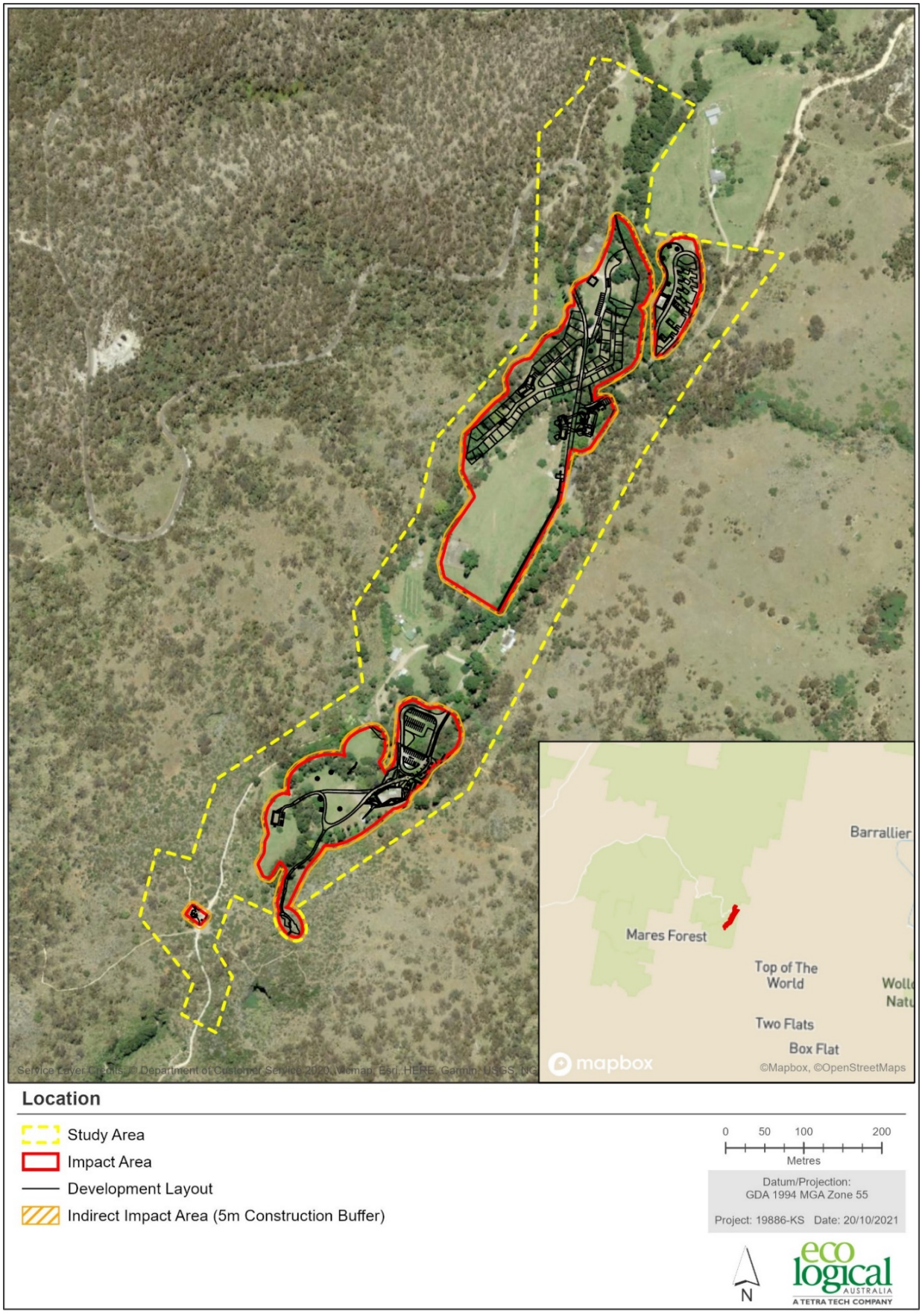

Figure 3 Wombeyan Caves visitor precinct (study area)

A summary of the proposed Stage 1 works (2022 to 2023 – subject to final budget) includes:

- upgrades to signage and wayfinding throughout the precinct
- upgrades to existing and provision of new camping facilities
- construction of new structured and powered camping sites
- upgrades to the cabins precinct, including removal of aged cabins
- construction of glamping/pre-pitch camping areas
- upgrades to day use parking area
- construction of new integrated Kui Kiosk Hub
- construction of several creek crossings
- construction of Wattle Hill wayfinding landing
- construction of Victoria Arch accessible path and Arch viewing landing
- upgrades to the existing Power House Building.

See Figure 4.

6.2.1 The proposed activity: pre-construction, construction and post-construction

The proposed activity involves a number of stages, listed below.

Pre-construction:

- Transport of machinery, equipment and materials to the study area and establishment of site storage areas within the Wombeyan Green and the nominated site compound plan. Machinery to be left on site overnight will be kept behind temporary security fencing.
- Installation of sediment and erosion protection measures in accordance with the erosion and sediment control plan, which will be developed using *Managing urban stormwater: soils and construction* (Landcom 2004, aka the 'blue book') with reference to Chapter 5 'Erosion control: management of water', and *Erosion and sediment control on unsealed tracks* (OEH 2012).
- Installation of protection and exclusion fencing around vegetation that is to be protected and to delineate area of works.

Construction/Operation:

The following items are all of the construction activities identified in the implementation scope plan. The construction methodology for these works will be defined by the construction contractor, and available budget. However, mitigation measures, which are provided in Section 9 of this REF, must be adhered to by the construction contractor to mitigate the potential impacts to the environment. The location of the proposed works is presented in Figure 4.

Site-wide

- Removal of vegetation and topsoil across all areas of works.
- Excavation for hardstand, maximum proposed depth of excavation across entire site is 900 mm (for the excavation of footings and drainage). Most excavation will take place to a depth of 500 mm.

Erection of signage

- Arrival signage on Wombeyan Caves Road
  - upgrade existing identity/entry signage
  - provide supplementary identity/entry signage
- Wayfinding signage on Wombeyan Caves Rd
  - provide wayfinding signage at entry points to accommodation

Construction/Upgrade of buildings

- Barmah Hub
  - widen building entries and targeted building upgrades
  - external gathering and seating spaces
  - accessible path links
- New Barmah Hub camping amenities
  - new amenities building and surrounding landscape
- New western camping amenities
  - new amenities building and surrounding landscape
- Existing northern amenities
  - minor maintenance works
- Cabins precinct
  - selective removal of aged cabins
  - selective refurbishment and relocation of family cabins
  - new accessible cabin
  - upgraded park setting and picnic facilities
- Kui Kiosk Hub
  - new integrated kiosk and NPWS office
  - landscaped plaza

Construction and designation of camping areas

- Structured camp sites including powered sites
  - individual camp sites and access roads
  - 17 powered sites
- Unstructured group camping lawns
  - open camping lawn areas with defined booking capacity
- Designated area for pre-pitch camping
  - additional group camping area suitable for licensing to pre-pitch camping operator
- Potential glamping set-up lawns
  - potential area for glamping operation by operator
- Wombeyan Green
  - conservation of existing open lawn
  - removal of existing tennis courts
- Kui Kiosk lawn
  - consolidate open lawn through removal of gravel roadway
  - addition of accessible path, picnic areas and access road

- Power House event glade
  - selective upgrades to building to make suitable for event use
  - seating/gathering terrace

Construction/Upgrade of carparks, access ways and viewing platforms

- Upgraded day use parking area
  - sealed parking area (17 spaces)
  - grassed parking area (34 spaces)
  - existing NPWS office to be demolished
- Victoria Arch
  - accessible path access to new Arch viewing landing
- Wattle Hill – wayfinder landing
  - rest and gathering point in sheltered location
- Creek crossings
  - creek crossing as stepping stones

Post-construction:

- General site clean-up including removal of excess construction materials and any construction refuse.
- Removal of signage, construction-related erosion and sediment control measures and delineation fencing.

Figure 4 Proposed works (based on NPWS 2021)

6.2.2 The activity footprint (size of the area of impact)

The size of the study area is 8.702 ha. This area is far greater than what will be impacted by the proposal and is considered a worst-case scenario assessment. The assessment has been conducted like this to allow for flexibility when constructing the proposed works. Direct impact areas are outlined in Table 1. Further discussion about the vegetation types and impacts is presented in Sections 8 and 9.

Table 1 Direct impact areas

Direct impact areas	Area (ha)
Exotic grassland	3.985
Ornamental	3.240
Plant community type (PCT) 1105 River Oak open forest of major streams, Sydney Basin Bioregion and South East Corner Bioregion	0.917
PCT 651 Apple Box - Chalker's Wattle woodland on limestone slopes near Wombeyan Caves, Sydney Basin Bioregion	0.167
Vegetation subtotal:	**8.309**
Building	0.114
Road	0.279
Total direct impact:	**8.702**

For the purposes of this REF, a 5 m construction buffer has been used to calculate indirect impacts. The breakdown of indirect impacts is shown in Table 2.

Table 2 Indirect impact areas

Indirect impact areas	Area (ha)
Exotic grassland	0.266
Ornamental	0.724
PCT 1105 River Oak open forest of major streams, Sydney Basin Bioregion and South East Corner Bioregion	0.238
PCT 651 Apple Box - Chalker's Wattle woodland on limestone slopes near Wombeyan Caves, Sydney Basin Bioregion	0.175
Vegetation subtotal:	**1.403**
Building	0.002
Road	0.017
Total indirect impact:	**1.422**

Figures 5 and 6 present the impact and the indirect impact area associated to the 5 m construction buffer for the northern and southern sections of the study area, respectively.

Figure 5 Impact area – northern study area

Figure 6 Impact area – southern study area

6.2.3 Proposed construction methods, materials and equipment

Construction methods have been prescribed in the technical drawings prepared for tender. In addition, mitigation measures which are provided in Section 9 of this REF must be adhered to by the construction contractor to mitigate the potential impacts to the environment. The contractor is responsible for completing contractor documents confirming construction details.

Equipment and materials to be used in construction of the proposed works will be determined by the construction contractor. However, below is an indicative list of equipment that may be used during construction.

Equipment and materials:

- excavators and/or posi-track
- tipper trucks
- bulldozer/grader
- hand tools for vegetation maintenance
- mulching tractor.

6.2.4 Receival, storage and on-site management for materials used in construction

A construction compound will be established on the Wombeyan Green and is presented in the nominated site compound plan (Appendix A).

6.2.5 Earthworks or site clearing including extent of vegetation to be removed

As a worst-case scenario, 1.08 ha of native vegetation may be directly impacted as part of the works. Earthworks are to occur to prepare the new camping ground, shown in Figure 4, this area is approximately 0.75 ha. Further assessments of this impact are discussed in Section 9.2.

6.2.6 Environmental safeguards and mitigation measures

Refer to Section 9.

6.2.7 Sustainability measures – including choice of materials (such as recycled content) and water and energy efficiency

All works undertaken will be in accordance with the National Construction Code. The manual provides for the use of recycled content, as well as water- and energy-efficient fittings

6.2.8 Construction timetable and staging and hours of operation

Works hours will be in accordance with the *Interim construction noise guidelines* (DECC 2009):

- Monday to Friday – 7 am to 6 pm
- Saturday – 8 am to 1 pm
- no work on Sunday or public holidays.

6.2.9 Ancillary facilities to support construction and operation

Temporary signage to signal area closures and works in progress will be erected prior to any construction works starting and will be removed following completion.

NPWS will advise the public of any temporary closures via the NPWS visitor website. During construction, the reserve will be closed to visitors. Public vehicular access through the reserve on Wombeyan Caves Road is unlikely to be impacted, however, there may be a need for temporary traffic diversion during construction.

7. Reasons for the activity and consideration of alternatives

7.1 Objectives and reasons for the proposal

The key objectives of the project include:

1. to revitalise and activate an iconic tourism asset
2. to create an outstanding experience for Wombeyan Caves to act as a demand driver for the region
3. to increase visitation and length of dwell and stay in the region by:
   a. revitalising and activating an iconic tourism asset
   b. supporting a new tourism strategy that links Wombeyan Caves visitation to a 2- to 3-day nature-based tourism experience
   c. developing improved event, recreational and accommodation infrastructure including improved accessibility.

7.1.1 Reasons for the activity

The Wombeyan Karst Conservation Reserve is known for its remarkable karst formations and is a popular destination for family holiday-makers and day visitors. The visitor precinct offers a range of accommodation (camping and hard-roofed) and nature-based recreational activities.

At the same time the precinct is considered ‘tired’ and lacking the visitor amenity and quality that can take advantage of the area’s stunning natural attractions. As a result, visitation to Wombeyan Caves is currently under-performing compared to other regional tourism destinations. The site’s ageing infrastructure is under-utilised, detracts from the spectacular setting, and no longer meets user and NPWS expectations.

The proposal is required in order to revitalise the iconic tourism asset and create an outstanding experience for Wombeyan Caves to act as a demand driver for visitation to the region. The project is to be funded by $9,611,350 from the Restart NSW Fund.

7.2 Consideration of alternatives

7.2.2 Alternatives to the proposal

The ‘do nothing’ approach was considered, and it was deemed to not be appropriate as the existing visitor infrastructure is considered not fit for purpose and does not meet the expectations of visitors to the area or NPWS. If the work was not completed, then the visitor infrastructure would further deteriorate and likely reduce the attractiveness/amenity of the reserve to potential visitors.

No other location was considered as it was deemed the most appropriate location as it has access to existing infrastructure, such as the road, is in an already cleared location, and in close proximity to the tourism attractions such as the Victoria Arch, and access to the caves.

The scope of works has been refined, and the current choice does not include a number of activities that were considered a lower priority and only to be undertaken if funding was available. These additional activities included the provision of more accommodation choices, family and compact cabins, enhanced landscaping, additions to Barmah Hub, further

upgrades to existing amenities blocks, a new tennis court and upgrades to walking tracks in the reserve.

7.2.3 Justification for preferred option

If the currently proposed activity is not approved the visitor infrastructure would continue to deteriorate and rates of visitors to the Wombeyan Caves Area would continue to decrease.

The preferred option provides a range of visitor infrastructure that can support a variety of visitor needs, from day trippers to those wanting longer stays. The proposed works will help bring tourists back to the Wombeyan Caves by providing facilities that complement the outstanding natural beauty of the area.

If the mitigation measures provided in Section 9 are adhered to, the risk of significant impacts on the environment is minimal.

8. Description of the existing environment

The proposed works will be undertaken on areas within the Wombeyan Caves visitor precinct (also referred to as the study area). The study area contains existing infrastructure and development associated with visitor services and tourism. The study area includes the valley floor, intersected by Wombeyan Creek, with the Victoria Arch Cave at the southern extent; and cabins, exotic grassland and ornamental trees at the northern extent. A key feature of the study area is the Wombeyan Creek which flows north to south through the site. The creek is mostly vegetated and contains remnant native vegetation.

As a part of the proposed works, several patches of vegetation within the campground will be impacted. The proposed works are located on land reserved under the NPW Act which is zoned E1: National Parks and Nature Reserves (Upper Lachlan LEP 2010). Surrounding lands, partly within the study area buffer but not within the area of the proposed activity, are zoned as (see Figure 7):

- E3: Environmental Management
- RU2: Rural Landscape.

8.1 Natural values

8.1.1 Climate

The closest weather station is Taralga, approximately 17 km to the south-west. The average summer temperature is between 12°C and 26°C. The average winter temperature is between 0°C and 10°C. The wettest month of the year on average is June, and the driest is April. The average rainfall for the area is approximately 800 mm per year (Australian Bureau of Meteorology 2021).

8.1.2 Geology, geomorphology and topography

The geology of the area consists of marble in karst system. Marble was mined in the area from 1915 to 1997.

Scientifically, the geology of the study area is known as the Bindook porphyry and is characterised by quartz and feldspar set in a greenish to black groundmass, minor dacite, felsite and tuff.

The topography of the area consists of steep to precipitous hills and mountains with elevations from around 60–1,000 m. Slope gradients vary from 30 to greater than 50%, with local relief between 200–400 m. Closely spaced, permanent erosional stream channels form a non-directional and diverging tributary network.

The landforms of the reserve have been shaped by geological events and weathering processes, which have taken place over the past 350 million years. These have produced one of the most cavernous karst areas in New South Wales with over 500 known caves in an area of less than 600 ha.

The reserve has a wide range of surface karst features, including funnel- or saucer-shaped sinkholes in the limestone (dolines), blind valleys, deposits of calcite around springs (tufa), surface solutional formations (karren) and a beautiful limestone canyon.

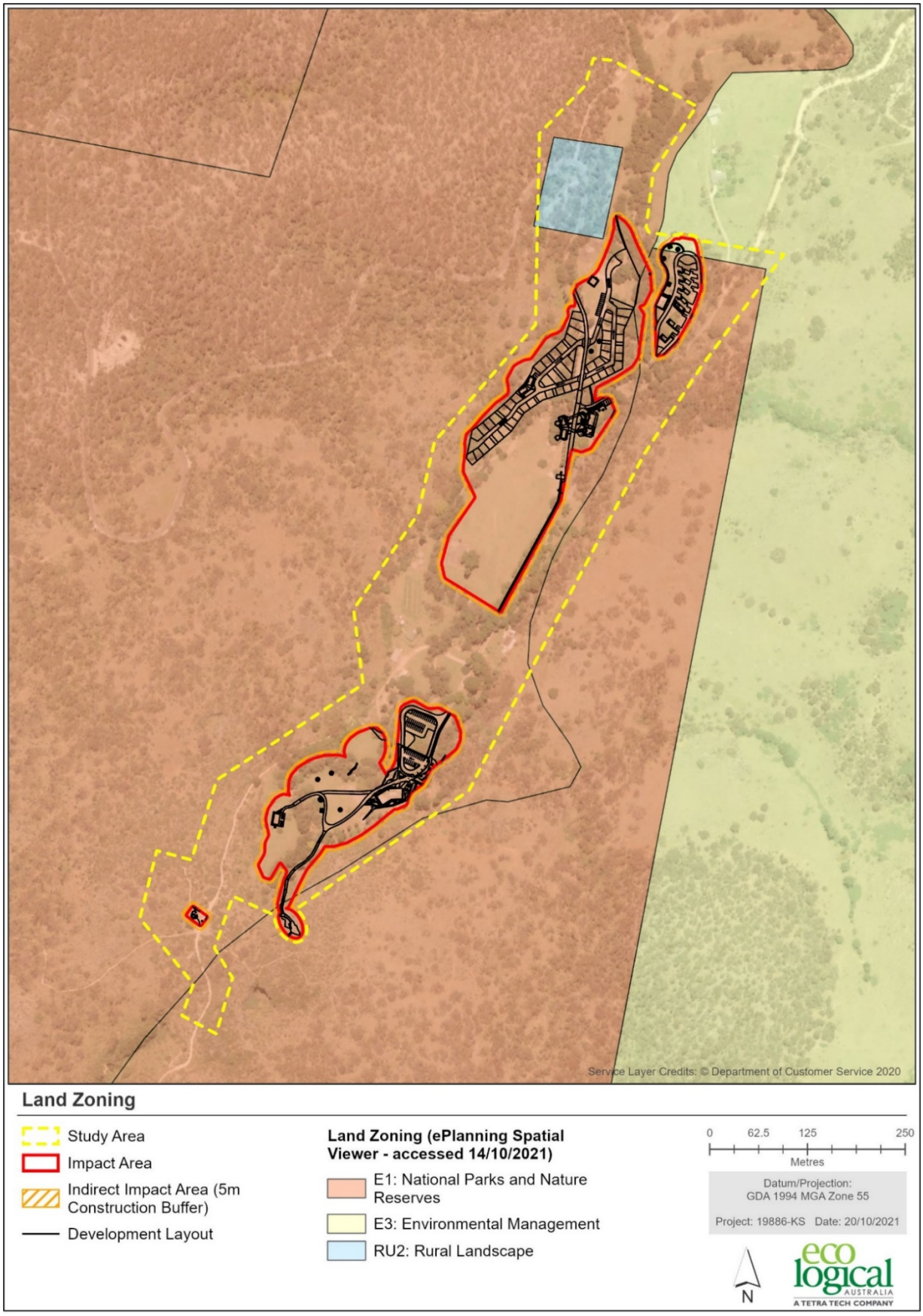

Figure 7 Land zoning within the study area

8.1.3 Soil types and properties (including contamination)

Goodmans Ford Soil Landscape

The soil landscape associated with the study area is Goodmans Ford Soil Landscape (SL-gf) on the Soil Landscapes of the Gosford-Lake Macquarie 1:100,000 Sheets (Murphy and Tille 1993). See Figure 8.

The soil is shallow and formed on steep to precipitous hills and mountains near the Wollondilly River. The soil comprises shallow loams and red earths (Um and Gn1) with minor shallow red podzolic soils (Dr2) on crests and side slopes; red and yellow podzolic soils (Dy) on colluvial foot slopes; and sandy alluvials on flats. Some steep rocky escarpments, minor to moderate sheet erosion, soil creep, gullying and stream bank erosion occur in this soil type.

8.1.4 Watercourses, waterbodies and wetlands (including their catchment values)

The proposed works are alongside Wombeyan Creek, a fifth order watercourse. Numerous mapped first order tributaries flow into Wombeyan Creek in the study area (Figure 9). Direct impacts to the watercourse will occur as a result of the construction of the stepping-stone crossing. Indirect impacts to the watercourse may occur during the construction phase of the works, including sedimentation of the creek.

The hydrology, physical form, in-stream habitat, streamside vegetation and overall condition of reaches along the watercourse as shown in Figure 10 are summarised in Table 3 with supporting photographs below.

Threatened species distribution modelling (Riches et al. 2016) shows that the Wollondilly River downstream of the study area is potential habitat for Macquarie perch (*Macquaria australasica*), listed as an endangered species under the FM Act. However, the aquatic habitat within the site is unlikely to be suitable for this species.

There are no mapped subterrain groundwater-dependent ecosystems in the study area based on the Groundwater Dependent Ecosystem Atlas. However, previous studies in the reserve indicate that the area is one of the richest stygofauna sites in eastern Australia (Thurgate et al. 2001). There are at least 40 different taxa of stygofauna present within the reserve; this is considered to be very diverse (Thurgate et al. 2001). It is considered likely that the Wombeyan Creek contains some stygofauna.

Wombeyan is one of the most cavernous karst areas in New South Wales and has been subjected to 3 or 4 periods of karstification since the Devonian (Osborne 1993). As part of this process, the caves have been subjected to burial and infilling at various times, promoting the blockage and diversion of groundwater flows leading to the development of the complex hydrology described above. The resulting isolation of cave systems may have contributed to the distinctive faunal patterns between catchments and is considered one of the reasons for the high diversity of stygofauna in the area.

The proposed works at Wombeyan Caves are located within the Warragamba catchment, part of Sydney's drinking water supply.

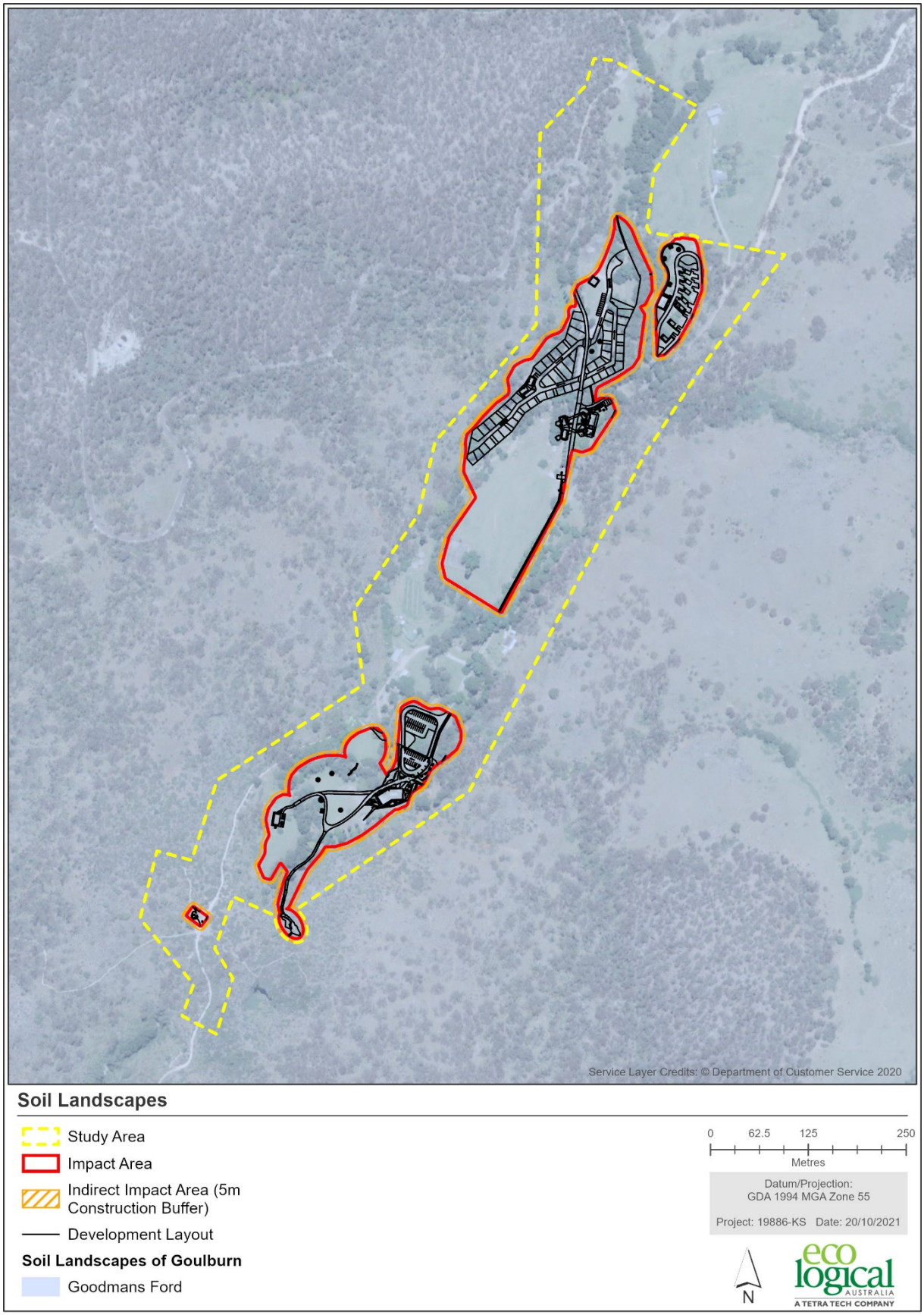

Figure 8 Soil landscapes

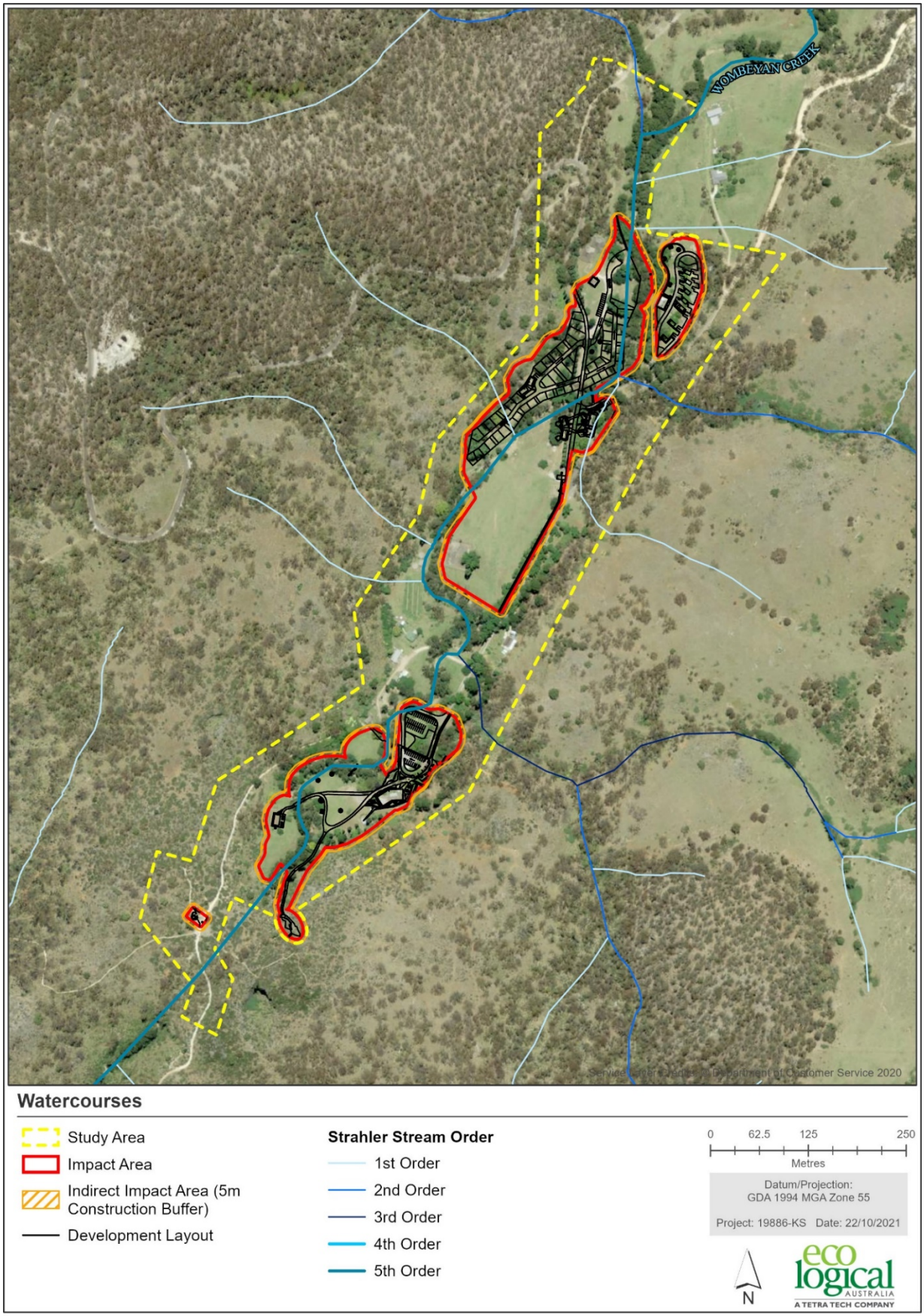

Figure 9 Mapped watercourses within the study area

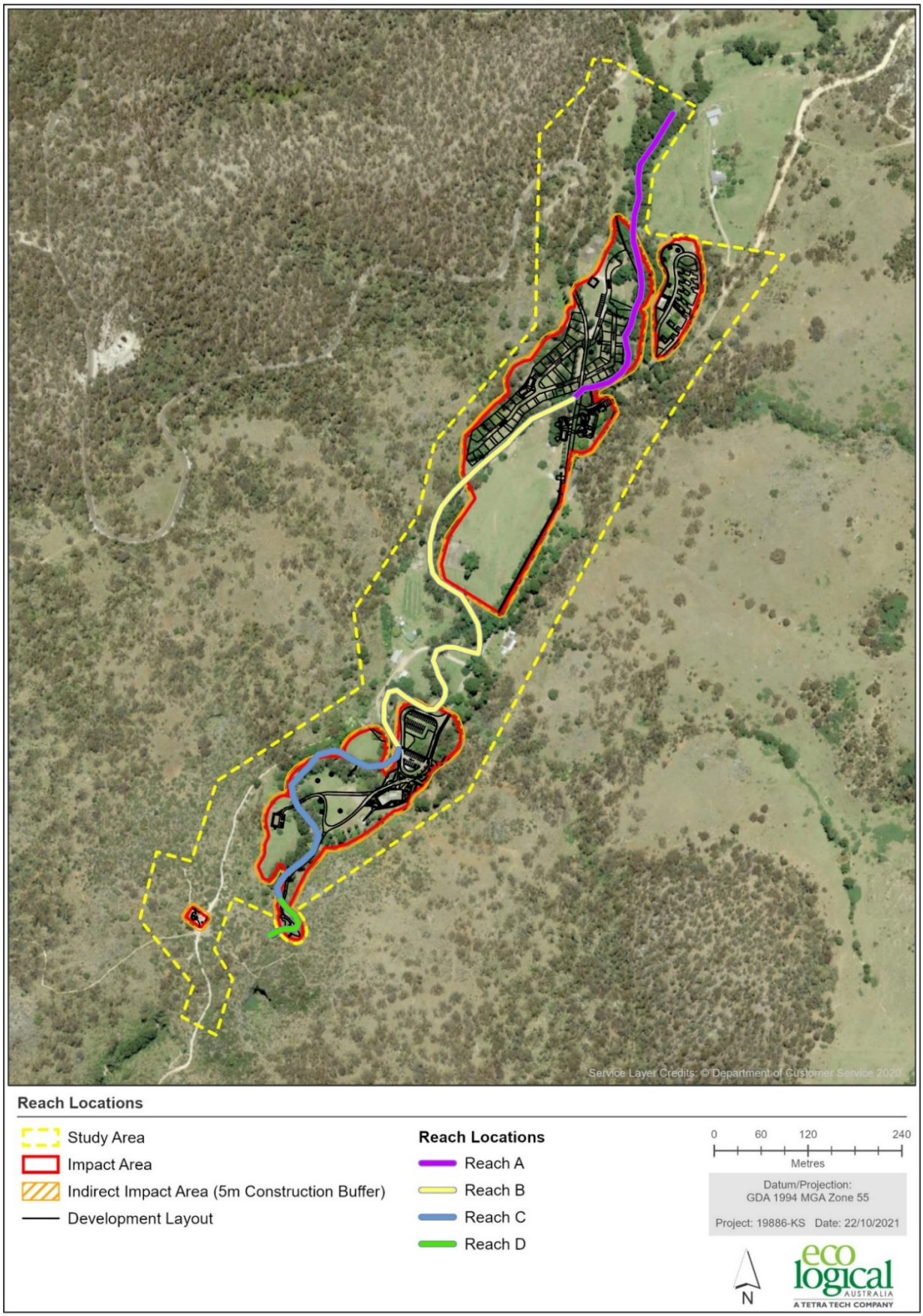

Figure 10 Reach locations within the study area

Table 3 Summary of reach condition within the study area

Reach (see location map in Figure 10)	Hydrology	Physical form	In-stream habitat	Streamside vegetation	Overall condition
Reach A Upstream of crossing	5th order stream. <1/3 cleared catchment. Ephemeral flows. Minor overland flow paths and tributaries across floodplain. No impoundments or significant barriers to flow. Ford crossing flush with upstream bed.	Channel typically 3 m wide but up to 6 m wide upstream near confluence. Banks <0.5 m high, mostly <30° slope. Channel has low grade and low sinuosity and is well defined through tree-lined floodplain. No substantial bank or bed erosion, but minor sheet erosion on floodplain flow paths, and scouring around foot bridges. Substrate dominated by cobble, mixed with sand, gravel, pebble and boulder.	Key fish habitat – Type 3 *minimally* sensitive due to ephemeral flows and lack of aquatic plants. Flowing at time of survey (<1 m/sec) and typically <10 cm deep. 50% pool, 50% riffle/run sequence. Minor large woody debris, but not contributing to habitat. Channel suited to amphibians and small fish. No fish observed. Ford creates a barrier to upstream fish migration due to eroded drop down. No macrophytes. Water very clear.	Moderate riparian extent and continuity, typically a narrow riparian corridor through the cleared reserve. Some evidence of natural recruitment of woody natives but dominated by large *Casuarina cunninghamiana* fringing the bank. Riparian structure notably absent of a mid-storey: • 70% tree cover • 5% shrub cover • 40% grass/ground cover.	Moderate condition, stabilised by rocky bed and large trees.
Reach B Crossing to Ranger Station	5th order stream. <1/3 cleared catchment. Ephemeral flows. Minor overland flow paths and tributaries across floodplain.	Channel typically 3 m wide but up to 6 m in parts. Banks mostly <0.5 m high, <30° slope except were eroded to 2 m high and 60° slope. Channel has low grade and moderate sinuosity	Key fish habitat – Type 3 *minimally* sensitive due to ephemeral flows and lack of aquatic plants. Flowing at time of survey (<1 m/sec) and typically <10 cm deep	Poor riparian extent and continuity, typically a narrow riparian corridor through the cleared reserve (less trees than Reach A). Some evidence of natural recruitment of woody natives but	Poor condition, impacted by reduced riparian extent and erosion.

Reach (see location map in Figure 10)	Hydrology	Physical form	In-stream habitat	Streamside vegetation	Overall condition
	No impoundments or significant barriers to flow.	and is well defined through mix of tree-lined and grass floodplain. Substantial bank erosion was common, such as drop down from ford, gullying off cleared floodplain, sheet scouring exposing tree roots, and slumping near tennis court and outer bends. Substrate dominated by cobble, mixed with sand, gravel, pebble and boulder. Some gabion and boulder bank reinforcement used. Minor pipe crossings encased with concrete.	but several small pools <30 cm deep. 50% pool, 50% riffle/run sequence. Minor large woody debris, but not contributing to habitat. Channel suited to amphibians and small fish. No fish observed. No macrophytes. Water slightly turbid in pools with blue-grey tint, otherwise clear.	dominated by large *Casuarina cunninghamiana* fringing the bank and other exotic deciduous trees. Riparian structure notably absent of a mid-storey: • 50% tree cover • 5% shrub cover • 60% grass/ground cover.	
Reach C Ranger Station to cave	5th order stream. <1/3 cleared catchment. Ephemeral flows. No impoundments or significant barriers to flow.	Channel typically 3 m wide. Banks 0.5–2 m high, mostly 30–45° slope. Channel has low grade and moderate sinuosity and is well defined through trees and constricted valley margins.	Same as Reach B.	Moderate riparian extent and continuity, typically a narrow riparian corridor through the cleared reserve, abutted by constricting valley margin. Some evidence of natural recruitment of woody natives but	Moderate condition, stabilised by narrowing valley floor and large trees.

Reach (see location map in Figure 10)	Hydrology	Physical form	In-stream habitat	Streamside vegetation	Overall condition
		Bank scouring and slumping erosion common. Substrate dominated by cobble, mixed with sand, gravel, pebble and boulder.		dominated by large *Casuarina cunninghamiana* fringing the bank. Riparian structure notably absent of a mid-storey: • 70% tree cover • 10% shrub cover • 40% grass/ground cover.	
Reach D Inside cave	5th order stream. <1/3 cleared catchment. Ephemeral flows. No impoundments or significant barriers to flow.	Channel typically 1–2 m wide confined to cave walls. Channel has low grade and moderate sinuosity and is well defined through cave floor. No erosion. Substrate dominated by cobble, mixed with sand, gravel, pebble and boulder.	Key fish habitat – Type 3 *minimally* sensitive due to ephemeral flows and lack of aquatic plants. Flowing at time of survey (<1 m/sec) and typically <10 cm deep. 50% pool, 50% riffle/run sequence. No large woody debris. Channel suited to amphibians and small fish. No fish observed. No macrophytes. Water clear.	NA	Good condition, and stable.

Reach A upper section near farm 30/9/21

Reach A footbridge 30/9/21

Reach A typical channel features 30/9/21

Reach A sheet erosion from overland flows 30/9/21

Reach B dropdown erosion at ford 30/9/21

Reach B gully erosion on cleared banks 30/9/21

Reach B slump erosion at tennis court 30/9/21

Reach B outer bed erosion and rock armour 30/9/21

Reach C pool between riffles 30/9/21

Reach C informal crossing (wallabies and humans) 30/9/21

Reach C cleared versus uncleared banks 30/9/21

Reach C scoured banks behind trees 30/9/21

Reach D facing upstream at entrance 30/9/21

Reach D facing right bank at entrance 30/9/21

Reach D facing left bank at entrance 30/9/21

Reach D facing downstream at entrance 30/9/21

8.1.5 Coasts and estuaries

The site is not mapped in a coastal risk area.

8.1.6 Areas of outstanding biodiversity value or critical habitat

Areas of outstanding biodiversity value and critical habitat are declared under both the BC Act and EPBC Act. No critical habitat or areas of outstanding biodiversity value are relevant to the study area and would not be affected by the project.

8.1.7 Threatened ecological communities

Upon reviewing previous vegetation mapping across the study area, it was noted that the vegetation had not been assigned to any vegetation community (see Figure 11).

During the field survey, 5 vegetation types were identified, 3 of which correspond with plant community types (PCTs) (see Figure 12 – northern study area, and Figure 13 – southern study area). Two vegetation types were classified as ornamental and exotic grassland based on the significant composition and likely structural changes because of historic clearing and use of the study area as a tourist and visitor precinct. The 5 vegetation types present were:

- PCT 651: Apple Box – Chalker's Wattle woodland on limestone slopes near Wombeyan Caves, Sydney Basin Bioregion

- PCT 840: Forest Red Gum – Yellow Box woodland of dry gorge slopes, southern Sydney Basin Bioregion and South Eastern Highlands Bioregion
- PCT 1105: River Oak open forest of major streams, Sydney Basin Bioregion and South East Corner Bioregion
- Ornamental
- Exotic grassland.

PCT 840 forms part of the threatened ecological community (TEC) White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions listed as critically endangered under the NSW BC Act. PCT 840 also forms part of the TEC White Box – Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands which is listed as critically endangered under the Commonwealth EPBC Act. The vegetation within the study area meets the minimum condition thresholds for the Commonwealth TEC outlined in the approved listing information guide (DEH 2006). A vegetation description of each PCT vegetation zone follows, with supporting photographs below.

PCT 651: Apple Box - Chalker's Wattle woodland on limestone slopes near Wombeyan Caves, Sydney Basin Bioregion

The PCT formed the majority of the vegetation surrounding the study area and was dominant in the study area. This PCT was an open woodland with a canopy about 10–15 m in height, dominated by *Brachychiton populneus* (kurrajong), *Eucalyptus bridgesiana* (apple box), and an occasional *Allocasuarina* sp. The shrub layer was dominated by *Acacia chalkeri* (Chalker's wattle), *Grevillea arenaria*, *Cassinia laevis* (cough bush), *Melicytus dentata* (tree violet) and *Myoporum montanum* (western boobialla). The ground cover was diverse, and some exotic herbs were present where it met tracks or existing development. The ground cover comprised *Dichondra repens* (kidney weed), *Lomandra longifolia* (spiny-headed mat-rush), *Austrostipa* sp., *Rytidosperma caespitosum* (ringed wallaby grass), *Clematis aristata* (old man's beard), *Geranium solanderi* (native geranium), *Acaena novae-zelandiae* (bidgee-widgee), *Rubus parvifolius* (native raspberry), *Pimelea linifolia* (slender rice flower), *Bulbine bulbosa* (native leek), *Vittadinia* sp. and *Plectranthus* sp. The exotic species encountered included *Verbascum thapsus* (great mullein), *Cirsium vulgare* (spear thistle), *Conyza* sp. (fleabane), *Silybum marianum* (variegated thistle) and *Cerastium glomeratum* (mouse-ear chickweed). The exotic cover was minimal and tended to be associated with the edges of tracks.

This PCT extended to the edges of the valley floor, where it met the ornamental, exotic grassland or remnants of the river oak forest (see description below).

PCT 840: Forest Red Gum - Yellow Box woodland of dry gorge slopes, southern Sydney Basin Bioregion and South Eastern Highlands Bioregion

This PCT bordered the study area in 2 locations, at the northern extent adjacent to the existing Tanderra Dormitory building, and on the trail leading to the proposed Wattle Hill wayfinder landing. The vegetation was in good condition and contained a canopy about 15–20 m comprising *E. melliodora* (yellow box), *E. tereticornis* (forest red gum) and the occasional *B. populneus* (kurrajong). The shrub component was dominated by *Bursaria spinosa*, *M. dentata* (tree violet) and the occasional *Acacia melanoxylon*. The ground cover was dominated by native grasses and forbs, including *Microlaena stipoides* var. *stipoides* (weeping grass), *Geranium solanderi* and *Lomandra longifolia*.

PCT 1105: River Oak open forest of major streams, Sydney Basin Bioregion and South East Corner Bioregion

This PCT was restricted to the riparian corridor and was only about 10 m wide. This PCT appears to have been modified due to the lack of mid-storey and the simplified ground cover. This PCT comprised several discrete patches along the banks of Wombeyan Creek, which was a flowing cobblestone creek. The canopy comprised only mature *Casuarina cunninghamiana* (river oak) with a very sparse mid-storey of the occasional *M. dentata* (tree violet). The ground cover varied in the proportion of natives, but in general comprised more than 50% native ground cover including *Microlaena stipoides* var. *stipoides*, *D. repens* (kidney weed), *Veronica plebeia* (trailing speedwell), *Adiantum aethiopicum* (common maidenhair fern), *A. novae-zelandiae* (bidgee-widgee) and *Pteridium esculentum* (common bracken). The exotic species encountered included *Plantago lanceolata* (lamb's tongue), *V. thapsus* (great mullein), *Hypericum perforatum* (St John's wort), *Phalaris aquatica* (phalaris) and *Conium maculatum* (hemlock).

Ornamental

The ornamental vegetation occurred on the valley floor in areas that have been cleared and developed for tourism. The species typically present included *Populus* sp. (poplar), *Fraxinus* sp. (ash), *Ulmus* sp. (elm), *Cotoneaster* sp. (cotoneaster) and *Quercus* sp. (oak). Where these trees were present, there was generally no mid-storey and the ground cover was highly modified. Where canopy cover was sparse, the dominant mid-storey species tended to include *C. maculatum* (hemlock), *Verbena rigida* (veined verbena) and *Rubus fruticosus* (blackberry). The exotic ground cover species encountered included *P. lanceolata* (lamb's tongue), *V. thapsus* (great mullein), *H. perforatum* (St John's wort), *P. aquatica* (phalaris) and *Nassella trichotoma* (serrated tussock).

Exotic grassland

This vegetation type dominated the areas of the valley floor between the ornamental tree canopy and the river oak forest. This vegetation type was heavily grazed by a mob of eastern grey kangaroos (*Macropus giganteus*) and it is likely to be mown or slashed. This made identification of the species present very difficult. Species observed included *P. lanceolata* (lamb's tongue), *H. perforatum* (St John's wort), *P. aquatica* (phalaris), *Festuca* sp. and *N. trichotoma* (serrated tussock).

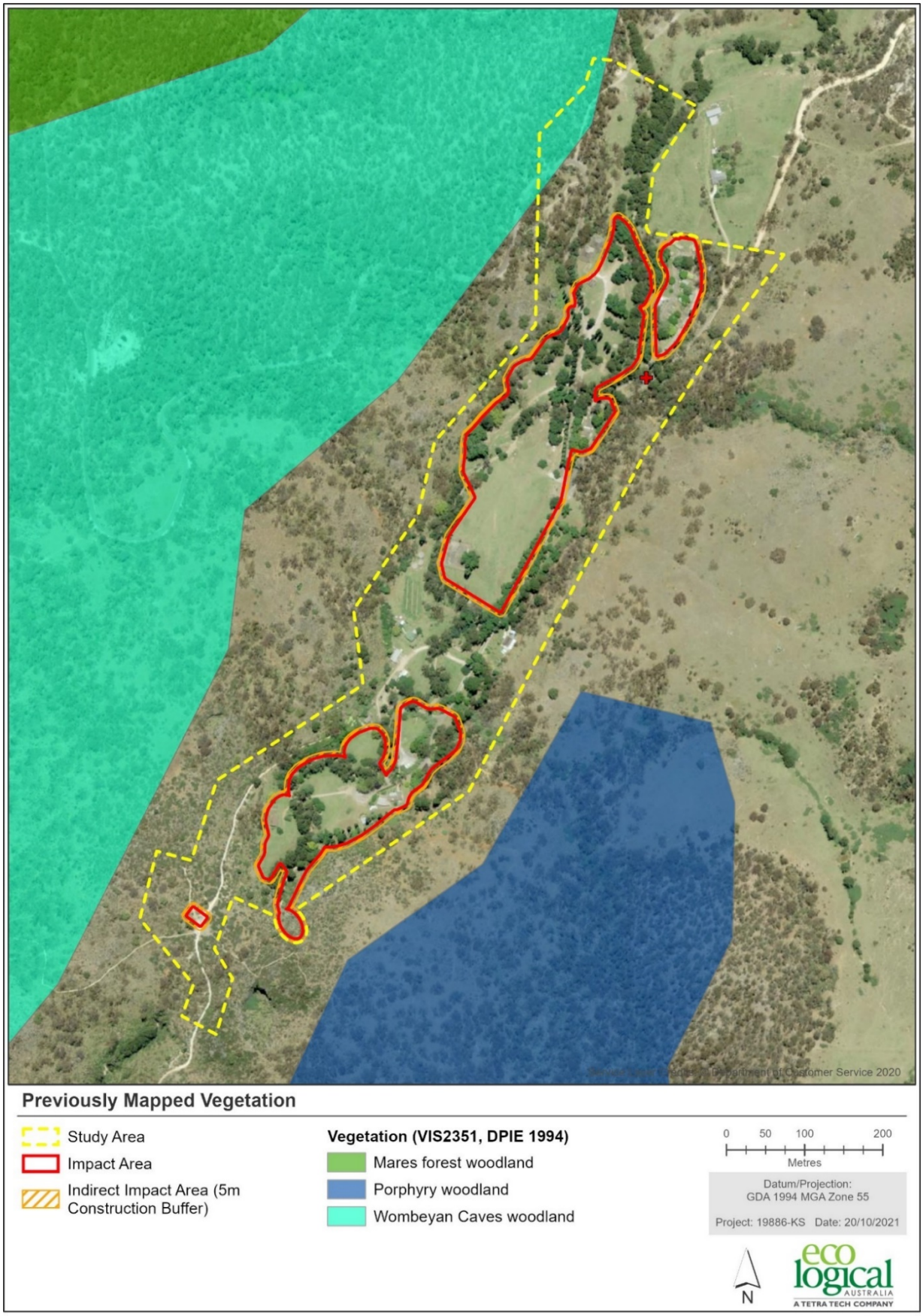

Figure 11 Previous vegetation mapping within the study area (SEED data portal Natural vegetation of the Sydney 1:100 000 map sheet VIS_ID2354)

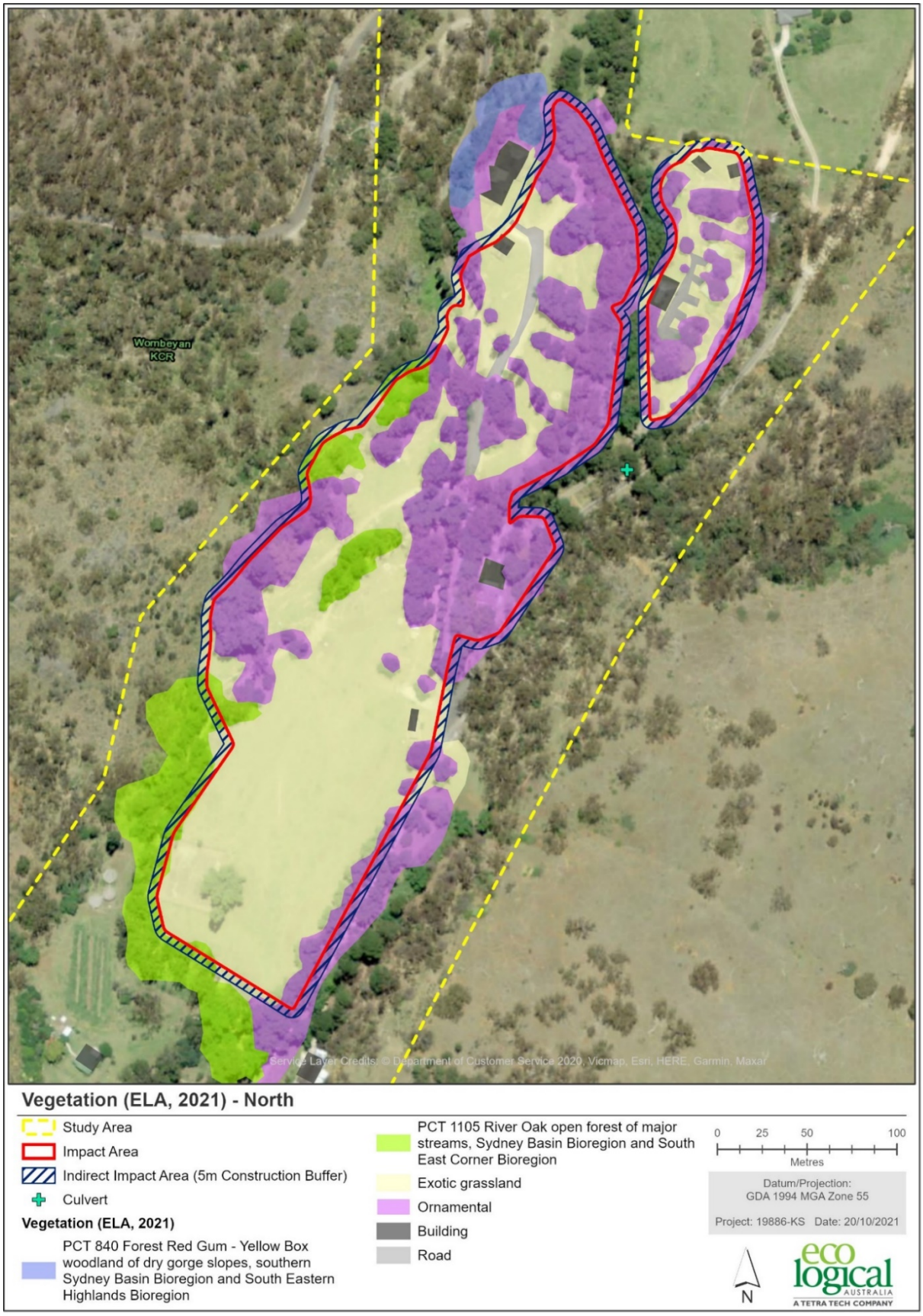

Figure 12 Vegetation within the northern section of the study area (validated by Ecological Australia)

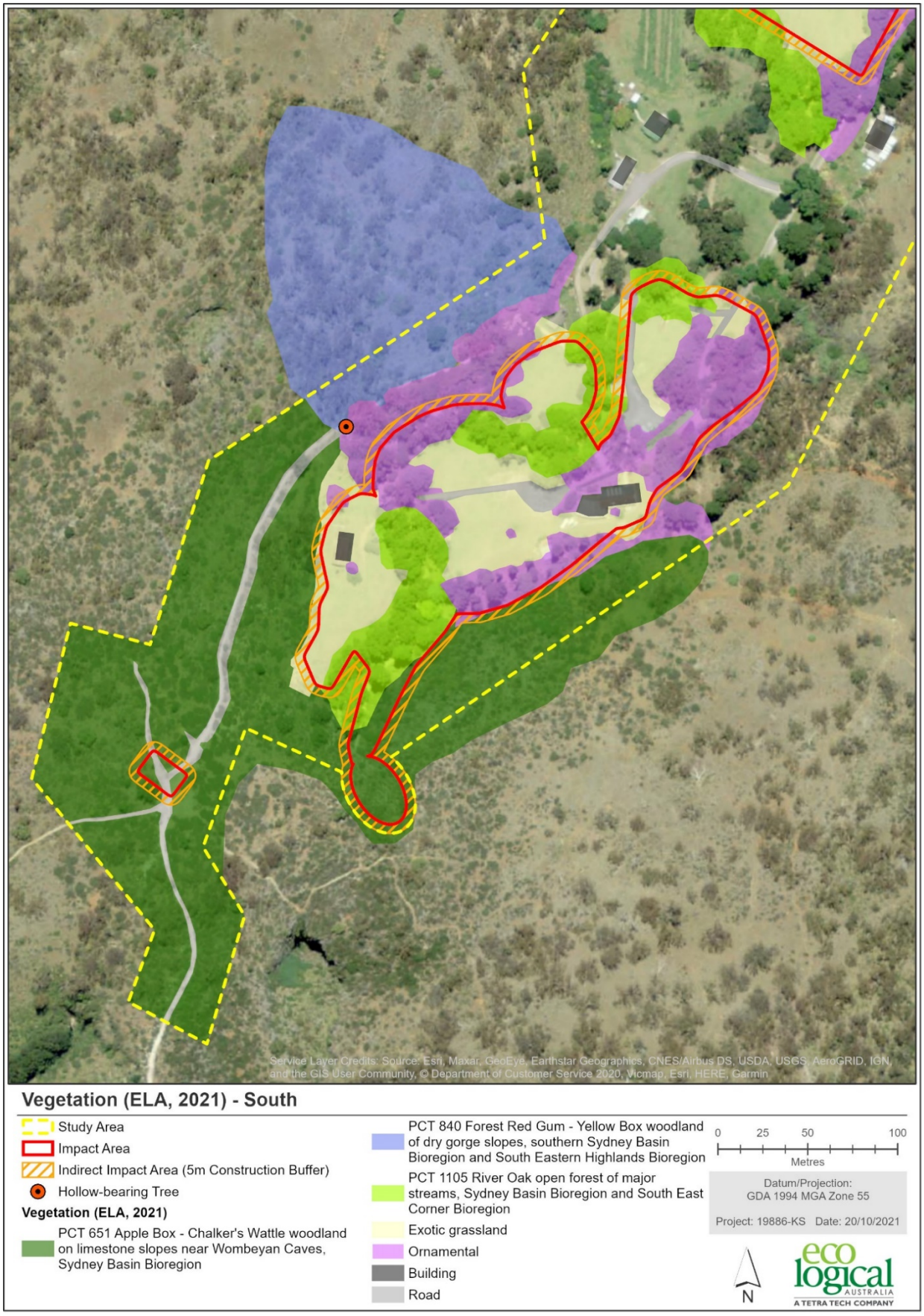

Figure 13 Vegetation within the southern section of the study area (validated by Eco Logical Australia)

PCT 651 vegetation within the study area

PCT 840 vegetation within the study area

PCT 1105 vegetation within the study area

Ornamental vegetation within the study area

Photo 1 Exotic grassland vegetation within the study area

8.1.8 Threatened species and populations

Threatened flora

A total of 41 flora species were recorded during the field survey. Of these, 28 were native species and 14 were exotic. A full list of flora species recorded within the study area sites is provided in Appendix B.

Two species identified during the field survey are listed as both state priority weeds under the *Biosecurity Act 2015* and Weeds of National Significance. These species are *Rubus fruticosus* (blackberry) and *Nassella trichotoma* (serrated tussock). As priority weeds, these species have a general biosecurity duty which means 'any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable'. Infestations were observed infrequently across the study area. It should also be noted that within the *South East Regional Strategic Weed Management Plan 2017–2022* (LLS 2017), the above species are both listed as state priority weeds. Mitigation measures for these species are listed in Section 9.2 of this REF.

An assessment of likelihood of occurrence was made for threatened species identified from searches of the NSW BioNet and EPBC Protected Matters Search Tool (Appendix C). A total of 29 threatened flora species were considered in this assessment, 11 of which had been recorded or had the potential to occur in the surrounding region. Only one species (*Eucalyptus aggregata*) has been recorded within a 5 km radius of the study area. Figure 14 shows the BioNet records for threatened flora within a 5 km radius of the study area. The likelihood of occurrence assessment (Appendix C Table 12) determined that none of the 11 flora species were considered likely to occur within the study area. As the study area was relatively small, traverses to search for any of the listed species were undertaken during the field survey. This resulted in no threatened species being identified on site. In addition to this, the habitat within the study area is not suitable for many of the species that were identified during the database searches.

Threatened fauna

No threatened fauna were recorded within the study area during the field survey. A total of 33 fauna species were observed, mostly birds (see list in Appendix B). Observation types include hearing calls, identifying scats and physically observing a species.

No fish were observed in Wombeyan Creek during the field survey.

No species recorded during the survey are listed as having conservation significance.

As mentioned, an assessment of likelihood of occurrence was made for threatened species identified from searches of NSW BioNet and EPBC Protected Matters Search Tool. A total of 57 fauna species were considered in this assessment, including 26 species which had been recorded or had the potential to occur in the surrounding region. Figure 14 shows the BioNet records for threatened fauna within a 5 km radius of the study area. Seven of these species have the potential to utilise the vegetation within the study area. These species include:

- *Callocephalon fimbriatum* (gang-gang cockatoo)
- *Calyptorhynchus lathami* (glossy black-cockatoo)
- *Chalinolobus dwyeri* (large-eared pied bat)
- *Miniopterus orianae oceanensis* (large bentwing-bat)
- *Petroica boodang* (scarlet robin)
- *Petroica phoenicea* (flame robin)
- *Scoteanax rueppellii* (greater broad-nosed bat).

No breeding habitat for these species is considered to occur within the impact area, however, there is likely to be breeding habitat for these species within, or within close proximity to, the study area. Habitat features that facilitate this include hollow-bearing trees and the various cave systems near the study area. Foraging habitat for these species is considered to occur within the impact area.

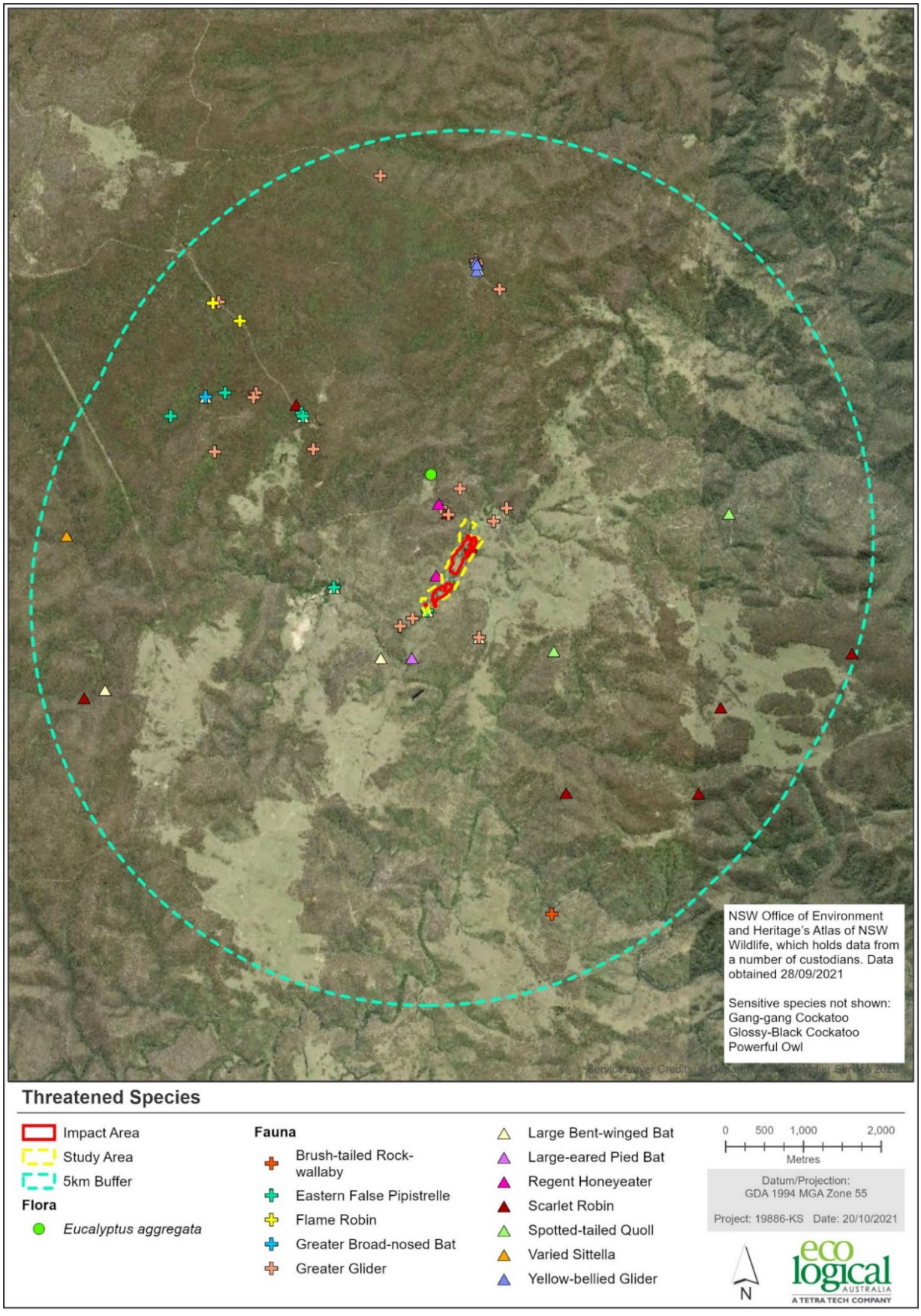

Figure 14 NSW BioNet Atlas search results for threatened species within a 5 km radius of the study area

8.2 Cultural values

8.2.9 Aboriginal cultural heritage

As part of the Aboriginal heritage impact permit process, an archaeological survey of the proposed upgrade areas was conducted in February 2021 (Jackson Ward Archaeology 2022). Eleven open sites (8 open campsites and 3 isolated finds) and 3 PADs (potential archaeological deposits) were identified in the study area during the survey. These sites occur within the larger cultural context, partly relayed in the Gundungurra story, 'The Journey of Gurangatch and Mirrigan', where Gurangatch, a 'gigantic eel', entered the subterranean karst system in order to escape from the hunter Mirragan.

A test excavation program was conducted in December 2021, including the sites 'Wombeyan Caves PAD 02', 'Wombeyan 3', and the northern camping precinct, called 'Camp Area West'. Isolated artefacts were recovered from Wombeyan Caves PAD 02, Camp Area West contained a medium density artefact distribution and isolated finds, while low to medium density artefact distributions were found at Wombeyan PAD 3.

The results of the survey and testing program confirmed that all sites range between low to high archaeological significance. The testing program found that, while not encountered in all test squares, subsurface archaeological material does occur across a wide area of the valley.

8.2.10 Historic heritage values

A statement of heritage impact has been completed (ELA 2022). The assessment found that the proposed activity is considered to not significantly impact on locally listed heritage items nor other items within the reserve that contain natural or cultural heritage values.

In 1864, the NSW Surveyor General established a reserve to protect the caves, one of the earliest in Australia. As more caves were discovered and explored, the reserve was enlarged several times. Therefore, the study area has been protected and used for visitor and tourism uses for more than 150 years. Mining and agricultural uses have occurred within and adjacent to the reserve. Mining for marble stopped in areas adjacent to the reserve in 1997. Some of the exotic species used for landscaping have cultural significance to the precinct, such as the poplars that line some of the precinct roads.

Wombeyan Caves is a listed item of local heritage significance (landscape) on the Upper Lachlan LEP 2010 (item number I171). The listing curtilage is smaller than the reserve curtilage. See Figure 15.

The Blacksmith Shed, 2 quarries and the timber slab building are listed as potential heritage items on NPWS Historic Heritage Information Management System which means they have not been formally assessed.

The Australian Heritage Database is an archive of information about more than 13,000 places throughout Australia. Wombeyan Caves are listed as a natural place for its geological formations and caves and does not include any other items within the study area. The Australian Heritage Database is not a statutory list.

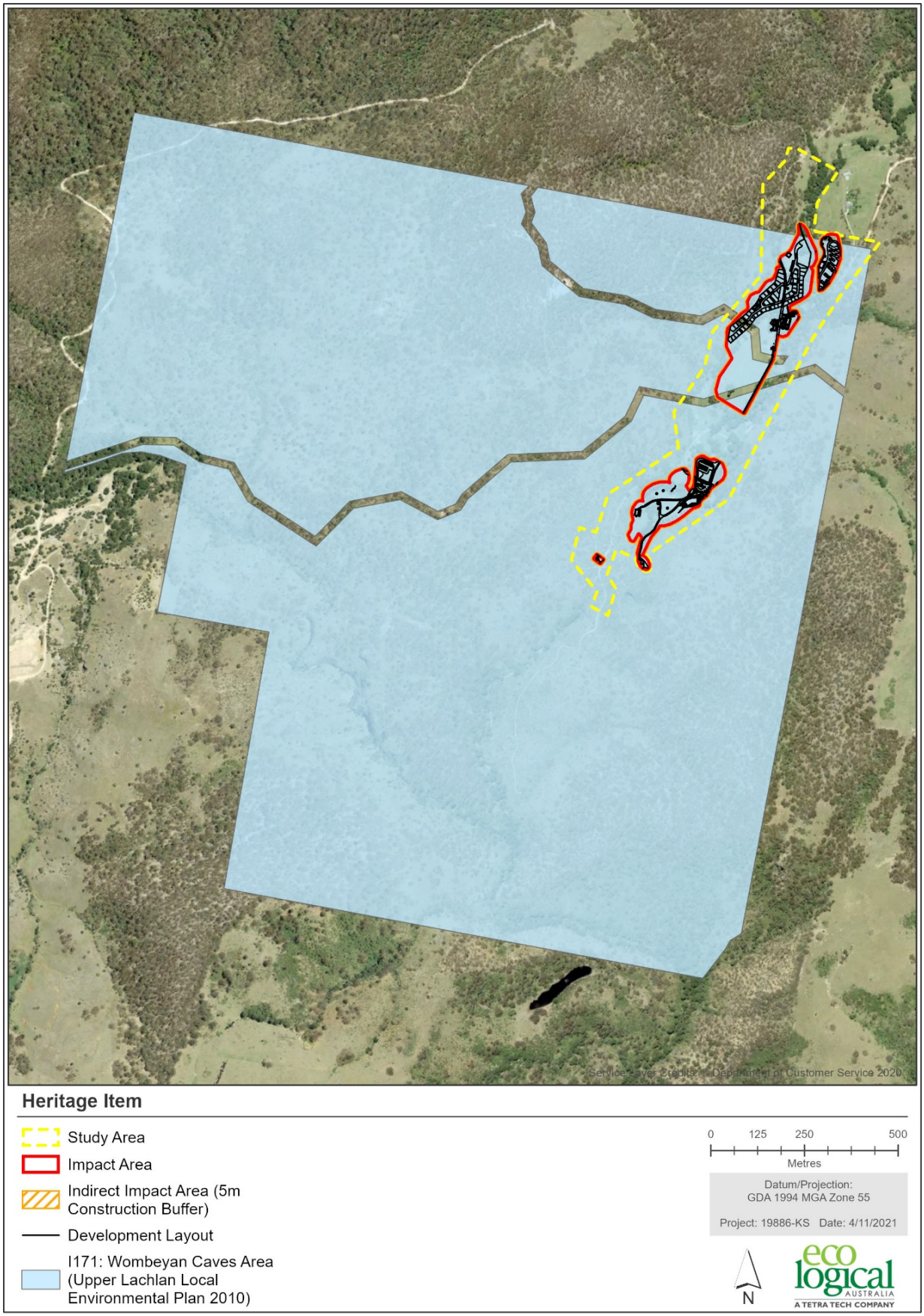

Figure 15 Listed heritage items

8.3 Social values

8.3.11 Recreation values

The main attraction of the reserve is the many caves with their spectacular formations and cave decorations. Four of the caves are used for guided tours, while others provide for self-guided cave tours, adventure cave tours and speleological activities. The reserve also provides for bushwalking, picnicking, barbecues, accommodation in dormitories and vans, camping and caravanning, school educational groups and conferences/workshops.

8.3.12 Scenic and visually significant areas

The study area is not mapped as Scenic Protection Land in accordance with the Upper Lachlan LEP 2010 nor Wingecarribee LEP 2010.

8.3.13 Education and scientific values

The reserve and its regional setting within a larger natural area offers an outstanding range of research opportunities in relatively close proximity to the highest concentration of research institutions in Australia. The karst formations of the reserve provide a vast range of scientific values for researchers to study. Wombeyan Caves are one of the most cavernous karst areas in New South Wales and there are at least 40 different taxa of stygofauna present within the reserve; this is considered to be very diverse (Thurgate et al. 2001). The area has previously been used for educational purposes and is known to host university and school groups.

8.3.14 Interests of external stakeholders

The study area is adjacent to farmland to the east and north. There are 2 dwellings located in proximity to the study area. One is approximately 100 m to the north of the area while the other is approximately 1,000 m to the east.

8.4 Matters of national environmental significance

Two matters of national environmental significance occur, or have the potential to occur, within the study area.

C. dwyeri (large-eared pied bat) is listed as vulnerable under the EPBC Act. This species could use the study area as foraging habitat. An assessment of significance was completed for this species (see Section 12).

One species of fish – *Macquaria australasica* (Macquarie perch) – listed as endangered under the EPBC Act, has the potential to occur within the study area. However, it is unlikely that this species would be found within the study area due to the absence of suitable habitat. In addition, no works are proposed that would obstruct fish passage and as such an assessment of significance was not completed.

It is unlikely that other values of the Greater Blue Mountains World Heritage Area are likely to occur in the study area.

9. Impact assessment

9.1 Physical and chemical impacts during construction and operation

Is the proposed activity likely to… Applicable?	Impact level	Reasons	Safeguards/mitigation measures
1. Is the proposal likely to impact on soil quality or land stability? Applicable? ☒ Yes ☐ No	Low (short-term)	The proposed works will require the removal of vegetation and excavation of rock and soil to construct the proposed upgrades, including the new campground. Potential impacts regarding soil and erosion include erosion and sediment runoff, weed invasion and soil compaction. However, such impacts are only likely to occur during the construction phase and within the direct impact area. Due to the proximity of the works to the karst system, and the likely presence of stygofauna in the study area, there is potential for transport of sediment to impact the system. Impacts can include changes to the chemical weathering process of the cave system. This can exacerbate the potential for cave collapses, sedimentation of small cave fissures and cracks which provide habitat for various stygofauna and troglofauna. In addition, sediment can clog pore space and prevent exchange of water.	• Preparation of a construction environmental management plan (CEMP) prior to any construction works to address measures to be adopted to minimise impacts on the environment as a result of the construction works, including erosion and sedimentation. • Inspect erosion controls regularly (daily during workdays) and after significant rainfall. Fix damaged controls immediately. Remove accumulated sediment or waste material from within the sediment controls regularly. • Ensure only the minimum required vegetation is removed, maintaining the ground cover vegetation, where possible, in all areas of work. • Leave erosion and sediment controls in place until after the works are completed. • Schedule the work outside of predicted or forecasted heavy rain periods. • Stop work during and after heavy rainfall to reduce risk of mobilising sediment.

Is the proposed activity likely to… Applicable?	Impact level	Reasons	Safeguards/mitigation measures
2. Is the activity likely to affect a waterbody, watercourse, wetland or natural drainage system? Applicable? ☒ Yes ☐ No	Low	Wombeyan Creek and downstream watercourses have the potential to be impacted by the works from: • creation of watercourse crossings • excess sediment input into the waterway • pollution of the waterway (ground water or surface water) from chemical spills (e.g. fuel, oil, construction materials) • impacts to water quality have the ability to impact the karst system. Impacts can include changes to the chemical weathering process of the cave system. This can exacerbate the potential for cave collapses, sedimentation of small cave fissures and cracks which provide habitat for various stygofauna and troglofauna.	• Implement sediment and silt control measures (mainly silt fencing/trapping and clean water diversions etc.) prior to commencement of works according to: ○ *Erosion and sediment control on unsealed tracks* (OEH 2012) ○ *Managing urban stormwater: soils and construction*, volume 1, 4th edition (the 'blue book') ○ *Managing urban stormwater, soils and construction*, volume 2A Installation of services (DECC 2008). • Regular monitoring of sediment controls as well as inspections after heavy rainfall and follow-up work to repair/install erosion and sedimentation controls. • Weather forecasts will be checked daily to ensure that work is not carried out immediately before or during high rainfall. • Store all chemicals in appropriate bunding/storage systems. • Ensure appropriate spill kits, shovels and buckets are carried with the equipment. If a small spill occurs, quickly shovel the contaminated dirt into the bucket and dispose of appropriately. • Wash all equipment, including erosion and sediment control measures and trailers, to prevent spread of exotic species. A visual check for vegetation and seeds on all equipment machinery to be used in the activities must be carried out before work commences. • Create new watercourse crossings in areas where informal crossings used by animals and members of the public already exist, to prevent any additional vegetation needing to be removed. • Revegetate bare areas of the bank and riparian corridors to stabilise the soil and prevent additional sediment from entering the creek.

Is the proposed activity likely to… Applicable?	Impact level	Reasons	Safeguards/mitigation measures
3. Is the activity likely to change flood or tidal regimes, or be affected by flooding? Applicable? ☐ Yes ☒ No	N/A	N/A	N/A
4. Is the activity likely to affect coastal processes and coastal hazards, including those projected by climate change (e.g. sea level rise)? Applicable? ☐ Yes ☒ No	N/A	N/A	N/A
5. Does the activity involve the use, storage, or transport of hazardous substances or the use or generation of chemicals, which may build up residues in the environment? Applicable? ☒ Yes ☐ No	Low	The NSW EPA Contaminated Land Register was checked in 2021 for known contaminated land or potential contamination risk using keywords 'Wombeyan Caves'. The search produced no known contamination issues located within or in proximity to the study area. Nonetheless, there remains a low probability that unknown contamination sources are present. Use of hazardous chemicals will be required to undertake the works. Chemicals such as fuel and oil for the running of machinery will be used. Herbicides may also be used when maintaining vegetation.	• Any excess spoil material where potentially contaminating activities have been identified on site will be tested and classified prior to leaving site. For any excess spoil material classified as contaminated, disposal of this material will be at an appropriately licensed landfill in accordance with the EPA *Waste classification guidelines* (EPA 2014). • Store all chemicals (e.g. fuel, oil) in appropriate bunding/storage systems. • Ensure appropriate spill kits are carried with the equipment. • Dedicated refuelling areas are to be established away from creek lines. These areas are to bunded to ensure any spills do not enter the riparian vegetation areas.

Is the proposed activity likely to… Applicable?	Impact level	Reasons	Safeguards/mitigation measures
6. Does the activity involve the generation or disposal of gaseous, liquid or solid wastes or emissions? Applicable? ☒ Yes ☐ No	Low	Most waste is likely to be generated from excess spoil from earthworks and general waste from staff and contractors. Potential impacts from waste generation include: • reduced aesthetics within the reserve • minor spills from hazardous fuel and chemical use • pollution of the environment from other general wastes. Minor emissions are anticipated due to the use of construction machinery and vehicles, however, are thought to be negligible and short term. Removal and appropriate disposal of general waste generated by the contractors during the proposed works is the responsibility of the contractors unless advised differently by NPWS.	• Resource management options for the project must be considered against a hierarchy of the following order embodied in the *Waste Avoidance and Resource Recovery Act 2001*: ○ avoid unnecessary resource consumption ○ recover resources (including reuse, reprocessing, recycling and energy recovery) ○ dispose (as a last resort). • All wastes must be classified in accordance with the *Waste classification guidelines* (EPA 2014) prior to disposal and transported to a licensed waste disposal facility. • All waste must be removed from each site on completion of the works. • Upon completion of waste disposal, all original weighbridge/disposal receipts issued by the receiving waste facility must be retained in a waste register as evidence of proper disposal. • An adequate number of bins must be placed at the sites for workers and all litter will be placed in these bins. Work areas of the project site would be kept clean and free of litter, including cigarette butts (note that smoking is not permitted in the reserve or any national park), at all times. • Plant and equipment must be regularly inspected to ascertain that fitted emission controls are operating efficiently. • Plant and equipment must be maintained in accordance with manufacturer's specifications to ensure that it is in a proper and efficient condition. • Do not have machinery running while not in use. • Minimise use of machinery for required activity only.

Is the proposed activity likely to… Applicable?	Impact level	Reasons	Safeguards/mitigation measures

7. Will the activity involve the emission of dust, odours, noise, vibration or radiation in the proximity of residential or urban areas or other sensitive locations?
Applicable?
☒ Yes
☐ No
	Low	Minor dust emissions are predicted as part of the proposed works. The study area is in a relatively isolated location, however, there are 2 residential properties located within proximity of the study area. One is located approximately 100 m to the north and the other approximately 1,000 m to the east. Therefore, there is potential to impact 'sensitive receivers'.
		Dust, noise, and vibration emissions may impact residents and visitors to the reserve. As these impacts are associated with construction only and not operation of the visitor precinct, they are anticipated to be minimal and short term.
		Whilst there is potential for minor noise impacts during the works, particularly to park neighbours, these are anticipated to be minimal and short term.
		The proposed works may also have indirect noise and vibration impacts to threatened fauna and may deter threatened species from the study area, though this impact will be negligible and short term.
			• The below mitigation measures are developed in reference to the 'Qualitative assessment method' section of the *Interim construction noise guideline* (DECC 2009):
			  ○ Avoid simultaneous operation of noisy plant within discernible range of a sensitive receiver.
			  ○ Works will only occur during the following times:
			  ○ Monday to Friday – 7 am to 6 pm.
			  ○ Saturday – 8 am to 1 pm.
			  ○ Where possible, maximise the distance between noisy plant items and nearby residential receivers and potential fauna habitat.
			  ○ Where possible, orient equipment so that offensive noise carries away from residential receivers and potential fauna habitat.
			  ○ Plant used intermittently is to be throttled or shut down when not required.
			  ○ Maintain a noise and vibration complaints log. Complete 3-step process in section 5.1 'Qualitative assessment method' of the *Interim construction noise guideline* (DECC 2009).
			• Works must be minimised during high wind periods.
			• Dust suppression should be applied as required to limit excessive dust generation. Water will be the only material used for this purpose.
			• Maximise the distance between noisy plant items and potential fauna habitat.
			• Orient equipment so that offensive noise carriers away from potential fauna habitat.

9.2 Biodiversity impacts during construction and operation

Is the proposed activity likely to… Applicable?	Likely impact	Reasons	Safeguards/mitigation measures
1. Is any vegetation to be cleared or modified? (includes vegetation of conservation significance or cultural landscape value) Applicable? ☒ Yes ☐ No	Low	As a part of this assessment, ELA and NPWS have taken a precautionary approach and assumed all vegetation within the impact area will be removed. Realistically, this is an overestimate of the likely impacts to vegetation. The proposed activity will result in approximately 9.71 ha of total impacts to vegetation (i.e. direct and indirect impacts). See Tables 1 and 2 in Section 6.2.2. Of this, 8.31 ha of this impact will be as a result of direct removal of vegetation. The remaining 1.40 ha of impact will arise as a result of indirect impacts such as accidental trampling of vegetation, sediment and erosion runoff and the spread of exotic flora species. Table 4 (at the end of this section) outlines how each vegetation zone will be impacted and whether those impacts will through a direct or indirect manner.	The site-specific CEMP should be prepared and should address the following (refer to Section 9.1): • Limit works to daytime hours. • The site-specific CEMP must include instructions for dealing with orphaned or injured native animals, the contact details for the NSW Wildlife Information, Rescue and Education Service Inc (WIRES), the location of the nearest veterinary clinic and basic information on how to temporarily care for wildlife. • Construction vehicles and equipment are to be cleaned and free of dirt or debris from other construction sites prior to entry to the reserve, to manage the introduction and spread of weed propagules. • If priority weeds are identified on site, remove the weeds and dispose at a waste management facility. • Site personnel should be familiar with the hygiene guidelines for wildlife (EES 2020) around mitigating the impacts of environmental pathogens. As above, equipment and machinery should be washed down prior to and after work every day to minimise any spread of pathogenic material. • Areas that are not to be impacted should be delineated prior to any works commencing, in order to prevent workers from accidentally tramping vegetation that is to be conserved.

Is the proposed activity likely to… Applicable?	Likely impact	Reasons	Safeguards/mitigation measures
2. Is the activity likely to have a significant effect on threatened flora species, populations, or their habitats, or area of outstanding biodiversity value (refer to threatened species assessment of significance (5-part test))? Applicable? ☐ Yes ☒ No	Low	The proposed activity is considered unlikely to have a significant impact on any of the threatened flora that have been recorded, or have the potential to occur, within a 5 km radius of the study area. The study area lacks suitable habitat for several of the listed threatened flora species. For those that the study area could provide suitable habitat for, none were observed during the field survey. In addition to this, some species did not have an overlapping distribution with the study area.	• Refer to above
3. Does the activity have the potential to endanger, displace or disturb fauna (including fauna of conservation significance) or create a barrier to their movement? Applicable? ☐ Yes ☒ No	Low	It is unlikely that the proposed works have the potential to endanger, displace or disturb fauna or create a barrier to their movement as there is no breeding habitat located within the impact area. There is always the chance that fauna may traverse through the impact area as works are being undertaken, however, this is unlikely.	• Minimise the time spent operating machinery around any identified habitat features. This includes any hollow-bearing trees. • Limit works to daytime hours.
4. Is the activity likely to have a significant effect on threatened fauna species, or their habitats, or areas of outstanding biodiversity value (refer to threatened species assessment of significance (5-part test))? Applicable? ☐ Yes ☒ No	Low	The study area provides potential foraging habitat for 7 threatened species, all of which are listed as vulnerable under the BC Act. These species are: • *Callocephalon fimbriatum* (gang-gang cockatoo) • *Calyptorhynchus lathami* (glossy black-cockatoo) • *Chalinolobus dwyeri* (large-eared pied bat) • *Miniopterus orianae oceanensis* (large bentwing-bat) • *Petroica boodang* (scarlet robin)	• If feasible, works should be undertaken outside of nesting/fledging times. These are typically late autumn to early spring. • The site-specific CEMP must include instructions for dealing with orphaned or injured native animals and include the contact details for WIRES.

Is the proposed activity likely to… Applicable?	Likely impact	Reasons	Safeguards/mitigation measures
		• *Petroica phoenicea* (flame robin) • *Scoteanax rueppellii* (greater broad-nosed bat). The proposed works will not directly impact on any breeding habitat for these species, however, noise and vibration has potential to impact breeding activity in the area. Direct impacts are associated with foraging habitat. Tests of significance were undertaken for the above species. The results of these tests can be found in Section 11 of this REF and concluded that the proposed works are unlikely to result in a significant impact to any of the above species.	
5. Is the activity likely to impact on an ecological community of conservation significance? Applicable? ☐ Yes ☒ No	Low	No threatened ecological communities will be impacted by the proposed works.	N/A
6. Is the activity likely to have a significant effect on an endangered ecological community or its habitat (refer to threatened species assessment of significance (5-part test))? Applicable? ☐ Yes ☒ No	N/A	No threatened ecological communities will be impacted by the proposed works.	N/A

Is the proposed activity likely to… Applicable?	Likely impact	Reasons	Safeguards/mitigation measures
7. Is the activity likely to cause a threat to the biological diversity or ecological integrity of an ecological community? Applicable? ☐ Yes ☒ No	Low	No threatened ecological communities will be impacted by the proposed works.	N/A
8. Is the activity likely to introduce noxious weeds, vermin, feral species or genetically modified organisms into an area? Applicable? ☒ Yes ☐ No	Low	The removal and maintenance of vegetation will result in increased light and disturbance, potentially supporting weed infestations. Movement of workers and machinery have the potential to facilitate the spread of priority weeds through the study area. Twelve weed species are already located within the areas that will be impacted by the proposed activity, as such the recommended mitigation measures should be implemented to reduce the risk of their spread.	• If priority weeds are identified on site, remove the weeds and dispose at a waste management facility. • Site personnel should be familiar with the hygiene guidelines for wildlife (EES 2020) around mitigating the impacts of environmental pathogens. As above, equipment and machinery should be washed down prior to and after work every day to minimise any spread of pathogenic material. • Areas that are not to be impacted should be delineated prior to any works commencing, in order to prevent workers from accidentally tramping vegetation that is to be conserved.
9. Is the activity likely to affect any declared area of outstanding biodiversity value? Applicable? ☐ Yes ☒ No	N/A	No. No areas within the study area are listed areas of outstanding biodiversity value.	N/A

Is the proposed activity likely to… Applicable?	Likely impact	Reasons	Safeguards/mitigation measures
10. Is the activity likely to affect any joint management agreement under the BC Act? Applicable? ☐ Yes ☒ No	N/A	N//A	N/A

Table 4 Summary of proposed impacts to vegetation

Plant community type	Amount directly impacted (ha)	Amount indirectly impacted (ha)	Total area impacted (ha)
Exotic grassland	3.98	0.27	4.25
Ornamental	3.24	0.72	3.96
PCT 1105: River Oak open forest of major streams, Sydney Basin Bioregion and South East Corner Bioregion	0.92	0.24	1.15
PCT 651: Apple Box – Chalker's Wattle woodland on limestone slopes near Wombeyan Caves, Sydney Basin Bioregion	0.17	0.17	0.34
Total area impacted (ha)	**8.31**	**1.40**	**9.71**

9.3 Community impacts during construction and operation

Is the proposed activity likely to… Applicable?	Impact level	Reasons	Safeguards/mitigation measures
1. Is the activity likely to affect community services or infrastructure? Applicable? ☐ Yes ☒ No	Low (during construction)	During construction, the entire site (i.e. the reserve) will be closed to visitors. Vehicles will still be able to drive through the reserve via Wombeyan Caves Road.	• Prepare a traffic management plan to ensure ongoing access and safety for vehicles during construction. • Signage will be erected to communicate site closure to visitors for the duration of the construction works. • NPWS will advise the public of the temporary closures via the NPWS visitor website. • Public vehicular access through the reserve on Wombeyan Caves Road is unlikely to be impacted, however, there may be a need for traffic diversion during construction.
2. Does the activity affect sites of importance to local or the broader community for their recreational or other values or access to these sites? Applicable? ☒ Yes ☐ No	Low (during construction)/ Positive	During construction, some roads may require closures. The entire site (i.e. the reserve) and all pedestrian routes through the study area will be closed. The proposed upgrades to the visitor precinct will provide increased amenity for recreational users of the area and the associated walking tracks.	• As above.
3. Is the activity likely to affect economic factors, including employment, industry and property value? Applicable? ☐ Yes ☒ No	Low (during construction) /Positive	During construction there is expected to be disruptions to the businesses that are run from the visitor precinct, including the kiosk, campsite and cabins. Operationally the proposed upgrades to the visitor precinct will provide increased amenity for recreational users and are anticipated to increase visitation to the area.	N/A

Is the proposed activity likely to… Applicable?	Impact level	Reasons	Safeguards/mitigation measures
4. Is the activity likely to have an impact on the safety of the community? Applicable? ☒ Yes ☐ No	Low (during construction)	During construction, the campsite, carpark and facilities will be closed to the public, including no access to walking tracks. Use of heavy machinery and vehicle movement may result in a slight risk to public safety, however, this will be mitigated if the appropriate mitigation measures are adhered to.	• Vehicles, materials and equipment must be positioned to minimise impacts to vehicle access through the reserve. • Heavy vehicles will be restricted to specified routes. • Appropriate signage must be erected in order to prevent pedestrian access during the works. Temporary signage will be placed prior to works commencing. • Signage must be removed following construction. • NPWS will advise the public of the temporary closures via the NPWS visitor website. • Stakeholders will be notified in advance of the construction period.
5. Is the activity likely to cause a bushfire risk? Applicable? ☒ Yes ☐ No	Low (during construction)	The risk of a bushfire as a result of the proposed works is considered low. However, a bushfire may occur due to improper use of machinery or negligent behaviour by contractors.	• Smoking is prohibited within all national parks. • Hot works are not permitted on days of 'very high' fire danger rating or above. • Ignition minimisation should be practised at all times. • Ignition suppression equipment should be available at all times. • Bushfire safety plan to be included in the CEMP.
6. Will the activity affect the visual or scenic landscape? This should include consideration of any permanent or temporary signage (e.g. signs advertising an event and related sponsorship). Applicable? ☒ Yes	Low	The proposed works will occur within native vegetation within the reserve. However, impacts to native vegetation are only proposed within proximity of areas previously utilised for visitor infrastructure which will minimise the impact to visual amenity within the broader environment. The proposed works will involve minor earthworks in order to facilitate the new campsite and road design. Any signage to be placed to delineate the works areas will be removed following construction.	• All work areas are to be completely removed of rubbish, excessive spoil and other waste materials upon competition of works. • All signage, delineation fencing, and sediment and erosion controls are to be removed upon completion of works. • The proposed amenities are to be designed in accordance with the NPWS *Park facilities manual* (NPWS 2016a) by a qualified design team.

Is the proposed activity likely to… Applicable?	Impact level	Reasons	Safeguards/mitigation measures
☐ No		Additionally, construction fencing will be required to exclude the public from the construction area.	
7. Is the activity likely to cause noise, pollution, visual impact, loss of privacy, glare or overshadowing to members of the community, particularly adjoining landowners? Applicable? ☐ Yes ☒ No	Low	Dust, noise and vibration emissions may impact nearby residents. As these impacts are associated with construction only and not operation of the visitor precinct, they are anticipated to be minimal and short term. Timing of works will reduce impacts to neighbours.	See safeguards under Section 9.1.7

9.4 Natural resource during construction and operation

Is the proposed activity likely to… Applicable?	Impact level	Reasons	Safeguards/mitigation measures
1. Is the activity likely to result in the degradation of the park or any other area reserved for conservation purposes? Applicable? ☒ Yes ☐ No	Low	The proposed works will result in minor impacts to vegetation within the reserve. The direct impact areas have generally been previously degraded or cleared to some extent as a result of previous visitor infrastructure. As a worst-case scenario, a total of 8.31 ha of vegetation within the reserve will be directly impacted, of which 1.08 ha is native. There will be 1.40 ha of vegetation indirectly impacted, of which 0.41 ha is native. No additional impacts or ongoing degradation will occur as a result of the works. There is potential for the footings associated to the Victoria Arch viewing platform to disturb troglofauna and stygofauna. However, this is unlikely as the proposed location is not a sensitive karstic area as it is predominantly rubble and it is in the photic zone of the cave, bathed in sunlight. However, mitigation measures have been provided to reduce potential impacts.	• See soil and erosion measures (Section 9.1.1). • The extent of vegetation maintenance must be marked out with delineated 'no-go' zones and minimised where possible. • Footings are to be located in rock sections and not within the stream bed. • Footings should be concreted over where they connect to the ground in order to block the exchange of air and water in underling rock. • Core piles for the Victoria Arch viewing platform are to only be drilled in the area underneath the proposed platform. • Stability of cave features adjacent to piling locations should be checked prior to core piling. If instability is observed prior to or during construction, work must cease and a geotechnical assessment must be undertaken.
2. Is the activity likely to affect the use of, or the community's ability to use, natural resources? Applicable? ☐ Yes ☒ No	N/A	N/A	N/A

Is the proposed activity likely to… Applicable?	Impact level	Reasons	Safeguards/mitigation measures
3. Is the activity likely to involve the use, wastage, destruction or depletion of natural resources including water, fuels, timber or extractive materials? This should include opportunities to utilise recycled or alternative products. Applicable? ☐ Yes ☒ No	N/A	N/A	N/A
4. Does the activity provide for the sustainable and efficient use of water and energy? Where relevant to the proposal, this should include consideration of high efficiency fittings, appliances, insulation, lighting, rainwater tanks, hot water and electricity supply. Applicable? ☒ Yes ☐ No	Positive	All works undertaken will be in accordance with the NPWS *Park facilities manual* (NPWS 2016a). In accordance with the manual, the proposed works involve the use of water-efficient fittings with stop valves and timers, efficient lighting and design for natural ventilation. Walls and roofs will be insulated. Designs are in accordance with the NSW Building Sustainability Index (BASIX) and the National Construction Code Section J (Energy Efficiency).	N/A

9.5 Aboriginal cultural heritage impacts during construction and operation

Is the proposed activity likely to… Applicable?	Impact level	Reasons	Safeguards/mitigation measures
1. Will the activity disturb the ground surface or any culturally modified trees? Applicable? ☒ Yes ☐ No	Low	The testing program found that whilst not encountered in all test squares, subsurface archaeological material does occur across a wide area of the valley, however, mostly low-intensity occupation evidence was found.	• An Aboriginal heritage impact permit (AHIP), s 90A of the NPW Act, should be made for the proposed Wombeyan Caves upgrade works. • Wombeyan PAD 02 — Construction works must occur above the level at which artefacts were found during the test excavation (150 mm), or outside of PAD areas, or along routes of existing services. (Refer to Aboriginal cultural heritage assessment [ACHA]). • Wombeyan PAD 3 – Aboriginal community, including the Gundungurra Indigenous land use agreement committee, on site to monitor construction of amenities building, gravity-fed sewer and stormwater drainage. • Barmah building upgrades – Construction works must occur above the level at which artefacts were found during the test excavation at Test Square 3 (220 mm). • NPWS are to ensure that construction strictly adheres to depth parameters. • Camp Area West – A development exclusion zone to occur in a 5 m radius around Test Square 5. • Ensure track works are confined to existing tracks and no subsurface works to be conducted at recorded site locations. • All artefacts recovered during the project be reburied in an undisturbed location on the site landform. • If any suspected human remains are discovered during any activity works, all activity in the vicinity must cease immediately. The remains must be left in place and protected from harm or damage. The NSW Police must be notified immediately, and they will subsequently inform the Coroner's Office. Following this, and if the human remains are likely to be Aboriginal in origin, the find will be reported to the Aboriginal parties and Heritage NSW. If the find is likely to be

Is the proposed activity likely to… Applicable?	Impact level	Reasons	Safeguards/mitigation measures
			non-Aboriginal in origin and more than 100 years in age, the Heritage Council of NSW will be notified of the find under s 146 of the NSW Heritage Act.
2. Does the activity affect known Aboriginal objects or Aboriginal places? Include all known sources of information on the likely presence of Aboriginal objects or places, including AHIMS search results. Applicable? ☒ Yes ☐ No	N/A	The upgrade design had the potential to impact only 2 identified sites: • Wombeyan Caves PAD 02 • Wombeyan 3 (AHIMS # # 51-3-0017). It may also impact the Camp Area West. The test excavation program was conducted in December 2021, including the sites Wombeyan Caves PAD 02, Wombeyan 3, and Camp Area West. Artefacts were recovered in the 3 locations. See ACHA and excavation report (Jackson Ward Archaeology 2022). Based on the results of the archaeological survey, NPWS amended the proposed upgrades to minimise harm to sites found during the survey. Mitigation measures have been recommended in the ACHA and an AHIP application is being sought.	As above, and in accordance with an approved AHIP.
3. Is the activity likely to affect wild resources or access to these resources, which are used or valued by the Aboriginal community? Applicable? ☐ Yes ☒ No	N/A	Not identified	

9.6 Other cultural heritage impacts during construction or operation

Is the proposed activity likely to… Applicable?	Likely impact	Reasons	Safeguards/mitigation measures
1. What is the impact on places, buildings, landscapes or moveable heritage items? Attach relevant supporting information where required, such as a heritage impact statement. Applicable? ☒ Yes ☐ No	Low	Wombeyan Caves is a listed item of local heritage significance (landscape) on the Upper Lachlan LEP 2010 (item number I171). The listing curtilage is smaller than the reserve curtilage. See Figure 15. Victoria Arch is part of the karst system and is therefore a significant element of the study area. None of the buildings, trees or associated components within the study area have been identified as significant in the LEP or any other listing. The proposal provides for continued use in keeping with the original intention of the place, it enhances the accessibility, use and amenity of the place and will not be subject to impact to views, setting, archaeology or heritage items and is not considered to have a significant impact on the heritage values of the study area.	• All contractors undertaking works on site should be briefed on the protection of historical heritage items and places under the NSW Heritage Act, and the penalties for damage to these items. Heritage items on site may include archaeological remnants, built structures as well as significant views, listed vegetation (including plantings) and landscape elements. • Earth disturbance is to be kept to a minimum within the heritage curtilage of items within the subject site to avoid potential impacts to known or potential archaeology. • All work should be undertaken in accordance with relevant landscape and archaeology specialist reports. • Little interpretation is provided in the visitor precinct and additional historical interpretation should be considered. • Changes in the landscape/buildings should be documented. • A standard unexpected finds process should be adopted during works associated with the proposal as a mitigation measure.
Is any vegetation of cultural landscape value likely to be affected (e.g. gardens and settings, introduced exotic species, or evidence of broader remnant land uses)? Applicable? ☒ Yes ☐ No	Negligible	The main natural landscape elements in the study area include Victoria Arch at the southern extent of the study area, Wombeyan Creek which winds through the reserve and the avenue of trees along Victoria Arch Drive. All of the features above are to be retained and the cultural landscape value is unlikely to be affected by the proposed works.	• Vegetation and landscape features to be retained must be provided appropriate exclusion areas in the CEMP.

9.7 Matters of national environmental significance under the EPBC Act

Is the proposed activity likely to… Applicable?	Impact level	Reasons	Safeguards/mitigation measures
1. Is the activity likely to affect listed threatened species or ecological communities)? Applicable? ☒ Yes ☐ No	Low	There are no threatened vegetation communities listed on the EPBC Act within the impact area. The proposed activity is unlikely to significantly impact any listed EPBC Act species. The EPBC listed species *C. dwyeri* (large-eared pied bat) could use the site as foraging habitat. As no breeding habitat will be impacted, the impacts to this species are exclusive to foraging habitat. Given the location of the study area, suitable foraging habitat will continue to exist for this species. Additionally, foraging habitat will also remain within the study area. Construction during nesting/fledging times may cause indirect impacts to avian species. It is therefore recommended if feasible to avoid construction in late autumn to early spring. However, mitigation measures are provided to reduce potential impacts. *Macquaria australasica* (Macquarie perch), listed as endangered under the EPBC Act, has the potential to occur within the study area. No aquatic species protected under the EPBC Act are likely to have habitat within the study area.	• If feasible, works should be undertaken outside of nesting/fledging times. These are typically late autumn to early spring. • Limit works to daytime hours. • The site-specific CEMP must include instructions for dealing with orphaned or injured native animals, the contact details for WIRES, the location of the nearest veterinary clinic and basic information on how to temporarily care for wildlife. • Areas that are not to be impacted should be delineated prior to any works commencing, in order to prevent workers from accidentally tramping vegetation that is to be conserved. • Noisy plant should be located away from native vegetation to minimises potential sound impacts on fauna.
2. Is the activity likely to affect listed migratory species? Applicable? ☒ Yes ☐ No	Low	No migratory species are considered likely to utilise the study area as foraging habitat or breeding habitat. The proposed activity is considered unlikely to impact any such species.	N/A

Is the proposed activity likely to… Applicable?	Impact level	Reasons	Safeguards/mitigation measures
3. Is the activity likely to affect the ecology of Ramsar wetlands? Applicable? ☐ Yes ☒ No	N/A	N/A	N/A
4. Is the activity likely to affect Commonwealth marine environment Applicable? ☐ Yes ☒ No	N/A	N/A	N/A
5. Is the activity likely to affect the World Heritage values of World Heritage properties? Applicable? ☐ Yes ☒ No	NA	The reserve is not part of the Greater Blue Mountains World Heritage Area (which is also listed as a national heritage place). At its nearest, the impacted site is located approximately 1 km from the southernmost extent of this World Heritage property. The description of the property's World Heritage values has been reviewed (UNESCO 2021). The study area is unlikely to support any of the world or national heritage values of the property.	N/A
6. Is the activity likely to affect the national heritage values of national heritage places? Applicable? ☐ Yes ☒ No	N/A	The reserve is not listed as a national heritage place. See above for comments in relation to potential to affect the national heritage values of the Greater Blue Mountains World Heritage Area.	N/A

10. Proposals requiring additional information

10.1 Activities within the Sydney Drinking Water Catchment

Activities within the catchment are subject to the provisions of the Chapter 8 of the *SEPP (Biodiversity and Conservation) 2021*. The following factors require consideration.

Factors requiring consideration	Response
Does the activity incorporate any current recommended practices and performance standards endorsed or published by WaterNSW that relate to the protection of water quality?	Yes, soil and erosion controls are in accordance with *Managing urban stormwater: soils and construction - volume 1, 4th edition* (the 'blue book').
If the activity does not incorporate current practices or standards referred to in question 1, how will the activity achieve outcomes not less than these?	N/A
Will the activity have a neutral or beneficial effect on water quality?	A neutral or beneficial impact is predicted as the proposed works are primarily within the previous disturbance footprint, impervious surfaces are not proposed to be greatly increased, and increased revegetation and returfing are proposed.

11. Threatened species test of significance (BC Act)

The 'test of significance' (also known as the 5-part test) is applied to species, populations and ecological communities listed on Schedules 1 and 2 of the BC Act. The assessment sets out 5 factors which, when considered, allow proponents to undertake a qualitative analysis of the likely impacts of an action and to determine whether a significant impact is likely. All factors must be considered, and an overall conclusion made based on all factors in combination.

Tests of significance have been undertaken for the following threatened entities:

- Callocephalon fimbriatum (gang-gang cockatoo)
- *Calyptorhynchus lathami* (glossy black-cockatoo)
- *Chalinolobus dwyeri* (large-eared pied bat)
- Miniopterus orianae oceanensis (large bentwing-bat)
- *Petroica boodang* (scarlet robin)
- Petroica phoenicea (flame robin)
- *Scoteanax rueppellii* (greater broad-nosed bat).

Species have been grouped based on habitat preferences and type of fauna. No breeding habitat for any of the above species is expected to be impacted. Impacts will be confined to foraging habitat.

The following terms have been used, in this section of the REF only, for these assessments:

- Impact area: The area being directly impacted by the proposed activity outlined in Figure 3.
- Study area: The area outside of the impact area that may be indirectly impacted by the proposed activity.

The following test of significance (Table 5) encompasses all microbat species that have the potential to utilise the study area. These species have been grouped together as most share similar foraging habitat. It has been assumed that no breeding habitat will be impacted as no hollow-bearing trees will be removed, nor any rocky outcrops. These species include:

- *Chalinolobus dwyeri* (large-eared pied bat)
- Miniopterus orianae oceanensis (large bentwing-bat)
- *Scoteanax rueppellii* (greater broad-nosed bat).

All of the above species are listed as vulnerable under the BC Act. No breeding habitat will be impacted by the proposed activity. Impacts are restricted to foraging habitat. For this assessment, only patches of native vegetation within the impact area have been considered to be foraging habitat for these species. The proposed activity will impact a total of 1.49 ha of potential foraging habitat.

Table 5 Test of significance – microbat species

BC Act	Question	Response
7.3.1 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.	The proposed activity will impact 1.49 ha of potential foraging habitat. No breeding habitat will be impacted. For highly mobile species, such as microbats, the proposed impacts are unlikely to have an adverse effect on the life cycle of the species. It is likely that these species will be able to continue to forage amongst the unimpacted vegetation within the study area.
7.3.1 b) i	In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: 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	N/A
7.3.1 b) ii	In the case of an endangered ecological community or critically endangered ecological community: Whether the proposed development or activity 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.	N/A
7.3.1 c) i	In relation to the habitat of a threatened species or ecological community: The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity.	No breeding habitat for these species will be impacted. 1.49 ha of potential foraging habitat will be removed. As mentioned, microbats are highly mobile and likely to either forage within the unimpacted vegetation within the study area or venture to other patches within the surrounding region.
7.3.1 c) ii	In relation to the habitat of a threatened species or ecological community: 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.	No breeding habitat will be removed as a part of the proposed activity. The impacts to the foraging habitat will not result in the patch of vegetation becoming isolated or fragmented from another patch. Additionally, there are numerous extensive patches within the surrounding region that may could be utilised by these species.
7.3.1 c) iii	In relation to the habitat of a threatened species or ecological community: The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.	No breeding habitat for microbat species will be impacted by the proposed activity. The condition of the foraging habitat was in a moderate condition. Potential foraging habitat will remain within the study area, as well as the surrounding region. As such, the 1.49 ha of impact are unlikely to impact this species.

BC Act	Question	Response
7.3.1 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).	No. The proposed activity is not situated in an area of declared area of outstanding biodiversity value.
7.3.1 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.	The proposed activity will contribute to one key threatening process, i.e. the clearing of native vegetation, see Figure 12 and 13. A total of 1.49 ha of patches within the impact area are considered potential foraging habitat.
Conclusion	**Is there likely to be a significant impact?**	No. The proposed activity will not impact any breeding habitat for any of the listed microbat species. The impacts to foraging habitat are considered to be minor. It is likely that the listed microbat species will forage beyond the vegetation within the study area. Given the above information: • The proposed activity is unlikely to significantly impact the life cycle of the listed microbat species. • The proposed impacts are unlikely to modify/impact any important habitat for the listed microbat species. • Fragmentation/isolation of important habitat is unlikely to result from the proposed activity. • No important breeding habitat will be removed. The loss of foraging habitat is considered to be minor. The proposed activity is unlikely to result in a significant impact to any of the listed microbat species.

The following test of significance (Table 6) encompasses all avian species that have the potential to utilise the study area. These species have been grouped as they share similar habitat requirements. These species include:

- Callocephalon fimbriatum (gang-gang cockatoo)
- *Calyptorhynchus lathami* (glossy black-cockatoo)
- *Petroica boodang* (scarlet robin)
- Petroica phoenicea (flame robin).

All of these species are listed as vulnerable under the BC Act. Similar to the microbat species, no potential breeding habitat for these species will be impacted by the proposed activity. Impacts will be confined to potential foraging habitat. For this assessment, only patches of native vegetation within the impact area have been considered to be foraging habitat for these species. The proposed activity will impact a total of 1.49 ha of potential foraging habitat.

Table 6 Test of significance – avian species

BC Act	Question	Response
7.3.1 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	It is unlikely that the proposed activity will have an adverse effect on the above species. No breeding habitat will be impacted. Impacts will be confined to potential foraging habitat. The 1.49 ha of impact will affect moderate condition foraging habitat. During the field survey, no nests were observed. For highly mobile species, the 1.49 ha of impact is unlikely to impact the life cycle of these species as they will be able to continue to forage within the study area and surrounding region.
7.3.1 b) i	In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: 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	N/A
7.3.1 b) ii	In the case of an endangered ecological community or critically endangered ecological community: Whether the proposed development or activity 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.	N/A
7.3.1 c) i	In relation to the habitat of a threatened species or ecological community: The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity	For highly mobile species, such as the 4 listed avian species, an impact of 1.49 ha is unlikely to significantly impact these species. High-quality habitat extends beyond the vegetation within the study area and is likely to support these species.
7.3.1 c) ii	In relation to the habitat of a threatened species or ecological community: 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	A large proportion of the vegetation within the study area will not be removed. In addition to this, areas of cleared land also exist within the impact area. The proposed works are unlikely to result in the fragmentation/isolation of habitat. For highly mobile species, the existing distances between patches are unlikely to impact these species. It is unlikely that the proposed activity will exacerbate this.
7.3.1 c) iii	In relation to the habitat of a threatened species or ecological community: The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the	The condition of the vegetation within the study area was in a moderate condition. It is likely that the vegetation that exists within the surrounding region is of a higher quality that will provide better foraging and breeding habitat. As such, the importance

BC Act	Question	Response
	species, population or ecological community in the locality.	of the 1.49 ha of moderate condition vegetation is low.
7.3.1 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).	No. The proposed activity is not situated in an area of declared area of outstanding biodiversity value.
7.3.1 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.	The proposed activity will contribute to the one key threatening process, this being the clearing of native vegetation, see Figure 12 and Figure 13. A total of 1.49 ha of patches within the impact area are considered potential foraging habitat.
Conclusion	**Is there likely to be a significant impact?**	No. The proposed activity is unlikely to result in a significant impact to the listed avian species. For highly mobile species, 1.49 ha of impact is unlikely to impact habitat that is critical for the survival of these species. High-quality vegetation occurs within the surrounding region and could be utilised by these species as both foraging and breeding habitat.

12. Threatened species assessment of significance (EPBC Act)

The EPBC Act establishes a process for assessing the environmental impact of activities and developments where matters of national environmental significance (MNES) may be affected. Under the Act, any action which 'has, will have, or is likely to have a significant impact on a matter of MNES' is defined as a controlled action, and requires approval from the Australian Government Department of Climate Change, Energy, the Environment and Water (previously Department of Agriculture Water and Environment), which is responsible for administering the EPBC Act.

The process includes undertaking an 'assessment of significance' for listed threatened species and ecological communities that represent an MNES that will be affected as a result of the proposed action. Significant impact guidelines that outline a number of criteria have been developed by the Commonwealth of Australia (DoE 2013), to provide assistance in conducting the assessment and help decide whether or not a referral to the Australian Government is required.

One MNES has been assessed as a part of this assessment – *Chalinolobus dwyeri* (large-eared pied bat). See Table 7.

The large-eared pied bat is listed as vulnerable under the EPBC Act. Breeding habitat for this species is considered to be maternity roosts (arch caves with dome roofs). There is no breeding habitat for this species within the study area though there is likely breeding habitat for this species within the cave systems surrounding the Wombeyan Caves Campground. For this assessment, only patches of native vegetation within the impact area have been considered to be foraging habitat for this species. The proposed activity will impact a total of 1.49 ha of potential foraging habitat.

Table 7 Assessment of significance – large-eared pied bat

Criterion	Question	Response
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:		
1)	lead to a long-term decrease in the size of an important population of a species	It is unlikely that the proposed activity will lead to the long-term decrease of a population of this species as: It is unlikely that any breeding habitat will be impacted, thus the potential to breed and rear offspring should not be hindered by the proposed activity. 1.49 ha of foraging habitat will be impacted by the proposed works. For a highly mobile species such as *C. dwyeri* (large-eared pied bat), this is unlikely to affect a population. It is likely that this species will continue to forage within the study area as well as the surrounding region.
2)	reduce the area of occupancy of an important population	The *National recovery plan for large-eared pied bat Chalinolobus dwyeri* (DERM 2011) notes that the largest known populations of this species occur in areas dominated by sandstone escarpments. Within NSW, based on available records, the largest concentration of

Criterion	Question	Response
		populations appears to be in the sandstone escarpments of the Sydney Basin and north-west slopes of NSW. The Wombeyan Caves are not characterised by this type of geology but rather comprise volcanics combined with intruding granite and limestone which has metamorphised into marble. There are no known populations of this species occupying the study area, nor are there likely to be any as there is no known breeding habitat within the study area for this species to utilise. As mentioned, the site could provide potential foraging habitat for this species but the impact of 1.49 ha is unlikely to reduce an area of occupancy of an important population.
3)	fragment an existing important population into two or more populations	No known populations exist within the study area. Breeding habitat is likely present outside of the study area, however, this will not be impacted. This footprint is unlikely to act as any sort of barrier for a highly mobile species such as large-eared pied bat. The proposed activity is unlikely to fragment an existing population.
4)	adversely affect habitat critical to the survival of a species	The national recovery plan for the large-eared pied bat (DERM 2011) notes that: Any maternity roosts must be considered habitat critical to the survival of the species. Sandstone cliffs and fertile wooded valley habitat within close proximity of each other should be considered habitat critical to the survival of the large-eared pied bat. No maternity roots nor breeding habitat are present within the study area. Foraging habitat for this species is vast within the surrounding region. As no maternity roots or potential breeding habitat will be impacted and the amount of foraging habitat to be impacted is minor, the proposal is unlikely to affect habitat critical to the survival of this species.
5)	disrupt the breeding cycle of an important population	There are no known populations within the study area. Additionally, there is no breeding habitat within the study area for this species to utilise. As such, it is highly unlikely that the proposed activity will disrupt the breeding cycle of an important population of this species.
6)	modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The proposed activity will remove 1.49 ha of potential foraging habitat, this is native vegetation that conforms to PCT 1105 and PCT 651. No maternity roosts or breeding habitat will be impacted. The extent of foraging habitat to be removed is unlikely to lead to a decline in the species.
7)	result in invasive species that are harmful to a vulnerable species	Predation by introduced predators such as cats, foxes and rats on the large-eared pied bat has not been investigated. It is possible that

Criterion	Question	Response
	becoming established in the vulnerable species' habitat	mortality is a factor, particularly where roosts are limited and bats are forced to roost close to the ground, which would appear to make them vulnerable to attack from cats, foxes and possibly rats. As there are no large-eared pied bat maternity roots or breeding habitat identified within the study area.
8)	introduce disease that may cause the species to decline, or	There are no known diseases within Australia that impact this species.
9)	interfere substantially with the recovery of the species.	The national recovery plan for the large-eared pied bat (DERM 2011) lists 5 specific recovery objectives for this species: Objective 1: Identify priority roost and maternity sites for protection Objective 2: Implement conservation and management strategies for priority sites Objective 3: Educate the community and industry to understand and participate in the conservation of the large-eared pied bat Objective 4: Research the large-eared pied bat to augment biological and ecological data to enable conservation management Objective 5: Determine the meta-population dynamics throughout the distribution of the large-eared pied bat. The proposed works are unlikely to substantially interfere with the recovery of the species as recovery actions related to maternity roots will not apply and the proposed works are unlikely to interfere with any educational or research-related actions defined for the recovery of this species.
Conclusion	**Is there likely to be a significant impact?**	No. The proposed impacts of 1.49 ha will only impact potential foraging habitat. No breeding habitat was identified within the study area. For a highly mobile species, such as the large-eared pied bat, the removal of 1.49 ha of potential foraging habitat from the study area is unlikely to significantly impact this species. This species will be able to continue to forage in the unimpacted vegetation within the study area, as well as the other patches within the locality. Further, the proposed works are unlikely to result in the establishment of invasive species which would harm the species, and the recovery plan objectives for this species are unlikely to be interfered with as a result of these works. Given the above, a referral to the Australian Government is not recommended.

13. Summary of impacts and conclusions

Category of impact	Significance of impacts		
	Extent of impact	Nature of impact	Environmentally sensitive features
Physical and chemical	Low	The majority of the potential issues relate to potential for erosion and sediment runoff during the construction phase. There is also the potential for accidental pollution of waterways from chemical spills. Vegetation maintenance also has the potential to increase weed invasion and soil compaction unless appropriate mitigation measures are implemented. The proposed works also have the potential to create minor dust emissions and noise and vibration associated impacts.	Watercourses and aquatic habitat Threatened species habitat and native vegetation
Biological	Low	The direct impact area associated with the proposed activity is 8.70 ha. There will be 1.49 ha of direct and indirect impacts to native vegetation. Direct impacts associated with the proposed activity will result in the removal of 8.31 ha of vegetation. Indirect impacts may arise through accidental trampling of vegetation, sediment erosion and the spreading of exotic species. A 5 m buffer has been used to calculate indirect impacts on all vegetation to an area of 1.40 ha. Tests and assessments of significance under the BC Act and EPBC Act were undertaken for threatened fauna that have the potential to occur within the study area. Through the use of these tests it was determined that the proposed activity is unlikely to result in a significant impact to any of these species (see Section 11 and Section 12). Therefore, the preparation of a biodiversity development assessment report or species impact statement is not required, and the activity is not a 'controlled action' and referral to the Australian Government is not recommended.	One hollow-bearing tree within the study area Karst systems surrounding the study area
Natural resources	Negligible	N/A	N/A
Community	Negligible and Positive	The proposed visitor precinct upgrades will have a positive impact on the local and broader community as they will increase the amenity	N/A

Category of impact	Significance of impacts		
	Extent of impact	Nature of impact	Environmentally sensitive features
		for visitors to the reserve and are anticipated to increase visitor numbers. The proposed works will be conducted within areas of vegetation which have been the subject of previous clearance in order to minimise the level of vegetation clearance necessary. Careful consideration of the proposed works has been undertaken in order to ensure that visual impacts are minimised.	
Cultural heritage	Low	The results of the survey and testing program confirmed that all sites range between low to high archaeological significance. The testing program found that whilst not encountered in all test squares, subsurface archaeological material does occur across a wide area of the valley. However, given the low-impact nature of the proposed works, generally shallow nature of construction, and mostly low-intensity occupation evidence found, no further archaeological salvage works are deemed to be necessary. An Aboriginal heritage impact permit is being sought for sites that will be impacted by the works. Wombeyan Caves is a listed item of local heritage significance (landscape) on the Upper Lachlan LEP 2010 (item number I171). The listing curtilage is smaller than the reserve curtilage. Victoria Arch is part of the karst system and is therefore a significant element of the study area. None of the buildings, trees or associated components within the study area have been identified as significant in the LEP or any other listing. The proposal provides for continued use in keeping with the original intention of the place, it enhances the accessibility, use and amenity of the place and will not be subject to impact to views, setting, archaeology or heritage items and is not considered to have a significant impact on the heritage values of the study area.	Items of Aboriginal Significance include: Test Square 5 (to become Wombeyan Caves 50 AHIMS # 51-3-0066) Wombeyan Caves 3 (AHIMS #51-3-0017) PAD 02 (to become Wombeyan Caves 49 AHIMS #51-3-0065). Mitigation measures have been recommended in the Aboriginal cultural heritage assessment, and an Aboriginal heritage impact permit application is being sought. Items of cultural historic significance: Upper Lachlan LEP 2010 (item number I171)

In conclusion there is not likely to be a significant effect on the environment and an environmental impact statement is not required.

The proposed activity will result in approximately 9.71 ha of direct and indirect impact to vegetation within the study area. Of this, 8.31 ha of direct impact will be as a result of removal of vegetation of the following plant community types (PCTs) as described in Table 4:

- Exotic grassland (3.98 ha)
- Ornamental (3.24 ha)
- PCT 1105 (0.92 ha)
- PCT 651 (0.17 ha).

The remaining 1.40 ha of impact will arise as a result of indirect impacts to the PCTs listed above. This area is far greater than what will be impacted by the proposal and is considered a worst-case scenario assessment. The assessment has been conducted like this to allow for flexibility when constructing the proposed works. In addition, the vegetation communities to be impacted are not listed communities under either the BC Act or EPBC Act.

A test of significance and significance assessment under both the BC Act and EPBC Act was undertaken for the following species:

- *Callocephalon fimbriatum* (gang-gang cockatoo)
- *Calyptorhynchus lathami* (glossy black-cockatoo)
- *Chalinolobus dwyeri* (large-eared pied bat)
- *Miniopterus orianae oceanensis* (large bentwing-bat)
- *Petroica boodang* (scarlet robin)
- *Petroica phoenicea* (flame robin)
- *Scoteanax rueppellii* (greater broad-nosed bat).

The assessments concluded that the study area is not considered to provide suitable habitat for threatened fauna species.

Although there are identified heritage items within the subject site the proposed activity will not impact on the historical fabric of these listings.

During construction there is anticipated to be some impacts to the neighbouring residences, visitors and businesses. These impacts will primarily be associated to the air quality, noise, vibration, access and traffic. It is anticipated that the mitigation measures provided in Section 9 will reduce these potential impacts to a low level. Furthermore, NPWS is consulting with nearby residents to provide more information about the projected works and methods to discuss and resolve any issues during construction.

There is not likely to be a significant effect on threatened species, populations, ecological communities or their habitats, within the meaning of the NSW BC Act, and a species impact statement is not required.

The proposed activity will result in approximately 9.71 ha of total impact to vegetation located within the study area. Of this, 8.31 ha of this impact will be as a result of direct removal of vegetation. The remaining 1.40 ha of impact will arise as a result of indirect impacts. This area is far greater than what will be impacted by the proposal and is considered a worst-case scenario assessment. The assessment has been conducted like this to allow for flexibility when constructing the proposed works. The subject site lacks suitable habitat for most threatened species that have the potential to occur within a 5 km radius of the subject site. Only highly mobile fauna species could utilise the site as marginal foraging habitat, though this is considered unlikely given the vast amount of foraging habitat

surrounding the subject site. No threatened flora species were observed during the field survey.

No threatened species or vegetation communities listed under either the BC Act, FM Act or EPBC Act are considered likely to occur within the study area. As mentioned, there is a lack of suitable habitat within the study area for many of the threatened flora and fauna species that have the potential to occur within a 5 km radius of the study area. Only highly mobile fauna species could utilise the site as marginal foraging habitat, though this is considered unlikely given the vast amount of foraging habitat surrounding the study area.

Given the above information, no significant impacts are likely to occur as a result of the proposed activity, therefore an environmental impact statement is not required. No referral of a controlled action to the Australian Government is required.

The activity is not part of critical habitat and is not likely to significantly impact matters of national environmental significance listed under the Commonwealth EPBC Act.

One matter of national environment significance (large-eared pied bat) occurs within the study area and was assessed. Due to the small scale of the impacts, the proposed activity is unlikely to result in a significant impact to this species. As such, no referral of a controlled action to the Australian Government is required.

The activity will require certification to the *Building Code of Australia, Disability (Access to Premises – Buildings) Standards 2010* or Australian Standards in accordance with the NPWS Construction Assessment Procedure.

14. Supporting documentation

Documentation supporting this application is detailed below, including appendix number.

Appendix	Document title	Author	Date
Appendix A	Nominated site compound plan	NPWS	March 2022
Appendix B	Flora species list	Eco Logical Australia	November 2021
Appendix C	Likelihood of occurrence table	Eco Logical Australia	November 2021

15. References

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DECC (2009) *Interim construction noise guideline* [PDF 1.2MB], DECCW, Sydney South.

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NPWS (2016b) *Parks signage manual* [unpublished report], NPWS, Sydney.

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NPWS (2021) 'Wombeyan Karst Conservation Reserve: Wombeyan Caves visitor precinct plan', Department of Planning, Industry and Environment, Sydney, New South Wales.

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UNESCO (United Nations Educational, Scientific and Cultural Organisation) (2021) *Greater Blue Mountains Area*, accessed 27 August 201.

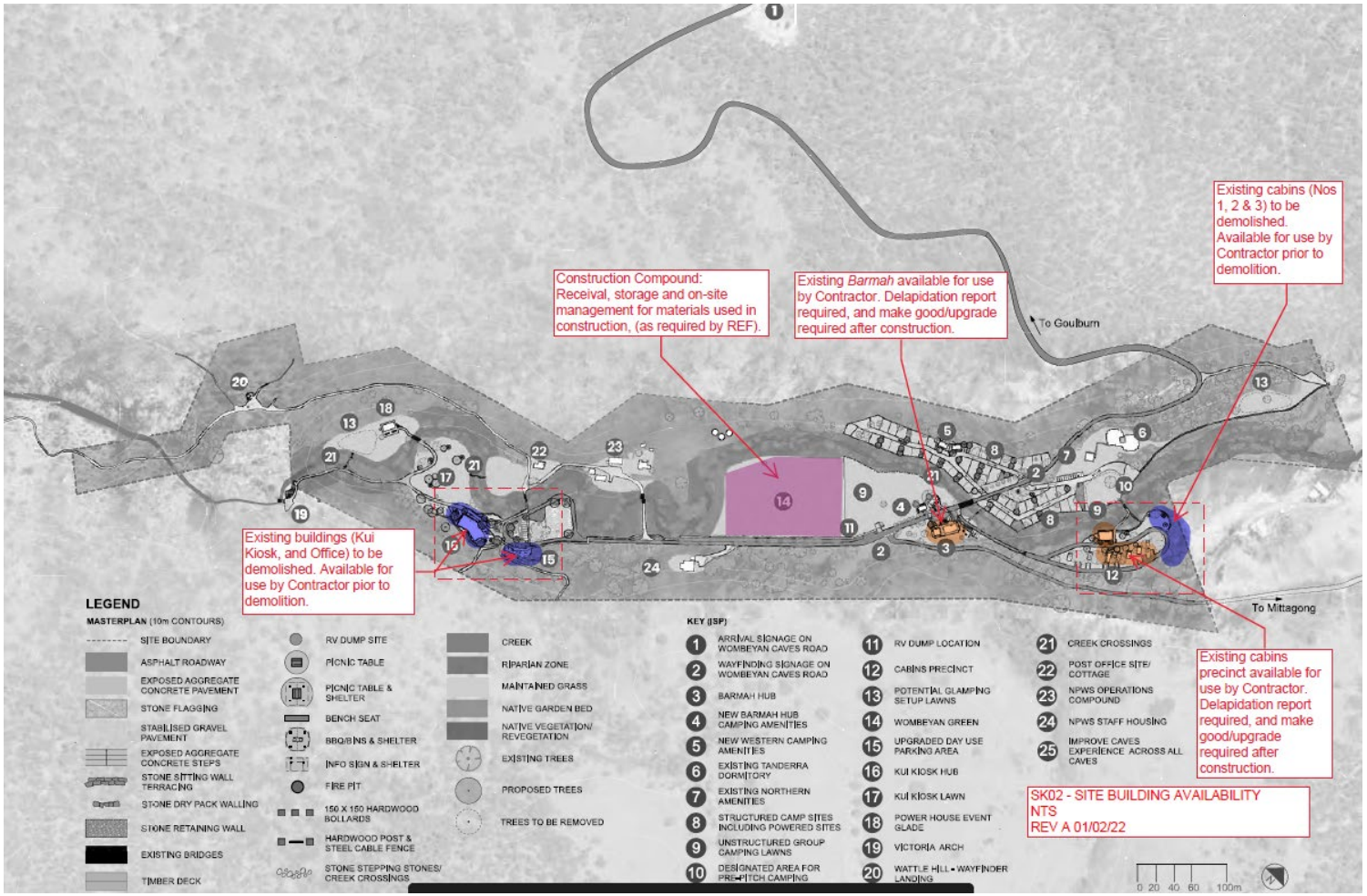
Upper Lachlan Shire Council (2010) *Upper Lachlan Local Environmental Plan*.

More information

- BioNet Vegetation Classification webpage, accessed 24 September 2021
- EPBC Act Protected Matters Search Tool, DAWE website, accessed 24 September 2021
- NPWS park policies:
  - Caves access policy
  - Commercial tour operator policy
  - Events, functions and venues policy
  - Neighbour relations policy
  - No smoking in parks policy
  - Vehicle access policy
  - Visitor accommodation policy
  - Visitor safety policy
  - Walking tracks policy
- NSW BioNet, accessed September 2021
- NSW EPA Contaminated lands register webpage
- Sharing and Enabling Environmental Data in NSW (SEED) data portal: Natural vegetation of the Sydney 1:100 000 map sheet VIS_ID 2354
- Wombeyan Karst Conservation Reserve: Wombeyan Caves visitor precinct plan
- Acts, regulations and environmental planning instruments:
  - Biodiversity Conservation Act 2016
  - Biosecurity Act 2015
  - Environmental Planning and Assessment Regulation 2000, Schedule 3
  - Fisheries Management Act 1994 No 38
  - National Parks and Wildlife Act 1974
  - State Environmental Planning Policy (Biodiversity and Conservation) 2021 (Chap 8)
  - State Environmental Planning Policy (Resilience and Hazards) 2021
  - State Environmental Planning Policy (Transport and Infrastructure) 2021, section 2.73

Appendix A. Nominated site compound plan

(Source: NPWS)



Appendix B. Species lists

Table 8 Flora species identified during the field survey

Family	Species name	Common name	Exotic
Alliaceae	*Agapanthus praecox* subsp. *orientalis*	Agapanthus	Yes
Apocynaceae	*Parsonsia straminea*	Common silkpod	
Araliaceae	*Hedera helix*	English ivy	Yes
Araliaceae	*Hydrocptyle laxiflora*	Stinking pennywort	
Asparagaceae	*Lomandra obliqua*		
Asparagaceae	*Lomandra longifolia*	Spiny-headed mat-rush	
Asparagaceae	*Lomandra multiflora*	Many-flowered mat-rush	
Asphodelaceae	*Dianella caeurlea* var. *caerulea*	Blue flax lily	
Asphodelaceae	*Dianella revoluta* var. *revoluta*	Blueberry lily	
Asphodelaceae	*Xanthorrhoea sp.*	Grass tree	
Asteraceae	*Hypochaeris radicata*	Castear	Yes
Asteraceae	*Bidens pilosa*	Farmers friends	Yes
Asteraceae	*Taraxicum sp.*	Dandelion	Yes
Bignoniaceae	*Pandorea pandorana*	Wonga wonga vine	
Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	Yes
Casuarinaceae	*Allocasuarina littoralis*	Black she-oak	
Commelinaceae	*Tradescantia fluminensis*	Trad	Yes
Convolvulaceae	*Dichondra repens*	Kidney weed	
Cyperaceae	*Caustis flexuosa*	Curly wig	
Dennstaedtiaceae	*Pteridium esculentum*	Common bracken	
Ericaceae (Epacridoideae)	*Sprengelia incarnata*	Pink swamp heath	
Euphorbiaceae	*Euphorbia peplus*	Petty spurge	Yes
Fabaceae (Faboideae)	*Trifolium repens*	Clover	Yes
Fabaceae (Faboideae)	*Hardenbergia violacea*	False sarsparilla	
Fabaceae (Mimosoideae)	*Acacia elata*	Mountain cedar wattle	
Fabaceae (Mimosoideae)	*Acacia parramattensis*	Parramatta wattle	
Fabaceae (Mimosoideae)	*Acacia brownii*	Heath wattle	
Fabaceae (Mimosoideae)	*Acacia longifolia* subsp. *longifolia*	Sydney golden wattle	
Geraniaceae	*Geranium homeanum*		

Family	Species name	Common name	Exotic
Goodeniaceae	*Dampiera stricta*		
Lamiaceae	*Prostanthera incana*	Velvet mint-bush	
Lauraceae	*Cassytha glabella*		
Lindsaeaceae	*Lindsaea linearis*	Screw fern	
Myrtaceae	*Eucalyptus sieberi*	Slivertop ash	
Myrtaceae	*Eucalyptus saligna*	Sydney blue gum	
Myrtaceae	*Leptospermum trinervium*	Flaky-barked tea-tree	
Myrtaceae	*Melaleuca hypericifolia*	Hillock bush	
Myrtaceae	*Melaleuca styphelioides*	Prickly-leaved tea-tree	
Pittosporaceae	*Pittosporum undulatum*	Native daphne	
Plantaginaceae	*Plantago lanceolata*	Lambs tongue	Yes
Poaceae	*Poa labillardierei*	Tussock	
Poaceae	*Entolasia stricta*	Wiry panic	
Poaceae	*Cynodon dactylon*	Couch	
Poaceae	*Sporobolus creber*	Western rat-tail grass	
Poaceae	*Ehrharta erecta*	Panic veldtgrass	Yes
Poaceae	*Cenchrus clandestinus*	Kikuyu	Yes
Poaceae	*Eragrostis curvula*	African love grass	Yes
Primulaceae	*Lysimachia arvensis*	Scarlet pimpernel	Yes
Proteaceae	*Banksia serrata*	Old-man banksia	
Proteaceae	*Hakea dactyloides*	Finger hakea	
Proteaceae	*Persoonia levis*	Broad-leaved geebung	
Proteaceae	*Lambertia formosa*	Mountain devil	
Proteaceae	*Banksia spinulosa*	Hairpin banksia	
Proteaceae	*Hakea sericea*	Needlebush	
Proteaceae	*Isopogon anemonifolius*	Broad-leaf drumsticks	
Ranunculaceae	*Clematis glycinoides*	Headache vine	
Ranunculaceae	*Ranunculus repens*	Creeping buttercup	Yes
Rosaceae	*Rubus fruticosus* (species aggregate)	Blackberry	Yes
Solanaceae	*Solanum mauritianum*	Tobacco tree	Yes
Solanaceae	*Solanum nigrum*	Blackberry nightshade	Yes

Table 9 Fauna species identified during field survey

Class	Family	Scientific name	Common name	Observation type
Aves	Artamidae	*Cracticus tibicen*	Australian magpie	Observed
Aves	Psittacidae	*Platycercus elegans*	Crimson rosella	Heard
Aves	Meliphagidae	*Manorina melanocephala*	Noisy miner	Observed
Aves	Turdidae	*Turdus merula*	Blackbird	Heard
Aves	Eupetidae	*Psophodes olivaceus*	Eastern whipbird	Heard
Aves	Rhipiduridae	*Rhipidura leucophrys*	Willy wagtail	Heard
Aves	Charadriidae	*Vanellus miles*	Masked lapwing	Observed
Aves	Acanthizidae	*Acanthiza pusilla*	Brown thornbill	Observed
Aves	Anatidae	*Chenonetta jubata*	Australian wood duck	Observed
Aves	Artamidae	*Strepera graculina*	Pied currawong	Observed
Aves	Meliphagidae	*Philemon corniculatus*	Noisy friarbird	Heard
Aves	Meliphagidae	*Manorina melanophrys*	Bell miner	Heard
Aves	Maluridae	*Malurus cyaneus*	Superb fairy wren	Observed
Aves	Anatidae	*Anas superciliosa*	Pacific black duck	Observed
Aves	Timaliidae	*Zosterops lateralis*	Silvereye	Heard
Aves	Hirundinidae	*Hirundo neoxena*	Welcome swallow	Observed
Aves	Ptilonorhynchidae	*Ptilonorhynchus violaceus*	Satin bowerbird	Observed
Aves	Monarchidae	*Grallina cyanoleuca*	Magpie lark	Observed
Aves	Cuculidae	*Cacomantis flabelliformis*	Fan-tailed cuckoo	Heard
Aves	Petroicidae	*Eopsaltria australis*	Eastern yellow robin	Heard
Aves	Halcyonidae	*Dacelo novaeguineae*	Kookaburra	Heard
Aves	Pachycephalidae	*Colluricincla harmonica*	Grey shrike-thrush	Heard
Aves	Podargidae	*Podargus strigoides*	Tawny frogmouth	Heard
Aves	Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo	Observed
Aves	Rhipiduridae	*Rhipidura albiscapa*	Grey fantail	Heard
Aves	Psittacidae	*Platycercus eximius*	Eastern rosella	Observed
Aves	Meliphagidae	*Anthochaera carunculata*	Red wattlebird	Heard
Aves	Pardalotidae	*Pardalotus striatus*	Striated pardalote	Heard

Class	Family	Scientific name	Common name	Observation type
Aves	Artamidae	*Cracticus torquatus*	Grey butcherbird	Heard
Aves	Meliphagidae	*Phylidonyris novaehollandiae*	New Holland honeyeater	Observed
Lissamphibia	Myobatrachidae	*Crinia signifera*	Common easter froglet	Heard
Lissamphibia	Myobatrachidae	*Limnodynastes dumerilii*	Pobblebonk	Observed
Mammalia	Leporidae	*Oryctolagus cuniculus*	European wild rabbit	Scats observed
Mammalia	Macropodidae	*Macropus giganteus*	Eastern grey kangaroo	Observed

Appendix C. Likelihood of occurrence table

An assessment of likelihood of occurrence was made for threatened and migratory species identified from the database search. Five terms for the likelihood of occurrence of species are used in this report. This assessment was based on database or other records, presence or absence of suitable habitat, features of the proposal site, results of the site inspection and professional judgement. Some migratory or marine species identified from the Commonwealth database search have been excluded from the assessment, due to lack of habitat. The terms for likelihood of occurrence are defined as:

- known = the species was or has been observed on the site
- likely = a medium to high probability that a species uses the site
- potential = suitable habitat for a species occurs on the site, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur
- unlikely = a very low to low probability that a species uses the site
- no = habitat on site and in the vicinity is unsuitable for the species.

A test of significance was conducted for threatened species that were recorded within the study area or had a higher likelihood of occurring and were not recorded during the site visit. It is noted that some threatened fauna species that are highly mobile, wide ranging and vagrant may use portions of the study area intermittently for foraging. For these fauna species, the habitat present and likely to be impacted is not considered to be important to the threatened species, particularly in relation to the amount of similar habitat remaining in the surrounding landscape. As such, a test of significance in reference to state or Commonwealth legislation was not considered necessary.

The records column refers to the number of records occurring within 5 km of the study area, as provided by the NSW BioNet Atlas and EPBC Act Protected Matters Search Tool database search.

Information provided in the habitat associations column has primarily been extracted (and modified) from the Commonwealth Species Profile and Threats Database and the NSW threatened species profiles.

Table 10 Plant community types likelihood of occurrence

Scientific name	BC Act status	EPBC Act status	Distribution and habitat	Likelihood of occurrence on site	Assessment of significance required
Natural Temperate Grassland of the South Eastern Highlands		CE	Natural temperate grassland is grassy vegetation dominated by moderately tall (25–50 cm) to tall (50–100 cm), dense to open tussock grasses in the genera *Austrodanthonia*, *Austrostipa, Bothriochloa, Poa* and *Themeda*. Up to 70% of all plant species may be forbs (i.e. herbaceous, non-grassy/non-grass-like plants). The community may be treeless or contain up to 10% cover of trees, shrubs or sedges. Generally corresponds with the Monaro, Murrumbateman, Bungonia and Crookwell subregions of the South Eastern Highlands Bioregion. Remnants are known to be located in various subregions of the Hawkesbury/Nepean, Lachlan, Murrumbidgee and Southern Rivers catchment management regions of NSW.	No – this community does not occur within the study area.	No.
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E	CE	The structure of the community may vary from tall open forests (>40m) to woodlands. The most widespread and abundant dominant trees include *Eucalyptus tereticornis* (forest red gum), *E. amplifolia* (cabbage gum), *Angophora floribunda* (rough-barked apple) and *A. subvelutina* (broad-leaved apple). *Eucalyptus baueriana* (blue box), *E. botryoides* (bangalay) and *E. elata* (river peppermint) may be common south from Sydney. *E. ovata* (swamp gum) occurs on the Far South Coast, *E. saligna* (Sydney blue gum) and *E. grandis* (flooded gum) may occur north of Sydney, while *E. benthamii* is	No – this community does not occur within the study area.	No.

Scientific name	BC Act status	EPBC Act status	Distribution and habitat	Likelihood of occurrence on site	Assessment of significance required
			restricted to the Hawkesbury floodplain. A layer of small trees may be present, including *Melaleuca decora*, *M. styphelioides* (prickly-leaved tea-tree), *Backhousia myrtifolia* (grey myrtle), *Melia azadarach* (white cedar), *Casuarina cunninghamiana* (river oak) and *C. glauca* (swamp oak). Scattered shrubs include *Bursaria spinosa, Solanum prinophyllum, Rubus parvifolius, Breynia oblongifolia*, *Ozothamnus diosmifolius*, *Hymenanthera dentata*, *Acacia floribunda* and *Phyllanthus gunnii*. The ground cover is composed of abundant forbs, scramblers and grasses. Found on the river flats of the coastal floodplains. Known from parts of the local government areas of Port Stephens, Maitland, Singleton, Cessnock, Lake Macquarie, Wyong, Gosford, Hawkesbury, Baulkham Hills, Blacktown, Parramatta, Penrith, Blue Mountains, Fairfield, Holroyd, Liverpool, Bankstown, Wollondilly, Camden, Campbelltown, Sutherland, Wollongong, Shellharbour, Kiama, Shoalhaven, Palerang, Eurobodalla and Bega Valley.		
Temperate Highland Peat Swamps on Sandstone		E	Temporary or permanent swamps with a substrate of peat over sandstone, and vegetation characterised by the presence of sedges, graminoids and forbs, with or without shrubs. The structure of the vegetation varies from open shrubland to closed heath or open heath (dominated by shrub species but with a sedge and graminoid understorey and occasionally with scattered low trees) to sedgeland and	No – this community does not occur within the study area.	No.

Scientific name	BC Act status	EPBC Act status	Distribution and habitat	Likelihood of occurrence on site	Assessment of significance required
			closed sedgeland. Components of the community include the Blue Mountains Swamps, Butlers Swamp, Jacksons Bog (Mila Swamp), Newnes Plateau Swamps, Paddys River Swamps - Hanging Rock, Long, Mundego and Stingray swamps, Wildes Meadow Swamp and Wingecarribee Swamp.		
Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion		E	Typically occurs as an open to tall open forest with a sparse to dense layer of shrubs and vines, and a diverse understorey of native grasses, forbs, twiners and ferns. Dominant canopy species are most often *Eucalyptus fastigata* (brown barrel), *E. viminalis* (ribbon gum) and *E. radiata subsp. radiata* (narrow-leaved peppermint). *Eucalyptus obliqua* (messmate stringybark), *E. elata* (river peppermint), *E. quadrangulata* (white-topped box) and *E. smithii* (ironbark peppermint) are also common. *Eucalyptus oreades* (Blue Mountains ash) and *E. blaxlandii* (Blaxland's stringybark) are prevalent in the Blue Mountains forms. *Eucalyptus cypellocarpa* (mountain grey gum) is widespread in drier sites, while *E. piperita* (Sydney peppermint) and *E. ovata* (swamp gum) may also be present. *Acacia melanoxylon* (blackwood) is a common sub-canopy tree. Occasional rainforest trees such as *Doryphora sassafras* (sassafras) and *Hedycarya angustifolia* (native mulberry) may also occur. Generally confined to the Sydney Basin Bioregion, including the Moss Vale, Ettrema, Burragorang, Sydney Cataract,	No – this community does not occur within the study area.	No.

Scientific name	BC Act status	EPBC Act status	Distribution and habitat	Likelihood of occurrence on site	Assessment of significance required
			and Wollemi IBRA subregions. However, some patches may extend into in the Kanangra and Oberon IBRA subregions of the South Eastern Highlands bioregion.		
White Box-Yellow Box-Blakely's Red Gum Woodland	E	CE	Open woodland community (sometimes occurring as a forest formation), in which the most obvious species are one or more of the following: *Eucalyptus albens* (white box), *E. melliodora* (yellow box) and *E. blakelyi* (Blakely's red gum). Intact sites contain a high diversity of plant species, including the main tree species, additional tree species, some shrub species, several climbing plant species, many grasses and a very high diversity of herbs. Modified sites include areas where the main tree species are present ranging from an open woodland formation to a forest structure, and the ground layer is predominantly composed of exotic species; and sites where the trees have been removed and only the grassy ground layer and some herbs remain. Tablelands and western slopes of NSW.	No – this community does not occur within the study area.	No.
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	E	CE	Characterised by a species-rich understorey of native tussock grasses, herbs and scattered shrubs, and the dominance, or prior dominance, of *Eucalyptus albens* (white box), *E. melliodora* (yellow box) and *E. blakelyi* (Blakely's red gum). In the Nandewar Bioregion, *E. microcarpa* or *E. moluccana* (grey box) may also be dominant or co-dominant. The tree cover is generally discontinuous and consists of widely	No – this community does not occur within the study area.	No.

Scientific name	BC Act status	EPBC Act status	Distribution and habitat	Likelihood of occurrence on site	Assessment of significance required
			spaced trees of medium height in which the canopies are clearly separated. Occurs in an arc along the western slopes and tablelands of the Great Dividing Range from southern Queensland through NSW to central Victoria. In NSW, it occurs in the Brigalow Belt South, Nandewar, New England Tableland, Sydney Basin, NSW North Coast, South Eastern Highlands, South East Corner, NSW South Western Slopes and Riverina bioregions.		

BC Act = Biodiversity Conservation Act.

EPBC Act = Environment Protection and Biodiversity Conservation Act.

E = endangered, CE = critically endangered.

Table 11 Likelihood of occurrence of threatened fauna species within the study area

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
Actitis hypoleucos	Common sandpiper		M	Summer migrant. In NSW, widespread along coastline and also occurs in many areas inland. Coastal wetlands and some inland wetlands, especially muddy margins or rocky shores. Also estuaries and deltas, lakes, pools, billabongs, reservoirs, dams and claypans, mangroves.	0	No. The study area provides no habitat for this species.	No.
Anthochaera phrygia	Regent honeyeater	E4A	CE	Inland slopes of south-east Australia, and less frequently in coastal areas. In NSW, most records are from the North West Plains, North West and SouthWest Slopes, Northern Tablelands, Central Tablelands and Southern Tablelands regions; also recorded in the Central Coast and Hunter Valley regions. Eucalypt woodland and open forest, wooded farmland and urban areas with mature eucalypts, and riparian forests of *Casuarina cunninghamiana* (river oak).	1	Unlikely. A single record has been made within a 5 km radius of the study area. The site could act as marginal foraging habitat, however, it is more likely that this species would utilise the expansive wilderness surrounding the study area over the vegetation that is located within the study area.	No.
Aprasia parapulchella	Pink-tailed legless lizard	V	V	In NSW, only known from the Central and Southern Tablelands, and the South Western Slopes. Sloping, open woodland areas with	0	Unlikely. The study area provides marginal habitat for this species. No records have been	No.

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
				predominantly native grassy ground layers, rocky outcrops or scattered, partially buried rocks.		made within a 5 km radius of the study area.	
Apus pacificus	Fork-tailed swift		M	Recorded in all regions of NSW. Riparian woodland, swamps, low scrub, heathland, saltmarsh, grassland, spinifex sandplains, open farmland and inland and coastal sand dunes.	0	Unlikely. The study area provides marginal habitat for this species. No records have been made within a 5 km radius of the study area.	No.
Ardea ibis	Cattle egret		Mar.	Widespread and common across NSW. Grasslands, wooded lands and terrestrial wetlands.	0	No. The study area provides no habitat for this species.	No.
Botaurus poiciloptilus	Australasian bittern	E1	E	Found over most of NSW except for the far north-west. Permanent freshwater wetlands with tall, dense vegetation, particularly *Typha* spp. (bullrushes) and *Eleocharis* spp. (spikerushes).	0	No. The study area provides no habitat for this species.	No.
Calidris acuminata	Sharp-tailed sandpiper		M	Summer migrant. Widespread in most regions of NSW, especially in coastal areas, but sparse in the south-central Western Plain and east Lower Western Regions. Shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation.	0	No. The study area provides no habitat for this species.	No.

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
Calidris ferruginea	Curlew sandpiper	E1	CE, M	Occurs along the entire coast of NSW, and sometimes in freshwater wetlands in the Murray–Darling Basin. Littoral and estuarine habitats, including intertidal mudflats, non-tidal swamps, lakes and lagoons on the coast and sometimes inland.	0	No. The study area provides no habitat for this species.	No.
Calidris melanotos	Pectoral sandpiper		M	Summer migrant to Australia. Widespread but scattered in NSW. East of the Great Divide, recorded from Casino and Ballina, south to Ulladulla. West of the Great Divide, widespread in the Riverina and lower western regions. Shallow fresh to saline wetlands, including coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.	0	No. The study area provides no habitat for this species.	No.
Callocephalon fimbriatum	Gang-gang cockatoo population in the Hornsby and Ku-ring-gai local government areas	E2, V		The population is believed to be largely confined to an area bounded by Thornleigh and Wahroonga in the north, Epping and North Epping in the south, Beecroft and Cheltenham in the west, and Turramurra/South Turramurra	0	No. The study area is too far from this population.	No.

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
				to the east. Forest and woodland, urban fringes.			
Callocephalon fimbriatum	Gang-gang cockatoo	V		In NSW, distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and South West Slopes. Isolated records known from as far north as Coffs Harbour and as far west as Mudgee. Tall mountain forests and woodlands in summer; in winter, may occur at lower altitudes in open eucalypt forests and woodlands, and urban areas.	3	Unlikely. The study area could act as marginal foraging habitat, however, it is more likely that this species would utilise the expansive wilderness surrounding the study area over the vegetation that is located within the study area.	No.
Calyptorhynchus lathami	Glossy black-cockatoo, Riverina population	E2, V		Within the Narrandera Range and to the north-west in the Brobenah Hills, McPhersons Range, Cocoparra Range, Lachlan Range and Jimberoo state forests, and the Naradhan Range. Largely restricted to hills and low ridges where suitable stands of its food plant *Allocasuarina verticillata* (drooping she-oak) remain.	0	No. The study area is too far from this population.	No.
Calyptorhynchus lathami	Glossy black-cockatoo	V		In NSW, widespread along coast and inland to the Southern Tablelands and Central Western Plains, with a small population in the Riverina. Open forest and	47	Unlikely. The study area lacked a suitable amount of preferred feed trees for this species. Despite this, the study area could act	No.

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
				woodlands of the coast and the Great Dividing Range where stands of she-oak occur.		as marginal foraging habitat. It is more likely that this species would utilise the expansive wilderness surrounding the study area over the vegetation that is located within the study area.	
Cercartetus nanus	Eastern pygmy-possum	V		In NSW extends from the coast inland as far as the Pilliga, Dubbo, Parkes and Wagga Wagga on the western slopes. Rainforest, sclerophyll forest (including box-ironbark), woodland and heath.	2	Unlikely. Marginal habitat is located within the study area. It is more likely that this species would utilise the expansive wilderness surrounding the study area over the vegetation that is located within the study area.	No.
Chalinolobus dwyeri	Large-eared pied bat	V	V	Recorded from Rockhampton in Qld south to Ulladulla in NSW. Largest concentrations of populations occur in the sandstone escarpments of the Sydney Basin and the NSW North West Slopes. Wet and dry sclerophyll forests, cyprus pine dominated forest, woodland, sub-alpine woodland, edges of rainforests and sandstone outcrop country.	0	No. No habitat for this species was recorded during the field survey.	No.

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
Daphoenositta chrysoptera	Varied sittella	V		Distribution in NSW is nearly continuous from the coast to the far west. Inhabits eucalypt forests and woodlands, mallee and *Acacia* woodland.	21	Unlikely. Records of this species have been made within close proximity to the study area, however, these records have been made within the more intact vegetation away from any man-made infrastructure. It is more likely that this species would utilise the vegetation located in the surrounding wilderness.	No.
Dasyurus maculatus	Spotted-tailed quoll	V	E	Found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Qld. Rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.	54	Unlikely. Numerous records of this species have been made within close proximity to the study area, however, these records have been made within the more intact vegetation away from any man-made infrastructure. No hollow-bearing trees were identified in the study area. It is more likely that this species would utilise the vegetation located in the surrounding wilderness.	No.

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
Eulamprus leuraensis	Blue Mountains water skink	E1	E	Restricted to the middle and upper Blue Mountains, from Newnes Plateau in the north-west to just south of Hazelbrook in the south-east. Sedge and shrub swamps with boggy soils, probably permanently wet.	126	Unlikely. No suitable habitat is located within the study area.	No.
Falco hypoleucos	Grey falcon	E1		Arid and semi-arid zones. In NSW, found chiefly throughout the Murray–Darling Basin, with the occasional vagrant east of the Great Dividing Range. Shrubland, grassland and wooded watercourses, occasionally in open woodlands near the coast, and near wetlands.	0	Unlikely. The study area provides marginal habitat for this species. No records have been made within a 5 km radius of the study area.	No.
Falsistrellus tasmaniensis	Eastern false pipistrelle	V		South-east coast and ranges of Australia, from southern Qld to Victoria and Tasmania. In NSW, records extend to the western slopes of the Great Dividing Range. Tall (greater than 20 m) moist habitats.	11	Unlikely. The study area provides marginal foraging habitat for this species.	No.
Gallinago hardwickii	Latham's snipe		M	Migrant to east coast of Australia, extending inland west of the Great Dividing Range in NSW. Freshwater, saline or brackish wetlands up to 2,000 m above sea level; usually freshwater swamps,	0	No. The study area provides no habitat for this species.	No.

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
				flooded grasslands or heathlands.			
Glossopsitta pusilla	Little lorikeet	V		In NSW, found from the coast westward as far as Dubbo and Albury. Dry, open eucalypt forests and woodlands, including remnant woodland patches and roadside vegetation.	18	Unlikely. Records for this species have been made within a 5 km radius of the study area, however, these records are located in the Kedumba Valley where there is presumably less disturbance than would exist within the study area. It is more likely that this species would continue to utilise the more intact patches of vegetation over those located within the study area.	No.
Grantiella picta	Painted honeyeater	V	V	Widely distributed in NSW, predominantly on the inland side of the Great Dividing Range but avoiding arid areas. Boree, Brigalow and box-gum woodlands and box-ironbark forests.	0	Unlikely. The habitat within the study area does not support that which is typically utilised by this species.	No.
Haliaeetus leucogaster	White-bellied sea-eagle	V		Distributed along the coastline of mainland Australia and Tasmania, extending inland along some of the larger waterways, especially in eastern Australia. Freshwater swamps, rivers, lakes,	0	No. The study area provides no habitat for this species as it is located too far inland.	No.

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
				reservoirs, billabongs, saltmarsh and sewage ponds and coastal waters. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, forest and urban areas.			
Heleioporus australiacus	Giant burrowing frog	V	V	South-eastern NSW and Victoria, in 2 distinct populations: a northern population in the sandstone geology of the Sydney Basin as far south as Ulladulla; and a southern population occurring from north of Narooma through to Walhalla, Victoria. Heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based.	1	Unlikely. The study area lacks suitable habitat for this species.	No.
Hirundapus caudacutus	White-throated needletail		M	All coastal regions of NSW, inland to the western slopes and inland plains of the Great Divide. Occur most often over open forest and rainforest, as well as heathland, and remnant vegetation in farmland.	1	Unlikely. A single record has been made with a 5 km radius of the study area.	No.
Hoplocephalus bungaroides	Broad-headed snake	E1	V	Largely confined to Triassic and Permian sandstones within the coast and ranges in an area within approximately 250 km of Sydney. Dry and	1	Unlikely. A single record has been made for this species within a 5 km radius. The study area	No.

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
				wet sclerophyll forests, riverine forests, coastal heath swamps, rocky outcrops, heaths, grassy woodlands.		lacks suitable habitat for this species.	
Isoodon obesulus obesulus	Southern brown bandicoot (eastern)	E1	E	Found in south-eastern NSW, east of the Great Dividing Range south from the Hawkesbury River. Heath or open forest with a heathy understorey on sandy or friable soils.	0	Unlikely. The vegetation within the study area lacks suitable habitat for this species. No records for this species have been made within a 5 km radius of the study area.	No.
Lathamus discolor	Swift parrot	E1	CE	Migrates from Tasmania to mainland in autumn–winter. In NSW, the species mostly occurs on the coast and South West Slopes. Box-ironbark forests and woodlands.	11	Unlikely. The habitat within the study area is not the preferred habitat type, however, may still act as marginal foraging habitat.	No.
Litoria booroolongensis	Booroolong frog	E1	E	Restricted to NSW and north-eastern Victoria, predominantly along the western-flowing streams of the Great Dividing Range. Several populations have recently been recorded in the Namoi catchment. Permanent streams with some fringing vegetation cover such as ferns, sedges or grasses.	0	Unlikely. The study area lacks suitable habitat for this species. No records have been made for this species within a 5 km radius of the study area.	No.
Litoria littlejohni	Littlejohn's tree frog	V	V	Plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest south to Buchan in Victoria. The species has not been recorded	0	Unlikely. The study area lacks suitable habitat for this species. No records have been made for this	No.

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
				in southern NSW within the last decade. Breeding habitat is the upper reaches of permanent streams and perched swamps. Non-breeding habitat is heath-based forests and woodlands.		species within a 5 km radius of the study area.	
Macquaria australasica	Macquarie perch	E1	E	Murray–Darling Basin (particularly upstream reaches) of the Lachlan, Murrumbidgee and Murray rivers, and parts of south-eastern coastal NSW, including the Hawkesbury and Shoalhaven catchments. River and lake habitats, especially the upper reaches of rivers and their tributaries.	0	No. The study area provides no habitat for this species.	No.
Merops ornatus	Rainbow bee-eater		M	Distributed across much of mainland Australia, including NSW. Open forests and woodlands, shrublands, farmland, areas of human habitation, inland and coastal sand dune systems, heathland, sedgeland, vine forest and vine thicket.	0	Unlikely. The study area lacks suitable habitat for this species.	No.
Micronomus norfolkensis	Eastern freetail-bat	V		Dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range.	0	Unlikely. No hollow-bearing trees were identified within the study area. Additionally, no records have been made within a 5 km radius of the study area.	No.

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
Miniopterus australis	Little bentwing-bat	V		East coast and ranges south to Wollongong in NSW. Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, *Melaleuca* swamps, dense coastal forests and banksia scrub.	0	Unlikely. No hollow-bearing trees were identified within the study area. Additionally, no records have been made within a 5 km radius of the study area.	No.
Miniopterus orianae oceanensis	Large bentwing-bat	V		Large bentwing-bats occur along the east and north-west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, stormwater tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes.	10	Unlikely. No hollow-bearing trees were identified within the study area. This species may pass through the study area.	No.
Mixophyes balbus	Stuttering frog	E1	V	Along the east coast of Australia from southern Qld to north-eastern Victoria. Rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range.	0	Unlikely. Habitat is available within the study area, however, this species was not recorded in the study area.	No.
Monarcha melanopsis	Black-faced monarch		M	In NSW, occurs around the eastern slopes and tablelands of the Great Divide, inland to	0	Unlikely.	No.

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
				Coutts Crossing, Armidale, Widden Valley, Wollemi National Park and Wombeyan Caves. It is rarely recorded farther inland. Rainforest, open eucalypt forests, dry sclerophyll forests and woodlands, gullies in mountain areas or coastal foothills, Brigalow scrub, coastal scrub, mangroves, parks and gardens.		Preferred habitat not present. Not recorded during field survey.	
Motacilla flava	Yellow wagtail		M	Regular summer migrant to mostly coastal Australia. In NSW recorded Sydney to Newcastle, the Hawkesbury and inland in the Bogan Local Government Area. Swamp margins, sewage ponds, saltmarshes, playing fields, airfields, ploughed land, lawns.	0	Unlikely. There is a lack of suitable habitat for this species within the study area.	No.
Myiagra cyanoleuca	Satin flycatcher		M	In NSW, widespread on and east of the Great Divide and sparsely scattered on the western slopes, with very occasional records on the western plains. Eucalypt-dominated forests, especially near wetlands, watercourses, and heavily vegetated gullies.	0	Unlikely. No records have been made for this species within a 5 km radius of the study area.	No.
Ninox strenua	Powerful owl	V		In NSW, it is widely distributed throughout the eastern forests from the coast inland to	2	Unlikely. There are no hollow-bearing trees within the study area.	No.

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
				tablelands, with scattered records on the western slopes and plains. Woodland, open sclerophyll forest, tall open wet forest and rainforest.		The site could act as marginal foraging habitat though it is much more likely that this species would utilise the expansive wilderness surrounding the study area.	
Numenius madagascariensis	Eastern curlew		CE, M	Summer migrant to Australia. Primarily coastal distribution in NSW, with some scattered inland records. Estuaries, bays, harbours, inlets and coastal lagoons, intertidal mudflats or sandflats, ocean beaches, coral reefs, rock platforms, saltmarsh, mangroves, freshwater/brackish lakes, saltworks and sewage farms.	0	Unlikely. There is no suitable habitat within the study area.	No
Petalura gigantea	Giant dragonfly	E1		Found along the east coast of NSW from the Victorian border to northern NSW. Not found west of the Great Dividing Range. Permanent swamps and bogs with some free water and open vegetation.	0	Unlikely. Vegetation within the study area is not suitable for this species.	No.
Petauroides volans	Greater glider	E2	V	Occupies eucalypt forests and woodlands. Utilises hollow-bearing trees for shelter and breeding.	22	Unlikely. No hollow-bearing trees were identified within the study area.	No.
Petaurus australis	Yellow-bellied glider	E2, V		The endangered population of the yellow-bellied glider occurs	0	No. Study area is too far from the known	No.

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
	population on the Bago Plateau			on the Bago Plateau; a westward extension of the Kosciuszko highlands in southern NSW. The habitat on the Bago Plateau consists of tall wet sclerophyll forest dominated by *E. delegatensis* (alpine ash), *E. dalrympleana* (mountain gum), *E. radiata* (narrow-leaved peppermint), and *E. rubida* (candlebark).		distribution of this population.	
Petaurus australis	Yellow-bellied glider	V		Along the eastern coast to the western slopes of the Great Dividing Range, from southern Qld to Victoria. Tall mature eucalypt forest generally in areas with high rainfall and nutrient-rich soils.	27	Unlikely. No feed tree species were identified within the study area. This species may occasionally pass through the study area.	No.
Petrogale penicillata	Brush-tailed rock-wallaby	E1	V	In NSW they occur from the Qld border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges.	0	Unlikely. No records have been made for this species within a 5 km radius of the study area.	No.
Petroica boodang	Scarlet robin	V		In NSW, it occurs from the coast to the inland slopes. Dry eucalypt forests and woodlands, and occasionally in	1	Unlikely. Habitat within the study area is marginal for this species.	No.

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
				mallee, wet forest, wetlands and tea-tree swamps.			
Petroica phoenicea	Flame robin	V		In NSW, breeds in upland areas, and in winter many birds move to the inland slopes and plains, or occasionally to coastal areas. Likely that there are 2 separate populations in NSW: one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands. Breeds in upland tall moist eucalypt forests and woodlands. In winter uses dry forests, open woodlands, heathlands, pastures and native grasslands. Occasionally occurs in temperate rainforest, herbfields, heathlands, shrublands and sedgelands at high altitudes.	4	Unlikely. Habitat within the study area is marginal for this species.	No.
Phascolarctos cinereus	Koala, Hawks Nest and Tea Gardens population	E2, V	V	Known from, and in the immediate vicinity of, the towns of Hawks Nest and Tea Gardens in the Great Lakes Local Government Area. Eucalypt forest and woodland communities, including coastal forests, rainforest, riparian areas, swamp sclerophyll forests, heathland and shrubland.	0	No. The study area is too far from the known distribution of this population.	No.

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
Phascolarctos cinereus	Koala in the Pittwater Local Government Area	E2, V	V	The endangered population occurs within the Pittwater Local Government Area, with most recent records occurring on the Barrenjoey Peninsula. Eucalypt forests and woodlands. Key likely habitats within Pittwater Council are swamp mahogany forest, ecotone between spotted gum forest and Hawkesbury sandstone open forest, northern form of coastal sandstone woodland at Whale Beach, red bloodwood - scribbly gum woodland, Bilgola Plateau forest and the grey ironbark - grey gum form of the Newport bangalay woodland.	0	No. The study area is too far from the known distribution of this population.	No.
Phascolarctos cinereus	Koala	V	V	In NSW it mainly occurs on the Central and North coasts with some populations in the west of the Great Dividing Range. There are sparse and possibly disjunct populations in the Bega District, and at several sites on the southern tablelands. Eucalypt woodlands and forests.	4	Unlikely. A handful of records have been made within a 5 km radius of the study area. No evidence of koalas was observed during the field survey.	No.
Prototroctes maraena	Australian grayling		V	Streams and rivers on the eastern and southern flanks of the Great Dividing Range. In NSW it occurs south from the Shoalhaven River. Coastal	0	No. There is no habitat for this species within the study area.	No.

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
				rivers and streams, fresh and brackish coastal lagoons.			
Pseudomys novaehollandiae	New holland mouse		V	Fragmented distribution across eastern NSW. Open heathlands, woodlands and forests with a heathland understorey, vegetated sand dunes.	1	Unlikely. A single record has been made within a 5 km radius of the study area. This record was made in the Kedumba Valley.	No.
Pseudophryne australis	Red-crowned toadlet	V		Confined to the Sydney Basin, from Pokolbin in the north, the Nowra area to the south, and west to Mount Victoria in the Blue Mountains. Open forests, mostly on Hawkesbury and Narrabeen sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings.	28	Unlikely. The study area lacked suitable breeding habitat.	No.
Pteropus poliocephalus	Grey-headed flying-fox	V	V	Along the eastern coast of Australia, from Bundaberg in Qld to Melbourne in Victoria. Subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.	36	Unlikely. The study area has potential to act as foraging habitat, though this highly mobile species is more likely to utilise the habitat that is in a better condition, such as the nearby Kedumba Valley.	No.
Rhipidura rufifrons	Rufous fantail		M	Coastal and near-coastal districts of northern and eastern Australia, including on and east of the Great Divide in NSW. Wet sclerophyll forests,	0	Unlikely. The study area does not contain ideal habitat for this species.	No.

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
				subtropical and temperate rainforests. Sometimes drier sclerophyll forests and woodlands.			
Rostratula australis	Australian painted snipe	E1	E	In NSW most records are from the Murray–Darling Basin. Other recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter valleys. Swamps, dams and nearby marshy areas.	0	Unlikely. Lack of suitable habitat for this species within the study area.	No.
Scoteanax rueppellii	Greater broad-nosed bat	V		Both sides of the Great Divide, from the Atherton Tableland in Qld to north-eastern Victoria, mainly along river systems and gullies. In NSW it is widespread on the New England Tablelands. Woodland, moist and dry eucalypt forest and rainforest.	1	Unlikely. No hollow-bearing trees were identified within the study area. This species may pass through the study area.	No.
Tringa nebularia	Common greenshank		M	Summer migrant to Australia. Recorded in most coastal regions of NSW. Also widespread west of the Great Dividing Range, especially between the Lachlan and Murray rivers and the Darling River drainage basin, including the Macquarie Marshes, and north-west regions. Terrestrial wetlands (swamps, lakes, dams, rivers, creeks,	0	No. Lack of suitable habitat within the study area.	No.

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
				billabongs, waterholes and inundated floodplains, claypans, saltflats, sewage farms and saltworks dams, inundated rice crops and bores) and sheltered coastal habitats (mudflats, saltmarsh, mangroves, embayments, harbours, river estuaries, deltas, lagoons, tidal pools, rock-flats and rock platforms).			
Tyto tenebricosa	Sooty owl	V		Occupies the easternmost one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands. Dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests.	5	Unlikely. No hollow-bearing trees were identified within the study area. The site could act as potential foraging habitat.	No.
Vespadelus troughtoni	Eastern cave bat	V		Found in a broad band on both sides of the Great Dividing Range south to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT. Dry open forest and woodland, near cliffs or rocky overhangs, cliff lines in wet eucalypt forest and rainforest.	1	Unlikely. There is no habitat for this species within the study area. This species could pass through the study area though this is considered unlikely.	No.

BC Act = Biodiversity Conservation Act:
E1 = endangered species
E2 = endangered population
E4A = critically endangered species
V = vulnerable species
EPBC Act = Environment Protection and Biodiversity Conservation Act:
E = endangered
CE = critically endangered
M = migratory
Mar. = marine
V = vulnerable

Table 12 Likelihood of occurrence threatened flora

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
Acacia baueri subsp. *aspera*		V		In NSW, restricted to the Sydney region, on the Kings Tableland in the central Blue Mountains and the Woronora Plateau in the Royal National Park, Mt Keira district and at Wedderburn. May also occur on the escarpment/Woronora Plateau in the Flat Rock Junction and Stanwell Tops area of the Illawarra. Low, damp heathlands, often on exposed rocky outcrops.	42	Unlikely. The habitat within the study area could provide marginal habitat for this species. This species was not observed during the field survey.	No.
Acacia bynoeana	Bynoe's wattle	E1	V	Found in central eastern NSW, from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains. Heath or dry sclerophyll forest on sandy soils.	6	Unlikely. The habitat within the study area is unlikely to be habitat for this species. This species was not observed during the field survey.	No.
Acrophyllum australe		V	V	Restricted to the Blue Mountains area, from Faulconbridge to Lawson, south of Bilpin and near Kings Tableland. Sheltered gullies beneath waterfalls and drip zones of rock overhangs and cliff faces, in crevices on the sandstone rock face or on talus slopes.	0	No. There is no habitat for this species within the study area.	No.
Boronia deanei	Deane's boronia	V	V	Scattered populations between the far south-east of NSW and the Blue Mountains (including the upper Kangaroo River near	0	No. The vegetation within the study area does not provide	No.

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
				Carrington Falls, the Endrick River near Nerriga and Nalbaugh Plateau). Wet heath, often at the margins of open forest adjoining swamps or along streams. Also found in drier open forest on poorly drained peat soils.		habitat for this species.	
Cryptostylis hunteriana	Leafless tongue orchid	V	V	In NSW, recorded mainly on coastal and near-coastal ranges north from Victoria to near Forster, with 2 isolated occurrences inland north-west of Grafton. Coastal heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodland, and lowland forest.	0	Unlikely. The habitat within the study area is marginal. No records have been made for this species within a 5 km radius of the study area. This species was not observed during the field survey.	No.
Cynanchum elegans	White-flowered wax plant	E1	E	Restricted to eastern NSW, from Brunswick Heads on the North Coast to Gerroa in the Illawarra region, and as far west as Merriwa in the upper Hunter River valley. Dry rainforest; littoral rainforest; *Leptospermum laevigatum-Banksia integrifolia* subsp. *integrifolia* (coastal tea-tree– coastal banksia) coastal scrub; *E. tereticornis* (forest red gum) or *Corymbia maculata* (spotted gum) open forest and woodland; and *Melaleuca armillaris* (bracelet honeymyrtle) scrub.	0	No. The study area does not provide any suitable habitat for this species.	No.

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
Epacris hamiltonii		E1	E	Occurs on the plateau of the upper Blue Mountains, within 3 creek catchments located on the northern side of the escarpment that flow into the Grose Valley. On or adjacent to Narrabeen sandstone cliffs, alongside perennial creeks with wet gully forest or swamp vegetation, often below plateau hanging swamps.	2	No. The known habitat for this species is not located within the study area.	No.
Eucalyptus benthamii	Camden white gum	V	V	Alluvial flats of the Nepean River and its tributaries. Mainly Kedumba Valley of the Blue Mountains National Park and Bents Basin State Recreation Area. Also along the Nepean River around Camden and Cobbitty, at Werriberri (Monkey) Creek in The Oaks, and on the Nattai River in Nattai National Park. Occurs in open forest. Requires a combination of deep alluvial sands and a flooding regime.	0	No. There is no suitable habitat for this species within the study area. The elevation of the study area is not suitable for this species.	No.
Eucalyptus copulans		E1	E	Only 2 trees currently known, on council reserve along Jamison Creek at Wentworth Falls in the Blue Mountains, NSW. Possibly also a disjunct population on the northern side of Wentworth Falls Lake. Originally in open woodland on swampy sandy soil.	1	Unlikely. The habitat within the study area could provide habitat for this species, however, no specimens were observed during the field survey.	No.

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
Eucalyptus macarthurii	Camden woollybutt	E1	E	From the Moss Vale District to Kanangra-Boyd National Park. Grassy woodland on relatively fertile soils on broad cold flats.	0	No. Suitable habitat not located within the study area.	No.
Euphrasia bowdeniae		V	V	Endemic to the upper Blue Mountains. Wet or damp vertical sandstone rock faces, in small pockets of damp, sandy soil on ledges or at the cliff base.	77	No. This species is endemic to cliff faces and ledges. The habitat within the study area is not suitable for this species.	No.
Genoplesium baueri	Bauer's midge orchid	E1	E	Has been recorded from locations between Nowra and Pittwater and may occur as far north as Port Stephens. Dry sclerophyll forest and moss gardens over sandstone.	0	Unlikely. No specimens were observed during the field survey. The study area is unlikely to provide suitable habitat. No moss gardens were observed.	No.
Haloragodendron lucasii		E1	E	Confined to a very narrow distribution on the north shore of Sydney. Dry sclerophyll forest and low open woodland on sheltered slopes near creeks, in moist sandy loam soils.	0	No. The study area is too far from the known distribution of this species.	No.
Kunzea cambagei	Cambage kunzea	V	V	Mainly occurs in the western and southern parts of the Blue Mountains, NSW. Other populations at Berrima, along the Wingecarribee River; Loombah Plateau east of Mount Werong; the	1	Unlikely. The habitat within the study area does not provide	No.

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
				Oberon-Colong Stock Route within Kanangra-Boyd National Park (NP); and Wanganderry Plateau within the Nattai NP. Restricted to damp, sandy soils in wet heath or mallee open scrub at higher altitudes on sandstone outcrops or Silurian group sediments.		suitable habitat for this species.	
Leionema lachnaeoides		E1	E	Upper Blue Mountains, within a 12 km range between Katoomba and Blackheath. Montane heath on exposed sandstone cliff tops and terraces, at 960–1000 m altitude.	0	Unlikely. Habitat is available, however, this species was not recorded in the study areas.	No.
Lepidosperma evansianum	Evans sedge	V		Three locations (at Blackheath and Wentworth Falls) within Blue Mountains NP. Wet sandstone cliff faces.	80	Unlikely. The study area does not contain suitable habitat for this species.	No.
Persoonia acerosa	Needle geebung	V	V	Recorded only on the Central Coast and in the Blue Mountains, from Mt Tomah in the north to as far south as Hill Top where it is now believed to be extinct. Dry sclerophyll forest, scrubby low-woodland and heath on low fertility soils.	300	Unlikely. Many records have been made within close proximity to the site. The habitat within the study area is marginal for this species. This species was not observed during the field survey.	No.

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
Persoonia hirsuta	Hairy geebung	E1	E	Scattered distribution around Sydney, from Singleton in the north, along the east coast to Bargo in the south and the Blue Mountains to the west. Sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.	0	Unlikely. Habitat within the study area is marginal. No specimens were observed during the field survey.	No.
Pherosphaera fitzgeraldii	Dwarf mountain pine	E1	E	Upper Blue Mountains between Wentworth Falls and Katoomba. Associated with drip lines, seepage areas or spray zones of waterfalls on steep sandstone cliffs and ledges.	192	No. The habitat required for this species is not present within the study area.	No.
Prasophyllum fuscum	Slaty leek orchid	E4A	V	Believed to be confined to the Blue Mountains area. Some authorities believe it is identical to *P. uroglossum* which occurs in the Wingecarribee area. Moist heath, often along seepage lines.	0	No. There is no suitable habitat for this species within the study area.	No.
Pultenaea glabra	Smooth bush-pea	V	V	Restricted to the higher Blue Mountains and has been recorded from the Katoomba-Hazelbrook and Mount Victoria areas, with unconfirmed sightings in the Mount Wilson and Mount Irvine areas. Swamp margins, hillslopes, gullies and creekbanks, within dry sclerophyll forest and tall damp heath on sandstone.	1,028	Unlikely. There are many records within 5 km of the study area. The habitat within the study area is not ideal for this species. No specimens were observed during the field survey.	No.
Rhizanthella slateri	*Rhizanthella slateri* (Rupp)	E2, V	E	The population occurs near Bulahdelah (within the Great Lakes	0	No. The known distribution of this	No.

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
	MA Clem. & Cribb in the Great Lakes local government area			Local Government Area). Sclerophyll forest in shallow to deep loams.		species does not overlap with the location of the study area.	
Rhizanthella slateri	Eastern Australian underground orchid	V	E	In NSW, currently known from fewer than 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area, Agnes Banks and near Nowra. Sclerophyll forest in shallow to deep loams.	0	No. The habitat within the study area is not suitable for this species.	No.
Thelymitra kangaloonica	Kangaloon sun orchid	E4A	CE	Only known to occur on the southern tablelands of NSW in the Moss Vale - Kangaloon – Fitzroy Falls area at 550–700 m above sea level. Swamps in sedgelands over grey silty grey loam soils.	0	Unlikely. The habitat within the study area is not suitable for this species.	No.
Thesium australe	Austral toadflax	V	V	In eastern NSW it is found in very small populations scattered along the coast, and from the Northern to Southern Tablelands. Grassland on coastal headlands or grassland and grassy woodland away from the coast.	0	No. The habitat within the study area is not suitable for this species.	No.
Xanthosia scopulicola		V		Only known from scattered locations between Kings Tableland (Wentworth Falls) and Boars Head rock (west of Katoomba) in the Blue Mountains. Cracks and crevices of sandstone cliff faces or on rocky outcrops above the cliffs.	76	Unlikely. Numerous records have been made for this species within close proximity to the	Mo

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
						study area. The study area, however, does not have suitable habitat for this species. This species was not observed during the field survey.	
Xerochrysum palustre	Swamp everlasting	P	V	In NSW, found in Kosciuszko NP and the eastern escarpment south of Badja. In or on the margins of swamps and bogs which are often dominated by heaths.	0	No. The study area is too far from the known populations of this species.	No.
Zieria involucrata		E1	V	North and west of Sydney; recent records come from 22 populations in the catchments of the Macdonald, Colo and Hawkesbury rivers between Melon Creek and Mogo Creek in the north to Little Cattai Creek (Hillside) and Wheeny Creek (Colo) in the south and from a single population in the upper Blue Mountains north of Katoomba. Also historically recorded south of Springwood Valley Heights and north-west of Kurrajong in the eastern Blue Mountains. Wet sclerophyll forest on mid to lower slopes and valleys; some populations extend upslope into drier vegetation.	0	Unlikely. The habitat within the study area is not ideal for this species. No specimens were observed during the field survey.	No.

Scientific name	Common name	BC Act status	EPBC Act status	Distribution and habitat	Records within 5 km radius	Likelihood of occurrence on Site	Assessment of significance required
Zieria murphyi	Velvet zieria	V	V	Mt Tomah in the Blue Mountains, Morton NP in the Bundanoon area, and at Penrose. Gullies in dry sclerophyll forest with sandy soil.	0	Unlikely. The geography of the study area is not typical of the habitat this species typically resides in. This species was not observed during the field survey.	No.

BC Act = Biodiversity Conservation Act:

E1 = endangered species

E2 = endangered population

E4A = critically endangered species

V = vulnerable species

P = protected plant

EPBC Act = Environment Protection and Biodiversity Conservation Act:

E = endangered

CE = critically endangered

V = vulnerable