Great Western Highway
Blackheath to Little Hartley

# Appendix H
# Biodiversity (part 1)

# Contents

## List of Tables

## List of Figures

## List of Photos



## List of Graphs

# Executive summary

The Great Western Highway is the key east-west road freight and transport route between Sydney and Central West New South Wales (NSW). Transport for NSW (Transport) is seeking approval under Division 5.2, Part 5 of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) to upgrade the Great Western Highway between Blackheath and Little Hartley (the project). The project would form part of a wider Upgrade program for the Great Western Highway between Katoomba and Lithgow. The project would comprise the construction and operation of new twin tunnels around 11 kilometres in length between Blackheath and Little Hartley, and associated surface road upgrade work for tie-ins to the east and west of the proposed tunnel portals.

The project has been declared as State Significant Infrastructure (SSI) and Secretary's Environmental Assessment Requirements (SEARs) have been released for the project (SSI-22004371). In accordance with the project SEARs, the Environmental Impact Statement (EIS) must be supported by a Biodiversity Development Assessment Report (BDAR) prepared in accordance with the NSW Biodiversity Assessment Method (BAM) (DPIE 2020a). This BDAR has been prepared by Accredited Assessors Jane Raithby-Veall (BAAS18134) and Matthew Hyde (BAAS22005) and describes the outcome of the development assessment cases (BAM Calculator case numbers 00028460/BAAS18134/21/00028461 and 00028460/BAAS18134/21/00029156) conducted consistent with the BAM.

## Native vegetation

The project is located within and adjacent to the Blue Mountains National Park, with the construction of the project requiring the removal and alteration of mature vegetation from this area of significant ecological value. This primarily occurs at the eastern end of the project within the Blackheath construction footprint with the majority of native vegetation in this location occurring within the Blue Mountains National Park. The Soldiers Pinch construction footprint is also located adjacent to the Blue Mountains National Park, however there are no direct impacts to the National Park in this location.

Field investigations, undertaken in accordance with the BAM, recorded 87.71 hectares of native vegetation within the study area, from seven Plant Community Types (PCTs). These include:

- PCT 708 *Blue Mountains Mallee Ash - Dwarf Casuarina heath of the upper Blue Mountains, Sydney Basin Bioregion*
- PCT 766 *Carex sedgeland of the slopes and tablelands*
- PCT 1078 *Prickly Tea-tree - sedge wet heath on sandstone plateaux, central and southern Sydney Basin Bioregion*
- PCT 1248 *Sydney Peppermint - Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin Bioregion*
- PCT 1256 *Tableland swamp meadow on impeded drainage sites of the western Sydney Basin Bioregion and South Eastern Highlands Bioregion*
- PCT 1615 *Monkey Gum - Eucalyptus blaxlandii shrubby open forest on basalt of the Sydney Basin*
- PCT 1740 *Tall Spike Rush freshwater wetland*.

In addition to native vegetation, 78.14 hectares of non-native vegetation was mapped across the study area. 72.08 hectares of this was present as pasture grassland comprised primarily of exotic species. The remaining 6.06 hectares was present as urban native/exotic vegetation, present as residential gardens, parks, and street trees.

A total of 36 BAM floristic plots were completed during the field investigation in order to adequately sample the vegetation present within the study area in the various condition states that were present, in accordance with the BAM.

The PCTs within the study area were found to be consistent with three threatened ecological communities (TECs), listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the NSW *Biodiversity Conservation Act 2016* (BC Act). These TECs are:

- *Blue Mountains Swamps in the Sydney Basin Bioregion* (Vulnerable Ecological Community [VEC], BC Act)
- *Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions* (Endangered Ecological Community [EEC], BC Act)
- Temperate Highland Peat Swamps on Sandstone (EEC, EPBC Act).

Following refinement of the final development footprint, four PCTs were found to be directly impacted as a result of the project; PCTs 708, 766, 1248, and 1615. These PCTs were present in a range of vegetation conditions and were stratified into a total of eight vegetation zones, based on unique PCT and condition types.

Avoidance of native vegetation, TECs and threatened species habitat has been undertaken to restrict impacts to 9.71 hectares of native vegetation. Consideration has been given to avoiding and minimising impacts to biodiversity where possible during the assessment and design. Avoidance and minimisation measures employed are:

- selection of tunnel excavation methodology to minimise the impact footprint and indirect impacts to groundwater
- removal of an ancillary construction site along Ridgewell Road
- locating the Little Hartley construction footprint within areas of exotic pasture grassland to avoid impacts to native vegetation
- locating parts of the Blackheath and Little Hartley construction footprints within areas that will be cleared as part of the Great Western Highway East - Katoomba to Blackheath and Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section). These two REF projects form part of the wider Upgrade program for the Great Western Highway between Katoomba and Lithgow.

Mitigation and management measures will be put in place to adequately address impacts associated with the project, both direct, indirect and prescribed.

## Biodiversity offset calculations

Habitat for three threatened species credit species was confirmed within the development footprint, and the vegetation integrity (VI) score of the vegetation to be impacted was calculated as between 24.1 and 86.8. As such, in accordance with Section 10 of the BAM, offsets are required to be secured for the project. These offset credit requirements are outlined below in Table ES-0-1. A further 7.33 hectares of habitat for Greater Glider *Petauroides volans*, a threatened species listed under the EPBC Act was also calculated.

Table ES-0-1: Biodiversity impacts and offset credit requirements

| Biodiversity value | Area (ha) | Credit requirement |
|---|---|---|
| **Native vegetation (PCTs) – Ecosystem credits** | | |
| PCT 708 Blue Mountains Mallee Ash - Dwarf Casuarina heath of the upper Blue Mountains, Sydney Basin Bioregion. | 1.79 | 51 |
| PCT 766 Carex sedgeland of the slopes and tablelands. | 0.43 | 5 |
| PCT 1248 Sydney Peppermint - Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin Bioregion. | 7.33 | 199 |

| Biodiversity value | Area (ha) | Credit requirement |
|---|---|---|
| PCT 1615 Monkey Gum - Eucalyptus blaxlandii shrubby open forest on basalt of the Sydney Basin. | 0.19 | 5 |
| **Threatened fauna species – Species credits** | | |
| Large-eared Pied Bat *Chalinolobus dwyeri* | 9.13 | 499 |
| Purple Copper Butterfly *Paralucia spinifera* | 0.35 | 11 |

The project is considered likely to result in potential impacts to species or communities listed under the EPBC Act and as such a referral to the Minister for the Environment and Water is recommended. In addition, the project is located adjacent to the Greater Blue Mountains Area, which is recognised as both a National Heritage Place and a World Heritage Area. Potential indirect impacts may occur as a result of altered hydrological regimes associated with proposed discharge points at the Blackheath construction footprint which are located upstream of the Greater Blue Mountains World Heritage Area. Furthermore, while the project does not occur directly within the heritage area, the Blackheath construction footprint does occur within an area mapped as The Greater Blue Mountains Area – Additional Value which is under consideration for inclusion on the National Heritage List (CoA 2022). Due to direct impacts to native vegetation within this area mapped as additional value, referral is recommended.

# Glossary

| Term | Definition |
|---|---|
| Accredited person or assessor | Means as person accredited under section 6.10 (of the BC Act) to prepare reports in accordance with the BAM. |
| Assessment area | Includes the subject land and the area of land within a 1500 metre buffer zone surrounding the subject land. It also includes the area within a 500 metre buffer zone (taken from the centre line) of the proposed tunnel alignment. This represents the area considered for prescribed and indirect impacts. |
| Biodiversity Assessment Method Calculator | Biodiversity Assessment Method Calculator – the online computer program that provides decision support to assessors and proponents by applying the BAM and referred to as the BAM-C. The BAM-C contains biodiversity data from the BioNet Vegetation Classification and the Threatened Biodiversity Data Collection that the assessor is required to use in a BAM assessment. The BAM-C applies the equations used in the BAM, including those to determine the number and class of biodiversity credits required to offset the impacts of a development, or created at a biodiversity stewardship site. It is published by the Department (DPIE 2020a). |
| Biodiversity credit report | The report produced by the BAM-C that sets out the number and class of biodiversity credits required to offset the remaining adverse impacts on biodiversity values at a development site, or on land to be biodiversity certified, or that sets out the number and class of biodiversity credits that are created at a biodiversity stewardship site (DPIE 2020a). |
| Biodiversity offsets | The gain in biodiversity values achieved from the implementation of management actions on areas of land, to compensate for losses to biodiversity values from the impacts of development (DPIE 2020a). |
| Biodiversity Offsets and Agreement Management System | The online system used to administer the Biodiversity Offsets Scheme. The BOAMS is used by accredited assessors (to carry out specific BAM-related tasks involving access to the BAM-C to perform assessments, submit data, generate credits and calculate a credit price), by landholders (to apply for a Biodiversity Stewardship Agreement and manage ongoing reporting obligations for their agreement) and by proponents of developments (to view their credit obligation or the payment required to the Biodiversity Conservation Fund). |
| BioNet Atlas | The DPE database of flora and fauna records (formerly known as the NSW Wildlife Atlas). The Atlas contains records of plants, mammals, birds, reptiles, amphibians, some fungi, some invertebrates (such as insects and snails listed under the BC Act) and some fish (DPIE 2020a). |
| BioNet Vegetation Classification | Refers to the vegetation community-level classification for use in vegetation mapping programs and regulatory biodiversity impact assessment frameworks in NSW. The BioNet Vegetation Classification is published by the Department and available at www.environment.nsw.gov.au/research/Visclassification.htm (DPIE 2020a). |
| Candidate species | Also known as 'species credit species', these are threatened species for which vegetation surrogates and/or landscape features cannot reliably predict the likelihood of their occurrence or components of their habitat. These species are identified in the TBDC. A targeted survey or an expert report is required to confirm the presence of these species on the subject land. Alternatively, for a development, activity, clearing or biodiversity certification proposal only, the proponent may elect to assume the species is present (DPIE 2020a). |

| Term | Definition |
|---|---|
| Central construction footprint | The full construction footprint required by the Blackheath to Little Hartley project. This area overlaps with the eastern and western REF projects that are part of the broader Great Western Highway Upgrade Program. Sections of the central construction footprint that overlap with the eastern and western REF project construction footprints do not require offsetting under this BDAR. |
| Construction footprint | All surface disturbance areas required for construction of the project. |
| Cumulative impact | The extent to which the development or activity contributes to the cumulative impacts of existing and planned developments or activities on threatened species, ecological communities, habitats, Areas of Outstanding Biodiversity Value and key threatening processes. |
| Development footprint | The three areas of direct impact that are being considered as part of this BDAR. It comprises the central construction footprint, minus the overlapping areas that are being assessed as part of the Great Western Highway East – Katoomba to Blackheath and Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) projects. For this assessment the development footprint and subject land cover the same area. |
| Direct impact | Direct impacts on biodiversity values include those related to clearing native vegetation and threatened species habitat, and impacts on biodiversity values prescribed by the Biodiversity Conservation Regulation 2017 (the BC Regulation) (DPIE 2020a). |
| Ecosystem credit species | Threatened species or components of species habitat that are identified in the Threatened Species Data Collection as requiring assessment for ecosystem credits. This is analogous with the definition of 'predicted species'. |
| Ecosystem credits | A measurement of the value of threatened ecological communities, threatened species habitat for species that can be reliably predicted to occur with a PCT, and PCTs generally. Ecosystem credits measure the loss in biodiversity values at a development, activity, clearing or biodiversity certification site and the gain in biodiversity values at a biodiversity stewardship site (DPIE 2020a). |
| Habitat | An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component (DPIE 2020a). |
| Important area (mapped) | Mapping of important habitat areas provided by the DPE for those species for which the habitat constraint in the Threatened Biodiversity Data Collection (TBDC) refers to a mapped important area. |
| Indirect impact | Impacts that occur when the project affects native vegetation and threatened species habitat beyond the subject land or within retained areas (e.g. transporting weeds or pathogens, dumping rubbish). This includes impacts from activities related to the construction or operational phase of the project and prescribed impacts (DPIE 2020a). |
| Locality | Refers to the land within a 10 kilometre radius of the subject land. |
| Matter of national environmental significance | A matter of national environmental significance (MNES) is any of the nine defined components protected by a provision of Part 3 of the EPBC Act (Commonwealth). |

| Term | Definition |
|---|---|
| Mitigation | Action to reduce the severity of an impact. |
| Native vegetation | Has the same meaning as in section 1.6 of the BC Act and section 60B of the LLS Act. In summary,<br>This includes:<br>(a) trees (including any sapling or shrub or any scrub),<br>(b) understorey plants,<br>(c) groundcover (being any type of herbaceous vegetation),<br>(d) plants occurring in a wetland.<br>A plant is native to New South Wales if it was established in New South Wales before European settlement.<br>Native vegetation does not extend to marine vegetation (being mangroves, seagrasses or any other species of plant that at any time in its life cycle must inhabit water other than fresh water). Marine vegetation is covered by the provisions of the FM Act. |
| NSW (Mitchell) landscape | Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000 (DPIE 2020a). |
| Operational footprint | The area that will be subject to ongoing operational impacts from the project. This includes the road, surrounding safety verges and infrastructure, fauna connectivity structures and maintenance access tracks. |
| Patch size | An area of native vegetation that:<br>• Occurs on the development site or biodiversity stewardship site.<br>• Includes native vegetation that has a gap of less than 100 m from the next area of native vegetation (or ≤30 m for non-woody ecosystems).<br>Patch size may extend onto adjoining land that is not part of the development site or biodiversity stewardship site (DPIE 2020a). |
| PlantNET | An online database of the flora of New South Wales which contains currently accepted taxonomy for plants found in the State, both native and exotic. |
| Population | A group of organisms, all of the same species, occupying a particular area (DPIE 2020a). |
| Predicted species | Also known as 'ecosystem credit species', these are threatened species whose occurrence can generally be predicted by vegetation surrogates and/or landscape features, or that have a low probability of detection using targeted surveys. The TBDC identifies the threatened species assessed for ecosystem credits. A targeted survey is not required to identify or confirm the presence of ecosystem credit species. |
| Prescribed impact | Means the prescribed impacts identified in clause 6.1 of the BC Regulation. Prescribed impacts can be direct or indirect impacts (DPIE 2020a). |
| Project | Refers to the Great Western Highway Blackheath to Little Hartley project which is the subject of this BDAR. This is the SSI that is subject to SEARs SSI-22004371. |
| Serious and irreversible impact | Impacts likely to contribute significantly to the risk of a threatened species or ecological community becoming extinct in accordance with the principles set out in clause 6.7(2) of the BC regulation (DPIE 2020a). |

| Term | Definition |
|---|---|
| Spatial datasets | Spatial databases required to prepare a BDAR:<br>• BioNet NSW (Mitchell) Landscapes – Version 3.1<br>• NSW Interim Biogeographic Regions of Australia (IBRA region and subregions) – Version 7<br>• NSW soil profiles<br>• hydrogeological landscapes<br>• acid sulfate soils risk<br>• digital cadastral database<br>• Vegetation Information Systems maps<br>• geological sites of NSW. |
| Species credit species | Threatened species or components of species habitat that are identified in the Threatened Species Data Collection as requiring assessment for species credits (DPIE 2020a). This is analogous with the definition of 'candidate species'. |
| Species credits | The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection (DPIE 2020a). |
| Species polygon | An area of land identified in Chapter 5 (of the BAM) that contains habitat or is occupied by a threatened species (DPIE 2020a). |
| Study area | The study area represents the original boundary that was used to inform field investigations for the project and to determine potential impacts which later informed final positioning of the development footprint. |
| Subject land | Land subject to a development, activity, clearing, biodiversity certification or a biodiversity stewardship project. It covers the three areas of direct impact that are being considered as part of this BDAR. It comprises the central construction footprint, minus the overlapping areas that are being assessed as part of the Great Western Highway East - Katoomba to Blackheath and Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section)d projects. It excludes the assessment area which surrounds the subject land (i.e. the area of land in the 1500 m buffer zone around the subject land) (DPIE 2020a). See also definition for development footprint. |
| Threatened Biodiversity Data Collection | A publicly assessable online database (registration required) which contains information for listed threatened species, populations and ecological communities (DPIE 2020a).<br>Part of the BioNet database, published by EESG and accessible from the BioNet website at www.bionet.nsw.gov.au. |
| Vegetation integrity (score) | The condition of native vegetation assessed for each vegetation zone against the benchmark for the PCT. The vegetation integrity score is the quantitative measure of vegetation condition calculated by the BAM-C (DPIE 2020a). |
| Vegetation zone | A relatively homogeneous area of native vegetation on a development site, clearing site, land to be biodiversity certified or biodiversity stewardship site that is the same PCT and has the same broad condition state (DPIE 2020a). |

| Abbreviations | |
|---|---|
| AOBV | Area of Outstanding Biodiversity Value |
| ASL | Above sea level |
| BAAS | Biodiversity Accredited Assessor System |
| BAM | Biodiversity Assessment Method |
| BAM-C | Biodiversity Assessment Method calculator |
| BC Act | *Biodiversity Conservation Act 2016* (NSW) |
| BC Regulation | Biodiversity Conservation Regulation 2017 (NSW) |
| BDAR | Biodiversity Development Assessment Report |
| BOAMS | Biodiversity Offsets and Agreement Management System |
| BOS | Biodiversity Offset Scheme |
| CEEC | Critically Endangered Ecological Community |
| CEMP | Construction Environmental Management Plan |
| DCCEEW | Commonwealth Department of Climate Change, Energy, the Environment and Water |
| DoIW | Directory of Important Wetlands |
| DPI | NSW Department of Primary Industries |
| DPE | NSW Department of Planning and Environment |
| EEC | Endangered ecological community |
| EES | NSW Environment Energy and Science group within the Department of Planning and Environment |
| EIS | Environmental Impact Statement |
| EP&A Act | *Environment Planning and Assessment Act 1979* (NSW) |
| EPB | Earth pressure balance |
| EPBC Act | *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) |
| Fisheries NSW Policy and Guidelines | Fisheries NSW Policy and guidelines for fish habitat conservation and management (Update 2013) |
| FM Act | *Fisheries Management Act 1994* (NSW) |

| Abbreviations | |
|---|---|
| GDE | Groundwater dependent ecosystems |
| GIS | Geographic Information System |
| IBRA | Interim Biogeographically Regionalisation of Australia |
| KTP | Key Threatening Process |
| LGA | Local Government Area |
| LLS | Local Land Services |
| MNES | Matters of national environmental significance |
| NSW | New South Wales |
| PCT | Plant community type |
| PMST | Protected Matters Search Tool |
| RRA | Rapid Riparian Appraisal |
| REF | Review of Environmental Factors |
| SAII | Serious and Irreversible Impacts |
| SEARs | Secretary's Environmental Assessment Requirements |
| SEPP | State Environmental Planning Policy |
| SSI | State Significant Infrastructure |
| TBDC | Threatened Biodiversity Data Collection |
| TECs | Threatened ecological communities (VECs, EECs and CEECs) |
| Transport | Transport for NSW |
| VEC | Vulnerable Ecological Community |
| VI | Vegetation integrity |

# Declarations

## i. Certification under clause 6.15 *Biodiversity Conservation Act 2016*

I certify that this report has been prepared based on the requirements of, and information provided under, the Biodiversity Assessment Method and clause 6.15 of the *Biodiversity Conservation Act 2016* (BC Act).

Signature: Jane Raithby-Veall

Date: Dec 19, 2022

BAM Assessor Accreditation no: BAAS18134

This BDAR has been prepared to meet the requirements of the BAM (DPIE 2020a). Annexure A provides an assessment of compliance with the minimum information requirements outlined in BAM Appendix K.

## ii. Details and experience of author/s and contributors

This BDAR has been certified by Jane Raithby-Veall (Accredited Assessor No. BAAS18134) and was carried out by appropriate qualified and experienced environmental professionals, ecologists and accredited people as demonstrated in Table D-0-1.

Table D-0-1: Authors and contributors of this report

| Name | BAM Assessor Accreditation no. (if relevant) | Position / Role | Tasks performed | Relevant qualifications |
|---|---|---|---|---|
| Jane Raithby-Veall | BAAS18134 | Project Director<br>Principal Ecologist<br>Accredited Assessor | • vegetation identification surveys<br>• BAM plots<br>• targeted flora surveys<br>• reporting | BAppSc EnvMgt<br>Certified Environmental Practitioner (Ecology Specialist) No. E20011<br>Over 19 years' experience undertaking ecological surveys within the Sydney Basin Bioregion. |
| Matthew Hyde | BAAS22005 | Project Manager<br>Senior Zoologist<br>Accredited Assessor | • targeted diurnal bird surveys<br>• targeted frog surveys<br>• targeted invertebrate and reptile surveys<br>• reporting | BSc (Hons 1)<br>Over 5 years' experience undertaking ecological surveys within the Sydney Basin Bioregion. |
| Mitch Palmer | BAAS17051 | Principal Ecologist<br>Accredited Assessor | • vegetation identification surveys<br>• BAM plots<br>• targeted flora surveys | BSc<br>Over 10 years' experience undertaking ecological survey within the Sydney Basin Bioregion. |
| Callan Wharfe | BAAS18138 | Senior Ecologist<br>Technical Lead – BAM<br>Accredited Assessor | • vegetation identification surveys | MConBio, BSc<br>Over 10 years' experience undertaking ecological surveys within the Sydney Basin Bioregion. |
| Paul Price | BAAS18089 | Senior Ecologist<br>Technical Lead – Botany<br>Accredited Assessor | • vegetation identification surveys | BASci, Botany<br>DipCALM<br>Over 20 years' experience in horticulture and conservation industries.<br>Experienced in undertaking ecological survey within the Sydney Basin Bioregion. |

| Name | BAM Assessor Accreditation no. (if relevant) | Position / Role | Tasks performed | Relevant qualifications |
|---|---|---|---|---|
| Anthony Cable | - | Senior Ecologist Technical Lead – Zoology | • targeted fauna survey design | BEnvSc<br>DipCALM<br>Over 16 years' experience working within the natural resource management field. |
| James Shepherd | - | Principal GIS Consultant | • GIS and map creation | BAInformatics (Hons)<br>Over 15 years' experience in the use and application of GIS to environmental and heritage consulting sectors. |
| Lauren Harley | - | Team Leader – GIS (NSW) and Senior GIS Consultant | • GIS and map creation | Gcert EnvMgt<br>BA IntSt, BSc EnvBio<br>Over 9 years' experience in the use and application of GIS. |
| Brendon True | BAAS18155 | Senior Botanist Accredited Assessor | • reporting | BSc<br>Over 10 years' experience undertaking ecological surveys throughout NSW with a key focus on identification of native flora and native vegetation communities. |
| Averill Wilson | - | Consultant Botanist | • vegetation identification surveys<br>• BAM plots<br>• targeted flora surveys | BSc<br>Over 5 years' experience undertaking ecological survey in the Sydney Basin Bioregion, combined with a strong background in bush regeneration and vegetation management. |
| Stephanie Cerato | - | Consultant Botanist | • BAM plots | BConsBio (Hons) (Dean'sSchol)<br>Over 5 years' experience undertaking ecological survey in the Sydney Basin Bioregion. Experience in applying the BAM. |

| Name | BAM Assessor Accreditation no. (if relevant) | Position / Role | Tasks performed | Relevant qualifications |
|---|---|---|---|---|
| Dr Caragh Heenan | - | Consultant Zoologist | • reporting | PhD(Sc)<br>BSc(Hons)<br>DipAppSc(AnTech)<br>Over 8 years' experience working in Natural Resource Management. |
| Felicity Williams | - | Consultant Zoologist | • microbat call analysis<br>• reporting | BSc (Hons)<br>GradDipEd (Secondary)<br>Over 8 years' experience in applied ecology and consulting with specialist skills in microbat acoustic data collection and analysis. |
| Jake Schwebel | - | Project Botanist | • BAM plots | BSc (Zoology)<br>Over 2 years' experience undertaking ecological survey in the Sydney Basin Bioregion, combined with a strong background in bush regeneration and vegetation management.<br>Experience in applying the BAM. |
| Sarah Allison | - | Project Zoologist | • targeted microbat surveys<br>• Microbat call analysis<br>• targeted diurnal bird surveys<br>• targeted nocturnal bird surveys<br>• targeted mammal surveys<br>• targeted invertebrate and reptile surveys<br>• reporting | BSc (Hons 1)<br>Over 6 years' experience undertaking threatened fauna surveys across the Sydney Basin Bioregion. |

| Name | BAM Assessor Accreditation no. (if relevant) | Position / Role | Tasks performed | Relevant qualifications |
|---|---|---|---|---|
| Zoe Goold | - | Project Zoologist | • targeted microbat surveys<br>• targeted frog surveys<br>• targeted diurnal bird surveys<br>• targeted nocturnal bird surveys<br>• targeted mammal surveys<br>• targeted frog surveys<br>• targeted invertebrate and reptile surveys | BSc<br>Over 2 years' experience undertaking threatened species survey, and 4 years' experience in aquatic ecology. |
| Astrid Mackegard | - | GIS Analyst | • GIS and map creation | BSc<br>Over 2 years' experience in the use and application of GIS. |
| Rosie Gray | - | Botanist | • reporting | BSc (Hons 1)<br>Over 1 year experience in ecological consulting. |
| Taliah Darcy-Shaw | - | Botanist | • BAM plots | Cert III Captive Animals<br>Dip Conservation and Land Management<br>Over 3 years' experience in natural resource management including a strong background in bush regeneration. |
| Joel Nicholson | - | Zoologist | • reporting | BEnvSc (Hons 1). |
| Claire Nelson | - | Research Assistant | • background research | MPhil Behavioural Ecology and Evolution<br>BSc Ecology and Evolutionary Biology<br>Cert 3 in Wildlife and Exhibited Animal Care. |

## iii. Conflict of interest

I declare that I have considered the circumstances and there is no actual, perceived or potential conflict of interest:

This declaration has been made in the interests of full disclosure to the decision-maker. Full disclosure has also been provided to the client.

Signature: Jane Raithby-Veall

Date: Dec 19, 2022

BAM Assessor Accreditation no: BAAS18134

# Stage 1 – Biodiversity assessment

# 1 Introduction

## 1.1 Project context and overview

The Great Western Highway is the key east to west road freight and transport route between Sydney and Central West New South Wales (NSW). Together, the Australian Government and the NSW Government are investing more than $4.5 billion towards upgrading the Great Western Highway between Katoomba and Lithgow (the Upgrade Program). Once upgraded, over 95 kilometres of the Great Western Highway will be two lanes in each direction between Emu Plains and Wallerawang.

The Upgrade Program comprises the following components:

- Great Western Highway Upgrade – Medlow Bath (Medlow Bath Upgrade): upgrade and duplication of the existing surface road corridor with intersection improvements and a new pedestrian bridge (approved)
- Great Western Highway East – Katoomba to Blackheath (Katoomba to Blackheath Upgrade): upgrade, duplication and widening of the existing surface road corridor, with connections to the existing Great Western Highway east of Blackheath (approved)
- Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) (Little Hartley to Lithgow Upgrade): upgrade, duplication and widening of the existing surface road corridor, with connections to the existing Great Western Highway at Little Hartley (approved)
- Great Western Highway Blackheath to Little Hartley: construction and operation of a twin tunnel bypass of Blackheath and Mount Victoria and surface road works for tie-ins to the east and west of the tunnel (the project).

The components of the Upgrade Program are shown in Figure 1-1.

Transport for NSW (Transport) is seeking approval under Division 5.2, Part 5 of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) to upgrade the Great Western Highway between Blackheath and Little Hartley (the project).

The project would comprise the construction and operation of new twin tunnels around 11 kilometres in length between Blackheath and Little Hartley, and associated surface road upgrade work for tie-ins to the east and west of the proposed tunnel portals.

The project would be located around 90 kilometres northwest of the Sydney CBD and located within the Blue Mountains and Lithgow Local Government Areas (LGA).

The majority of the project would be located below ground generally along or adjacent to the west of the existing Great Western Highway between around Blackheath and Little Hartley.

The project occurs within and adjacent to the Blue Mountains National Park, a World Heritage Listed National Park of significant ecological value within the Greater Sydney Local Land Services (LLS) region. As such, biodiversity impacts represent a key environmental issue for the project.

The project has been designated as State Significant Infrastructure (SSI) and therefore the Biodiversity Offset Scheme (BOS) applies in accordance with Section 7.9 of the *Biodiversity Conservation Act 2016* (BC Act). A Biodiversity Development Assessment Report (BDAR) is required to be prepared by an Accredited Assessor in accordance with the NSW Biodiversity Assessment Method (BAM) (DPIE 2020a). Biosis was commissioned by AECOM on behalf of Transport to undertake a biodiversity assessment of the project. This BDAR is one of a number of technical documents that forms part of the EIS. The purpose of this assessment was to apply the NSW BAM to the project and provide a BDAR to support the EIS being developed by AECOM for the project.

The Secretary's Environmental Assessment Requirements (SEARs) issued by the NSW Department of Planning and Environment (DPE), relating to biodiversity and where these requirements are addressed in this technical report are outlined in Table 1-1.

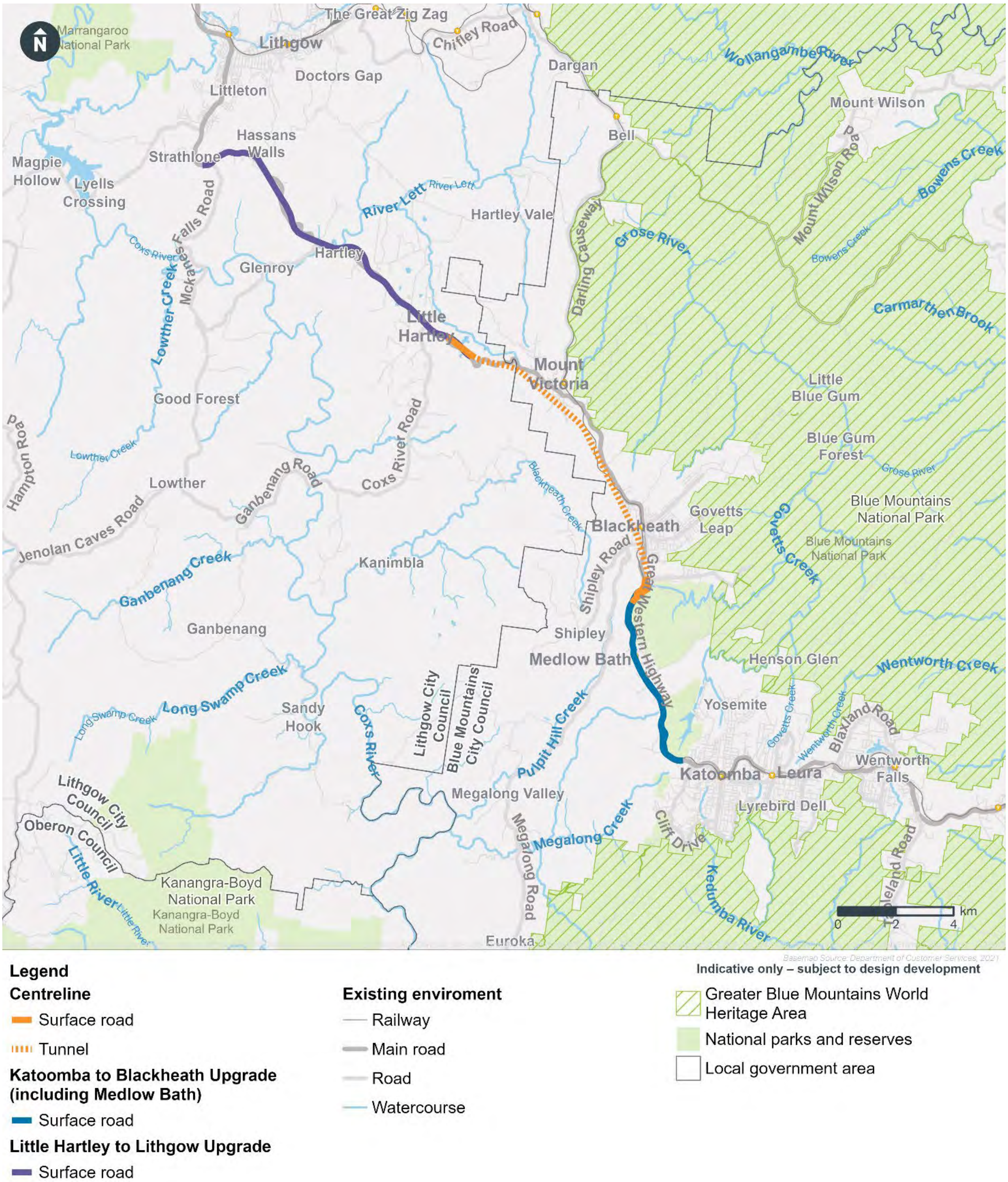


Figure 1-1: The Great Western Highway Upgrade Program

Table 1-1: Secretary's Environmental Assessment Requirements - Biodiversity

| Key issue and desired performance outcome | Requirement (specific assessment requirements in addition to the general requirements) | Section where addressed in report |
|---|---|---|
| The project design considers all feasible measures to avoid and minimise impacts on terrestrial and aquatic biodiversity.<br><br>The offsets and/or biodiversity conservation actions are assured and are equivalent to any residual impacts of project construction and operation. | 1. Prepare a BDAR that assesses biodiversity impacts in accordance with s7.9 of the BC Act and the BAM. | Addressed by this BDAR. |
| | 2. The BDAR must document the application of the; avoid, minimise and offset framework in accordance with the BAM. | Section 6 (Avoid and minimise)<br>Section 8 (Offsetting) |
| | 3. The BDAR must include information in the form detailed in s6.12 of the BC Act, cl6.8 of the Biodiversity Conservation Regulation 2017 (BC Regulation) and the BAM including details of the measures proposed to address the offset obligation as follows:<br>(a) the total number and classes of biodiversity credits required to be retired for the developments/project;<br>(b) the number of classes of like-for-like biodiversity credits proposed to be retired;<br>(c) the number and classes of biodiversity credits proposed to be retired in accordance with the variation rules;<br>(d) any proposal to fund a biodiversity conservation action;<br>(e) any proposal to make a payment to the Biodiversity Conservation Fund; and<br>(f) any staged retirement of credits based on when the development is carried out that would impact on biodiversity values.<br><br>**Note**: If seeking approval to use the variation rules, the BDAR must contain details of the reasonable steps that have been taken to obtain requisite like-for-like biodiversity credits. | Section 8 (Offsetting) |
| | 4. The BDAR must be submitted with all digital spatial data associated with the survey and assessment as per the BAM. | See supporting digital spatial data. |
| | 5. The BDAR must be prepared by a person accredited in accordance with the *Accreditation Scheme for the Application of the Biodiversity Assessment Method Order 2017* under s6.10 of the BC Act. | This BDAR was prepared by prepared by Accredited Assessor Jane Raithby-Veall (BAAS18134) and Matthew Hyde (BAAS22005). |
| | 6. The BDAR must include details of the measures proposed to address offset obligations. | Section 9.4 (Offsetting strategy) |
| | 7. Impacts on biodiversity values not covered by the BAM must be assessed. This includes a threatened aquatic species assessment (Part 7A *Fisheries Management Act 1994*) to address whether there are likely to be any significant impact on listed threatened species, populations or ecological communities listed under the *Fisheries Management Act 1994* (FM Act). | Section 5.6<br>Annexure H |
| | 8. Identify whether the project, or any component of the project, would be classified as a Key Threatening Process (KTP) in accordance with the listings in the BC Act, FM Act and the EPBC Act. | Section 7.1 |

## 1.2 EPBC Act assessment requirements

An assessment of the impacts to listed matters of national environmental significance (MNES) under the EPBC Act as a result of the project is required. This assessment has been undertaken in accordance with the MNES significant impact guidelines (Commonwealth of Australia 2013) and is included in Section 7.5. Due to potential impacts to MNES, a referral of the proposed project to the Commonwealth Minister for the Environment is recommended. A referral has been prepared and is currently under consideration.

## 1.3 Assessment guidelines used in this report

The assessment presented in this BDAR was undertaken in accordance with the BAM and the survey guidelines specified in the SEARs. These include:

**NSW survey guidelines**

- Biodiversity Assessment Method (DPIE 2020a)
- Surveying threatened plants and their habitats. NSW survey guide for the Biodiversity Assessment Method (DPIE 2020b)
- NSW Survey Guide for Threatened Frogs – a guide for the survey for threatened frogs and their habitats for the Biodiversity Assessment Method (DPIE 2020c)
- ‘Species credit’ threatened bats and their habitats – NSW survey guide for the Biodiversity assessment method (OEH 2018)
- Threatened biodiversity survey and assessment. Guidelines for developments and activities (working draft) (DEC 2004)
- Biodiversity Assessment Method 2020 Operational Manual Stage 1 (DPIE 2020d)
- Biodiversity Assessment Operational Manual Stage 2 (DPIE 2019).

**National survey guidelines**

- Survey Guidelines for Australia’s Threatened Bats (DEWHA 2010a)
- Survey Guidelines for Australia’s Threatened Frogs (DEWHA 2010b)
- Survey Guidelines for Australia’s Threatened Mammals (DEWHA 2011).

## 1.4 Sources of information

Sources of information used in the assessment included relevant databases, spatial data, literature and previous site reports.

In order to provide context for the assessment area, records of flora and fauna from within 10 kilometres (the locality) were collated from the following databases and datasets were reviewed:

- Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool for matters protected by the EPBC Act
- NSW BioNet - the database for the Atlas of NSW Wildlife, Environment, Energy and Science (EES), for species, populations and ecological communities listed under the BC Act
- NSW BAM Calculator (BAM-C)
- Biodiversity values map
- Native vegetation regulatory map
- BAM Important Areas maps

- PlantNET (The Royal Botanic Gardens and Domain Trust).

Other sources of biodiversity information relevant to the assessment area were sourced from:

- the NSW Plant Community Types (PCTs), as held within the BioNet Vegetation Classification database (DPE 2022a)
- relevant vegetation mapping including:
  - Southeast NSW Native Vegetation Classification and Mapping – SCIVI. VIS_ID 2230 (DPE 2010a)
  - State Vegetation Type Map: Central Tablelands Region Version 1.0. VIS_ID 4778 (DPE 2018).

The following reports were also reviewed and relied on to provide additional information:

- Great Western Highway East – Katoomba to Blackheath Review of Environmental Factors (Transport for NSW 2022a)
- Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) Review of Environmental Factors (Transport for NSW 2021a)
- Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) Biodiversity Addendum Report (Transport for NSW 2022b)
- Great Western Highway Upgrade – Medlow Bath Review of Environmental Factors (Transport for NSW 2021b)
- Great Western Highway, Blackheath to Little Hartley Scoping Report (Transport for NSW 2021c)
- Great Western Highway Upgrade Program, Katoomba to Lithgow Preliminary Environmental Investigation (Transport for NSW 2020).

Basemap data was obtained from NSW Land and property information (LPI) 1:25,000 digital topographic databases, with cadastral data obtained from the LPI digital cadastral database.

The following spatial datasets were utilised during the development of this report:

- Catchment Boundaries of New South Wales dataset
- Mitchell Landscapes Version 3.0
- Interim Biogeographic Regionalisation of Australia (IBRA) Version 7
- Directory of Important Wetlands (DoIW)
- NSW Soil and Land Information System
- Mapping has been produced using a Geographic Information System (GIS). The following maps and data have been provided:
  - digital mapping with aerial photography showing 1:1000 or finer
  - site map as described in subsection 3.1.1 of the BAM
  - location map as described in subsection 3.1.2 of the BAM
  - landscape map with features including 500 metre buffer (for linear development), as described in section 3.1.3 of the BAM.

# 2 The project

## 2.1 Key components of the project

Key components of the project are summarised in Table 2-1 and shown in Figure 2-1. These components are described in more detail in Chapter 5 (Project description) of the project EIS.

The indicative operational configuration of the surface road network at Blackheath and Little Hartley is shown in Figure 2-2 and Figure 2-3.

Table 2-1: Key components of the project

| Key project component | Summary |
|---|---|
| Tunnels | Twin tunnels around 11 km long between Blackheath and Little Hartley, connecting to the upgraded Great Western Highway at both ends.<br>Each tunnel would include two lanes of traffic and road shoulders and would range in depth from just below the surface near the tunnel portals, to up to around 200 metres underground at Mount Victoria. |
| Surface work | Surface road upgrade work would be required to connect the tunnels and surface road networks south of Blackheath and at Little Hartley. The twin tunnels would connect to the surface road network via:<br>• mainline carriage ways and on- and off-ramps at the Blackheath portal, located adjacent to the existing Great Western Highway and south of Evans Lookout Road<br>• mainline carriageways at the Little Hartley portal, located adjacent to the existing Great Western Highway at the base of the western escarpment below Victoria Pass and southwest of Butlers Creek. |
| Operational infrastructure | Operational infrastructure that would be provided by the project includes:<br>• a tunnel operations facility adjacent to the Blackheath portal<br>• in-tunnel ventilation systems including jet fans and ventilation ducts connecting to the ventilation facilities<br>• one of two options for tunnel ventilation currently being investigated which are:<br>  o a ventilation outlet at each portal (ventilation outlet option); or<br>  o portal emissions (portal emissions option)<br>• water quality infrastructure including sediment and water quality basins, an onsite detention tank at Blackheath and a water treatment plant at Little Hartley<br>• fire and life safety systems, emergency evacuation and ventilation infrastructure and Closed Circuit Television<br>• lighting and signage including variable message signs and associated infrastructure such as overhead gantries. |
| Utilities | Key utilities required for the project would include:<br>• a new electricity substation at Little Hartley to facilitate construction and operational power supply<br>• a new pipeline between Little Hartley and Lithgow to facilitate construction and operational water supply<br>• other utility connections and modifications, including electricity substations in the tunnel. |
| Other project elements | The project would also include:<br>• integrated urban design initiatives<br>• landscape planting. |

The direct biodiversity impacts associated with the project are located within three areas (Figure 2-4); the Blackheath construction footprint; an ancillary construction site known as the Soldiers Pinch construction footprint; and the Little Hartley construction footprint. Clearance of approximately 9.71 hectares of native vegetation is required within the development footprint at these locations to allow for the construction of the proposed project. This includes direct impacts to habitat for three threatened species credit species. These species are; Large-eared Pied Bat *Chalinolobus dwyeri*, Purple Copper Butterfly *Paralucia spinifera* and Greater Glider *Petauroides volans*. Additional clearance of native vegetation within the central construction footprint is being undertaken as part of the Great Western Highway East - Katoomba to Blackheath and Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) projects of the broader Upgrade Program. These impacts are detailed in Section 7.8 (Cumulative impacts).

In addition to direct impacts the project is required to consider several potential indirect and prescribed impacts that may arise as result of the proposed tunnelling works, including impacts associated with groundwater and surface water discharges, as well as potential impacts to geological features (caves, karts and cliff lines) which are a significant feature within the Blue Mountains National Park.

The proposed water supply pipeline from Little Hartley to Lithgow will be wholly located within the existing road reserves of the Great Western Highway within the area covered by the Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) project's construction footprint. It is understood that removal of vegetation is not required to accommodate this pipeline. Should vegetation removal become necessary, further assessment will be required prior to any impacts to vegetation. No further discussion of this pipeline is undertaken within this BDAR.

## 2.2 Project construction

Construction of the project would include:

- site establishment and enabling works
- tunnel portal construction
- tunnelling and associated works
- surface road upgrade works
- operational infrastructure construction and fit-out, including construction of operational environmental controls
- finishing works, testing, and commissioning.

These activities are described in more detail in Chapter 5 (Construction) of the EIS.

The indicative construction footprint for the project is shown in Figure 2-4. This figure also shows the construction footprints for the Great Western Highway East - Katoomba to Blackheath and Great Western Highway Upgrade Program - Little Hartley to Lithgow adjoining the project to the east and west respectively that will already be under construction when construction of the project commences. The development footprint (as defined in Section 2.3 below) is also shown.

The indicative layout and site access arrangements for the construction footprints are shown in Figure 2-5 (Blackheath), Figure 2-6 (Soldiers Pinch) and Figure 2-7 (Little Hartley).

Construction of the project is expected to be around eight years. Subject to planning approval, construction is planned to commence in early 2024 and be completed by late 2031; however, the project would be open to traffic by 2030.

### 2.2.1 Baseline environment

The Great Western Highway East - Katoomba to Blackheath and Great Western Highway Upgrade Program - Little Hartley to Lithgow adjoining the project to the east and west respectively would be under construction when construction of the project commences (refer to Figure 2-8). To minimise environmental impacts, parts of the Katoomba to Blackheath Upgrade and Little Hartley to Lithgow Upgrade construction footprints would be used to support construction of the project.

As a result, the following activities will be undertaken at the construction sites as part of the Katoomba to Blackheath and Little Hartley to Lithgow Upgrades:

- vegetation would be cleared
- topsoil would be levelled and compacted
- site access tracks would be established
- water quality controls such as water quality and sediment basins would be installed.

The environmental impacts associated with these works have been assessed as part of the Katoomba to Blackheath Upgrade and the Little Hartley to Lithgow Upgrade.

The construction footprint for these projects are shown in Figure 2-9 and Figure 2-10 and form the baseline environment considered at Blackheath and Little Hartley for the EIS and this BDAR.

No work is proposed at Soldiers Pinch as part of the Katoomba to Blackheath Upgrade or the Little Hartley to Lithgow Upgrade and therefore at this location the existing environment forms the baseline environment for this EIS.

## 2.3 Key terms

The terms project, subject land, central construction footprint, development footprint, assessment area, study area and the locality are used throughout this BDAR. These are defined as follows:

- the project refers to the Great Western Highway Blackheath to Little Hartley project which is the subject of this BDAR. This is the SSI that is subject to SEARs SSI-22004371
- the subject land relates to the three areas of direct impacts associated with the project's construction which are considered under this BDAR. This area comprises the central construction footprint, minus the areas that are being assessed as part of the Katoomba to Blackheath Upgrade and Little Hartley to Lithgow Upgrade projects (Figure 2-4)
- the development footprint has the same definition and area as the subject land
- the central construction footprint relates to the full construction footprint required by the Blackheath to Little Hartley project. This area overlaps with the eastern and western projects that are part of the broader Great Western Highway Upgrade Program. The Great Western Highway East - Katoomba to Blackheath and Great Western Highway Upgrade Program – Little Hartley to Lithgow projects and the associated clearing are being assessed through a separate planning approval process. These areas will be cleared prior to the commencement of the project (Figure 2-4)
- the study area represents the original boundary that was used to develop field investigations for the project and determine potential impacts which later informed final positioning of the development footprint (Figure 2-4)
- the assessment area includes the subject land and the area of land within a 1500 metre buffer zone surrounding the subject land. It also includes the area within a 500 metre buffer zone (taken from the centre line) of the proposed tunnel alignment. This represents the area considered for prescribed and indirect impacts
- the locality refers to the land within a 10 kilometre radius of the study area.

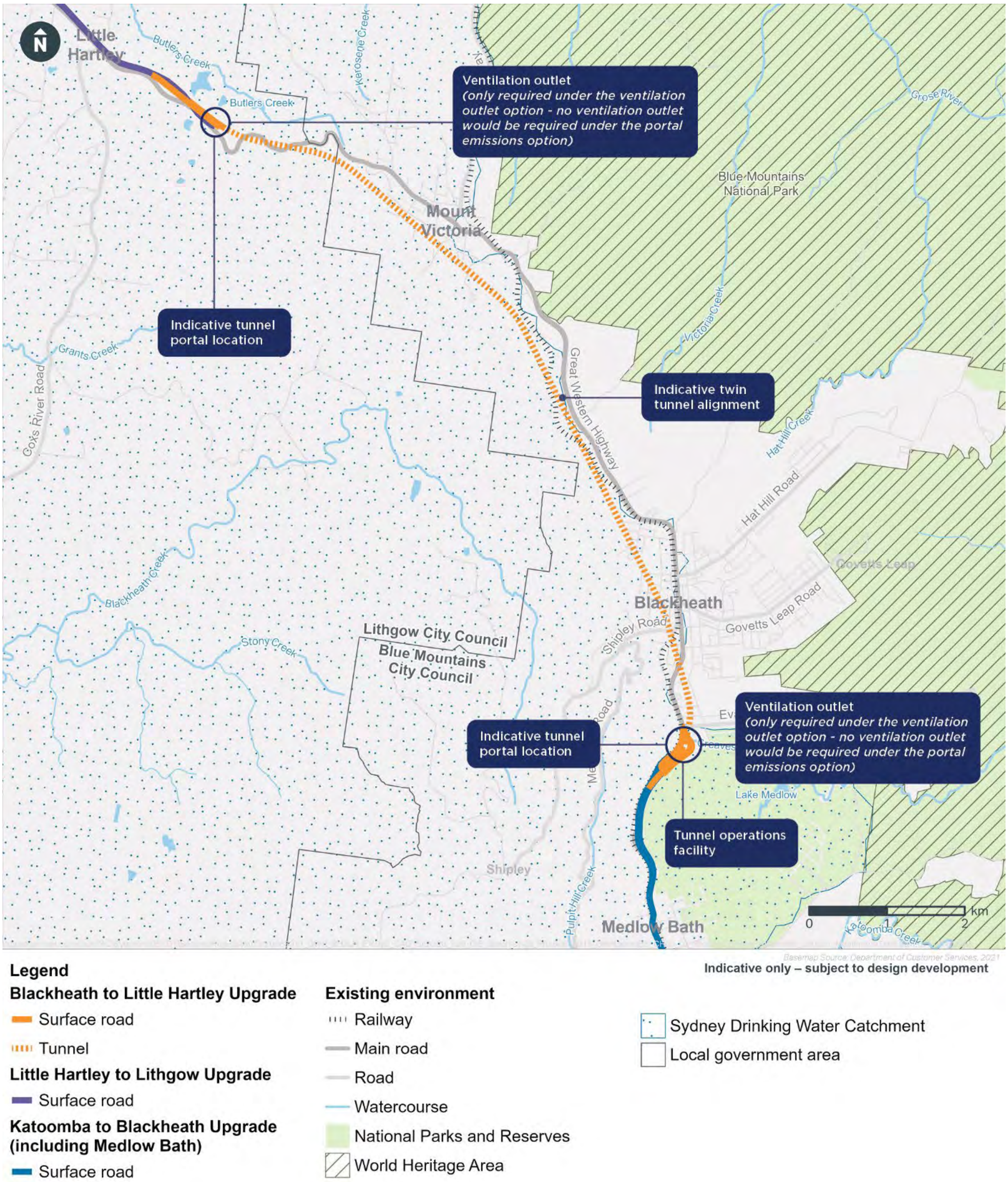


Figure 2-1: Overview of the project


Figure 2-2: Indicative operational configuration at Blackheath

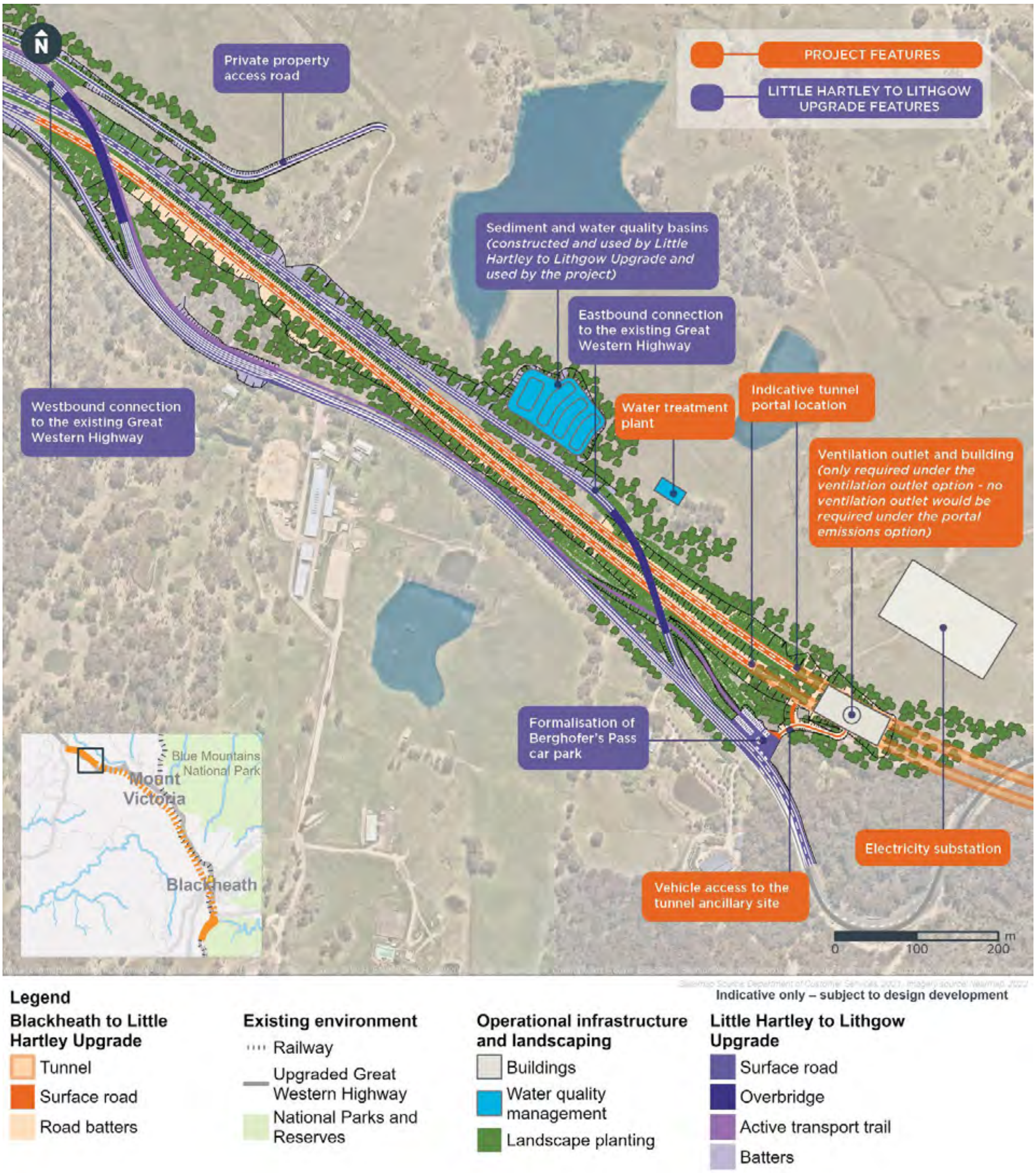


Figure 2-3: Indicative operational configuration at Little Hartley

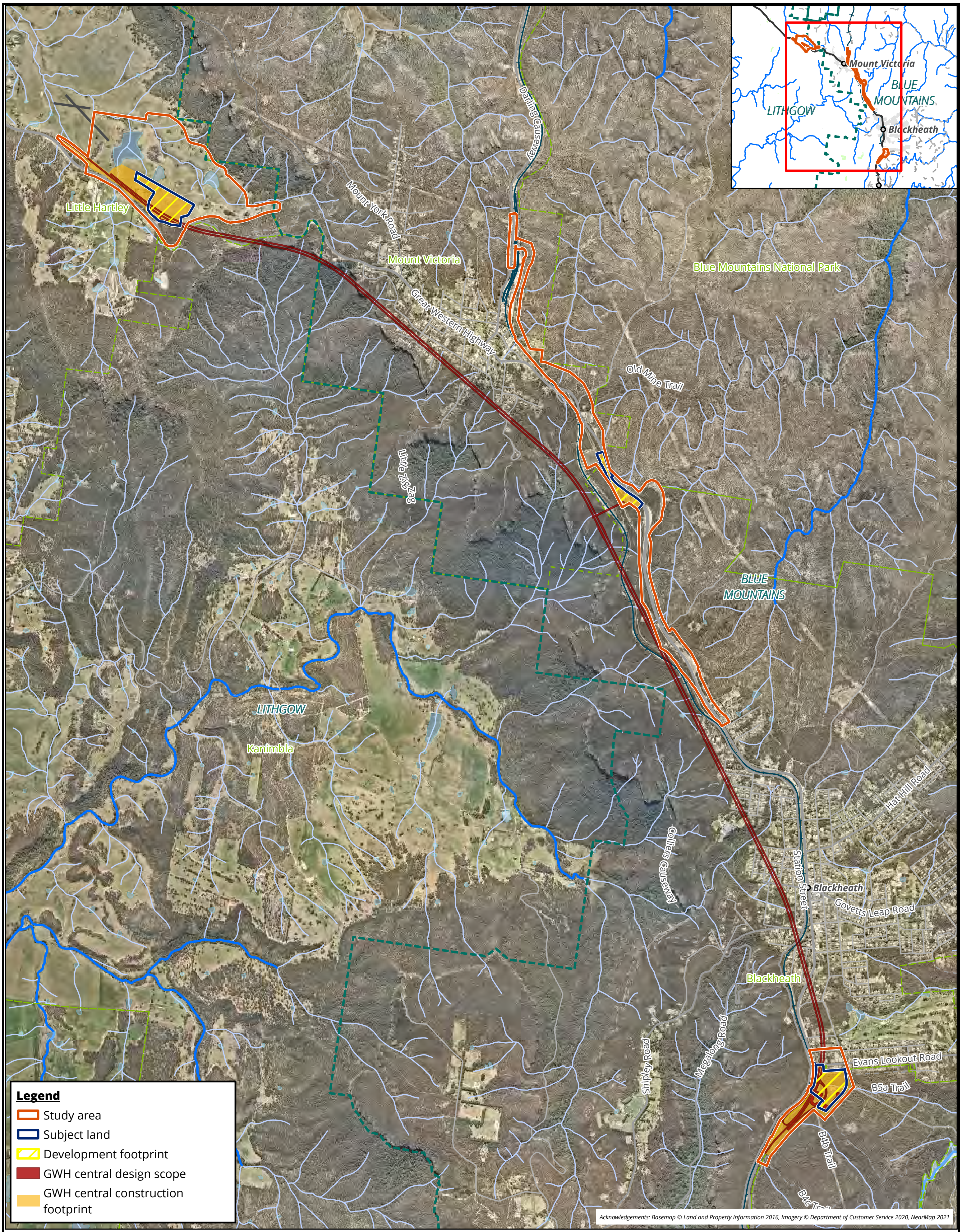


**Figure 2-4 Development footprint**

**Page 1 of 4**

biosis

Matter: 35727,
Date: 30 August 2022 ,
Prepared for: MH, Prepared by: AM, Last edited by: amackegard
Layout: 35727_BDAR_F2_The project
Project: P:\35700s\35727\Mapping\
35727_BDAR_portrait.aprx

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Metres
Scale 1:30,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

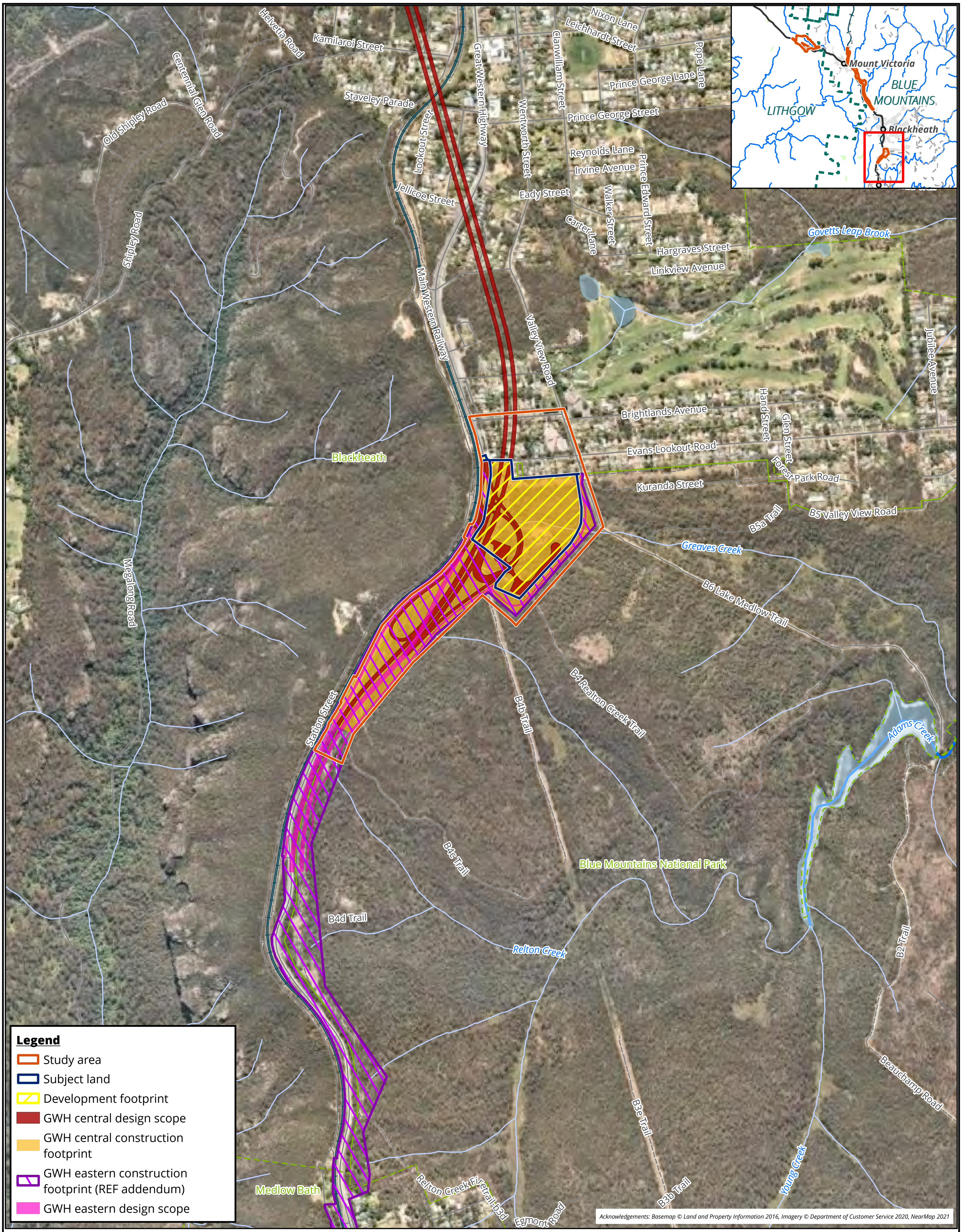


**Figure 2-4 Development footprint**

**Page 2 of 4**

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Matter: 35727,
Date: 30 August 2022 ,
Prepared for: MH, Prepared by: AM, Last edited by: amackegard
Layout: 35727_BDAR_F2_The project
Project: P:\35700s\35727\Mapping\
35727_BDAR_portrait.aprx

0 100 200 300 400 500
Metres
Scale 1:10,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

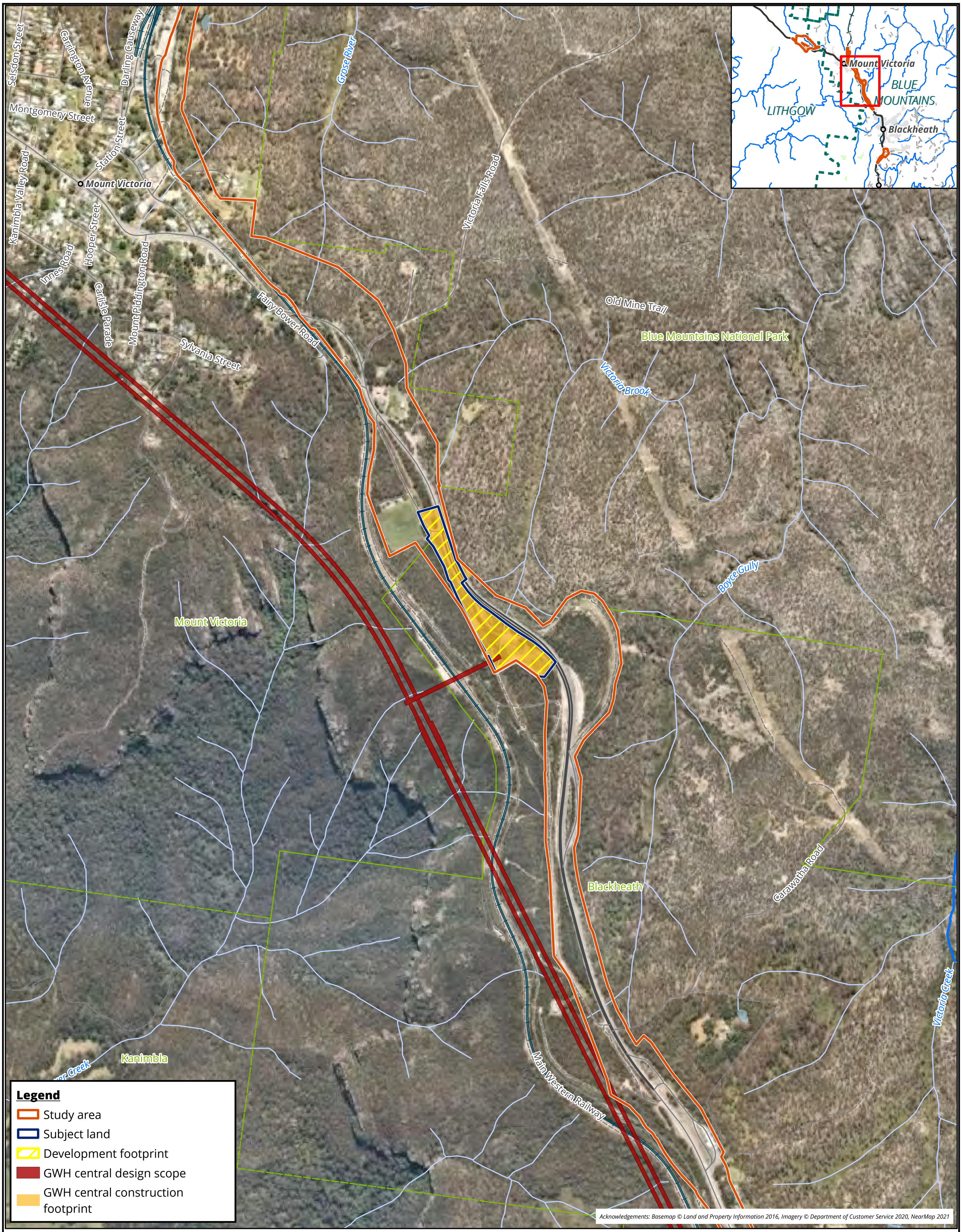


**Figure 2-4 Development footprint**
**Page 3 of 4**

0 100 200 300 400 500
Metres
Scale 1:10,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

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Matter: 35727,
Date: 30 August 2022 ,
Prepared for: MH, Prepared by: AM, Last edited by: amackegard
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Project: P:\35700s\35727\Mapping\
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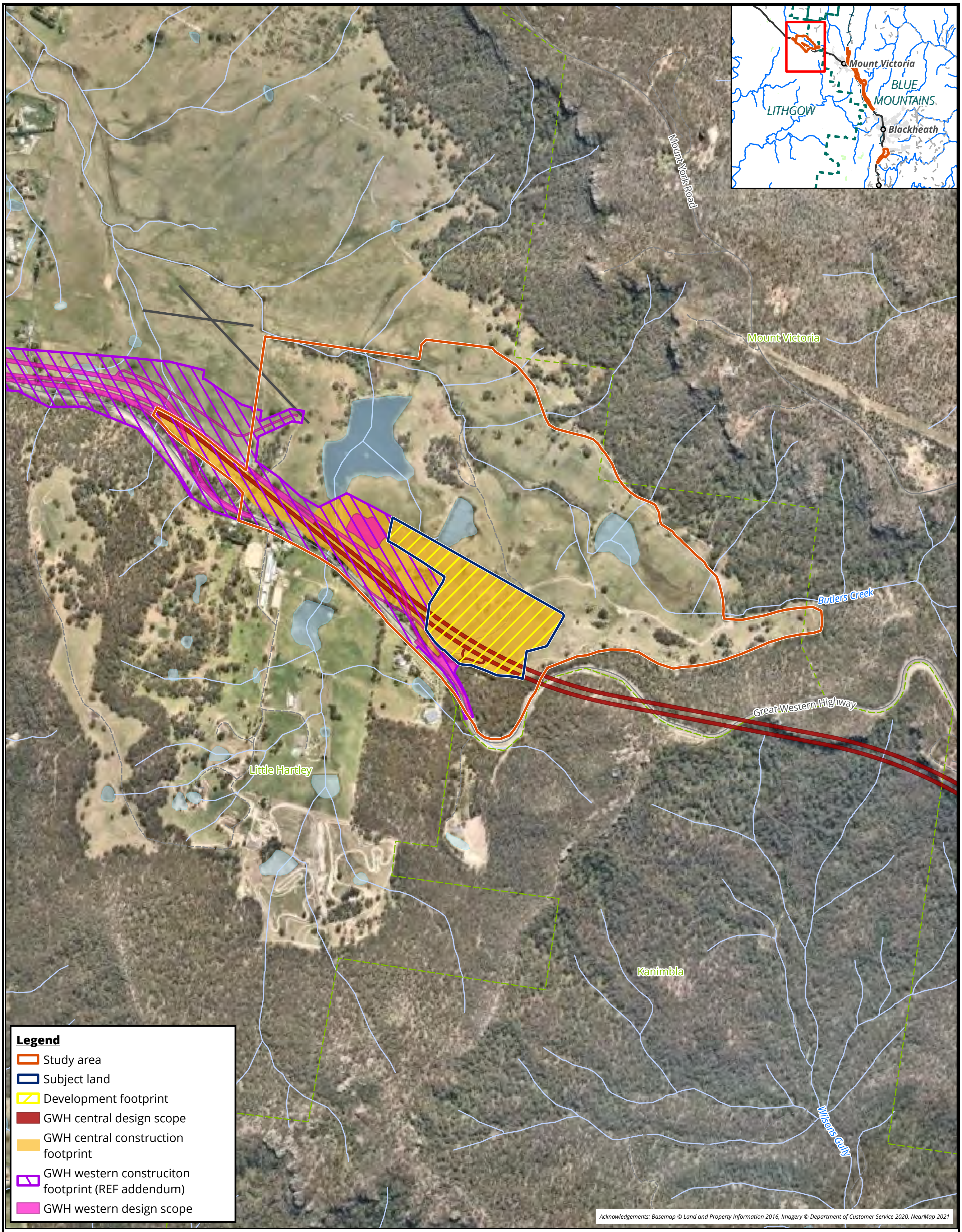


**Figure 2-4 Development footprint**

**Page 4 of 4**

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Date: 30 August 2022 ,
Prepared for: MH, Prepared by: AM, Last edited by: amackegard
Layout: 35727_BDAR_F2_The project
Project: P:\35700s\35727\Mapping\
35727_BDAR_portrait.aprx

0 100 200 300 400 500
Metres
Scale 1:10,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56
N

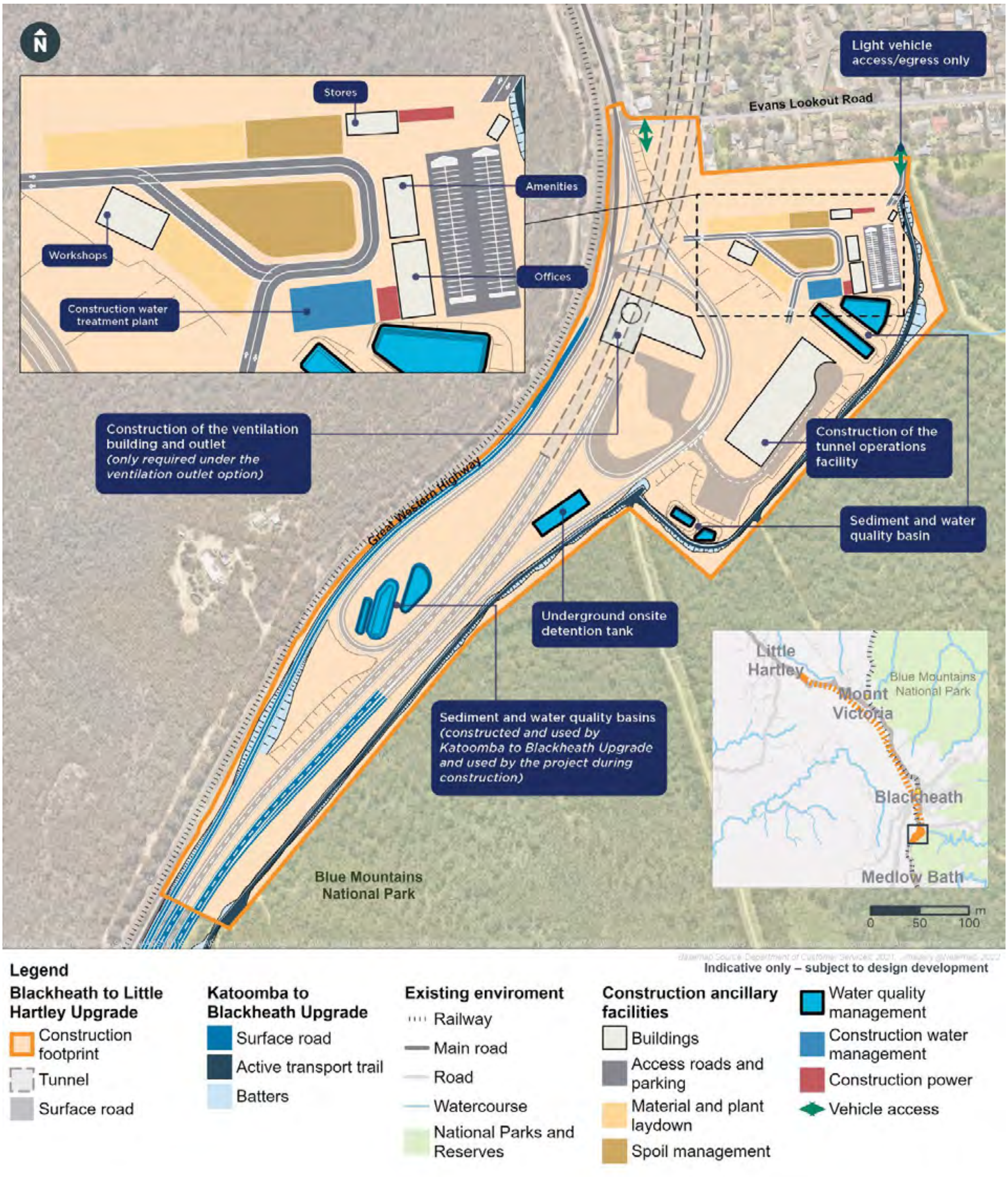



Figure 2-5: Indicative construction footprint at Blackheath


Figure 2-6: Indicative construction footprint at Soldiers Pinch

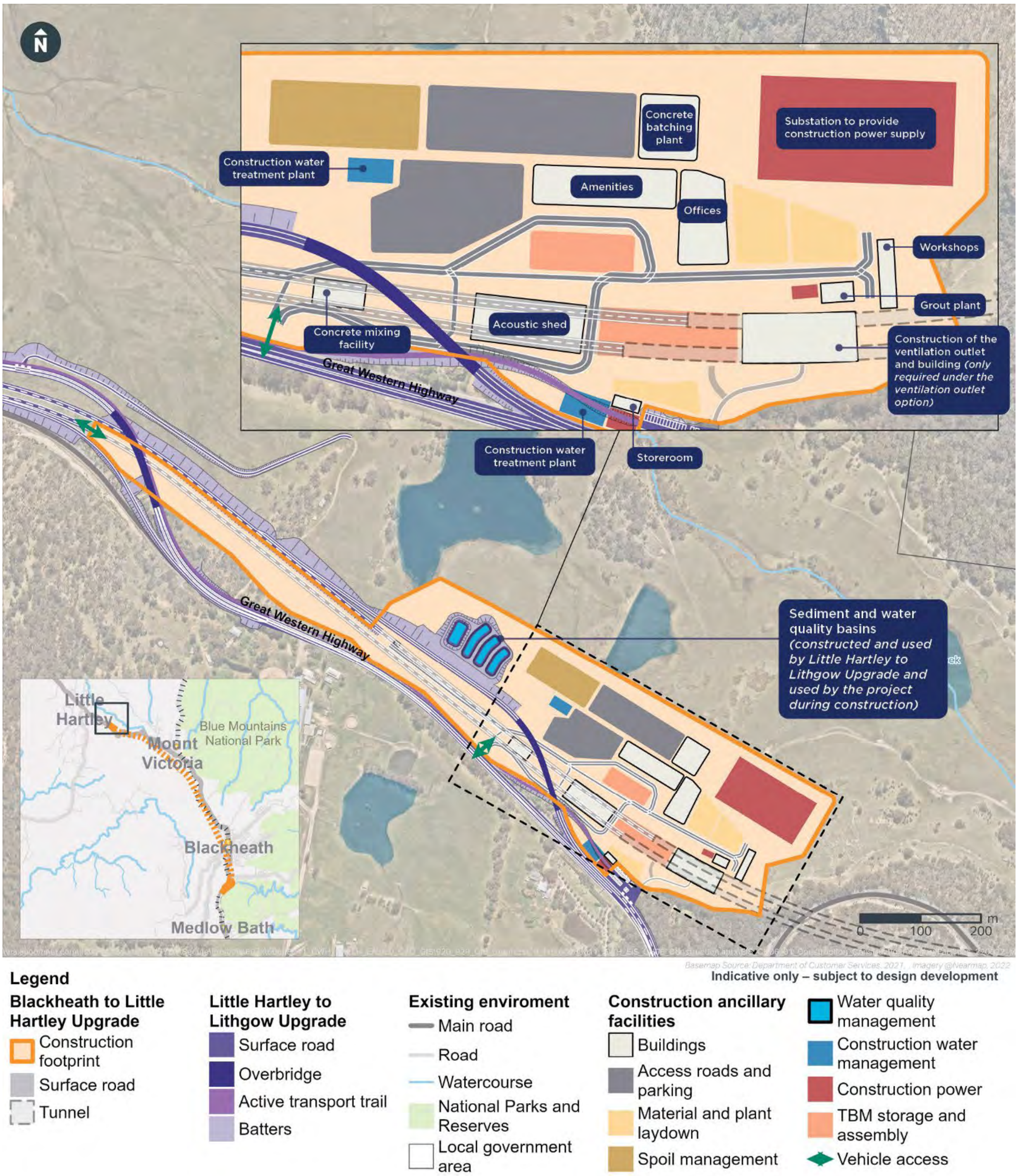



Figure 2-7: Indicative construction footprint at Little Hartley

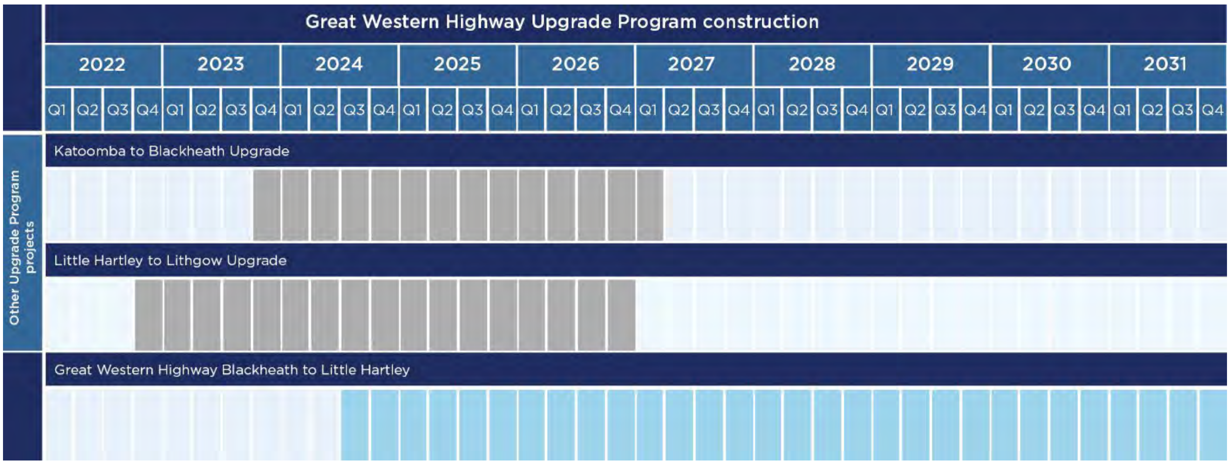



Figure 2-8: Great Western Highway Upgrade Program construction

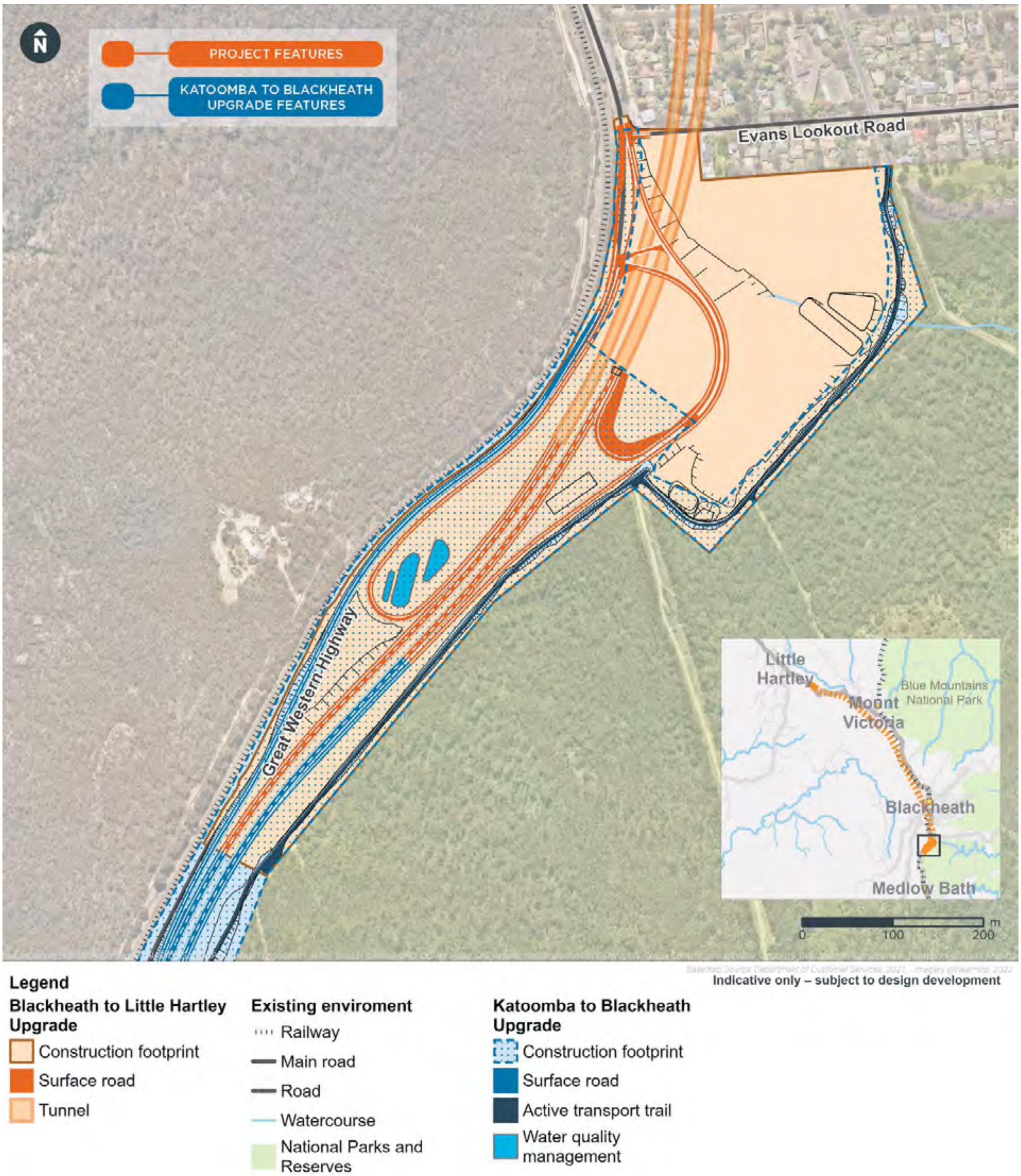



Figure 2-9: Baseline environment at Blackheath

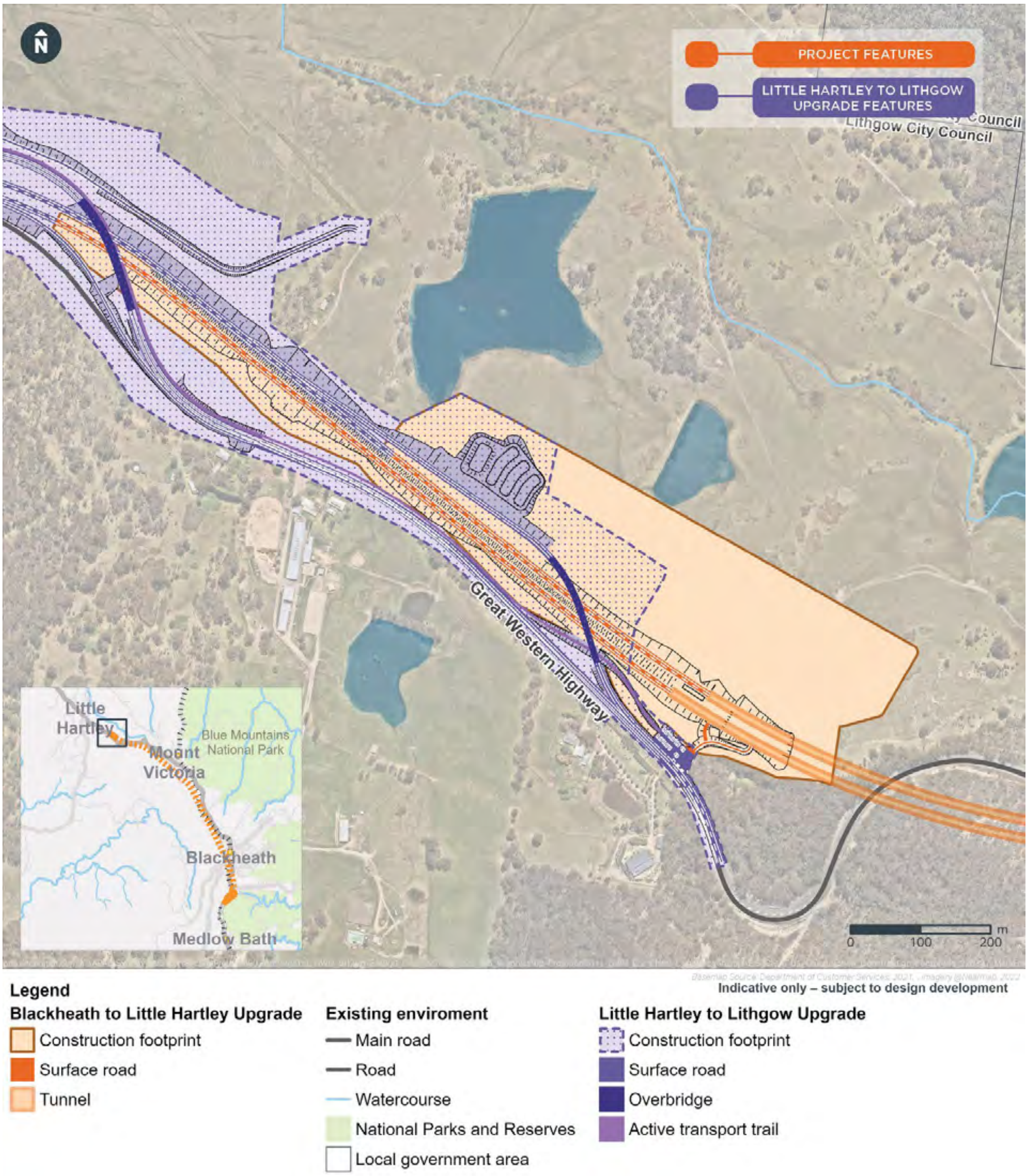



Figure 2-10: Baseline environment at Little Hartley

# 3 Landscape context

This chapter describes the landscape and site context of the study area and subject land, describing the landscape features present within the study area, subject land and assessment area, as required by the BAM (DPIE 2020a). Figure 3-1 and Figure 3-2 show the location of the subject land and landscape features within the assessment area.

## 3.1 Study area description

The study area is predominantly linear and generally follows the alignment of the existing Great Western Highway between Blackheath and Little Hartley. The subject land consists of three discrete patches of land which were initially considered as potential locations for project surface works:

- Blackheath study area: Located at the eastern end of the alignment, to the south of Blackheath and along the eastern edge of the Great Western Highway. This area covers approximately 26.85 ha and consists predominantly of remnant bushland
- Blackheath to Mount Victoria study area: This section of the study area is a predominantly linear section closely following the existing Great Western Highway, starting north of the Mount Victoria railway station and stretching south-east to the north-western entrance of the town of Blackheath. This area covers approximately 67.25 ha and consists predominantly of existing road infrastructure and patches of native bushland
- Little Hartley study area: Located at the western end of the alignment, to the west of Mount Victoria, and below the western slope of the Pass of Victoria. This area covers approximately 106.02 ha and consists of predominantly cleared agricultural land for cattle grazing.

These three patches represent the original area (approximately 200.12 hectares) that was considered for development by the project. These were later reduced into the three areas that comprise the final central construction footprint (i.e. the Blackheath construction footprint, Soldiers Pinch construction footprint, and the Little Hartley construction footprint as outlined in Section 2.3).

The current surrounding land use is peri-urban and residential, road reserves, as well as privately owned land. The Blackheath study area includes parts of the Blue Mountains National Park while the central section of the Blackheath to Mount Victoria study area (near the Soldiers Pinch construction footprint), occurs adjacent to the National Park (Figure 3-1). The Blackheath study area also occurs within an area mapped as The Greater Blue Mountains Area – Additional Values which is under consideration for inclusion on the National Heritage List (Figure 3-2).

## 3.2 Subject land description

The subject land is composed of three key areas of direct impacts, including:

- Blackheath subject land: Located at the eastern end of the alignment, south of Blackheath. This area is approximately 8.37 ha and covers the direct impacts associated with the Blackheath construction footprint
- Soldiers Pinch subject land: Located adjacent to Browntown Oval and extending southwards for 500 m, running adjacent to the existing alignment of the Great Western Highway. This area is approximately 4.27 ha and covers the direct impacts associated with the Soldiers Pinch construction footprint
- Little Hartley subject land: Located at the western end of the alignment, below the western slope of the Pass of Victoria. This area is approximately 10.74 ha and covers the direct impacts associated with the Little Hartley construction footprint

## 3.3 Landscape features

Landscape features within the subject land and broader assessment area are described below in Table 3-1.

Table 3-1: Landscape features

| Landscape feature | Assessment area |
|---|---|
| **IBRA bioregions and subregions** | The assessment area occurs within the Sydney Basin IBRA bioregion and the Burragorang (western extent of the subject land) and Wollemi (eastern extent of the subject land) IBRA subregions.<br>The Sydney Basin Bioregion lies on the central east coast of NSW and covers an area of approximately 3,624,008 hectares. It occupies about 4.53 per cent of NSW and is one of two bioregions contained wholly within the state. The bioregion extends from just north of Batemans Bay to Nelson Bay on the central coast, and almost as far west as Mudgee. The bioregion is bordered to the north by the North Coast and Brigalow Belt South bioregions, to the south by the South East Corner Bioregion and to the west by the South Eastern Highlands and South Western Slopes bioregions. The Sydney Basin Bioregion is one of the most species diverse in Australia. This is a result of the variety of rock types, topography and climates in the bioregion (DPE 2016a).<br>The Wollemi subregion occurs at the highest part of the Blue Mountains and is characterised by a sandstone plateau with benched rock deposits. The geology consists of Hawkesbury Sandstone and equivalent quartz sandstones of Narrabeen Group with a few volcanic necks. Vegetation typically consists of; Red Bloodwood *Corymbia gummifera*, Yellow Bloodwood *Corymbia eximia*, Rough-barked Apple *Angophora floribunda*, Smooth-barked Apple *Angophora costata*, Hard-leaved Scribbly Gum *Eucalyptus sclerophylla*, and Grey Gum *Eucalyptus punctata* with diverse shrubs and heaths on plateau. Smooth-barked Apple, Sydney Peppermint *Eucalyptus piperita*, Blue-leaved Stringybark *Eucalyptus agglomerata*, and Turpentine *Syncarpia glomulifera* and gully rainforests in gullies and canyon heads. Ribbon Gum *Eucalyptus viminalis* and Blaxland's Stringybark *Eucalyptus blaxlandii* on basalt. River Oak *Casuarina cunninghamiana* along main streams (CoA 2018).<br>The Burragorang subregion consists of rolling hills on a sandstone plateau with deep gorges and sandstone cliffs in the Burragorang valley. The underlying geology is Permian and Triassic sandstones and shales on the western edge of the Basin with limited basalt caps. Vegetation typically consists of heath, shrubland and woodland with Silvertop Ash *Eucalyptus sieberi*, Hard-leaved Scribbly Gum, Sydney Peppermint and Red Bloodwood on sandstone similar to other parts of the Basin. Deane's Gum, *Eucalyptus deanei,* Turpentine, Blue-leaved Stringybark immediately below escarpment passing to Grey Gum, Narrow-leaved Ironbark *Eucalyptus crebra* and Thin-leaved Stringybark *Eucalyptus eugenioides* on bouldery slopes. River Oak along main streams below the plateaux (CoA 2018). |

| Landscape feature | Assessment area |
|---|---|
| **NSW (Mitchell) landscapes** | The assessment area predominantly occurs within the Blue Mountains Plateau (Bmp) NSW (Mitchell) landscape, with the western-most areas occurring on the Sydney Basin Western Escarpment (Swe) landscape (Mitchell 2002).<br><br>**Blue Mountains Plateau**<br>The Blue Mountains Plateau landscape consists of elevated, dissected plateau of Triassic quartz sandstones, largely undeformed, prominent sub-horizontal bedding defining a plateau that rises to the west with maximum elevation of 1,100 metres and local relief in cliffed gorges up to 500 metres. The landscape has a very strong joint control on stream patterns and cliff lines, thin shale beds form stepped topography and deeply weathered sandstones form pagoda towers and turrets on gorge margins.<br>Vegetation includes; Dwarf She-oak *Allocasuarina nana* heath, Blue Mountains Ash *Eucalyptus oreades* and Silvertop Ash woodlands, perched swamps, or heaths, woodlands and forests with very high plant diversity on sandy soils (Mitchell 2002).<br><br>**Sydney Basin Western Escarpment**<br>The Sydney Basin Western Escarpment landscape consists of steep dissected slopes on the western margin of the Triassic rocks and descending into the Permian conglomerate, shale and sandstone. Cliffs and gorges to 100 metres, general elevation 250 to 1,000 metres, local relief 150 metres. Soil typically consists of brown loamy sands in rubbly soil on debris slopes, with deeper accumulations toward the valley floor.<br>On dry aspects the vegetation typically consists of open forests of Sydney Peppermint, Smooth-barked Apple, Grey Gum, Broad-leaved Ironbark *Eucalyptus fibrosa* ssp. *fibrosa* and Rough-barked Apple.<br>On moist aspects the vegetation typically consists of tall open forests of; Deane's Gum, Turpentine, Sydney Blue Gum *Eucalyptus saligna*, Blue-leaved Stringybark, Thin-leaved Stringybark and Narrow-leaved Ironbark. Coachwood *Ceratopetalum apetalum* and Sassafras *Doryphora sassafras* are typically present in the gullies (Mitchell 2002). |
| **Native vegetation cover** | Vegetation within the assessment area was assessed using aerial photographic interpretation, field survey results and existing vegetation mapping. Figure 3-3 shows the areas of native vegetation identified from existing vegetation mapping, and the current assessment, as occurring within the assessment area.<br>The total area covered by the assessment area is 3,142.56 hectares, with the area of native vegetation mapped within the assessment area being 2,321.96 hectares. This has a native vegetation cover of 74 per cent, and within the >70 per cent cover class as defined in Section 3.2 of the BAM (DPIE 2020a). This value was entered into the BAM-C. |
| **Cleared areas** | Areas of the subject land mapped as urban native/exotic with no native over storey or mid storey cover met the definition of non-native vegetation/cleared land and were not mapped as native vegetation (Figure 4-1).<br>Areas not shown as native vegetation cover within Figure 4-1, and which do not provide habitat for threatened species, are not included for further assessment in accordance with Section 5.1.1.5 of the BAM (DPIE 2020a). Non-native vegetation which does provide habitat for threatened species is required to be assessed.<br>A total of 851.79 hectares within the assessment area was found to consist of urban native/exotic vegetation or cleared areas. Additional areas of native vegetation will be cleared as part of the east and west projects that form part of the broader Upgrade Program. These areas are detailed in Section 7.8. |
| **Rivers, streams and estuaries** | The assessment area is located within the Greater Sydney LLS Region and the Hawkesbury catchment.<br>The river-mouth of the Hawkesbury River is located approximately 95 kilometres to the east of the assessment area. Tributaries and their Strahler order (Strahler 1964) originating from the assessment area (Figure 3-1, Figure 3-2) include: |

| Landscape feature | Assessment area |
|---|---|
| | • Adams Creek, a second and third (Strahler) order watercourse<br>• Boyce Gully, a second order watercourse<br>• Butlers Creek, a second, third and fourth order watercourse<br>• Centennial Glen, a second and third order watercourse<br>• Fairy Bower Creek, a second, third and fourth order watercourse<br>• Govetts Leap Brook, a second order watercourse<br>• Greaves Creek, a first, second and third order watercourse<br>• Grose River, a third order watercourse<br>• Porters Pass Gully, a first order watercourse<br>• Pulpit Hill, a second a third order watercourse<br>• Relton Creek, a first and second order watercourse<br>• Victoria Brook, a third order watercourse<br>• Victoria Gully, a second and third order watercourse<br>• Wilsons Gully, a third order watercourse<br>• Young Creek, a second order watercourse<br>• Approximately 678 km of unnamed first order watercourse segments<br>• Approximately 206 km of unnamed second order watercourse segments<br>• Approximately 23 km of unnamed third order watercourse segments.<br>There are Key Fish Habitats as mapped by the NSW Department of Primary Industries (DPI) within the study area (DPI 2022), located to the north-west of the Little Hartley subject land as part of Butlers Creek and its tributaries.<br>Aquatic habitats associated with Pulpit Hill Creek, Victoria Creek, Grose River and Fairy Dell Creek have also been previously identified as a freshwater fish community in poor condition and Butlers Creek identified as a freshwater fish community in very poor condition (DPI 2022). A full assessment of Key Fish Habitat is included within Annexure H. |
| **Wetlands** | The subject land is not mapped as part of a wetland included in the DoIW of Australia. The nearest wetland is the Pitt Town Lagoon, located 53 kilometres to the east of the subject land.<br>The development site lies approximately 93 kilometres north-west of the nearest Ramsar wetland, being Towra Point Nature Reserve south of Sydney.<br>Mapping of Temperate Highland Peat Swamps on Sandstone (both BC Act and EPBC Act listed) in the locality (CoA and Macquarie University 2016, DPE 2010b) indicates the presence of several swamps within the Little Hartley study area, including one within the study area near to the development footprint at Little Hartley, as well as above the proposed tunnel alignment. The swamp within the Little Hartley study area has been attributed within the mapping project as 'cleared, non-native vegetation, buildings', and surveys conducted as part of the current assessment confirmed that remaining swamp vegetation largely did not satisfy the condition thresholds of the EPBC Act TEC listing.<br>Swamps have also been mapped within the vicinity of the Blackheath study area within adjacent areas of the Blue Mountains National Park (CoA and Macquarie University 2016, DPE 2010b). Mapping of these Temperate Highland Peat Swamps on Sandstone occurs along Greaves Creek at Blackheath, near to the Blackheath development footprint and a surface water discharge location. |
| **Connectivity features** | Connectivity of native vegetation varies across each of the three patches that make up the subject land.<br><br>**Blackheath subject land**<br>At the Blackheath subject land, located at the eastern end of the project, south of the town of Blackheath and to the east of the existing Great Western Highway, native vegetation is present in high condition and forms a dense woodland directly connected to the Blue Mountains National Park. Connectivity within this area is high allowing for unrestricted movement of terrestrial and arboreal fauna. The |

| Landscape feature | Assessment area |
|---|---|
| | watercourses and drainage lines in this area, which include Greaves Creek and Relton Creek, also allow for the movement of amphibious species, with several native frog species detected during field investigations. These water features connect up to Adams Creek, a large water body located to the east of the subject land within the Blue Mountains National Park. |
| | **Soldiers Pinch subject land**<br>Within this linear section of the subject land there is significant pre-existing fragmentation associated with the existing Great Western Highway road corridor, Browntown Oval and several dirt access tracks that pass through and are located directly adjacent to, the subject land boundary. |
| | **Little Hartley subject land**<br>At the Little Hartley subject land, located at the western end of the project, native vegetation has been predominantly cleared to allow for grazing paddocks supporting farming enterprises. Movement of terrestrial and arboreal mammals across this area is limited to scattered paddock trees which would facilitate some movement across this area. In addition, Butlers Creek runs in an east-west orientation across this area and facilitates movement for aquatic and amphibious species with several native frog species detected during field investigations. Butlers Creek has been highly modified and three large dams are located along its length. The riparian corridor associated with Butlers Creek is also degraded with large infestations of weeds (particularly Blackberry *Rubus fruticosus* sp. agg.), however several small patches of remnant vegetation provide protection for fauna moving through the environment.<br>The Blue Mountains Western Escarpment wildlife corridor also traverses the assessment area between Mount Victoria and Little Hartley, and potential severance of this corridor is therefore an important consideration (DECC 2005). |
| **Areas of geological significance and soil hazard features** | There were no recorded karst or caves located directly within the subject land, however four caves (Mermaids Cave, Walls Cave, Coxs Cave and Ross Cave), approximately 121 kilometres of cliff lines and associated rock crevices are located within the broader assessment area. Rocky outcrops are also present within the study area, located within the Little Hartley and Blackheath to Mount Victoria sections. |
| **Areas of outstanding biodiversity value** | There are no areas of outstanding biodiversity value mapped within the subject land or broader assessment area. |

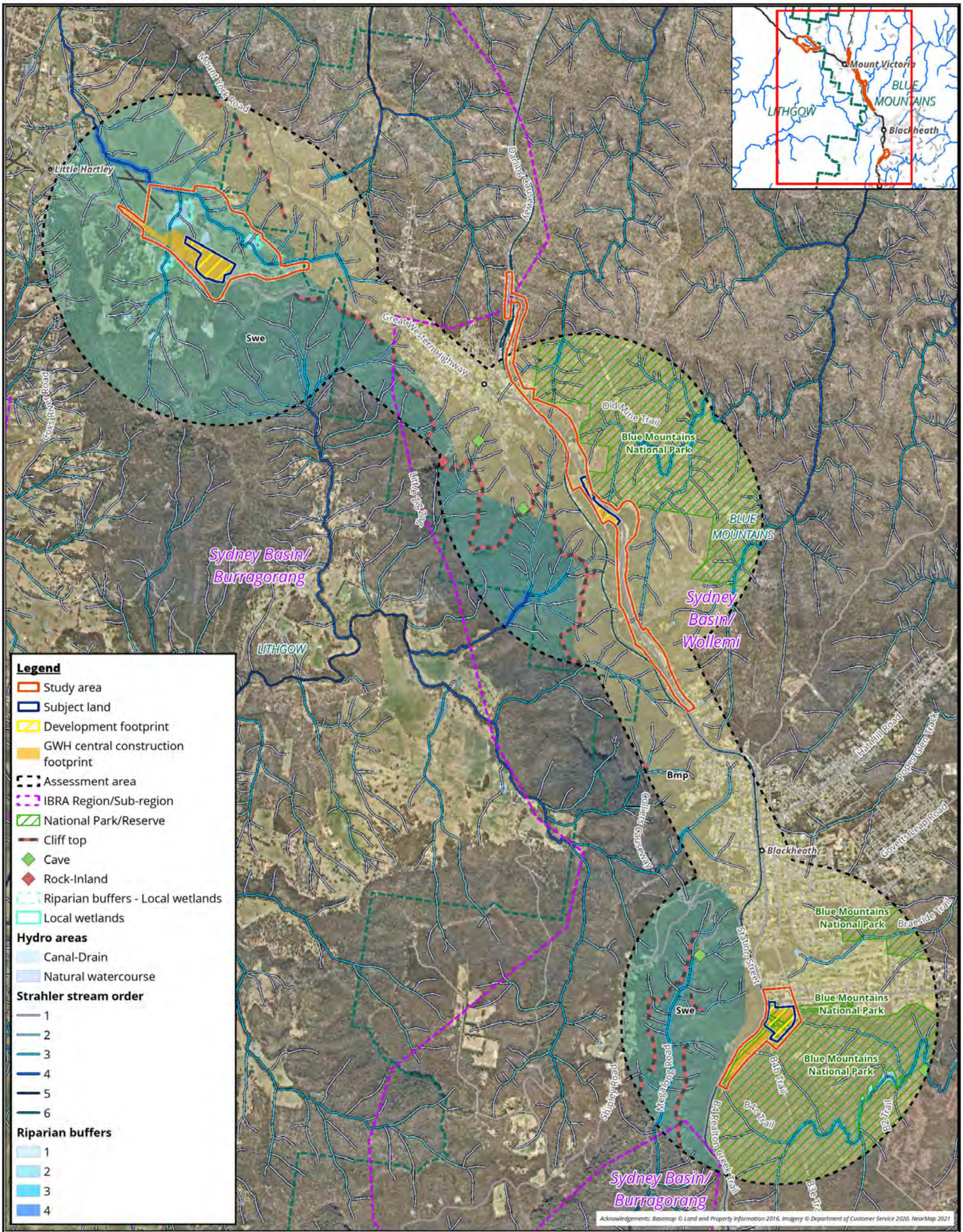
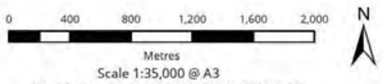



**Figure 3-1 Site map**
**Page 1 of 4**

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Date: 08 September 2022 ,
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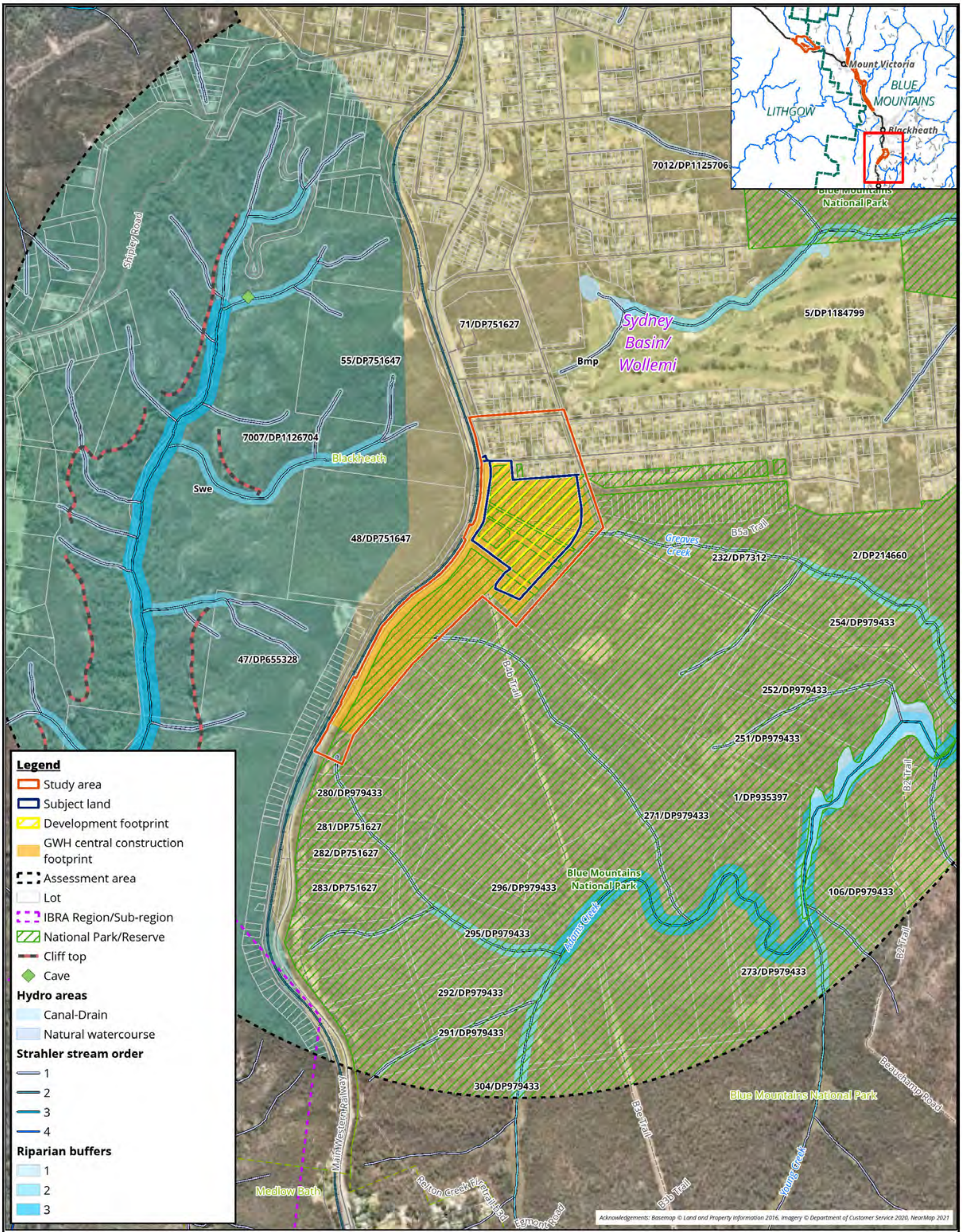
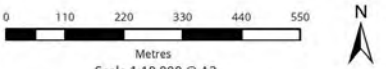



**Figure 3-1 Site map**
**Page 2 of 4**

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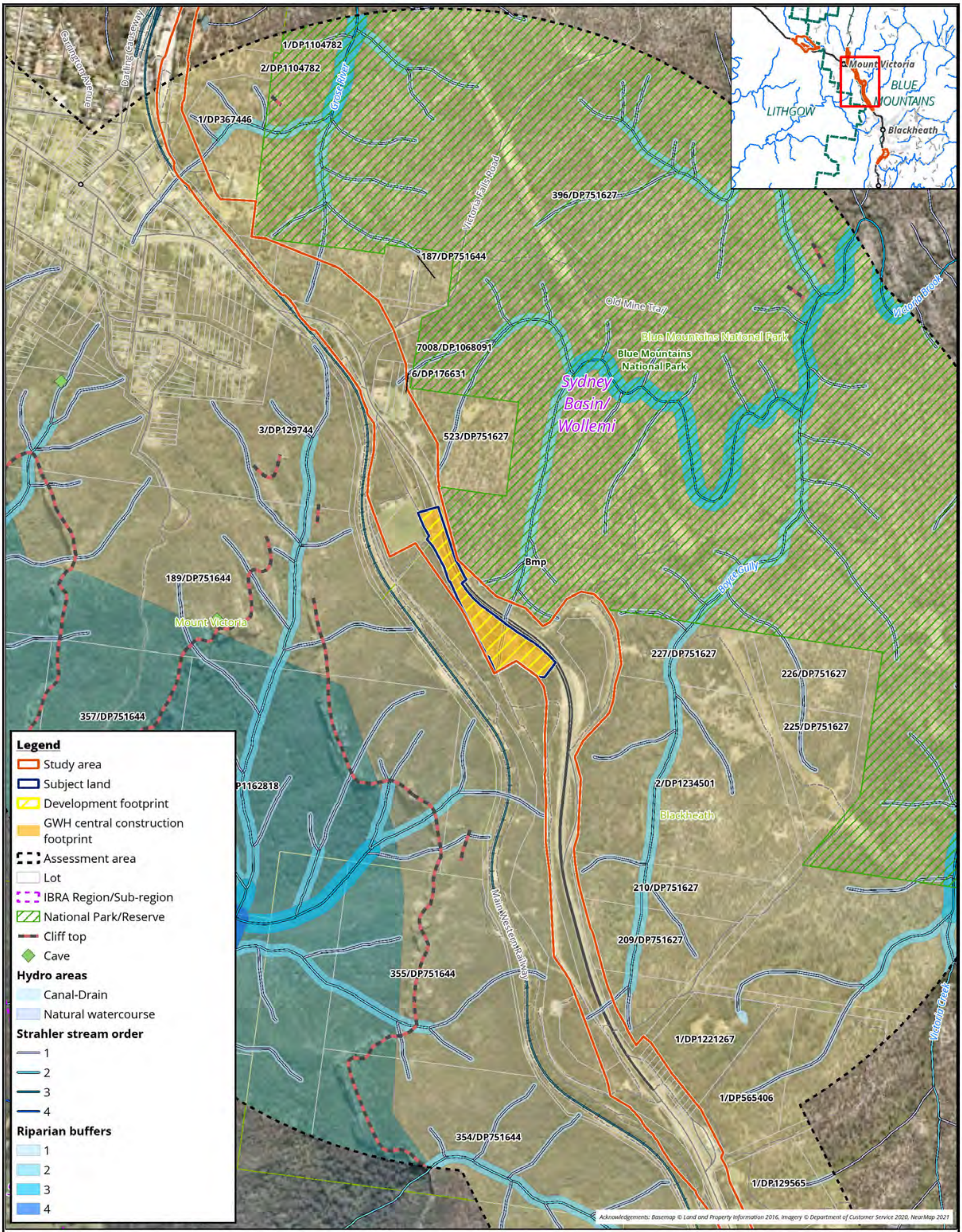


**Figure 3-1 Site map**
**Page 3 of 4**

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Prepared for: MH, Prepared by: AM, Last edited by: amackegard
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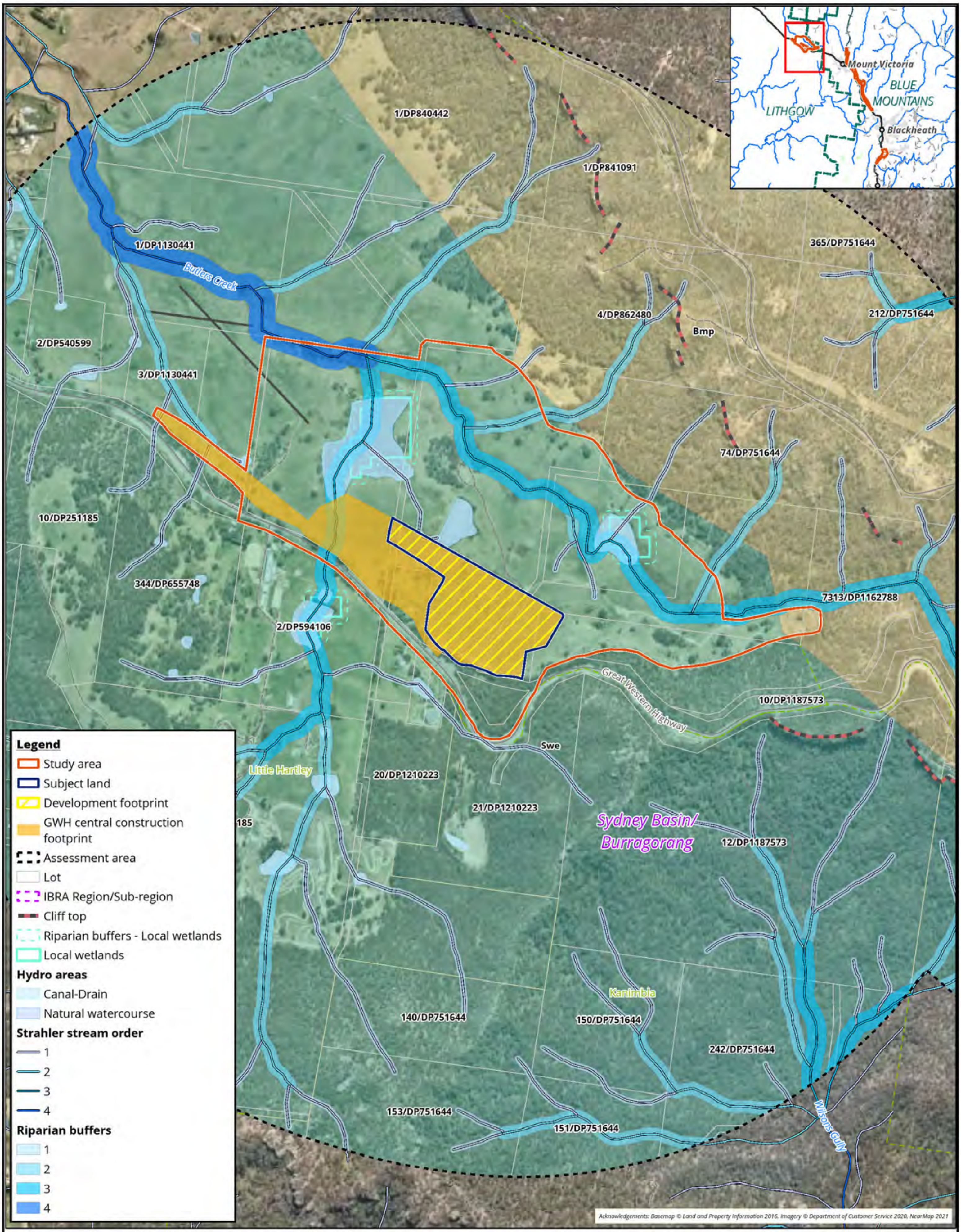


**Figure 3-1 Site map**
**Page 4 of 4**

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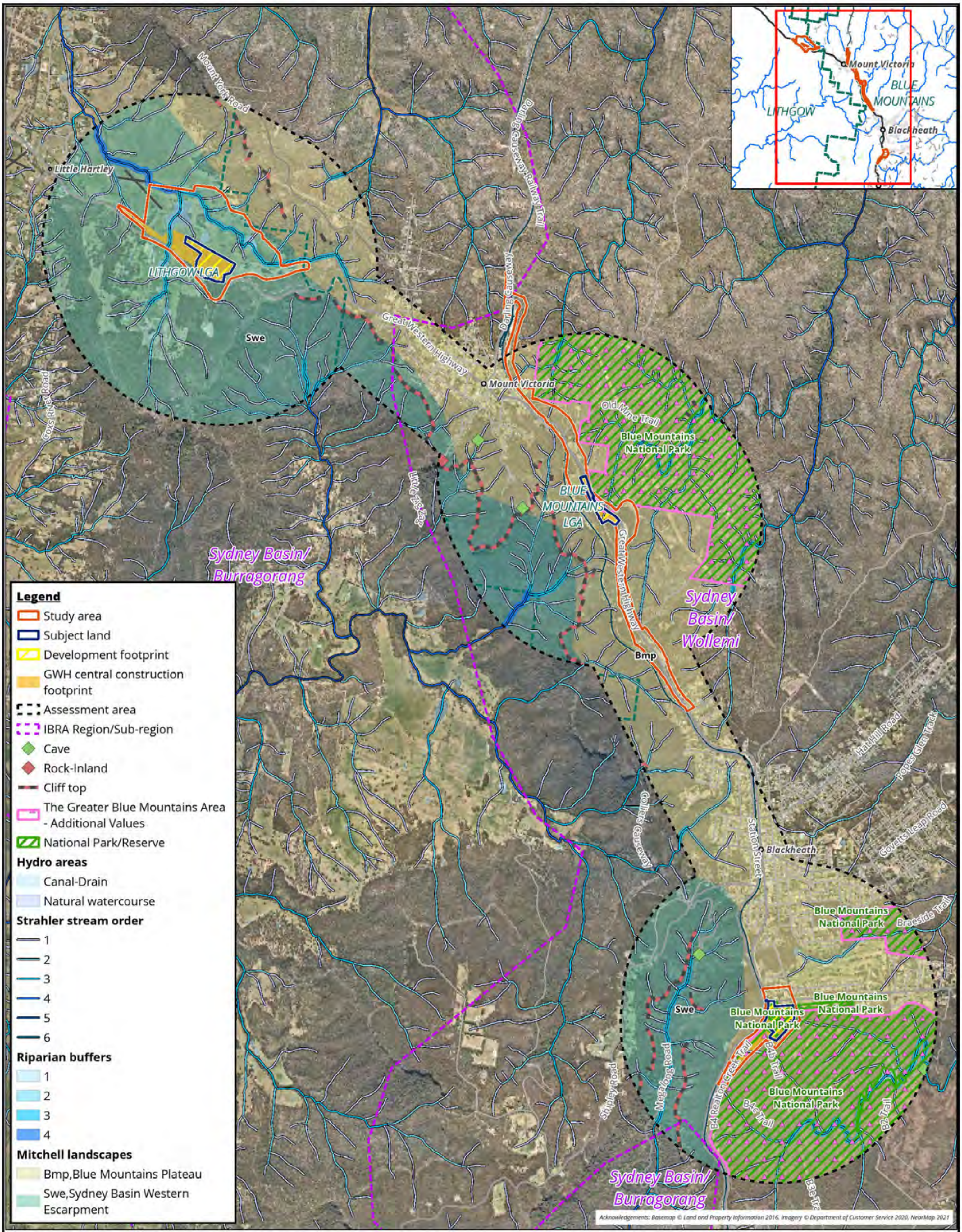


**Figure 3-2 Location map**
**Page 1 of 4**

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Layout: 35727_BDAR_F3-2_Location
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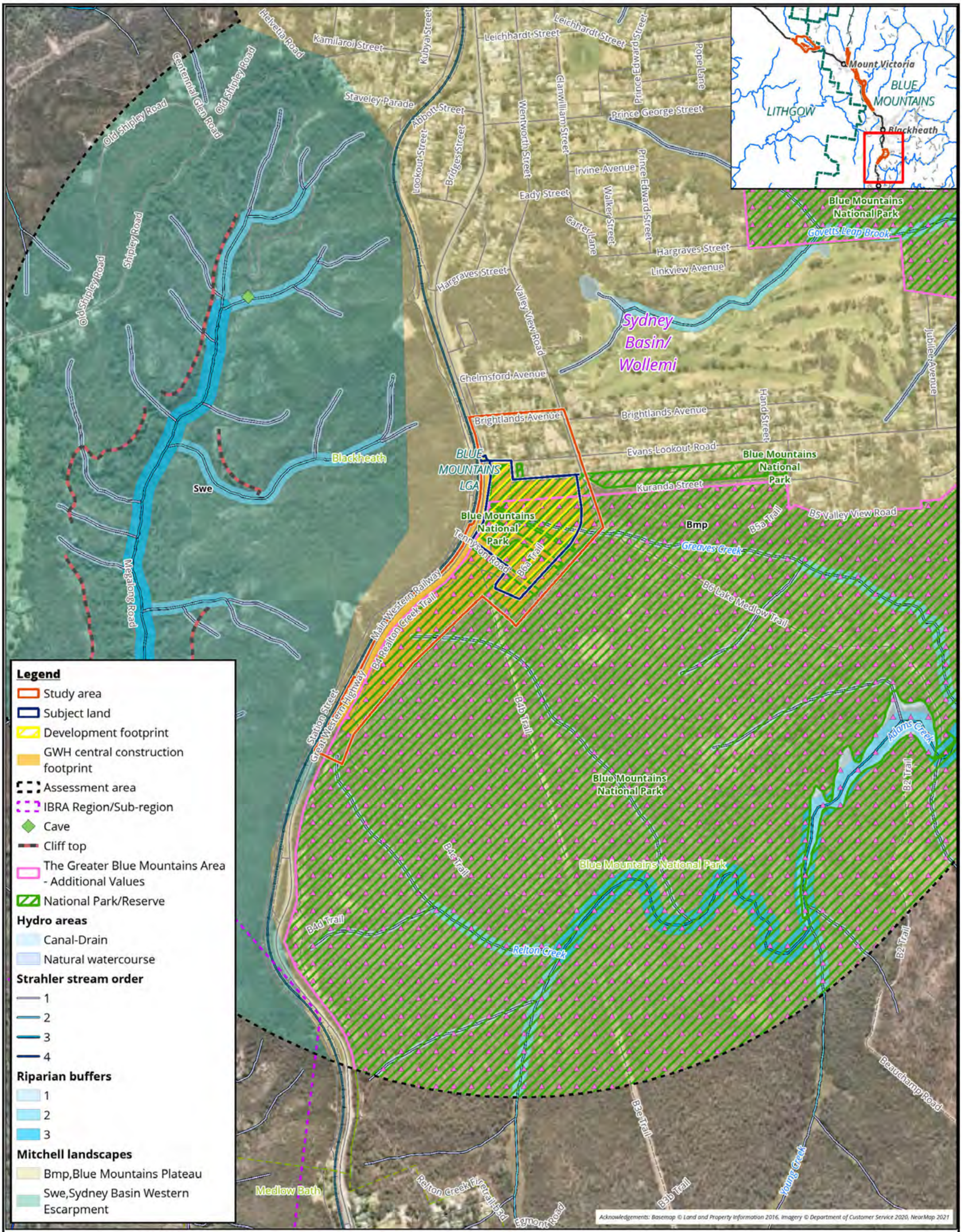


**Figure 3-2 Location map**
**Page 2 of 4**

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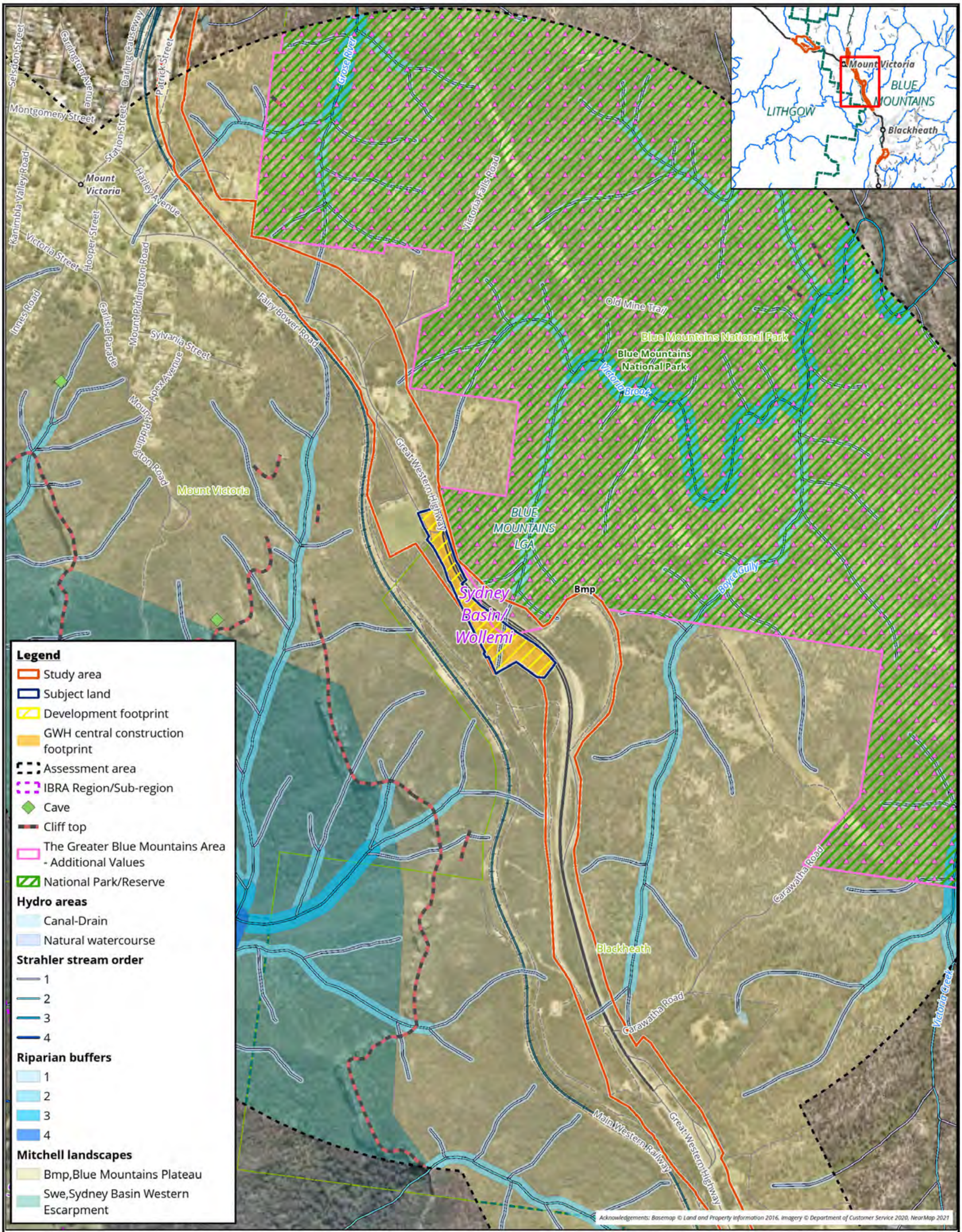


**Figure 3-2 Location map**
**Page 3 of 4**

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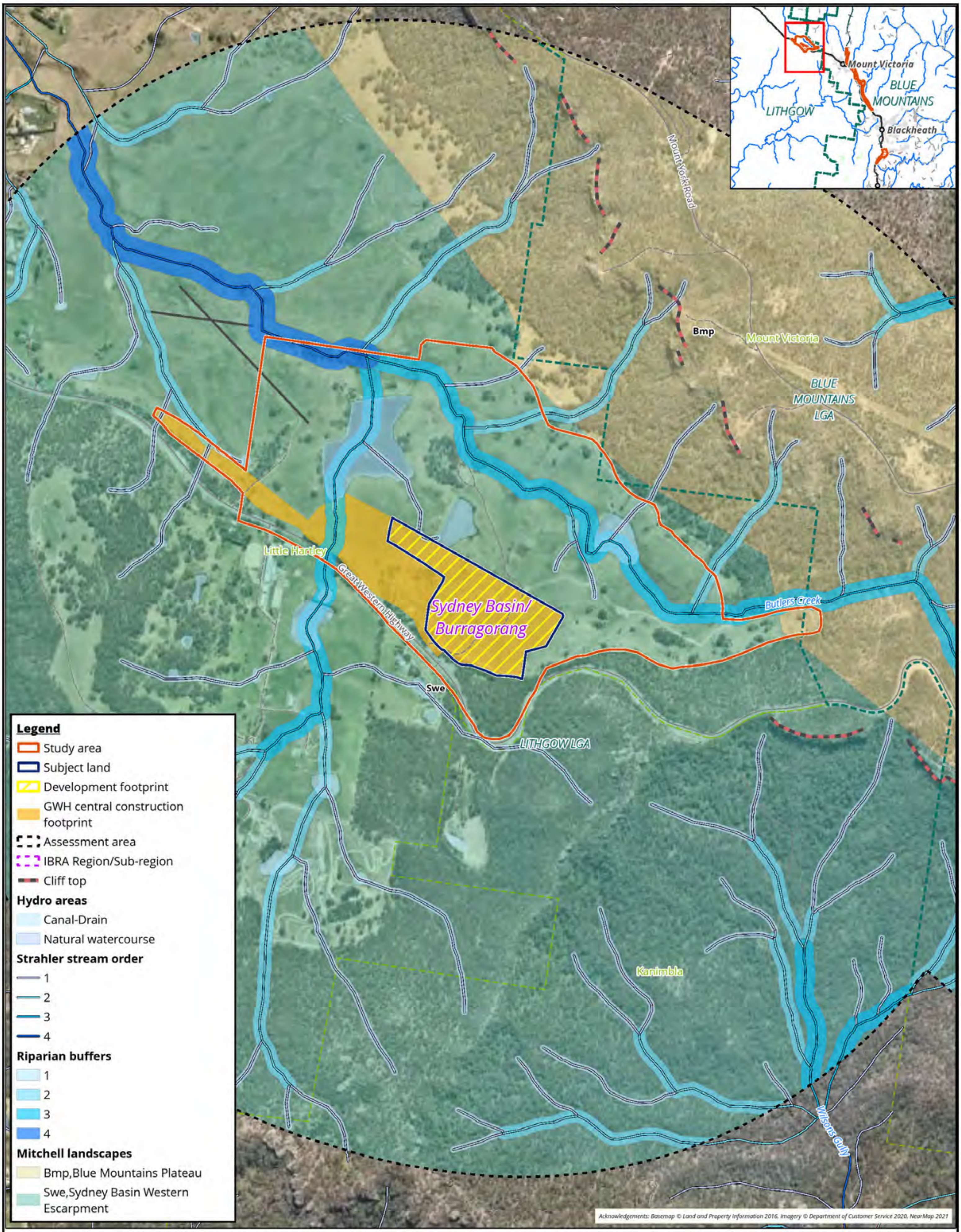


**Figure 3-2 Location map**
**Page 4 of 4**

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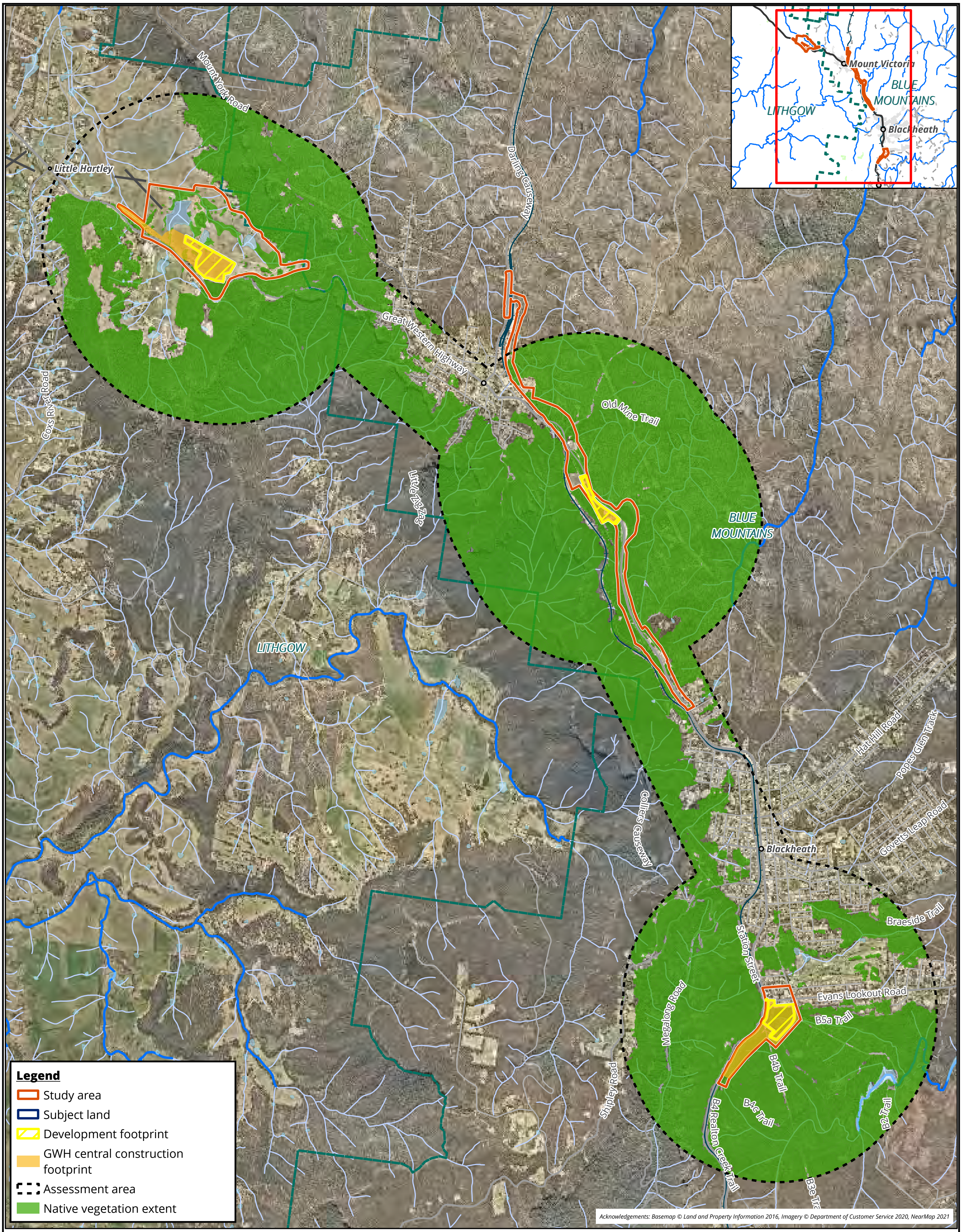


**Figure 3-3 Native vegetation extent**
**Page 1 of 4**

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Layout: 35727_BDAR_F3-3_NativeVeg
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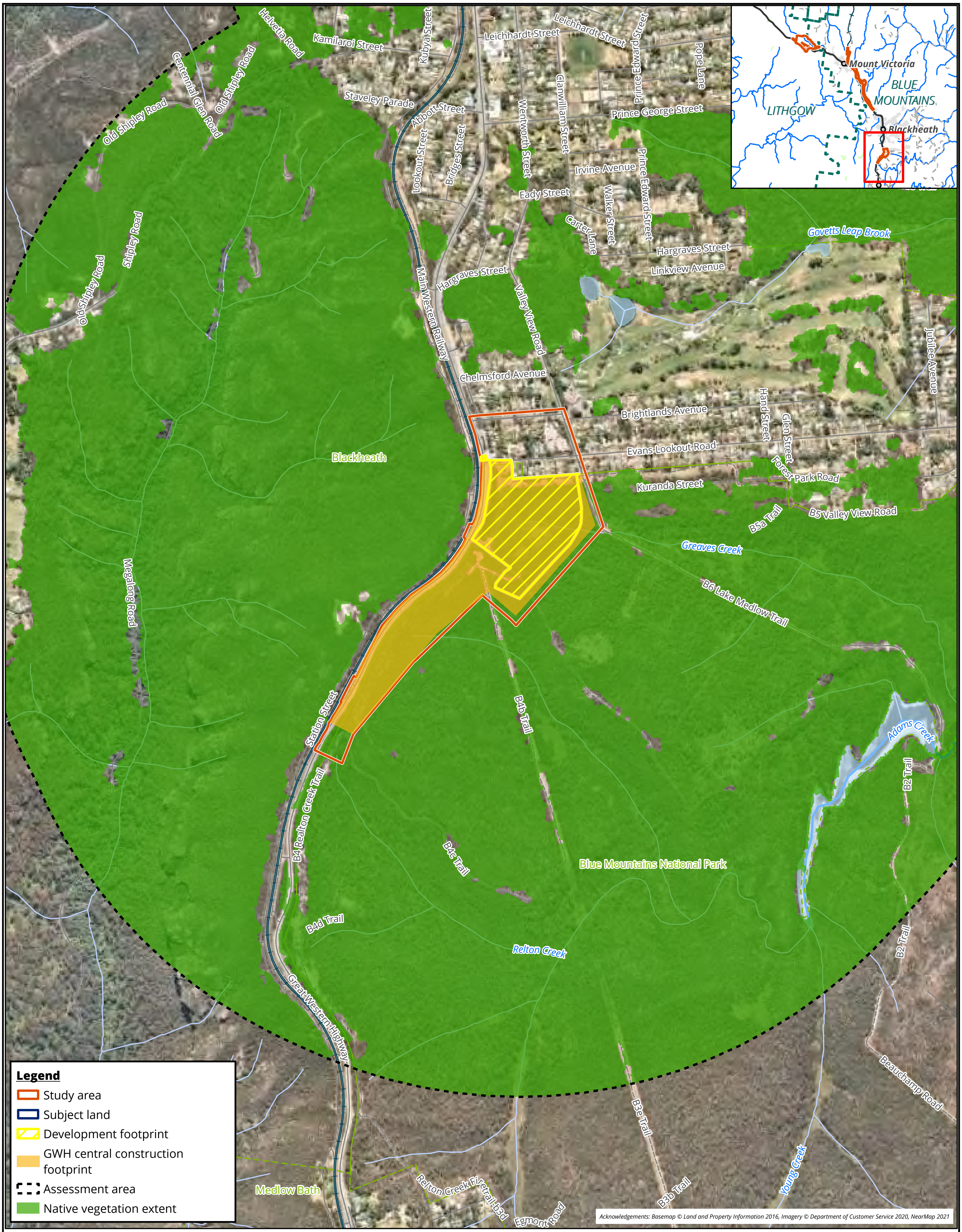


**Figure 3-3 Native vegetation extent**
**Page 2 of 4**

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Matter: 35727,
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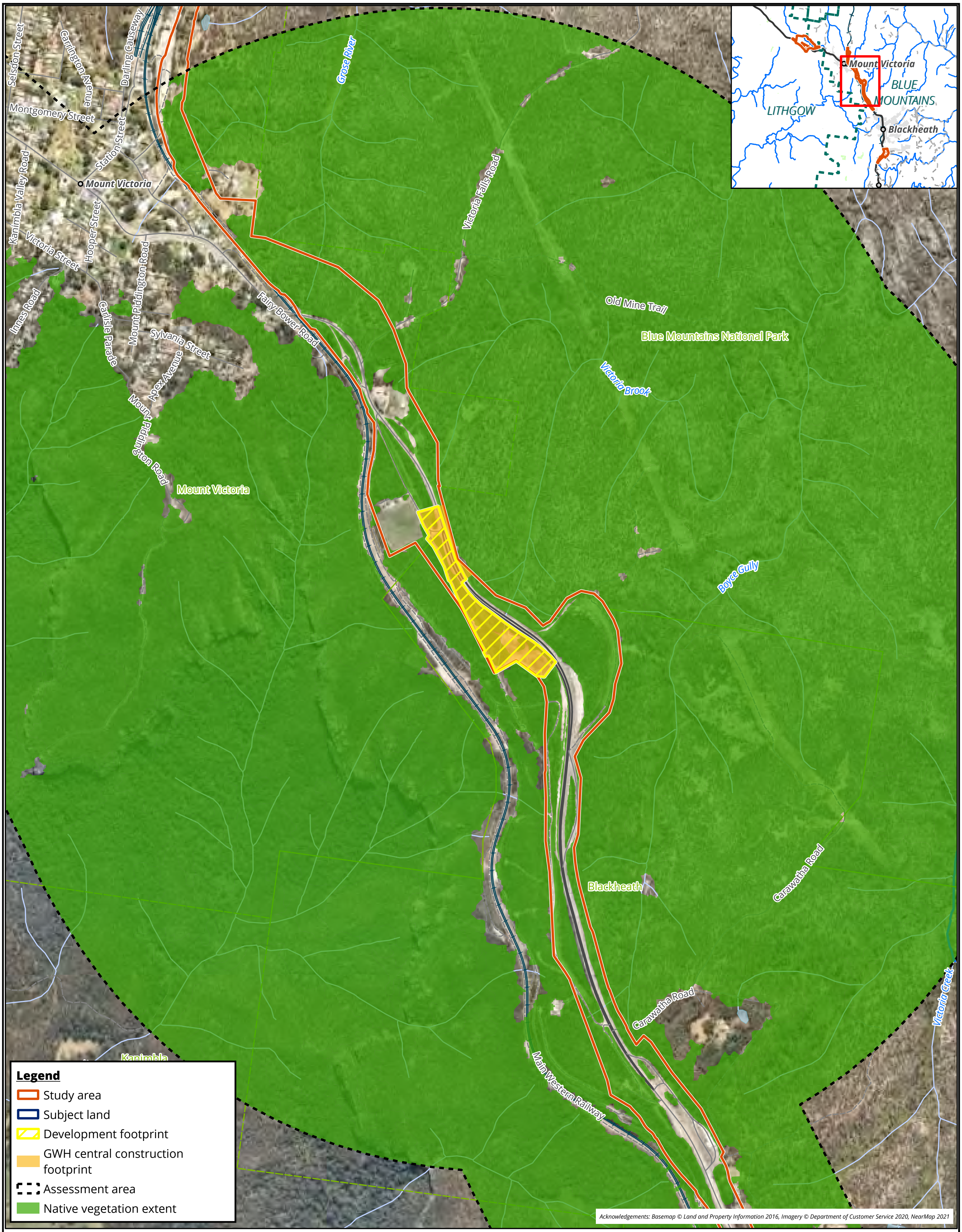


**Figure 3-3 Native vegetation extent**
**Page 3 of 4**

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Coordinate System: GDA 1994 MGA Zone 56

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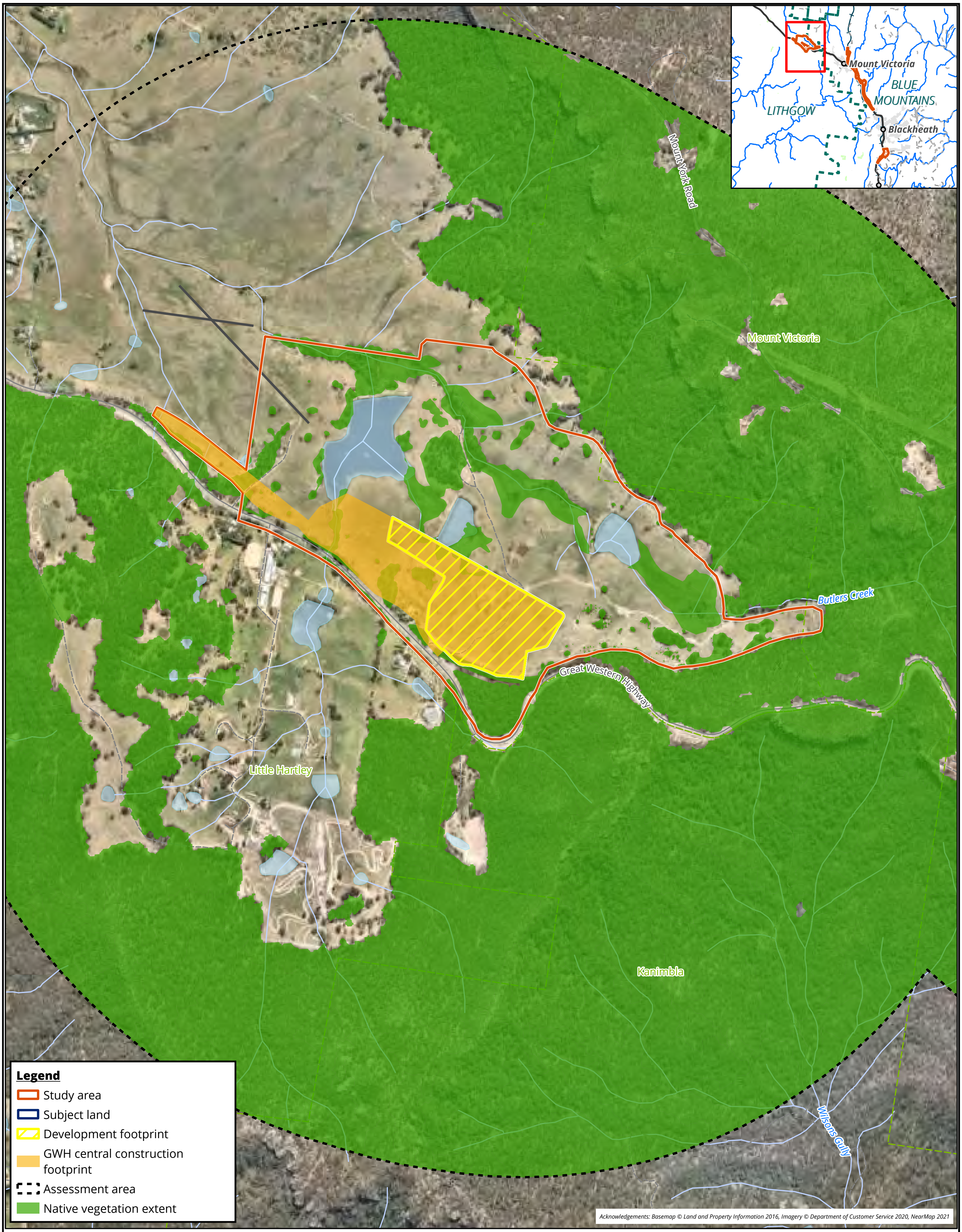


**Figure 3-3 Native vegetation extent**
**Page 4 of 4**

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Scale 1:10,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

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# 4 Native vegetation

The assessment of native vegetation undertaken for this BDAR was completed prior to the refinement of the project's final construction footprint. As such, the field investigations encompassed the study area, a much broader area than was included in the project's final construction footprint. This chapter details the methods and results of the native vegetation field investigations across the study area. This includes the extent of native vegetation within the study area's existing environment across both IBRA subregions (Wollemi and Burragorang), as well as identification of the PCTs and TECs present within the study area. The vegetation integrity score has then be calculated for the areas of native vegetation within the subject land, as required by Section 4 of the BAM (DPIE 2020a).

The study area has an area of approximately 200.12 hectares, of which approximately 87.71 hectares supports native vegetation with varying levels of disturbance. Vegetation that occurs on the interface with the exotic pastureland in the Little Hartley study area generally occurs in a more degraded condition as a result of historical under-scrubbing and ongoing grazing. The remainder of vegetation across the study area is in high condition, except for occasional pockets adjacent to the existing Great Western Highway which have been impacted by historical disturbances. Under-scrubbing has also occurred within the patch of vegetation at the Blackheath study area, however the canopy trees remain, and high threat weed egress is low.

## 4.1 Native vegetation assessment

### 4.1.1 Background research

Existing information regarding native vegetation was reviewed to inform field investigations including:

- the NSW PCTs, as held within the BioNet Vegetation Classification database (DPE 2022a)
- relevant vegetation mapping including:
    - Southeast NSW Native Vegetation Classification and Mapping – SCIVI. VIS_ID 2230 (DPE 2010a)
    - State Vegetation Type Map: Central Tablelands Region Version 1.0. VIS_ID 4778 (DPE 2018)
    - Temperate Highland Peat Swamps on Sandstone (THPSS) spatial distribution maps – VIS_IDs 4480 to 4485 (CoA and Macquarie University 2016).
- existing site reports including:
    - Great Western Highway East – Katoomba to Blackheath Review of Environmental Factors (Transport for NSW 2022a)
    - Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) Review of Environmental Factors (Transport for NSW 2021a)
    - Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) Biodiversity Addendum Report (Transport for NSW 2022b)
    - Great Western Highway Upgrade – Medlow Bath Review of Environmental Factors (Transport for NSW 2021b)
    - Great Western Highway, Blackheath to Little Hartley Scoping Report (Transport for NSW 2021c)
    - Great Western Highway Upgrade, Katoomba to Lithgow – Preliminary Environmental Investigation – September 2020 (Transport for NSW 2020).

Based on the results of the background review and the requirements of the BAM with respect to this BDAR, appropriate surveys in accordance with current survey guidelines were designed for the study area.

### 4.1.2 Mapping extent of native vegetation

The extent of native vegetation within the study area was determined using the results of site investigations and Section 4 of the BAM (DPIE 2020a).

Areas of native vegetation within the current assessment were identified based on the definition of native vegetation provided under Part 5A 60B of the NSW *Local Land Services Act 2013* (LLS Act). Native vegetation therefore includes any of the following types of plants native to NSW as defined under the LLS Act:

*(a) trees (including any sapling or shrub or any scrub)*

*(b) understorey plants*

*(c) groundcover (being any type of herbaceous vegetation)*

*(d) plants occurring in a wetland*

*A plant is native to New South Wales if it was established in New South Wales before European settlement.*

*Native vegetation does not extend to marine vegetation (being mangroves, seagrasses or any other species of plant that at any time in its life cycle must inhabit water other than fresh water).*

Figure 4-1 provides a map of the native vegetation extent recorded within the study area, as assessed during field investigations undertaken from October 2021 to May 2022. The figure includes all areas of native vegetation (native ground cover and areas with canopy) within the study area. Areas not shown as native vegetation cover are considered cleared and/or non-native vegetation. These areas have also been mapped and are addressed further in Section 4.1.5 below.

Mapping the extent of native vegetation involved detailed field mapping and collection of GPS point locations using hand-held (uncorrected) tablet units (Samsung Galaxy Tab X) running the ArcGIS Field Maps application, using the inbuilt GPS, and aerial photo interpretation. Spatial locations are therefore considered to have an accuracy of generally ± five metres.

### 4.1.3 Vegetation identification

A systematic biodiversity assessment was conducted from October 2021 to May 2022 under the terms of Biosis' Scientific Licence issued by the EES under the *National Parks and Wildlife Act 1974* (SL100758, expiry date 30 June 2023).

Assessment in accordance with the BAM was overseen and carried out by Accredited Assessor Jane Raithby-Veall (Accreditation number BAAS 18134). Vegetation identification surveys were undertaken by the Biosis ecologists outlined in Table D-0-1.

Revised PCTs for eastern NSW were publicly released in June 2022 by DPE. These PCTs will not apply to the BOS for a period of at least six months after the public release to allow stakeholders to become familiar with the new scientific data. These PCTs are also not currently available for use within the BAM-C. As such the existing ‘legacy’ PCTs currently available across NSW, as described in the BioNet Vegetation Classification database (DPE 2022a), have been used for this assessment.

The study area was surveyed in accordance with the BAM (DPIE 2020a) which involved:

- the identification and mapping of PCTs according to the structural definitions held in the BioNet Vegetation Classification database (DPE 2022a), with reference to information provided in reference mapping for the study area (DPE 2010a, DPE 2018)

- undertaking floristic plots within each vegetation zone in accordance with Section 4 of the BAM (DPIE 2020a), considering varying condition states and avoidance of ecotones, areas of disturbance, and edges
- the identification of native and exotic plant species, according to the Flora of NSW (Harden 1992, 1993, 2000, 2002) with reference to recent taxonomic changes
- targeted searches for plant species of conservation significance according to Surveying threatened plants and their habitats (DPIE 2020b)
- incidental observations using the “random meander” method (Cropper 1993)
- identification of previous and current factors threatening the ecological function and survival of native vegetation within and adjacent to the development site
- an assessment of the natural resilience of the vegetation of the site.

The conservation significance of plant species and plant communities was determined according to:

- BC Act for significance within NSW
- EPBC Act for significance within Australia.

The process of vegetation identification commenced with a review of regional vegetation mapping datasets, prior to the field investigations to identify patches of native vegetation and potential PCTs as a starting point for the field investigations. These areas were validated and refined during field investigations, with areas of native vegetation for which a PCT could validly be assigned being identified and delineated in the field, and their condition determined and assigned. Broad condition states (and therefore vegetation zones) were assigned in the field, based on the presence of *relatively homogeneous areas of native vegetation that were the same PCT and in the same broad condition state* (DPIE 2020a). In accordance with Section 4.3.1of the BAM, condition classes were assigned from recorded observations of tree, shrub and ground cover, grazing pressure and weed extent. The factors used to assign a condition class to each PCT are described in Table 4-1.

Table 4-1: Criteria used to assign vegetation condition class

| Condition class | Criteria |
|---|---|
| **Non-native exotic grassland** | Ground layer dominated by exotics, no native overstorey present.<br>If trees are present in the overstorey they are non-native or outside of known species range. |
| **Non-native planted/urban vegetation** | Clearly modified vegetation that is subject to regular maintenance, such as slashing.<br>Vegetation species composition not composed of locally occurring species. |
| **Native vegetation – low condition** | Low canopy cover, young age class of trees (regrowth), moderate shrub and ground layer diversity.<br>No old growth canopy trees.<br>Grazing pressure moderate to high.<br>Moderate to high presence of exotic species. |
| **Native vegetation – moderate condition** | Generally intact canopy cover, advanced tree age class, moderate to high shrub and ground layer diversity.<br>Limited old growth canopy trees with hollows.<br>Grazing pressure low.<br>Low cover of exotic species. |
| **Native vegetation – high condition** | High structural and floristic diversity.<br>Old growth canopy trees with hollows present.<br>Grazing pressure very low to absent. |

Following the field investigation, botanists confirmed these mapped PCTs and condition classes and also identified the remaining PCTs that could not be assigned during the field investigation.

This involved a process whereby the NSW PCT descriptions detailed in the NSW BioNet Vegetation Classification database (DPE 2022a) (including floristic assemblages, landscape position, soils and other determining variables) were compared to the collected floristic plot data and vegetation boundaries mapped in the field in order to confirm the final PCT status.

### 4.1.4 Local data

No local data has been used in the preparation of this BDAR. Benchmark data contained within the BAM-C for the PCTs present within the study area was used.

### 4.1.5 Non-native vegetation

The definition of native vegetation applied in this BDAR is consistent with that of the LLS Act. Areas mapped as non-native vegetation or exotic pasture grassland (Figure 4-1) either do not meet this definition or display a level of disturbance meaning that a PCT could not reliably be assigned. These latter areas are generally those that have been previously cleared and contain no native vegetation cover in the upper and middle stratum.

The Little Hartley study area contains the largest quantity of non-native vegetation, present as exotic pasture grassland. Approximately 72.08 hectares of this vegetation occurs within this area. A total of 78.14 hectares of non-native vegetation occurs across the entirety of the study area. In the other sections of the study area, outside of the Little Hartley area, areas of non-native vegetation occur within urban areas and consist of street trees, urban parks and other patches of planted vegetation that could provide habitat for native species. A total of 11.02 hectares of non-native vegetation occurs within the development footprint and will be directly impacted by the project.

Three vegetation plots were collected in the exotic pasture grassland located in the Little Hartley study area (B2L.08, B2L.12 and B2L.14) in order to confirm the non-native community status of this vegetation. While the percent cover of native vegetation in plot B2L.08 and B2L.12 were reasonably high (18 % and 27 % respectively), the majority of this cover is being driven by the presence of Couch *Cynodon dactylon* which, while native, is a widespread and very common species across NSW that is widely cultivated as a lawn grass and often used as a pasture grass (RBGDT 2022). Couch accounted for 10 % of the native vegetation in B2L.08 and 20 % of the native vegetation in B2L.12. Due to the widespread nature and cultivation of this species the presence of this native species alone is not sufficient to assign it to a PCT.

Native vegetation percent cover in plot B2L.14 was 37.3 %, largely driven by the presence of Weeping Grass *Microlaena stipoides* (25 %) and *Poa affinis* (10 %). Native species were recorded at a low species richness (six grass species in total), which includes Couch, present at 2 % cover. However, there is a greater richness and cover of exotic species within the plot, including 17 exotic species, and a total cover of 45.8 %. Common exotic species include; Parramatta Grass *Sporobolus africanus* (30 %), *Setaria parviflora* (5 %) and *Paspalum dilatatum* (5 %). If Couch is considered a non-native pasture grass, then the exotic species cover represented in the plot, increases further, well above the native species cover, and the exotic species richness is more than three time that of exotics. While it is acknowledged that plot B2L.14 supports native species at more than a negligible level of cover, it is considered that this plot is representative of the variation that exists across the very large areas of exotic pasture, which will in places support some disturbance tolerant native groundcover species. Furthermore, the groundcover does not support sufficient native species cover or abundance to be considered a derived native grassland, and overall the vegetation cover is >50 % exotic.

In accordance with Section 4.1.2 of the BAM (DPIE 2020a), areas mapped as non-native vegetation within Figure 4-1, and which do not provide habitat for threatened species in accordance with Section 5 of the BAM, have not been assessed further in this BDAR. No areas of non-native vegetation have been determined to constitute habitat for threatened species in accordance with Section 5.2.6 of the BAM. As such further assessment of non-native vegetation in accordance with Section 6.1.2 of the BAM (Prescribed Impacts) is not required.

### 4.1.6 Limitations

It is a recognised limitation that not all species present within an area are detectable at any one time or year over year. The random meander and plot-based surveys undertaken were carried out across varying seasons (spring, summer and autumn) providing a list of flora species readily detectable for those points in time. Repeated survey at the same locations over several seasons or years during ranging weather conditions may be required to detect all the species present. Therefore, the cover and abundance of native species recorded within each plot is assuredly less than what is truly present. As cover and abundance of native species is a key contributor to calculating vegetation integrity, the vegetation integrity scores for each vegetation zone within the subject land are limited by the season in which the plot data was collected.

## 4.2 Plant community types

The PCTs assessed as present within the study area are outlined in Table 4-2. Profiles for each mapped PCT are also provided in the subsequent sections.

Table 4-2: PCTs identified within the study area

| PCT | Extent within the study area (ha) | Extent within the development footprint (ha) |
|---|---|---|
| **Wollemi subregion** | | |
| PCT 708 Blue Mountains Mallee Ash - Dwarf Casuarina heath of the upper Blue Mountains, Sydney Basin Bioregion. | 2.51 | 1.80 |
| PCT 1078 Prickly Tea-tree - sedge wet heath on sandstone plateaux, central and southern Sydney Basin Bioregion. | 0.06 | 0 |
| PCT 1248 Sydney Peppermint - Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin Bioregion. | 58.39 | 7.29 |
| PCT 1740 Tall Spike Rush freshwater wetland. | 0.02 | 0 |
| **Burragorang subregion** | | |
| PCT 766 Carex sedgeland of the slopes and tablelands | 7.48 | 0.43 |
| PCT 1256 Tableland swamp meadow on impeded drainage sites of the western Sydney Basin Bioregion and South Eastern Highlands Bioregion. | 2.86 | 0 |
| PCT 1615 Monkey Gum - *Eucalyptus blaxlandii* shrubby open forest on basalt of the Sydney Basin. | 16.26 | 0.19 |
| PCT 1740 Tall Spike Rush freshwater wetland. | 0.13 | 0 |
| **Total native vegetation** | **87.71** | **9.71** |

### 4.2.1 PCT 708 Blue Mountains Mallee Ash - Dwarf Casuarina heath of the upper Blue Mountains, Sydney Basin Bioregion

#### PCT overview:

An overview of the PCTs is provided in Table 4-3 below, followed by a general description of the PCT based on its occurrence in the study area, supported by information from the NSW BioNet Vegetation Classification database (DPE 2022a) as required.

Table 4-3: Overview of PCT 708 Blue Mountains Mallee Ash - Dwarf Casuarina heath of the upper Blue Mountains, Sydney Basin Bioregion

| | |
|---|---|
| **PCT ID** | 708 |
| **PCT name** | Blue Mountains Mallee Ash - Dwarf Casuarina heath of the upper Blue Mountains, Sydney Basin Bioregion |
| **Vegetation formation** | Heathlands |
| **Vegetation class** | Sydney Montane Heaths |
| **Per cent cleared value (%)** | 5 |
| **Extent within study area (ha)** | 2.51 |

#### Description:

PCT 708 is characterised by a variable open to dense shrub canopy with emergent mallees and a groundcover of native sedges and forbs. It typically occupies areas of shallow, damp sandy loam on exposed Narrabeen sandstone plateaux at 600 to 1,150 metres above sea level (ASL), where mean annual rainfall varies from 1,000 to 1,350 millimetres (DPE 2022a).

Within the study area the canopy in both the high and moderate vegetation zones is dominated by Blue Mountains Mallee Ash *Eucalyptus stricta*. The middle stratum consists predominantly of; Dwarf She-oak, Heath-leaved Banksia *Banksia ericifolia,* Flaky-barked Tea-tree *Leptospermum trinervium,* Tantoon *Leptospermum polygalifolium*, and Conesticks *Petrophile pulchella.* Characteristic ground stratum species include; Blue Dampiera *Dampiera stricta,* Daisy Goodenia *Goodenia bellidifolia,* Blue Ridge Pale Mat Rush *Lomandra glauca* and Purple Flag *Patersonia sericea*. The moderate condition class had slightly less native cover with exotic shrub species present, such as; Spanish Heath *Erica lusitanica* and exotic ground cover species, such as Garden Coreopsis *Coreopsis lanceolata,* Catsear *Hypochaeris radicata* and Plantain *Plantago lanceolata.*

#### Vegetation condition:

This community was present in high and moderate condition states. Native vegetation was dominant in all stratum, with a dense shrub canopy evident in areas of high condition and a high native cover and richness. The moderate condition areas were located on the edge of roadways and had consequently had a greater presence of exotics (edge effected). Older growth canopy in these areas was also reduced.

#### PCT justification:

Potential areas of this PCT within the study area were initially identified during the background research stage, which included review of regional vegetation mapping as well as aerial imagery to identify potential areas of native vegetation. During the field investigation the area mapped as PCT 708 within the study area was found to align with the following diagnostic characteristics described within the BioNet Vegetation Classification database (DPE 2022a):

- occurs within the Burragorang and Wollemi IBRA subregions of the Sydney Basin bioregion

- occurs in the upper Blue Mountains within the expected altitudinal range of 600 to 1,150 metres
- occurs on exposed sandstone plateaux
- dominant species Blue Mountain Mallee Ash
- includes characteristic native species which align with this PCT.

The diagnostic species Blue Mountains Mallee Ash was recorded in both condition states and the remaining floristic composition of the plot data aligns strongly with the BioNet profile for PCT 708. Final assignment of this PCT was based on the diagnostic characteristics detailed above and interrogation of characteristic floristic species recorded from the vegetation plot data, using the diagnostic spreadsheet tools available from the BioNet Vegetation Classification database (DPE 2022a).

The floristic and structural summary of PCT 708 within the study area is provided in Table 4-4. High condition vegetation is shown in Photo 4-1 and moderate condition vegetation is shown in Photo 4-2.

Table 4-4: Floristic and structural summary of PCT 708 within the study area

| Growth form | Dominant species | |
|---|---|---|
| | Common name | Species name |
| Trees | Blue Mountains Mallee Ash | *Eucalyptus stricta* |
| Shrubs | Dwarf She-oak<br>Heath-leaved Banksia<br>Variable Smoke-bush<br>Coast Coral Heath<br>Flaky-barked Tea-tree<br>Conesticks | *Allocasuarina nana*<br>*Banksia ericifolia*<br>*Conospermum taxifolium*<br>*Epacris microphylla*<br>*Leptospermum trinervium*<br>*Petrophile pulchella* |
| Grass and grasslike | Blue Ridge Pale Mat Rush | *Lomandra glauca* |
| Forb | Blue Dampiera<br>Daisy Goodenia | *Dampiera stricta*<br>*Goodenia bellidifolia* |

Similar PCTs that were considered, and ultimately rejected, as part of the PCT determination of the best fit are included in Table 4-5. These rejections were made based on the PCT data detailed within the BioNet Vegetation Classification database (DPE 2022a).

Table 4-5: Similar PCTs considered during the determination of PCT 708

| Similar PCTs | | Justification for PCT rejection (BioNet PCT data) |
|---|---|---|
| PCT ID | PCT name | |
| 1078 | Prickly Tea-tree - sedge wet heath on sandstone plateaux, central and southern Sydney Basin Bioregion | • Characteristic Prickly Tea-tree of this PCT missing from dominant species of community within the study area. |
| 1256 | Tableland swamp meadow on impeded drainage sites of the western Sydney Basin Bioregion and South Eastern Highlands Bioregion | • An upper stratum is present in the community within the study area, yet no upper stratum described in scientific description of PCT 1256.<br>• Weak floristic matches in middle and ground stratums.<br>• Landscape positioning a poor match. Community occurs on the plateau's as opposed to valley floors described in scientific description of PCT 1256. |

### Conservation status:

Not consistent with any TECs listed under the BC Act or EPBC Act.

Photo 4-1: High condition PCT 708 within the study area

Photo 4-2: Moderate condition PCT 708 within the study area

## 4.2.2 PCT 766 Carex sedgeland of the slopes and tablelands

### PCT overview:

An overview of the PCT is provided in Table 4-6 below, followed by a general description of the PCT based on its occurrence in the study area, supported by information from the NSW BioNet Vegetation Classification database (DPE 2022a) as required.

Table 4-6: Overview of PCT 766 Carex sedgeland of the slopes and tablelands

| | |
|---|---|
| **PCT ID** | 766 |
| **PCT name** | Carex sedgeland of the slopes and tablelands |
| **Vegetation formation** | Freshwater wetlands |
| **Vegetation class** | Montane Bogs and Fens |
| **Per cent cleared value (%)** | 75 |
| **Extent within study area (ha)** | 7.48 |

### Description:

PCT 766 is typically associated in drainage depressions in valleys with undulating terrain above 400 to 500 metres in elevation (DPE 2022a, NSW Scientific Committee 2021). Within the study area the moderate condition vegetation demonstrated a high abundance of native grasses and forbs including; Tall Sedge *Carex appressa*, Common Rush *Juncus usitatus*, *Juncus sarophorus*, Nodding Club-rush *Isolepis cernua,* Tussock Grass *Poa labillardierei* var. *labillardierei* and Swamp Millet *Isachne globosa*. Areas of moderate condition vegetation also included some exotic species with; Blackberry, Paspalum and *Isolepis prolifera* having the highest abundance. Areas of low condition vegetation exhibited a lack of *Carex* spp., and were instead dominated by Tussock Grass and *Juncus* spp. Native species cover was also generally lower with an increased richness of exotic species.

### Vegetation condition:

This community was present in moderate and low condition states. Areas of moderate condition had a high cover of native species however presence of exotic species prevented a higher condition classification. Low condition areas still retained a relatively high cover of native species however exotic species richness and cover was generally higher.

### PCT justification:

PCT 766 is listed as being associated with the NSW Southern Western Slopes, Nandewar and Brigalow Belt South IBRA bioregions within the NSW BioNet Vegetation Classification database (DPE 2022a). While the PCT is not associated with the Sydney Basin IBRA region in BioNet, it is still considered to be the best fit for the native vegetation within the study area based on the following diagnostic characteristics (DPE 2022a):

- includes characteristic native species which align with this PCT including Tall Sedge, several characteristic perennial herb species such as *Juncus sarophorus*, *Juncus prismatocarpus, Juncus planifolius* and Tussock Grass
- occurs within the accepted landform for this community being drainage depressions in valley landscapes at altitudes over 500 m.

The PCT is also associated with the TEC *Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions* which is known to occur within the Sydney Basin region.

Final assignment of this PCT was based on the diagnostic characteristics detailed above and interrogation of characteristic floristic species recorded from the vegetation plot data, using the diagnostic spreadsheet tools available from the BioNet Vegetation Classification database (DPE 2022a).The floristic and structural summary of PCT 766 within the study area is provided in Table 4-7. Moderate condition vegetation is shown in Photo 4-3 and low condition vegetation is shown in Photo 4-4.

Table 4-7: Floristic and structural summary of PCT 766 within the study area

| Growth form | Dominant species | |
|---|---|---|
| | **Common name** | **Species name** |
| Grass and grass-like | Tall Sedge<br>Couch<br>Nodding Club-rush<br>*Juncus planifolius*<br>*Juncus sarophorus*<br>Common Rush<br>Swamp Millet<br>Tussock Grass | *Carex appressa*<br>*Cynodon dactylon*<br>*Isolepis cernua*<br>*Juncus planifolius*<br>*Juncus sarophorus*<br>*Juncus usitatus*<br>*Isachne globosa*<br>*Poa labillardierei* var. *labillardierei* |
| Forb | *Gonocarpus micranthus*<br>*Haloragis heterophylla*<br>Ivy-leaved Violet | *Gonocarpus micranthus*<br>*Haloragis heterophylla*<br>*Viola caleyana* |

Similar PCTs that were considered, and ultimately rejected, as part of the PCT determination of the best fit are included in Table 4-8. These rejections were made based on the PCT data detailed within the BioNet Vegetation Classification database (DPE 2022a).

Table 4-8: Similar PCTs considered during the determination of PCT 766

| Similar PCTs | | Justification for PCT rejection (BioNet PCT data) |
|---|---|---|
| **PCT ID** | **PCT name** | |
| 951 | Mountain Gum – Manna Gum open forest of the South Eastern Highlands Bioregion | • PCT 951 outlines three diagnostic canopy species, however the community present in study area has no canopy species at all.<br>• PCT was considered due to high number of matching ground stratum species detailed within the scientific description of the PCT held within BioNet Vegetation Classification database.<br>• PCT rejected due to being restricted to the South Eastern Highland IBRA bioregion. |
| 1256 | Tableland swamp meadow on impeded drainage sites of the western Sydney Basin Bioregion and South Eastern Highlands Bioregion | • Floristics did not fully match this PCT in the various strata.<br>• A dominance of *Carex appressa* and *Juncus* spp. was therefore considered a stronger match for PCT 766.<br>• Areas of small creek lines and soaks in the higher reaches of the sub catchment area, were determined to be modified/derived communities and were therefore not considered to be a match. |

### Conservation status:

NSW BC Act EEC: *Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions* (EEC).

Justification: The vegetation supports flora species characteristic of the BC Act TEC, occurs in the correct geographic location, and occurs as a swamp community supported by areas of impeded drainage lines on valley floors.

The vegetation (PCT 766) within the study area does not satisfy the condition thresholds of the associated EPBC Act *Natural Temperate Grassland of the South Eastern Highlands* (Critically Endangered Ecological Community [CEEC]). Principally, the vegetation does not include a foliage cover of at least 50 per cent for any of the following key characteristic associated species; Kangaroo Grass *Themeda triandra*, Tussock Grass *Poa labillardierei* and *Carex bichenoviana* (Threatened Species Scientific Committee 2016a).

Photo 4-3: Moderate condition PCT 766 within the study area

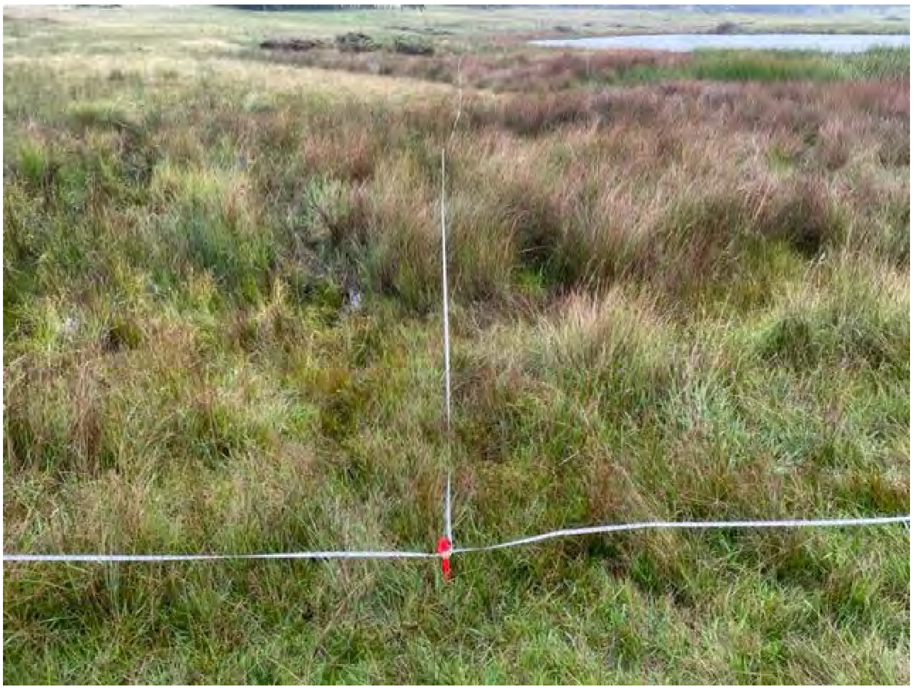

Photo 4-4: Low condition PCT 766 within the study area

### 4.2.3 PCT 1078 Prickly Tea-tree - sedge wet heath on sandstone plateaux, central and southern Sydney Basin Bioregion

#### PCT overview

An overview of the PCT is provided in Table 4-9 below, followed by a general description of the PCT based on its occurrence in the study area, supported by information from the NSW BioNet Vegetation Classification database (DPE 2022a) as required.

Table 4-9: Overview of PCT 1078 Prickly Tea-tree - sedge wet heath on sandstone plateaux, central and southern Sydney Basin Bioregion

| | |
|---|---|
| **PCT ID** | 1078 |
| **PCT name** | Prickly Tea-tree - sedge wet heath on sandstone plateaux, central and southern Sydney Basin Bioregion |
| **Vegetation formation** | Freshwater wetlands |
| **Vegetation class** | Coastal Heath Swamps |
| **Per cent cleared value (%)** | 5 |
| **Extent within study area (ha)** | 0.06 |

### Description:

PCT 1078 occurs from the Blue Mountains to the Morton Plateau on the Narrabeen and Shoalhaven soils groups. The community usually exhibits an open shrub canopy with a dense groundcover of sedges and forbs. It occurs on humic sandstone soils in headwater valleys of sandstone plateaux at altitudes of 450 to 1,100 metres (DPE 2022a).

Within the study area the community exhibited the characteristic midstorey species Heath-Leaved Banksia and Prickly Tea-Tree *Leptospermum juniperinum.* Characteristic ground cover species include; Forked Sundew *Drosera binata,* Wire Rush *Empodisma minus,* Buttongrass *Gymnoschoenus sphaerocephalus,* Swordsedge *Lepidosperma limicola,* Slender-Twine Rush *Leptocarpus tenax* and Tall Yellow Eye *Xyris operculata*.

### Vegetation condition:

This community was present in a high condition state within one small patch within the study area. Little evidence of weed invasion or substantial erosion/sedimentation was present.

### PCT justification:

Potential areas of this PCT within the study area were initially identified during the background research stage, which included review of regional vegetation mapping as well as aerial imagery to identify potential areas of native vegetation. During the field investigation the area mapped as PCT 1078 within the study area was found to align with the following diagnostic characteristics described within the BioNet Vegetation Classification database (DPE 2022a):

- occurs within the Burragorang and Wollemi IBRA subregions of the Sydney Basin bioregion
- occurs within the expected altitudinal range of 450 to 1,100 metres
- occurs over the correct soils
- includes characteristic native species which align with this PCT.

Final assignment of this PCT was based on the diagnostic characteristics detailed above and interrogation of characteristic floristic species recorded from the vegetation plot data, using the diagnostic spreadsheet tools available from the BioNet Vegetation Classification database (DPE 2022a).

The floristic and structural summary of PCT 1078 within the study area is provided in Table 4-10. High condition vegetation is shown in Photo 4-5.

Table 4-10: Floristic and structural summary of PCT 1078 within the study area

| Growth form | Dominant species | |
|---|---|---|
| | Common name | Species name |
| Trees | Scribbly Gum<br>Silvertop Ash | *Eucalyptus haemastoma*<br>*Eucalyptus sieberi* |
| Shrubs | Heath-leaved Banksia<br>Prickly Tea-Tree | *Banksia ericifolia*<br>*Leptospermum juniperinum* |
| Grass and grass-like | Wire Rush<br>Buttongrass<br>Swordsedge<br>Slender-Twine Rush<br>Tall Yellow Eye | *Empodisma minus*<br>*Gymnoschoenus sphaerocephalus*<br>*Lepidosperma limicola*<br>*Leptocarpus tenax*<br>*Xyris operculata* |
| Forb | Forked Sundew | *Drosera binata* |
| Fern | Fishbone Water Fern<br>Pouched Coral Fern | *Blechnum nudum*<br>*Gleichenia dicarpa* |

Similar PCTs that were considered, and ultimately rejected, as part of the PCT determination of the best fit are included in Table 4-11. These rejections were made based on the PCT data detailed within the BioNet Vegetation Classification database (DPE 2022a).

Table 4-11: Similar PCTs considered during the determination of PCT 1078

| Similar PCTs | | Justification for PCT rejection (BioNet PCT data) |
|---|---|---|
| PCT ID | PCT name | |
| 708 | Blue Mountains Mallee Ash - Dwarf Casuarina heath of the upper Blue Mountains, Sydney Basin Bioregion | • Characteristic Dwarf Casuarina was absent from community present in study area.<br>• Weak floristic matches in middle and ground stratums. |
| 1256 | Tableland swamp meadow on impeded drainage sites of the western Sydney Basin Bioregion and South Eastern Highlands Bioregion | • Weak floristic matches in middle and ground stratums.<br>• Landscape positioning a poor match. Community occurs on the plateau's as opposed to valley floors described in scientific description of PCT 1256. |

### Conservation status:

NSW BC Act VEC: *Blue Mountains Swamps in the Sydney Basin Bioregion*.

Justification: The vegetation supports flora species characteristic of the BC Act TEC, occurs in the correct geographic location, and occurs as a swamp community supported by areas of impeded drainage.

Photo 4-5: High condition PCT 1078 within the study area

### 4.2.4 PCT 1248 Sydney Peppermint - Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin Bioregion

#### PCT overview:

An overview of the PCT is provided in Table 4-12 below, followed by a general description of the PCT based on its occurrence in the study area, supported by information from the NSW BioNet Vegetation Classification database (DPE 2022a) as required.

Table 4-12: Overview of PCT 1248 Sydney Peppermint - Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin Bioregion

| | |
|---|---|
| **PCT ID** | 1248 |
| **PCT name** | Sydney Peppermint - Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin Bioregion |
| **Vegetation formation** | Dry Sclerophyll Forests (Shrubby sub-formation) |
| **Vegetation class** | Sydney Montane Dry Sclerophyll Forests |
| **Per cent cleared value (%)** | 20 |
| **Extent within study area (ha)** | 58.39 |

#### Description:

PCT 1248 is characterised by low-open forest or woodland with abundant sclerophyll shrubs, and a groundcover of sedges and forbs. The community is restricted to the upper Blue Mountains plateau north of the Kedumba Valley and extends beyond Bell. It occurs on sandy loams derived from Narrabeen sandstone between 650 and 1,050 metres ASL in areas with a mean annual rainfall of 1,000 and 1,400 millimetres (DPE 2022a).

Within the study area the canopy was dominated by characteristic eucalyptus species including; Sydney Peppermint, Silvertop Ash, Narrow-Leaved Peppermint *Eucalyptus radiata,* Hard-leaved Scribbly Gum and Narrow-Leaved Stringybark *Eucalyptus sparsifolia*. Characteristic middle stratum species included; Saw Banksia *Banksia serrata,* Hairpin Banksia *Banksia spinulosa,* Gorse Bitter Pea *Daviesia ulicifolia,* Finger Hakea *Hakea dactyloides,* Broad-Leaved Drumsticks *Isopogon anemonifolius,* Mountain Devil *Lambertia formosa*, Flaky Barked Tea-Tree, Crinkle Bush *Lomatia silaifolia,* Prickly Broom Heath *Monotoca scoparia,* Laurel Geebung *Persoonia laurina,* Broad-leaved Geebung, Carrot Tops *Platysace linearifolia* and Waratah *Telopea speciosissima.* Ground stratum species included; Variable Bossiaea *Bossiaea heterophylla,* Curly Wig *Caustis flexuosa,* Blue Dampiera, Wiry Panic *Entolasia stricta,* Blue Ridge Pale Mat Rush, *Lomandra obliqua,* Purple Flag, Bracken Fern *Pteridium esculentum* and Woolly Xanthosia *Xanthosia pilosa.*

### Vegetation condition:

This community was present in high, moderate and low condition states. High condition vegetation had good cover and richness of native species, approaching benchmark condition in some areas. Moderate condition vegetation similarly had a good representation of native species however tended to be under-scrubbed allowing for some weed encroachment. Low quality vegetation had an even greater abundance of exotic species which had further degraded the community.

### PCT justification:

Potential areas of this PCT within the study area were initially identified during the background research stage, which included review of regional vegetation mapping as well as aerial imagery to identify potential areas of native vegetation. During the field investigation the areas mapped as PCT 1248 within the study area were found to align with the following diagnostic characteristics described within the BioNet Vegetation Classification database (DPE 2022a):

- occurs within the Burragorang and Wollemi IBRA subregions of the Sydney Basin bioregion
- occurs on the Narrabeen soil landscape, on soils consisting of predominately sandstone
- occurs in the upper Blue Mountains within the expected altitudinal range of 600 to 1,050 m
- includes dominant canopy species Silvertop Ash and Sydney Peppermint
- includes characteristic native species which align with this PCT.

Final assignment of this PCT was based on the diagnostic characteristics detailed above and interrogation of characteristic floristic species recorded from the vegetation plot data, using the diagnostic spreadsheet tools available from the BioNet Vegetation Classification database (DPE 2022a).

The floristic and structural summary of PCT 1248 within the study area is provided in Table 4-13. High condition vegetation is shown in Photo 4-6, moderate condition in Photo 4-7 and low condition in Photo 4-8.

Table 4-13: Floristic and structural summary of PCT 1248 within the study area

| Growth form | Dominant species | |
|---|---|---|
| | Common name | Species name |
| Trees | Narrow-leaved Peppermint<br>Silvertop Ash<br>Sydney Peppermint | *Eucalyptus radiata*<br>*Eucalyptus sieberi*<br>*Eucalyptus piperita* |
| Shrubs | Flaky Barked Tea-Tree<br>Broad-leaved Geebung<br>Crinkle Bush<br>Waratah<br>Broad-leaved Drumsticks<br>Finger Hakea | *Leptospermum trinervium*<br>*Persoonia levis*<br>*Lomatia silaifolia*<br>*Telopea speciosissima*<br>*Isopogon anemonifolius*<br>*Hakea dactyloides* |
| Grass | Wiry Panic | *Entolasia stricta* |

| Growth form | Dominant species | |
|---|---|---|
| | Common name | Species name |
| Forb | Variable Bossiaea<br>Blue Ridge Pale Mat Rush | *Bossiaea heterophylla*<br>*Lomandra glauca* |
| Fern | Common Bracken | *Pteridium esculentum* |

Similar PCTs that were considered, and ultimately rejected, as part of the PCT determination of the best fit are included in Table 4-14. These rejections were made based on the PCT data detailed within the BioNet Vegetation Classification database (DPE 2022a).

Table 4-14: Similar PCTs considered during the determination of PCT 1248

| Similar PCTs | | Justification for PCT rejection (BioNet PCT data) |
|---|---|---|
| PCT ID | PCT name | |
| 1247 | Sydney Peppermint - Narrow-leaved Peppermint shrubby open forest on sheltered slopes of the Newnes Plateau, Sydney Basin Bioregion | • Canopy species detailed in BioNet Vegetation Classification database were a weaker match than PCT 1248.<br>• Nearest geographic location being the Newnes Plateau, was a weaker geographic match. |
| 1249 | Sydney Peppermint - Silvertop Ash shrubby low open forest of the upper Blue Mountains | • PCTs 1249 and 1248 are floristically very similar.<br>• PCT 1248 amalgamates several of the map units described in The Vegetation of the Western Blue Mountains (DEC 2006) which were considered to be present within the study area.<br>• Landscape match (open forests) not as strong as PCT 1248 (sandstone ridges of the upper Blue Mountains). |

### Conservation status:

Not consistent with any TECs listed under the BC Act or EPBC Act.

Photo 4-6: High condition PCT 1248 within the study area

Photo 4-7: Moderate condition PCT 1248 within the study area


Photo 4-8: Low condition PCT 1248 within the study area

### 4.2.5 PCT 1256 Tableland swamp meadow on impeded drainage sites of the western Sydney Basin Bioregion and South Eastern Highlands Bioregion

#### PCT overview:

An overview of the PCT is provided in Table 4-15 below, followed by a general description of the PCT based on its occurrence in the study area, supported by information from the NSW BioNet Vegetation Classification database (DPE 2022a) as required.

Table 4-15: Overview of PCT 1256 Tableland swamp meadow on impeded drainage sites of the western Sydney Basin Bioregion and South Eastern Highlands Bioregion

| | |
|---|---|
| **PCT ID** | 1256 |
| **PCT name** | Tableland swamp meadow on impeded drainage sites of the western Sydney Basin Bioregion and South Eastern Highlands Bioregion |
| **Vegetation formation** | Freshwater Wetlands |
| **Vegetation class** | Montane Bogs and Fens |
| **Per cent cleared value (%)** | 85 |
| **Extent within study area (ha)** | 2.86 |

#### Description:

PCT 1256 is characterised by a variable open to dense shrub canopy with a dense groundcover of water-tolerant, soft-leaved sedges and forbs. It typically occurs on peats and humic loams in sediment-filled valleys of up to 1,000 metres in the western Blue Mountains and Southern Tablelands. Vegetation structure and species composition of PCT 1256 varies locally in response to water table gradients. It is restricted to deep, waterlogged peats and humic loams in sediment-filled valleys 200 to 1,100 metres ASL where mean annual rainfall is 700 to 1,300 millimetres. (DPE 2022a).

Within the study area, the moderate condition vegetation had high native species richness and cover with some exotic species prevailing. A tree and shrub layer of Blackwood, Prickly Tea Tree and River Tea Tree *Leptospermum obovatum* was present, over a predominantly native ground cover species including; Tussock Grass, Weeping Grass, Wiry Panic *Entolasia stricta* and *Juncus spp.* Dominant exotic species included: Sweet Vernal Grass *Anthoxanthum odoratum,* Catsear, Paspalum and Blackberry.

The low condition zone consisted of similar characteristic native species however was with a greater occurrence of exotic species, particularly Blackberry and Paspalum.

### Vegetation condition:

This community was present in moderate and low condition states. Areas of moderate condition had a high cover of native species however presence of exotic species prevented a higher condition classification. Low condition areas still retained a relatively high cover of native species however weed egress was more apparent, particularly by larger shrub species such as Blackberry.

### PCT justification:

Potential areas of this PCT within the study area were initially identified during the background research stage, which included review of regional vegetation mapping (CoA and Macquarie University 2016) as well as aerial imagery to identify potential areas of native vegetation. During the field investigation the areas mapped as PCT 1256 within the study area were found to align with the following diagnostic characteristics described within the BioNet Vegetation Classification database (DPE 2022a):

- occurs within the Burragorang and Wollemi IBRA subregions of the Sydney Basin bioregion
- occurs within the expected landscape position of a sediment-filled valley, at the base of Mount Victoria (western Blue Mountains) at an elevation of 850 m
- includes characteristic native species which align with this PCT.

Final assignment of this PCT was based on the diagnostic characteristics detailed above and interrogation of characteristic floristic species recorded from the vegetation plot data, using the diagnostic spreadsheet tools available from the BioNet Vegetation Classification database (DPE 2022a).

The floristic and structural summary of PCT 1256 within the study area is provided in Table 4-16. Moderate condition vegetation is shown in Photo 4-9.

Table 4-16: Floristic and structural summary of PCT 1256 within the study area

| Growth form | Dominant species | |
|---|---|---|
| | Common name | Species name |
| Shrubs | Blackwood<br>Prickly Tea-Tree<br>River Tea Tree | *Acacia melanoxylon*<br>*Leptospermum juniperinum*<br>*Leptospermum obovatum* |
| Grass and grass-like | Wiry Panic<br>*Juncus planifolius*<br>*Juncus prismatocarpus*<br>Common Rush<br>Weeping Grass<br>Tussock Grass | *Entolasia stricta*<br>*Juncus planifolius*<br>*Juncus prismatocarpus*<br>*Juncus usitatus*<br>*Microlaena stipoides*<br>*Poa labillardierei* var. *labillardierei* |
| Forb | Native Geranium | *Geranium solanderi* |
| Exotic | Sweet Vernal Grass<br>Phalaris<br>Blackberry | *Anthoxanthum odoratum*<br>*Phalaris aquatica*<br>*Rubus fruticosus* sp. agg |
| High Threat Exotic | Paspalum | *Paspalum dilatatum* |

Similar PCTs that were considered, and ultimately rejected, as part of the PCT determination of the best fit are included in Table 4-17. These rejections were made based on the PCT data detailed within the BioNet Vegetation Classification database (DPE 2022a).

Table 4-17: Similar PCTs considered during the determination of PCT 1256

| Similar PCTs | | Justification for PCT rejection (BioNet PCT data) |
|---|---|---|
| PCT ID | PCT name | |
| 766 | Carex sedgeland of the slopes and tablelands | • Floristics detailed for this PCT were a weaker match and did not capture full diversity evident within the mapped areas of PCT 1256.<br>• Soil and landscape characteristics were a weaker match than that present in final mapped areas of PCT 1256. |
| 951 | Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion | • Considered due to high number of matching ground stratum species detailed within the scientific description of the PCT held within BioNet Vegetation Classification database.<br>• PCT rejected due to being restricted to the South Eastern Highland IBRA bioregion. |

### Conservation status:

Commonwealth EPBC Act EEC: *Temperate Highland Peat Swamps on Sandstone*.

NSW BC Act EEC: *Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions*.

Justification: The vegetation supports flora species characteristic of the BC Act and EPBC Act TECs, occurs in the correct geographic location, and occurs as a swamp community supported by areas of impeded drainage.

Photo 4-9: Moderate condition PCT 1256 within the study area

### 4.2.6 PCT 1615 Monkey Gum - Eucalyptus blaxlandii shrubby open forest on basalt of the Sydney Basin

#### PCT overview:

An overview of the PCT is provided in Table 4-18 below, followed by a general description of the PCT based on its occurrence in the study area, supported by information from the NSW BioNet Vegetation Classification database (DPE 2022a) as required.

Table 4-18: Overview of PCT 1615 Monkey Gum - Eucalyptus blaxlandii shrubby open forest on basalt of the Sydney Basin

| | |
|---|---|
| **PCT ID** | 1615 |
| **PCT name** | Monkey Gum - Eucalyptus blaxlandii shrubby open forest on basalt of the Sydney Basin |
| **Vegetation formation** | Wet Sclerophyll Forests (Shrubby sub-formation) |
| **Vegetation class** | Southern Escarpment Wet Sclerophyll Forests |
| **Per cent cleared value (%)** | 8 |
| **Extent within study area (ha)** | 16.26 |

#### Description:

PCT 1615 consists of open forests dominated by Monkey Gum *Eucalypts cypellocarpa*. The mid-storey consists of shrubs with scattered climbers and the ground layer is characterised moist herbaceous groundcover with sparse grasses with numerous forbs and small ferns. The community occurs on the western ranges of the Blue Mountains and within the Wollemi National Park at higher elevations, primarily on basalt. The community is restricted to basalt caps in the upper Blue Mountains at elevations generally from 750 to 1,050 metres ASL and with annual rainfall of 950 to 1,350 millimetres. (DPE 2022a).

Within the study area, patches of the PCT includes characteristic canopy tree species Blaxland's Stringybark *Eucalyptus blaxlandii* occurs alongside the dominant Monkey Gum. Characteristic middle stratum species include; Native Blackthorn *Bursaria spinosa,* Australian Blackwood *Acacia melanoxylon,* Honey-Gland Heath *Melichrus urceolatus,* Narrow-Leaved Geebung *Persoonia linearis,* Native Cranberry *Astroloma humifusum,* Crinkle Bush, Austral Indigo *Indigofera australis* and Headache Vine *Clematis glycinoides*. The ground stratum characteristic species include; Tussock Grass, Weeping Grass, Forest Hedgehog Grass *Echinopogon ovatus,* Prickly Starwort *Stellaria pungens,* Creeping Speedwell *Veronica plebeia,* Native Geranium *Geranium solanderi,* Shade Plantain *Plantago debilis,* Blue Flax Lily *Dianella caerulea,* Variable Sword-sedge *Lepidosperma laterale* and Spiny-headed Mat-rush *Lomandra longifolia.*

#### Vegetation condition:

This community was present in high, moderate and low condition states. High condition vegetation had good cover and richness of native species and tended to occur within larger remnant patches. Moderate condition vegetation similarly had a good representation of native species however tended to be under-scrubbed, occurring as more isolated smaller patches of vegetation. Low quality vegetation had a low cover and abundance of native species and tended to occur has scattered isolated trees over an understorey dominated by exotics.

#### PCT justification:

Potential areas of this PCT within the study area were initially identified during the background research stage, which included review of regional vegetation mapping as well as aerial imagery to identify potential areas of native vegetation. During the field investigation the areas mapped as

PCT 1615 within the study area were found to align with the following diagnostic characteristics described within the BioNet Vegetation Classification database (DPE 2022a):

- occurs within the Burragorang and Wollemi IBRA subregions of the Sydney Basin bioregion
- occurs on the ranges of the Western Blue Mountains
- occurs on basalt caps in the Blue Mountains area
- canopy dominated by Blaxland Stringybark and Monkey Gum
- includes characteristic native species which align with this PCT.

Final assignment of this PCT was based on the diagnostic characteristics detailed above and interrogation of characteristic floristic species recorded from the vegetation plot data, using the diagnostic spreadsheet tools available from the BioNet Vegetation Classification database (DPE 2022a).

The floristic and structural summary of PCT 1615 within the study area is provided in Table 4-19. High condition vegetation is shown in Photo 4-10, moderate condition vegetation is shown in Photo 4-11, low condition vegetation is shown in Photo 4-12.

Table 4-19: Floristic and structural summary of PCT 1615 within the study area

| Growth form | Dominant species | |
|---|---|---|
| | **Common name** | **Species name** |
| Trees | Blaxland's Stringybark<br>Monkey Gum | *Eucalyptus blaxlandii*<br>*Eucalyptus cypellocarpa* |
| Shrubs | Australian Blackwood<br>Native Blackthorn<br>Narrow-leaved Geebung | *Acacia melanoxylon*<br>*Bursaria spinosa*<br>*Persoonia linearis* |
| Grass and grass-like | Weeping Grass<br>Variable Sword-sedge<br>Spiny-headed Mat-rush | *Microlaena stipoides*<br>*Lepidosperma laterale*<br>*Lomandra longifolia* |
| Forb | Blue Flax Lily<br>Native Geranium<br>Creeping Speedwell | *Dianella caerulea*<br>*Geranium solanderi*<br>*Veronica plebeia* |
| Exotic | Blackberry | *Rubus fruticosus* sp. agg. |
| High Threat Exotic | Kikuyu Grass | *Cenchrus clandestinus* |

Similar PCTs that were considered, and ultimately rejected, as part of the PCT determination of the best fit are included in Table 4-20. These rejections were made based on the PCT data detailed within the BioNet Vegetation Classification database (DPE 2022a).

Table 4-20: Similar PCTs considered during the determination of PCT 1615

| Similar PCTs | | Justification for PCT rejection (BioNet PCT data) |
|---|---|---|
| **PCT ID** | **PCT name** | |
| 944 | Mountain Grey Gum - Narrow-leaved Peppermint grassy woodland on shales of the Southern Highlands, southern Sydney Basin Bioregion | • The dominant canopy species in PCT 944 were a weak match for PCT 1615.<br>• Poor species matches for middle and ground stratums.<br>• Landscape positioning (i.e. occurs on the Southern Highlands plateau from Mittagong to Bundanoon) was not a match. |

| Similar PCTs | | Justification for PCT rejection (BioNet PCT data) |
|---|---|---|
| PCT ID | PCT name | |
| 1247 | Sydney Peppermint - Narrow-leaved Peppermint shrubby open forest on sheltered slopes of the Newnes Plateau, Sydney Basin Bioregion | • Weak floristic species match with PCT 1615.<br>• Landscape positioning (i.e. occurs on steep protected slopes and in gorges that dissect the outer areas of the Newnes Plateau) was not a match. |
| 1254 | Sydney Peppermint - White Stringybark moist shrubby forest on elevated ridges, Sydney Basin Bioregion | • Weaker floristic species match for PCT 1615, particularly in middle stratum. |

### Conservation status:

This PCT can be associated with the EPBC Act listed TEC *Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion*. However, the occurrence of the PCT within the study area does not satisfy the key diagnostic characteristics detailed in the listing advice for this species. Principally it is not located over the correct basalt substrates.

Photo 4-10: High condition PCT 1615 within the study area

Photo 4-11: Moderate condition PCT 1615 within the study area

Photo 4-12: Low condition PCT 1615 within the study area

### 4.2.7 PCT 1740 Tall Spike Rush freshwater wetland

#### PCT overview:

An overview of the PCT is provided in Table 4-21 below, followed by a general description of the PCT based on its occurrence in the study area, supported by information from the NSW BioNet Vegetation Classification database (DPE 2022a) as required.

Table 4-21: Overview of PCT 1740 Tall Spike Rush freshwater wetland

| | |
|---|---|
| **PCT ID** | 1740 |
| **PCT name** | Tall Spike Rush freshwater wetland |
| **Vegetation formation** | Freshwater Wetlands |
| **Vegetation class** | Coastal Freshwater Lagoons |
| **Per cent cleared value (%)** | 70 |
| **Extent within study area (ha)** | 0.15 |

**Description:**

PCT 1740 consists of freshwater wetlands dominated by spike rushes. All three listed species (Tall Spike Rush, Frogsmouth *Philydrum lanuginosum* and Water Primrose *Ludwigia peploides*) may be common depending on local site conditions. Typically occurs over sandstone (DPE 2022a).

within the study area is restricted to two locations. The first occurrence is associated with a man-made detention basin dominated by Tall Spike Rush and Common Rush. Shrubs occurring around the margins included; Sunshine Wattle *Acacia terminalis*, Heath-leaved Banksia, Wallum Heath *Epacris pulchella* and Finger Hakea. The pond also supported a number of other native rush and sedge species including Nodding Club-rush, Variable Sword-sedge, Spiny-headed Mat-rush and *Lomandra obliqua*. Weeping Grass was also present.

The second occurrence is located on a portion of a farm dam within the Little Hartley study area. This patch occurs in low condition and is dominated by the occurrence of Tall Spike Rush and *Juncus* spp.

**Vegetation condition:**

This community occurs within a man-made detention basin and would not exist in this location with the support of this feature. As such it has been given a man-made condition state.

**PCT justification:**

This community occurs as a man-made feature, supported by a water detention basin. The floristic composition of the plot data matches the characteristic species of PCT 1740 listed within the BioNet Vegetation Classification. However, the Wollemi IBRA subregion within it occurs is not listed as part of its distribution. Considering the above, PCT 1740 was chosen as the most likely PCT for this small occurrence of freshwater wetland with the study area.

Final assignment of this PCT was based on the diagnostic characteristics detailed above and interrogation of characteristic floristic species recorded from the vegetation plot data, using the diagnostic spreadsheet tools available from the BioNet Vegetation Classification database (DPE 2022a).

The floristic and structural summary of PCT 1740 within the study area is provided in Table 4-22. The man-made condition vegetation is shown in Photo 4-13.

Table 4-22: Floristic and structural summary of PCT 1740 within the study area

| Growth form | Dominant species | |
|---|---|---|
| | Common name | Species name |
| Shrubs | Heath-leaved Banksia<br>Wallum Heath<br>Finger Hakea | *Banksia ericifolia*<br>*Epacris pulchella*<br>*Hakea dactyloides* |

| Growth form | Dominant species | |
|---|---|---|
| | Common name | Species name |
| Grass | Tall Spike Rush<br>Common Rush<br>Weeping Grass | *Eleocharis sphacelata*<br>*Juncus usitatus*<br>*Microlaena stipoides* |
| Forb | -<br>- | *Gonocarpus tetragynus*<br>*Pomax umbellata* |
| Exotic | Garden Coreopsis<br>Spanish Heath<br>Paspalum<br>Flaxleaf Fleabane | *Coreopsis lanceolata*<br>*Erica lusitanica*<br>*Paspalum dilatatum*<br>*Conyza bonariensis* |

Similar PCTs that were considered, and ultimately rejected, as part of the PCT determination of the best fit are included in Table 4-23. These rejections were made based on the PCT data detailed within the BioNet Vegetation Classification database (DPE 2022a).

Table 4-23: Similar PCTs considered during the determination of PCT 1740

| Similar PCTs | | Justification for PCT rejection (BioNet PCT data) |
|---|---|---|
| PCT ID | PCT name | |
| 1071 | Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion | • The dominant species, *Phragmites australis* and *Typha orientalis,* that make of PCT 1071 were not present within the community within the study area. |

### Conservation status:

PCT 1740 can be associated with the BC Act listed TEC *Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*. However, the man-made condition of this community precludes it from being considered as part of this TEC, with the final determination noting that artificial wetlands created on previously dry land specifically for purposes such as sewerage treatment, stormwater management and farm production, are not regarded as part of this community.

Photo 4-13: Man-made condition PCT 1740 within the study area

### 4.2.8 Threatened ecological communities

Vegetation within the study area was found to represent two TECs listed under the NSW BC Act, and one listed under the Commonwealth EPBC Act, as outlined in Table 4-24 and Table 4-25 below, and illustrated on Figure 4-2. TEC justifications are included within the PCT descriptions in the sections above for the relevant PCTs.

Table 4-24: Summary of BC Act TECs within the study area

| BC Act TEC | Associated PCTs | Listing status | Area (ha) |
|---|---|---|---|
| *Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions* | PCT 766 Carex sedgeland of the slopes and tablelands<br><br>PCT 1256 Tableland swamp meadow on impeded drainage sites of the western Sydney Basin Bioregion and South Eastern Highlands Bioregion | Endangered | 10.34 |
| *Blue Mountains Swamps in the Sydney Basin Bioregion* | PCT 1078 Prickly Tea-tree - sedge wet heath on sandstone plateaux, central and southern Sydney Basin Bioregion | Vulnerable | 0.06 |

Table 4-25: Summary of EPBC Act TECs within the study area

| EPBC Act TEC | Associated PCTs | Listing status | Area (ha) |
|---|---|---|---|
| *Temperate Highland Peat Swamps on Sandstone* | PCT 1256 Tableland swamp meadow on impeded drainage sites of the western Sydney Basin Bioregion and South Eastern Highlands Bioregion | Endangered | 2.86 |

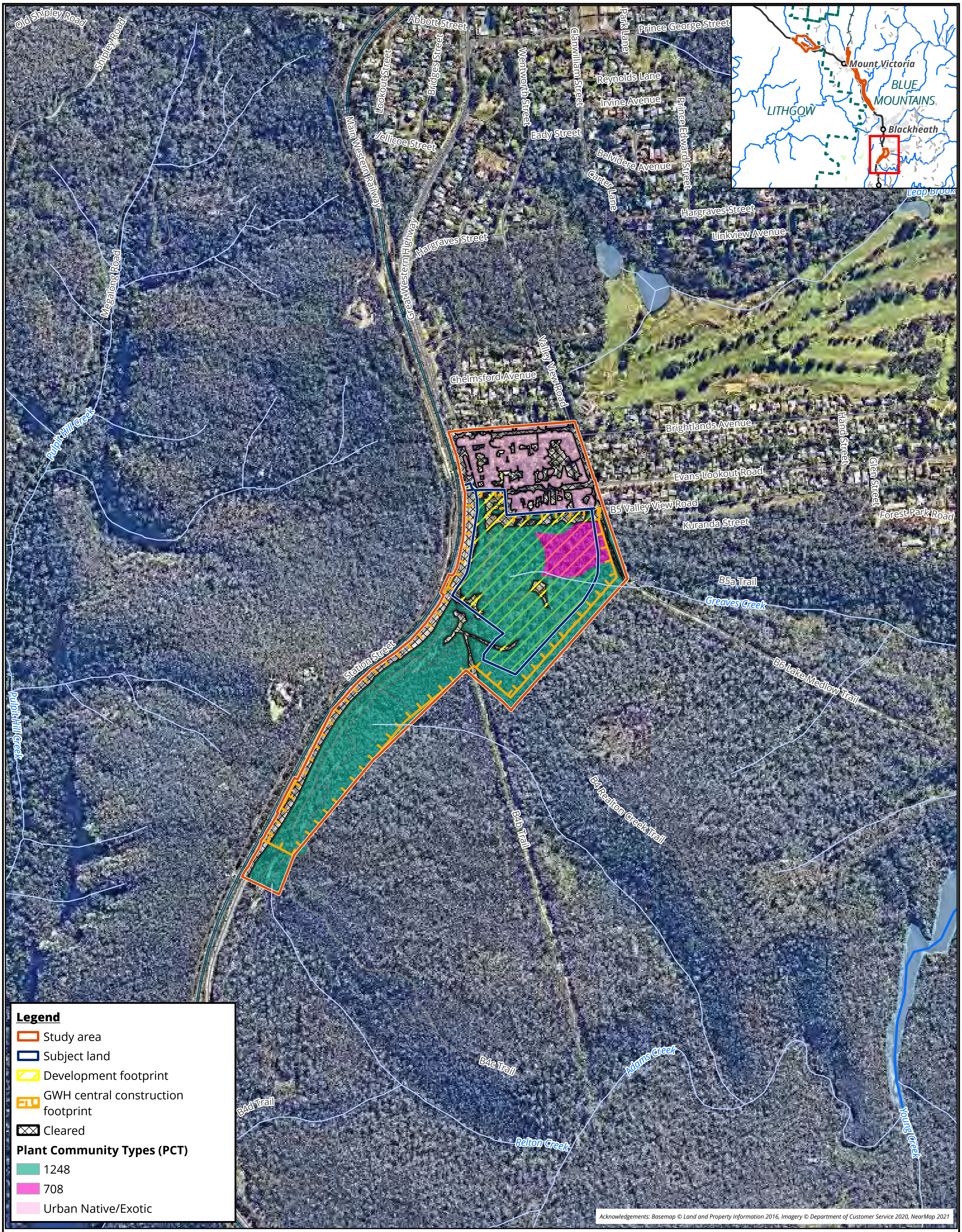


**Figure 4-1 Vegetation within the study area**

**Page 1 of 5**

biosis

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Metres
Scale 1:7,500 @ A3
Coordinate System: GDA 1994 MGA Zone 56


**Figure 4-1 Vegetation within the study area**
**Page 2 of 5**

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Matter: 35727,
Date: 12 September 2022 ,
Prepared for: MH, Prepared by: AM, Last edited by: amackegard
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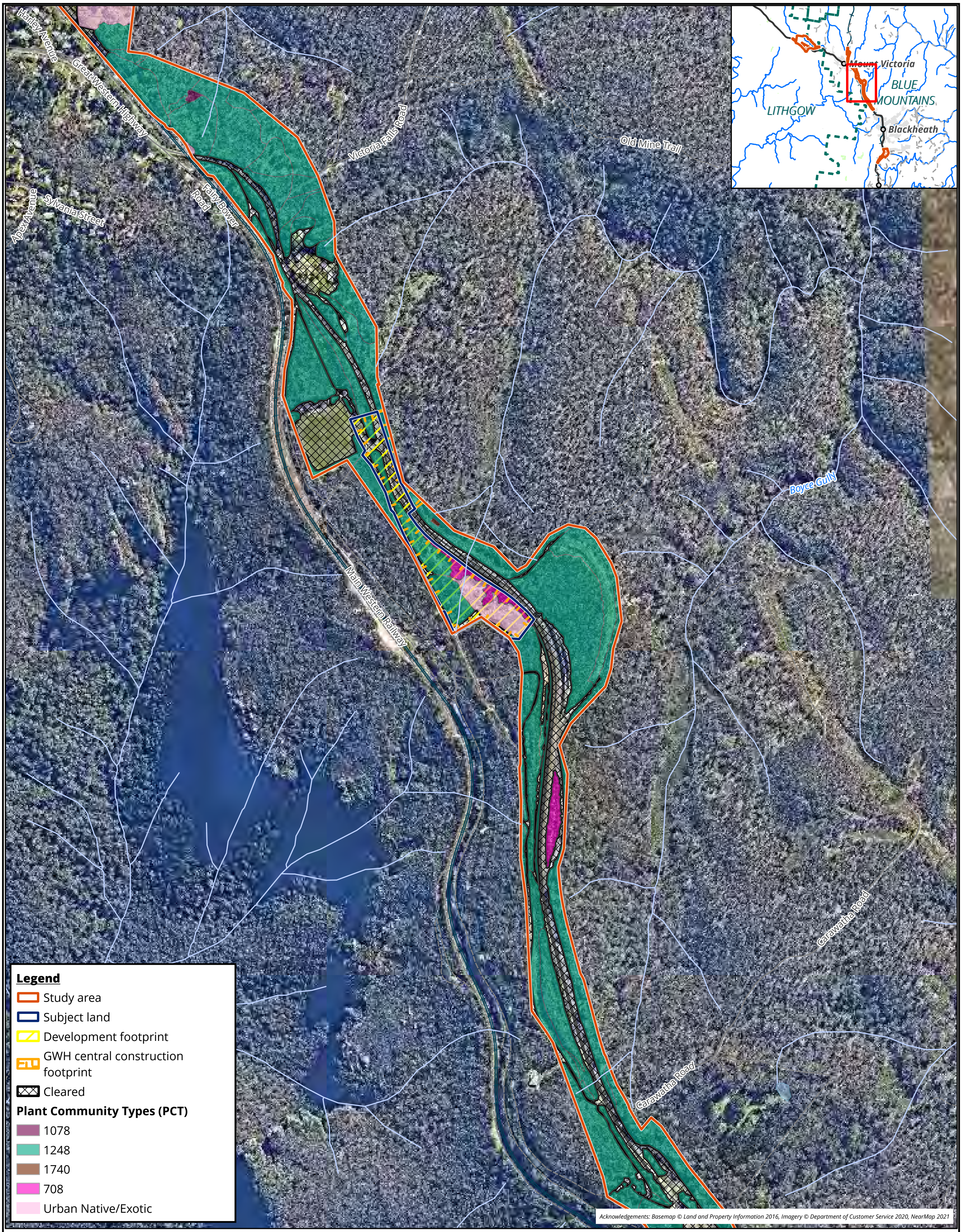


**Figure 4-1 Vegetation within the study area**
**Page 3 of 5**

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Date: 12 September 2022 ,
Prepared for: MH, Prepared by: AM, Last edited by: amackegard
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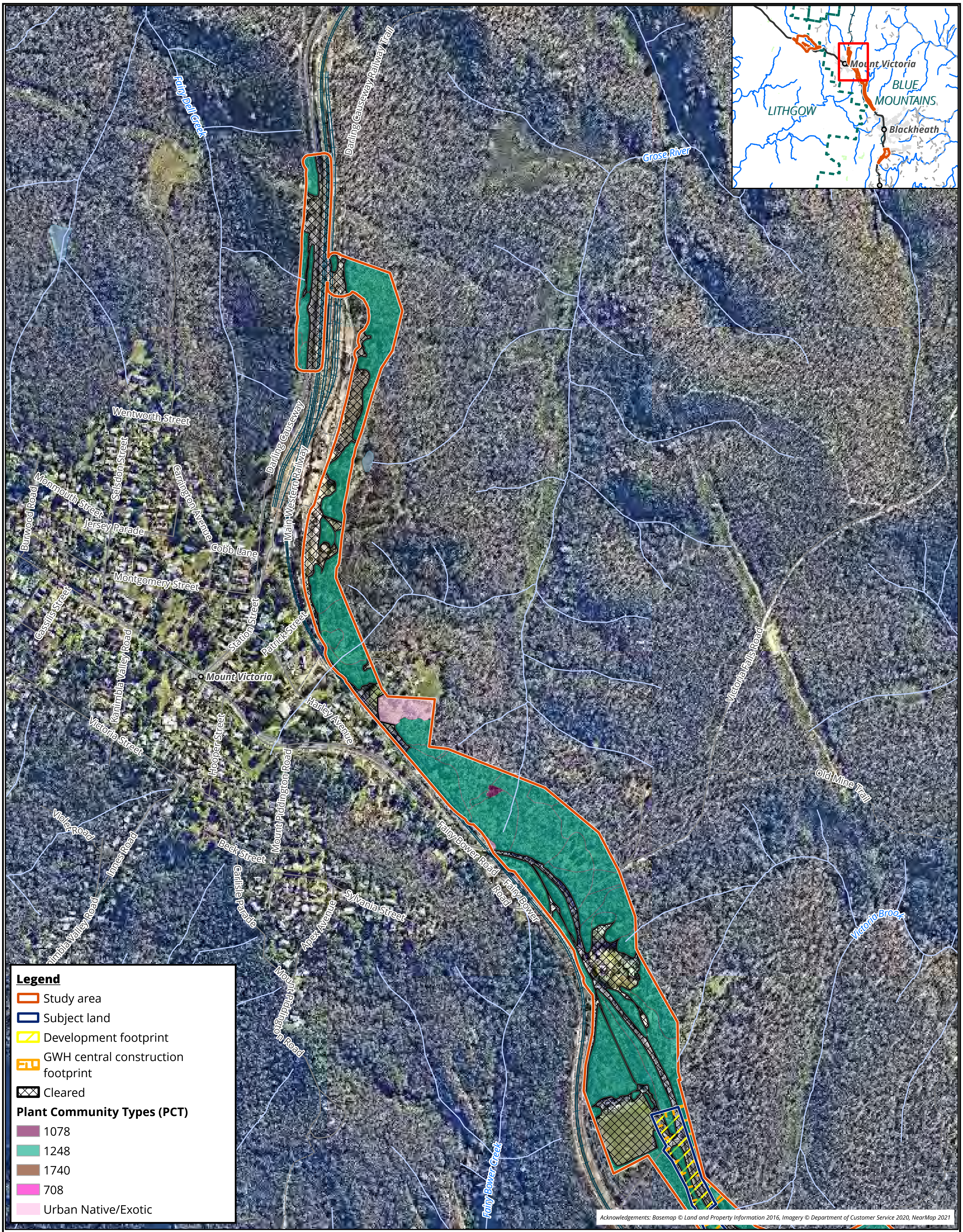


**Figure 4-1 Vegetation within the study area**
**Page 4 of 5**

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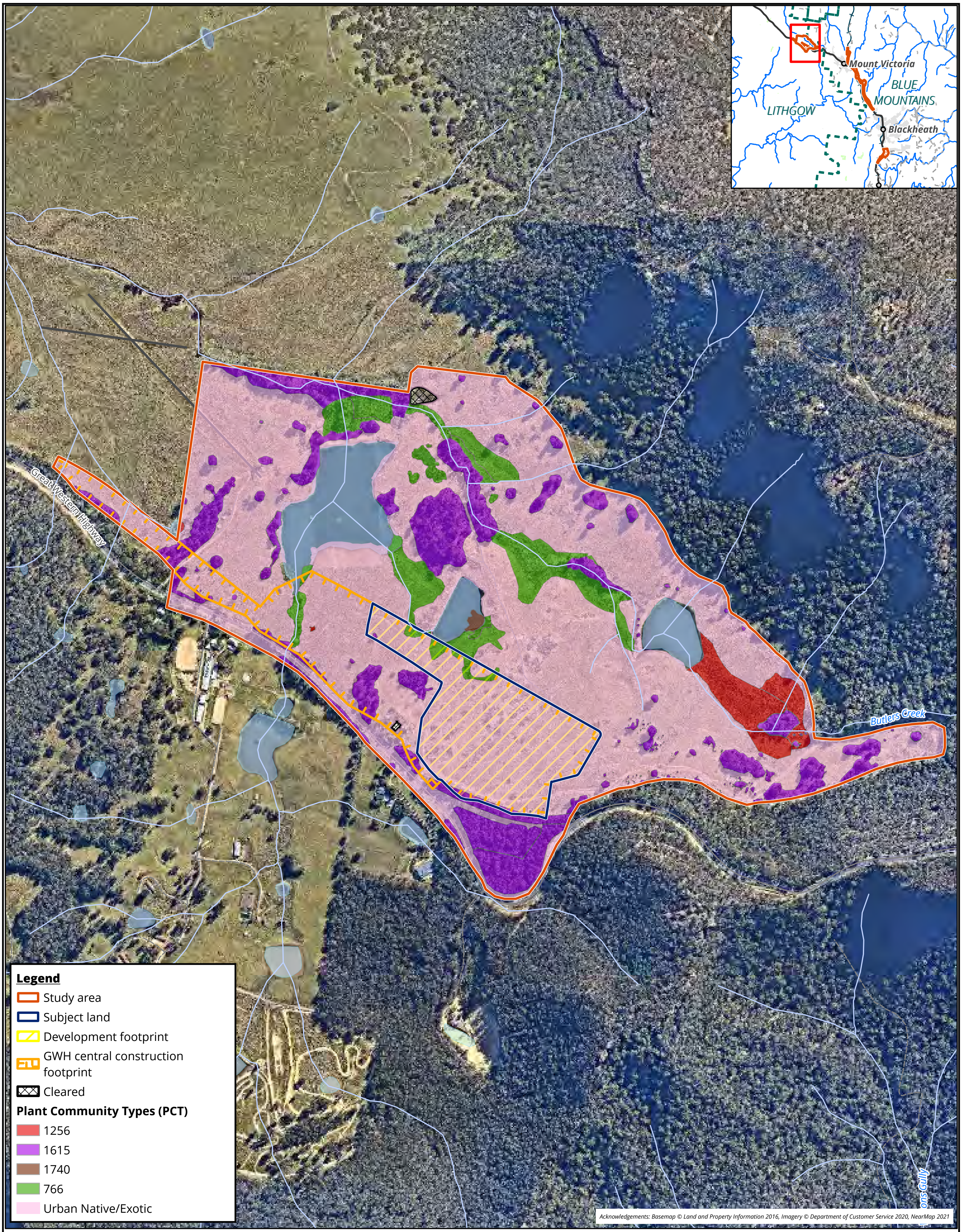


**Figure 4-1 Vegetation within the study area**
**Page 5 of 5**

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Scale 1:7,500 @ A3
Coordinate System: GDA 1994 MGA Zone 56
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**Figure 4-2 Threatened ecological communities**
**Page 1 of 5**

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**Figure 4-2 Threatened ecological communities**
**Page 2 of 5**

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Coordinate System: GDA 1994 MGA Zone 56

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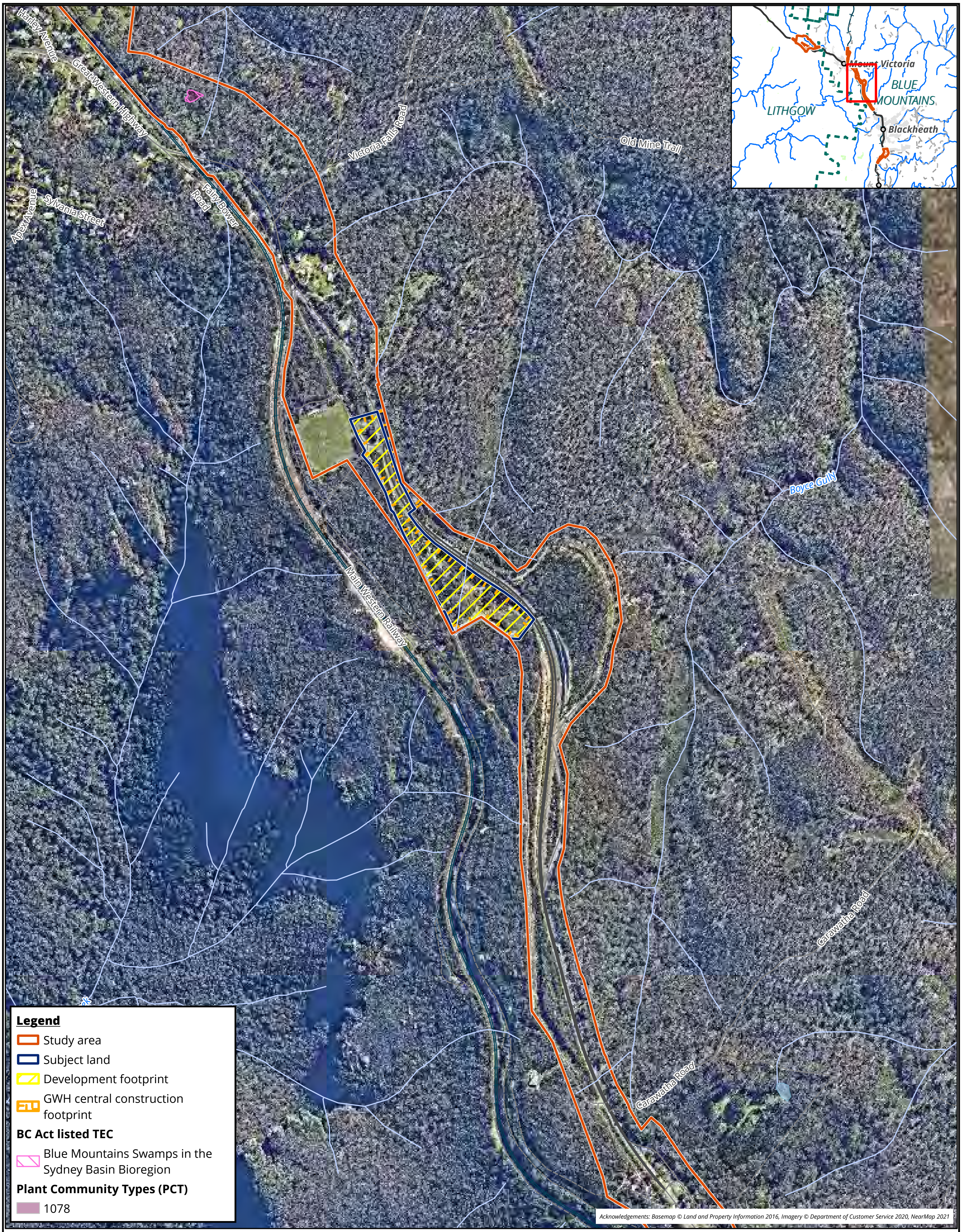


**Figure 4-2 Threatened ecological communities**
**Page 3 of 5**

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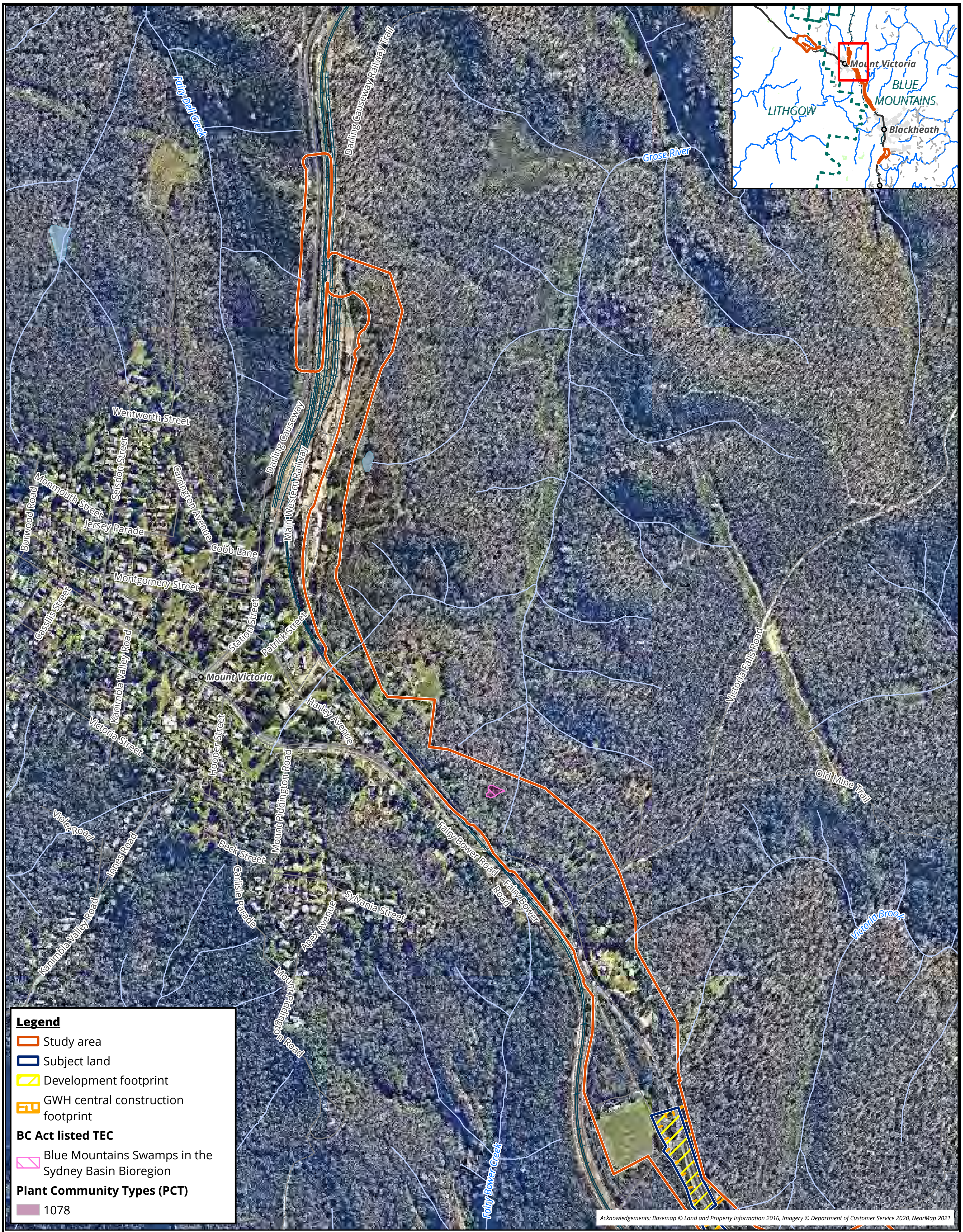


**Figure 4-2 Threatened ecological communities**
**Page 4 of 5**

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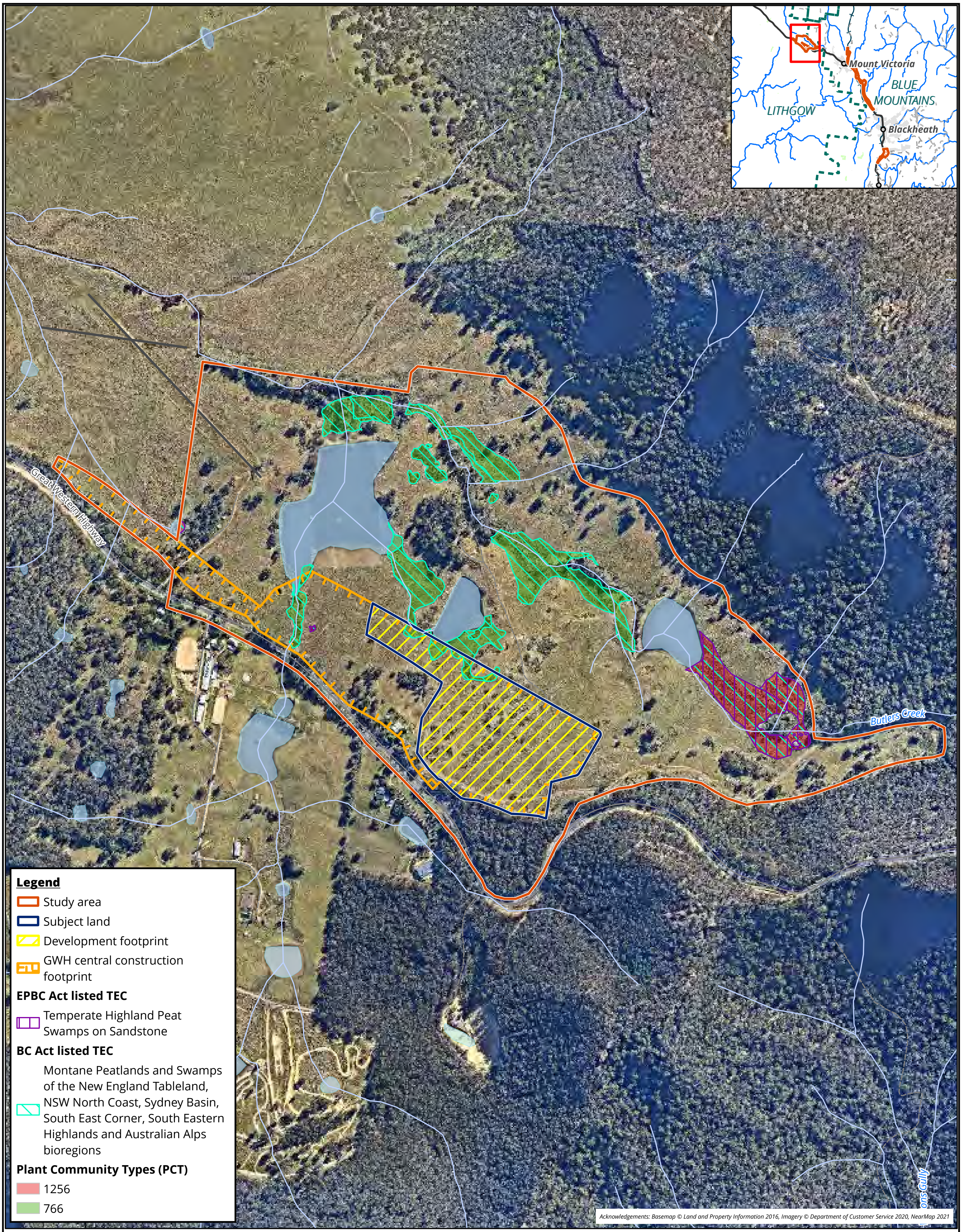


**Figure 4-2 Threatened ecological communities**

**Page 5 of 5**

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Date: 12 September 2022 ,
Prepared for: MH, Prepared by: AM, Last edited by: amackegard
Layout: 35727_BDAR_F4-2_TEC
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35727_BDAR_portrait.aprx

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Scale 1:7,500 @ A3
Coordinate System: GDA 1994 MGA Zone 56

## 4.3 Vegetation integrity assessment

### 4.3.1 Vegetation zones and patch size class

PCTs within the study area were assessed and stratified, based on broad condition state, into vegetation zones in accordance with Section 4.3 of the BAM. Eight such vegetation zones were identified within the development footprint which are described in Table 4-26. These eight zones represent the native vegetation that will be directly impacted as result of the project.

Patch size classes for each vegetation zone present within the development footprint were assessed as per Section 4.3.2 of the BAM (DPIE 2020a) using a select process in ArcGIS. All native vegetation with a gap of less than 100 metres from the next area of native vegetation (or ≤ 30 metres for non-woody ecosystems), is considered a single patch, with a patch able to extend onto adjoining land.

Native vegetation across the study area was also mapped sequentially, and it was found to form part of very large patches of connected vegetation with areas ranging from 209.70 to 589.69 hectares.

The patch size classes for each vegetation zone are also outlined in Table 4-26 below.

Table 4-26: Vegetation zones within the development footprint

| Vegetation zone | PCT | Condition | Area (ha) | Patch size (ha) |
|---|---|---|---|---|
| **Wollemi subregion (BAM-C case 00028460/BAAS18134/21/00028461)** | | | | |
| 708_High | PCT 708: Blue Mountains Mallee Ash - Dwarf Casuarina heath of the upper Blue Mountains, Sydney Basin Bioregion | High | 1.29 | >100 |
| 708_Moderate | PCT 708: Blue Mountains Mallee Ash - Dwarf Casuarina heath of the upper Blue Mountains, Sydney Basin Bioregion | Moderate | 0.50 | >100 |
| 1248_High | PCT 1248: Sydney Peppermint - Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin Bioregion | High | 6.14 | >100 |
| 1248_Moderate | PCT 1248: Sydney Peppermint - Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin Bioregion | Moderate | 0.86 | >100 |
| 1248_Low | PCT 1248: Sydney Peppermint - Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin Bioregion | Low | 0.33 | >100 |

| Vegetation zone | PCT | Condition | Area (ha) | Patch size (ha) |
|---|---|---|---|---|
| **Burragorang subregion (00028460/BAAS18134/21/00029156)** | | | | |
| 766_Low | PCT 766 Cared sedgeland of the slops and tablelands | Low | 0.43 | >100 |
| 1615_Moderate | PCT 1615: Monkey Gum - Eucalyptus blaxlandii shrubby open forest on basalt of the Sydney Basin | Moderate | 0.18 | >100 |
| 1615_Low | PCT 1615: Monkey Gum - Eucalyptus blaxlandii shrubby open forest on basalt of the Sydney Basin | Low | 0.01 | >100 |

### 4.3.2 Vegetation integrity

Vegetation integrity, or condition, was assessed using data obtained from undertaking BAM plots. Plot data was assessed via:

- a 20 metre x 50 metre quadrat and 50 metre transect for assessment of site attributes and function
- a 20 metre x 20 metre quadrat, nested within the larger quadrat for full floristic survey to determine composition and structure of the PCT.

Prior to the selection of the final development footprint, the collection of vegetation plots was undertaken based on the complete set of PCTs and condition types across the entire study area (as described at the start of Section 4). The required number of BAM plots was similarly determined based on the occurrence of these PCTs and condition states across the entire study area with the minimum number of BAM plots per PCT and condition state determined using Table 3 of the BAM (DPIE 2020a).

A total of 36 BAM plots have been completed in the native vegetation across the study area, details are provided in Table 4-27. Three of these plots (B2L.07, B2L.10 and B2L.14) occur within the development footprint and one (B2L.06) occurs partly within the development footprint. Biosis ecologists involved in undertaking BAM plots are detailed in Table D-0-1. While all plots did not occur within the development footprint, they occur within vegetation that provides a representative assessment of the vegetation integrity of the associated vegetation zone, as required under section 4.3.4 of the BAM (DPIE 2020a).

The minimum number of BAM plots required for each vegetation zone within the development footprint is detailed in Table 4-28, along with the total number of BAM plots that were collected within each zone across the study area.

Table 4-27: BAM plots completed within the study area

| PCT | Condition | BAM plot reference |
|---|---|---|
| PCT 708: Blue Mountains Mallee Ash - Dwarf Casuarina heath of the upper Blue Mountains, Sydney Basin Bioregion | High | B2L.07* |
| | Moderate | B2L.10* |
| PCT 766 Carex sedgeland on slopes and tablelands | Moderate | B2L.13, B2L.36 |
| | Low | B2L.26, B2L.35 |
| PCT 1078 Prickly Tea-tree - sedge wet heath on sandstone plateaux, central and southern Sydney Basin Bioregion | High | B2L.15 |

| PCT | Condition | BAM plot reference |
|---|---|---|
| PCT 1248: Sydney Peppermint - Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin Bioregion | High | B2L.02, B2L.04, B2L.05, B2L.06^, B2L.17, B2L.19, B2L.20, B2L.22 |
| | Moderate | B2L.03, B2L.23, B2L.33 |
| | Low | B2L.11, B2L.16#, B2L.18 |
| PCT 1256: Tableland swamp meadow on impeded drainage sites of the western Sydney Basin Bioregion and South Eastern Highlands Bioregion | Low | B2L.29 |
| PCT 1615: Monkey Gum - Eucalyptus blaxlandii shrubby open forest on basalt of the Sydney Basin | High | B2L.01, B2L.24 |
| | Moderate | B2L.09, B2L.21, B2L.25, B2L.27, B2L.28, B2L.30 |
| | Low | B2L.31, B2L.32 |
| PCT 1740 Tall Spike Rush freshwater wetland | Man-made | B2L.34 |
| Non-native vegetation (Exotic grassland) | - | B2L.08, B2L.12, B2L.14* |

* Marked plots occur within the development footprint.

^ Marked plot occurs partly within the development footprint.

# Plot not included in calculations.

Table 4-28: Minimum number of BAM plots required for each vegetation zone

| Vegetation zone | Area | Minimum number of plots | Plots collected |
|---|---|---|---|
| **Wollemi subregion** | | | |
| 708_High | 1.29 | 1 plot | 1 plot |
| 708_Moderate | 0.50 | 1 plot | 1 plot |
| 1248_High | 6.14 | 3 plots | 8 plots |
| 1248_Moderate | 0.86 | 1 plot | 3 plots |
| 1248_Low | 0.33 | 1 plot | 3 plots (only 2 utilised) |
| **Burragorang subregion** | | | |
| 766_Low | 0.43 | 1 plot | 2 plots |
| 1615_Moderate | 0.18 | 1 plot | 6 plots |
| 1615_Low | 0.01 | 1 plot | 2 plots |

Assessment of vegetation integrity was undertaken using standard benchmark data as outlined in the BAM and held in the BioNet Vegetation Classification database (DPE 2022a). A list of flora species recorded in each BAM plot is included in Annexure B. Records of all flora species will be submitted to EES for incorporation into the BioNet Atlas of NSW Wildlife.

### 4.3.3 Vegetation integrity score

For the eight vegetation zones that occur within the development footprint, all BAM plots collected within the broader study area that had a matching PCT and condition state were entered into the BAM-C to determine the vegetation integrity scores. Where BAM plots have not been located within the development footprint, they have been located within a contiguous and/or representative patch of vegetation suitable for collection of data commensurate with the impacted vegetation zone. This allows the vegetation integrity scores to be included in the BAM-Calculator to be consistent with the area impacted in the development footprint. The decision was made to include all collected BAM plots as this provides the best representation of the vegetation across the development footprint, as the full suite of collected plot data was integral to the final stratification of vegetation condition types. Plot data are presented in Annexure B, and the calculated vegetation integrity scores (VI score) for each vegetation zone are provided in Table 4-29.

Table 4-29: Vegetation zone integrity scores

| Vegetation zone | Composition score | Structure score | Function score | VI score* | Hollow-bearing trees | IBRA subregion |
|---|---|---|---|---|---|---|
| 708_High | 91.4 | 77.8 | 91.8 | 86.8 | No | Wollemi |
| 708_Moderate | 90.6 | 30.6 | 37.5 | 47.0 | No | Wollemi |
| 766_Low | 44.3 | 13.1 | - | 24.1 | No | Burragorang |
| 1248_High | 89 | 86.2 | 60.1 | 77.3 | Yes | Wollemi |
| 1248_Moderate | 77.7 | 21.9 | 79.0 | 51.2 | Yes | Wollemi |
| 1248_Low | 34.9 | 14.4 | 80.5 | 34.3 | No | Wollemi |
| 1615_Moderate | 53.4 | 57.9 | 77.8 | 62.2 | Yes | Burragorang |
| 1615_Low | 15.4 | 38.2 | 49.4 | 30.7 | No | Burragorang |

*Benchmark (pristine) condition vegetation would receive a VI score of 100.

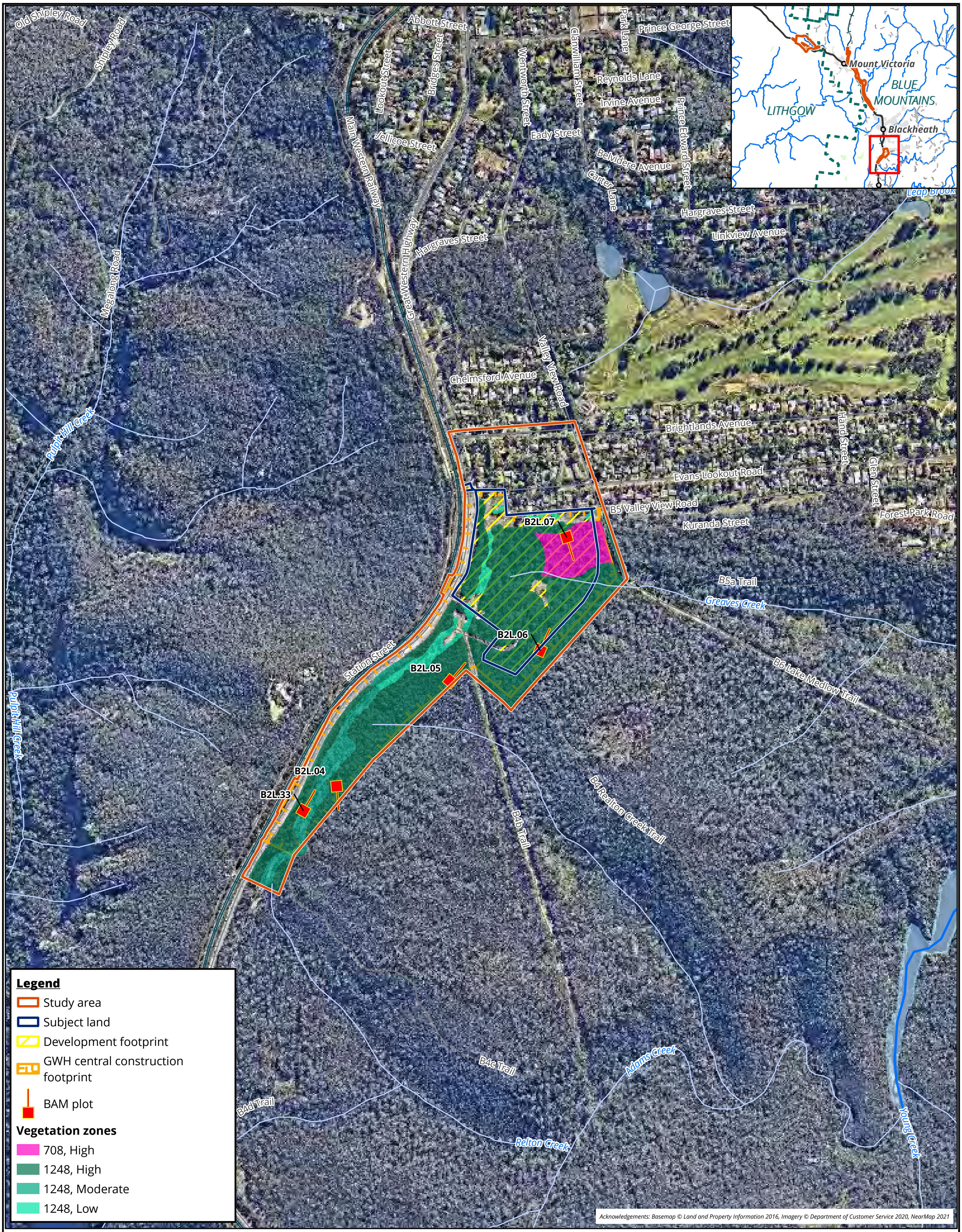


**Figure 4-3 Vegetation zones and plot locations**
**Page 1 of 5**

biosis

Matter: 35727,
Date: 12 September 2022 ,
Prepared for: MH, Prepared by: AM, Last edited by: amackegard
Layout: 35727_BDAR_F4-3_VZ
Project: P:\35700s\35727\Mapping\
35727_BDAR_portrait.aprx

0 100 200 300 400 500
Metres
Scale 1:7,500 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N


**Figure 4-3 Vegetation zones and plot locations**
**Page 2 of 5**

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Matter: 35727,
Date: 12 September 2022 ,
Prepared for: MH, Prepared by: AM, Last edited by: amackegard
Layout: 35727_BDAR_F4-3_VZ
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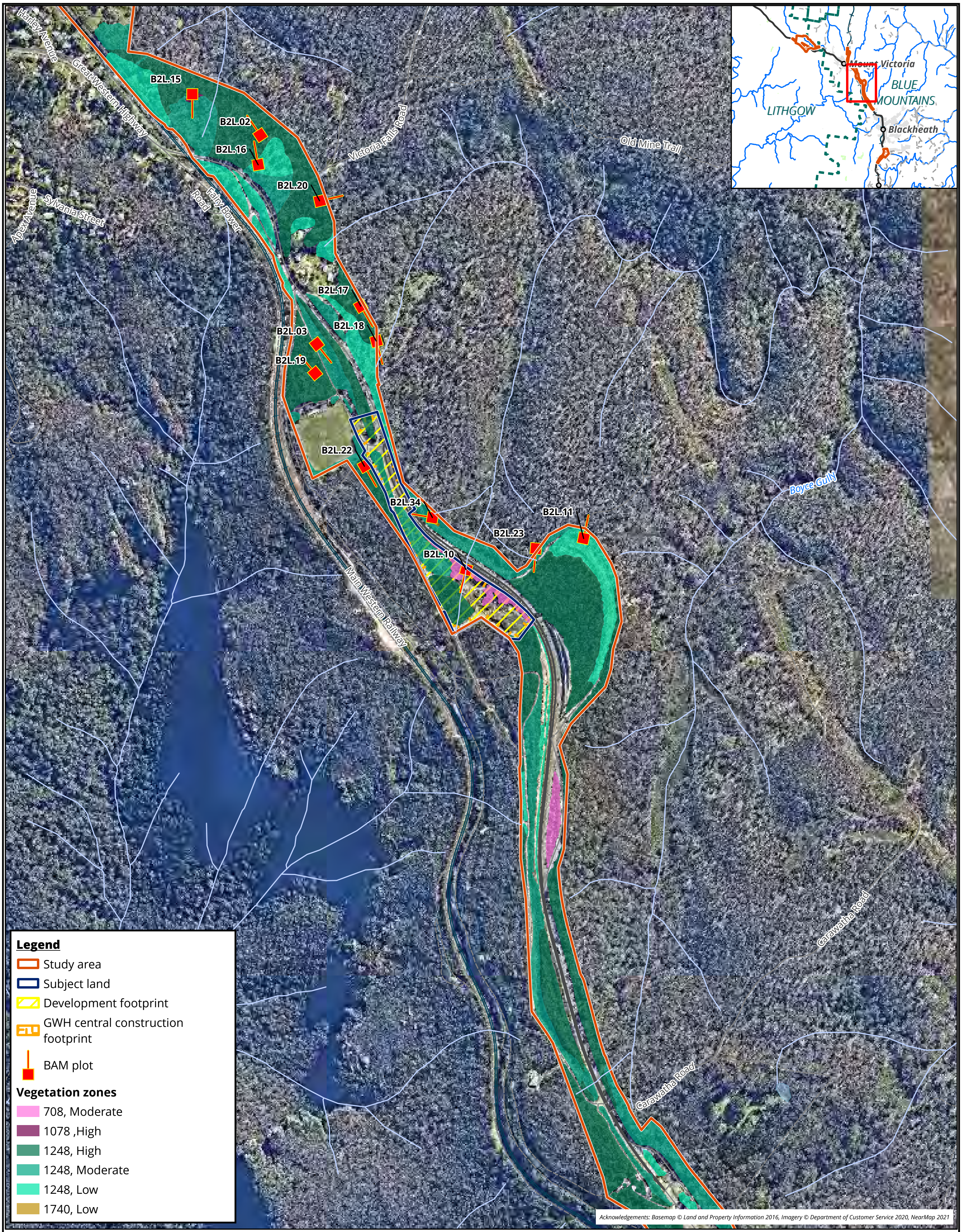


**Figure 4-3 Vegetation zones and plot locations**
**Page 3 of 5**

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Matter: 35727,
Date: 12 September 2022 ,
Prepared for: MH, Prepared by: AM, Last edited by: amackegard
Layout: 35727_BDAR_F4-3_VZ
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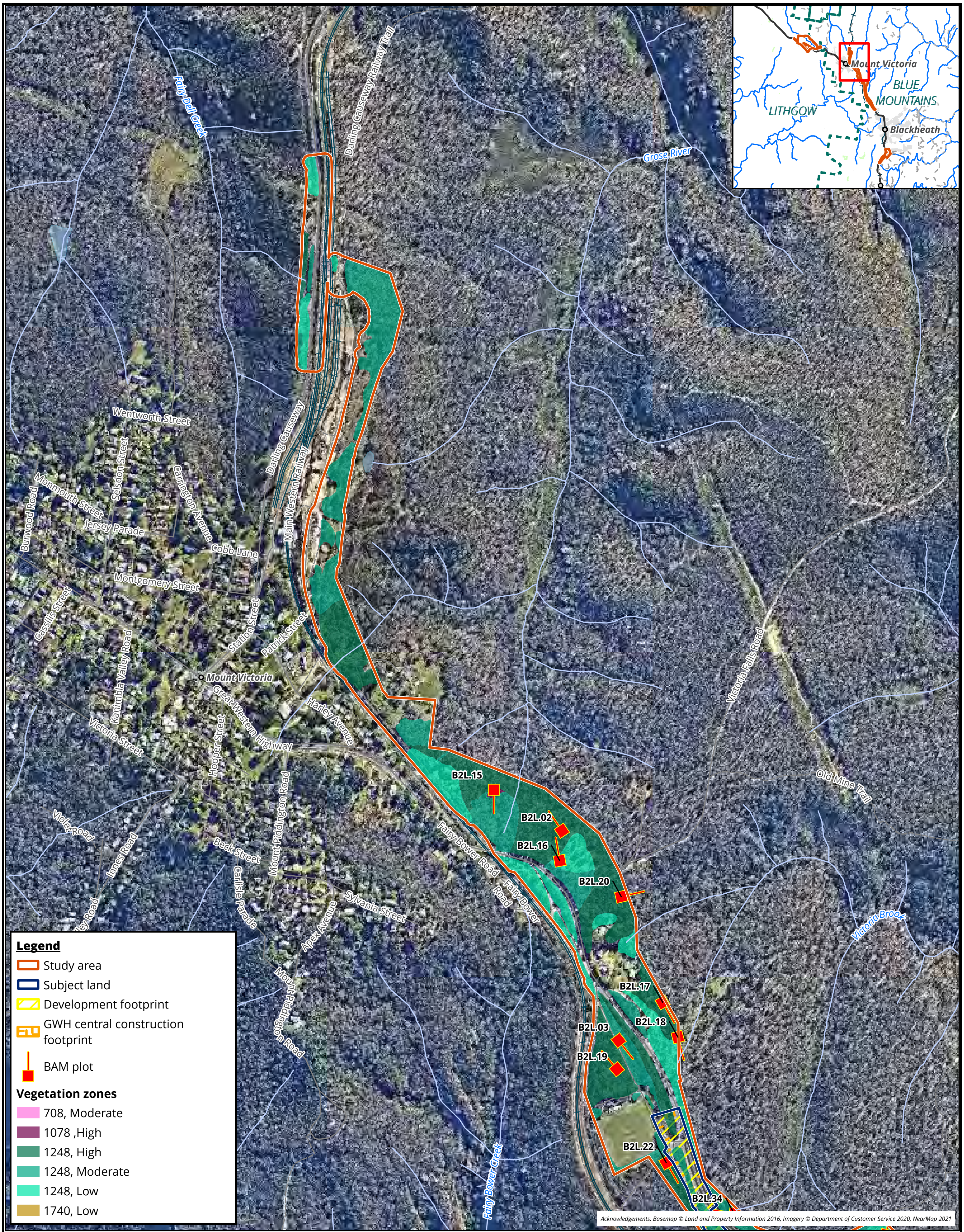


**Figure 4-3 Vegetation zones and plot locations**
**Page 4 of 5**

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Date: 12 September 2022 ,
Prepared for: MH, Prepared by: AM, Last edited by: amackegard
Layout: 35727_BDAR_F4-3_VZ
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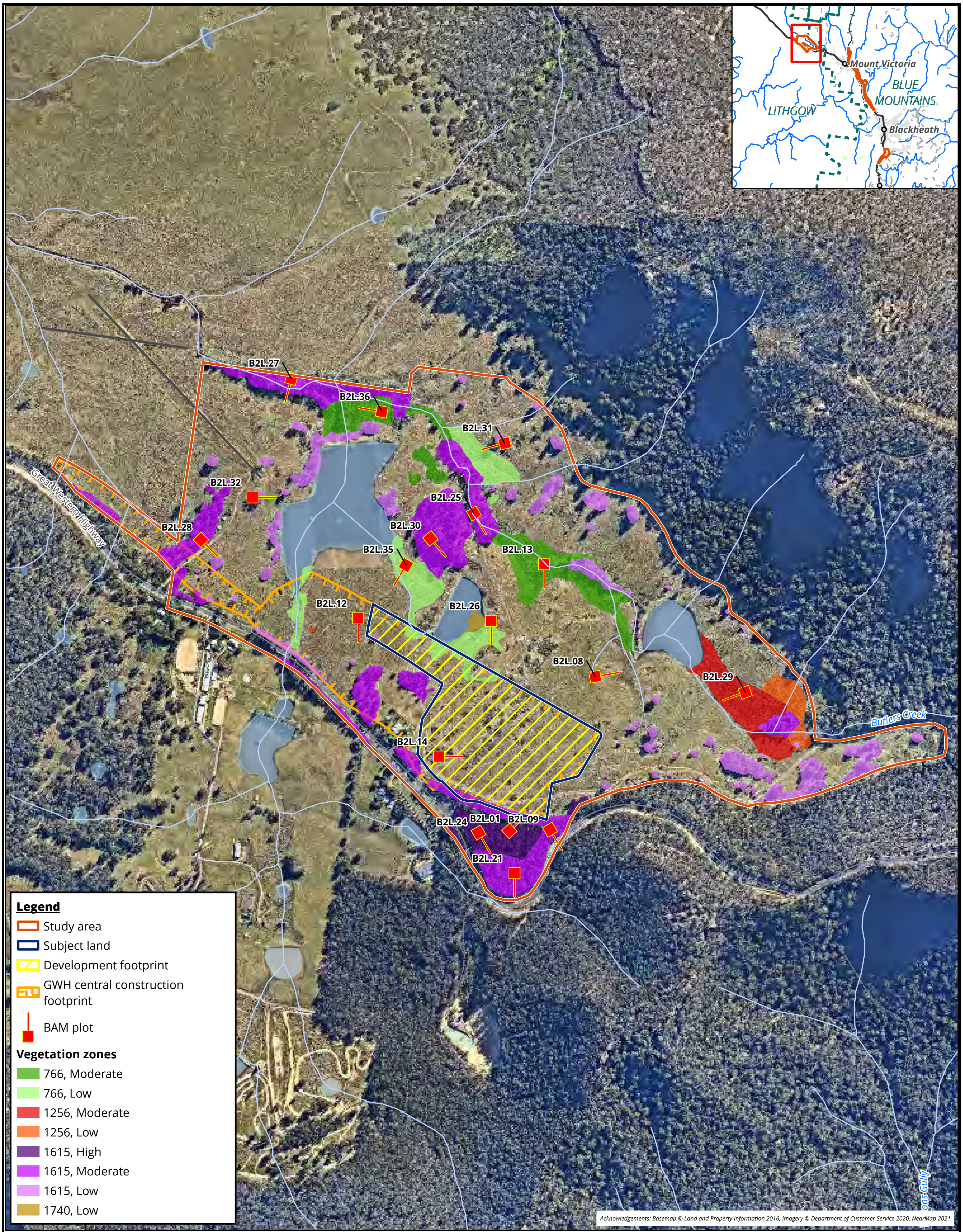


**Figure 4-3 Vegetation zones and plot locations**
**Page 5 of 5**

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Matter: 35727,
Date: 12 September 2022 ,
Prepared for: MH, Prepared by: AM, Last edited by: amackegard
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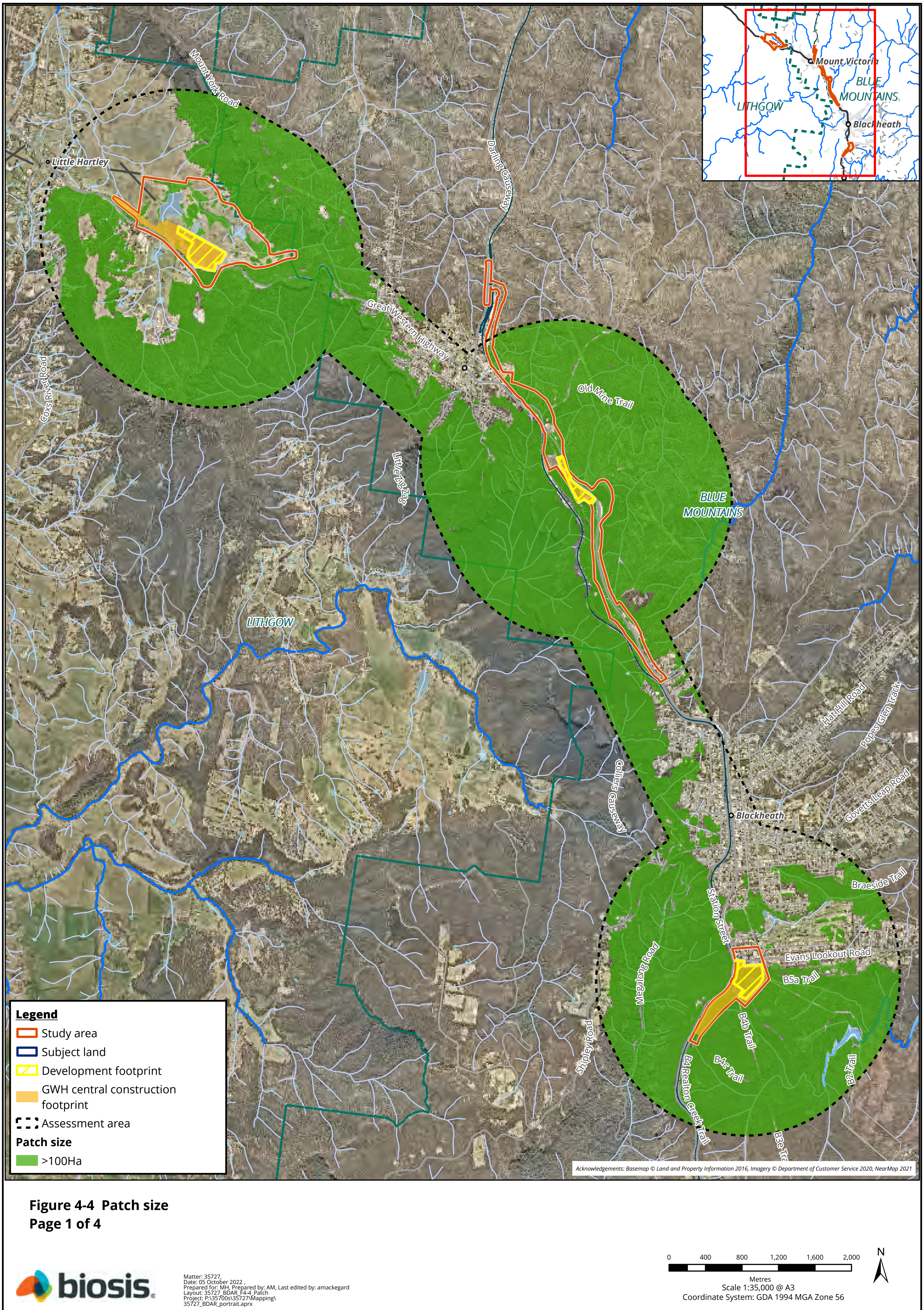


**Figure 4-4 Patch size**
**Page 1 of 4**

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Matter: 35727,
Date: 05 October 2022 ,
Prepared for: MH, Prepared by: AM, Last edited by: amackegard
Layout: 35727_BDAR_F4-4_Patch
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**Figure 4-4 Patch size**
**Page 2 of 4**

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Matter: 35727,
Date: 05 October 2022 ,
Prepared for: MH, Prepared by: AM, Last edited by: amackegard
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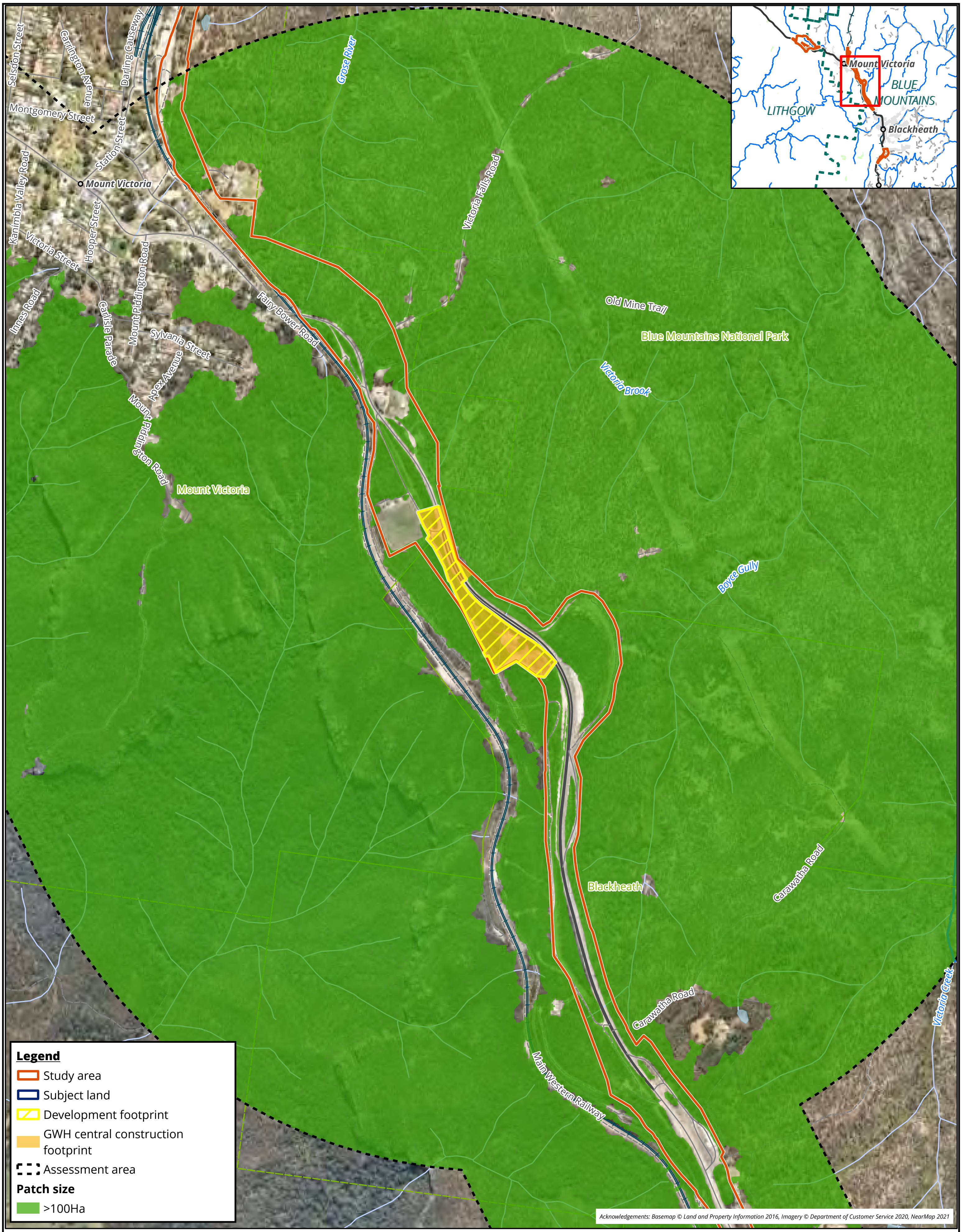


**Figure 4-4 Patch size**
**Page 3 of 4**

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Matter: 35727,
Date: 05 October 2022 ,
Prepared for: MH, Prepared by: AM, Last edited by: amackegard
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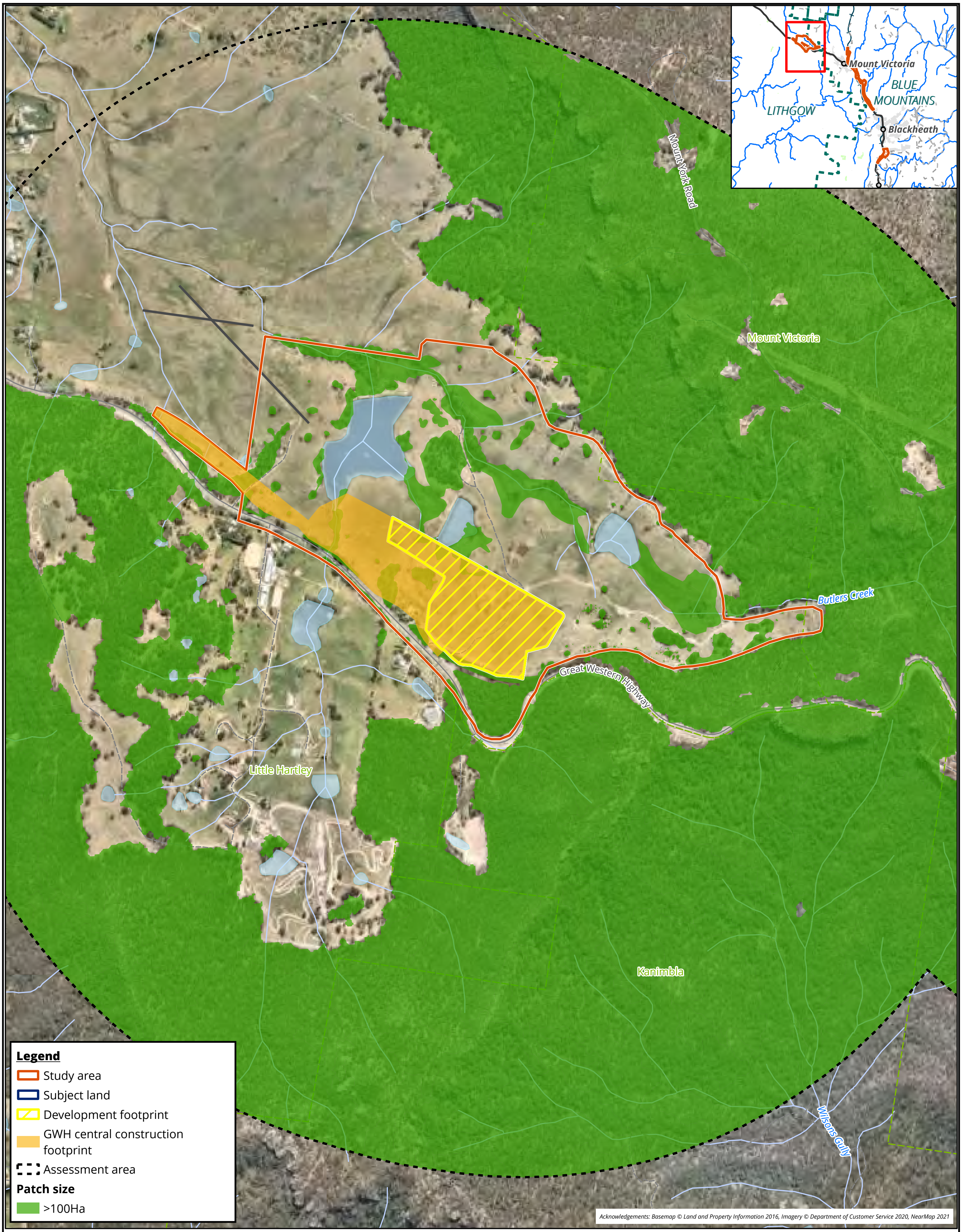


**Figure 4-4 Patch size**
**Page 4 of 4**

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Matter: 35727,
Date: 05 October 2022 ,
Prepared for: MH, Prepared by: AM, Last edited by: amackegard
Layout: 35727_BDAR_F4-4_Patch
Project: P:\35700s\35727\Mapping\
35727_BDAR_portrait.aprx

0 110 220 330 440 550
Metres
Scale 1:10,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

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## 4.4 Groundwater dependent ecosystems

Groundwater Dependent Ecosystems (GDEs) are defined by the NSW Department of Primary Industries (DPI) Water as *ecosystems that require access to groundwater to meet all or some of their water requirements so as to maintain their communities of plants and animals, ecological processes and ecosystem services*. To assist with the identification and mapping of these ecosystems, DPI Water has published the guidance document *Methods for the identification of high probability groundwater dependent vegetation ecosystems* (Kuginis et al. 2016). The following background section is taken from the literature review included in Kuginis et al. (2016).

### 4.4.1 Background

Plant species within a community may exhibit differing degrees of groundwater dependency (Hatton and Evans 1998) and can range from obligate (total/entire) to facultative (partial and infrequent (i.e. seasonal/episodic)) (Zencich et al. 2002; Eamus et al. 2006b; Froend and Drake 2006). Vegetation will extract water from sources that require the least amount of energy. This means that vegetation will use shallow soil water first before seeking deeper soil water or groundwater (Eamus and Froend 2006). Where there is insufficient soil water for plant physiological requirements, plants will become increasingly dependent on available groundwater as soil water is depleted (Howe et al. 2007) (Kuginis et al. 2016).

The decision rules used in the identification of potential GDEs are based on a fundamental tenet of ecology in '*that ecosystems will generally use resources in proportion to their availability and the availability of different resources will be a significant determinant of structure and composition*' (Eamus et al. 2006a). It is assumed that if an ecosystem can access groundwater then that ecosystem will (generally) develop some degree of dependence and that dependence will likely increase with increasing aridity (Hatton and Evans 1998) (Kuginis et al. 2016).

Key factors in the determination of identification of potential GDEs therefore include:

- proximity to groundwater
- root system distribution and depth
- location or position in the landscape
- species traits.

### 4.4.2 GDEs within the study area

All native vegetation within the study area is considered to have the potential for at least a facultative (opportunistic) dependency on groundwater for maintenance of its life-cycle. The probability of the vegetation actually relying on the presence of subsurface groundwater, or the surface expression of that groundwater, depends on the factors outlined in Section 4.4.1 above.

Kuginis et al (2016) includes a method for the determining the probability of a patch of vegetation being a GDE, which includes a multi-faced analysis of groundwater depth, vegetation community composition and structure, expert / scientific knowledge, and remote sensing technology. These various parameters have been used to build a GIS model that has produced an output of high probability GDEs across the major river catchments in NSW and includes data specific to the study area.

Rather than directly using the outputs from this GIS model, it was considered more appropriate to determine the likely groundwater dependence of the vegetation within the study area using the ground-truthed vegetation community data collected as part of this BDAR, rather than relying on modelled PCT mapping (from the East Coast PCT Revision SVTM layer). Similarly, this also allows for use of the groundwater depth data that has been modelled across the entire study area as part of the Technical Report – Groundwater (included as Appendix I of the EIS), rather than relying on the incomplete groundwater depth modelling included in Spatial Layer of Probable Vegetation Groundwater Dependent Ecosystems in NSW (DPE Water 2022).As such the methods used to develop the GIS model, which are detailed in Kuginis et al (2016), have been replicated, as part of the current assessment, using site specific data to determine the probability of the vegetation within the study area being a GDE.

The analysis undertaken by Kuginis et al (2016) is based on the results of three separate levels of assessment, applied in a hierarchical manner. Level 1 includes assessment of remote sensing data that indicates groundwater use (note no project specific data is available so data from Kuginis et al (2016) has been directly applied), groundwater depth information, and analysis of woody / non-woody vegetation types. Level 2 includes assessment of vegetation community mapping, vegetation descriptions and landscape information and subsequent analysis using published scientific literature and expert knowledge. This has resulted in data being available to PCT level on the potential for vegetation to be a GDE based on scientific knowledge and expert opinion. Level 3 then applies decision rules based on a combination of the results of the Level 1 and Level 2 assessments to determine the final probability of groundwater dependence.

An analysis of the PCTs within the study area was undertaken in line with Kuginis et al (2016) and is included in Annexure D. Based on application of these decision rules the probability of the vegetation within the subject land being a GDE is considered to be as follows:

- PCT 708 is a low probability GDE
- PCT 766 is an alternative water source non-GDE
- PCT 1078 is an alternative water source non-GDE
- PCT 1248 is a low probability GDE
- PCT 1256 is an alternative water source non-GDE
- PCT 1615 is a low probability GDE
- PCT 1740 is an alternative water source non-GDE.

It is unlikely that those communities selected as having a low probability of groundwater use would access groundwater except under conditions where the groundwater was very shallow and GDE class (remotely sensed groundwater use frequency) high. It is possible however that application of this rule as stated will miss those communities with an opportunistic use of groundwater, or smaller more localised areas of GDEs such as those that occur around springs (Kuginis et al. 2016). These findings are broadly in line with the GDE probability mapping included in the Spatial Layer of *Probable Vegetation Groundwater Dependent Ecosystems in NSW* (DPE Water 2022). The exception being that a small area of high probability GDE is included on the DPE Water mapping within the PCT 766 Moderate vegetation zone north of the Little Hartley subject land. Impacts to GDEs are discussed in Section 7.7.

Mapping of Temperate Highland Peat Swamps on Sandstone (both BC Act and EPBC Act listed) has also been undertaken within the locality (CoA and Macquarie University 2016, DPE 2010b) with this mapping indicating the presence of several swamps within the Little Hartley study area, including one within the study area near to the development footprint at Little Hartley, as well as above the proposed tunnel alignment. The swamp within the Little Hartley study area has been attributed within the mapping project as “Cleared, non-native vegetation, buildings”, and surveys conducted as part of the current assessment confirmed that remaining swamp vegetation largely did not satisfy the condition thresholds of the EPBC Act TEC listing.

Peat swamps have also been mapped within the vicinity of the Blackheath study area within adjacent areas of the Blue Mountains National Park (CoA and Macquarie University 2016, DPE 2010b). Mapping of these Temperate Highland Peat Swamps on Sandstone occurs along Greaves Creek at Blackheath, near to the Blackheath development footprint and a surface water discharge location.

### 4.4.3 GDEs within assessment area

Mapping of high probability GDEs has been undertaken across NSW by DPE Water, following the *Methods for the identification of high probability groundwater dependent vegetation ecosystems* (Kuginis et al. 2016). Outside of the study area covered by the GDE assessment detailed in

Section 4.4.2 above, medium probability GDEs have been mapped to the south-east of the Blackheath subject land (associated with Adams Creek), as well as to the south-west of the Soldiers Pinch subject land (associated with Fairy Bower Creek). A high probability GDE is also mapped within the Little Hartley study area along with several medium probability GDEs, with these areas predominantly associated with Butlers Creek, farm dams, and low-lying drainage lines (Figure 4-5). Several medium probability GDEs have been mapped either directly above the proposed tunnel alignment or with the surrounding assessment area (DPE Water 2022) (Figure 4-5).

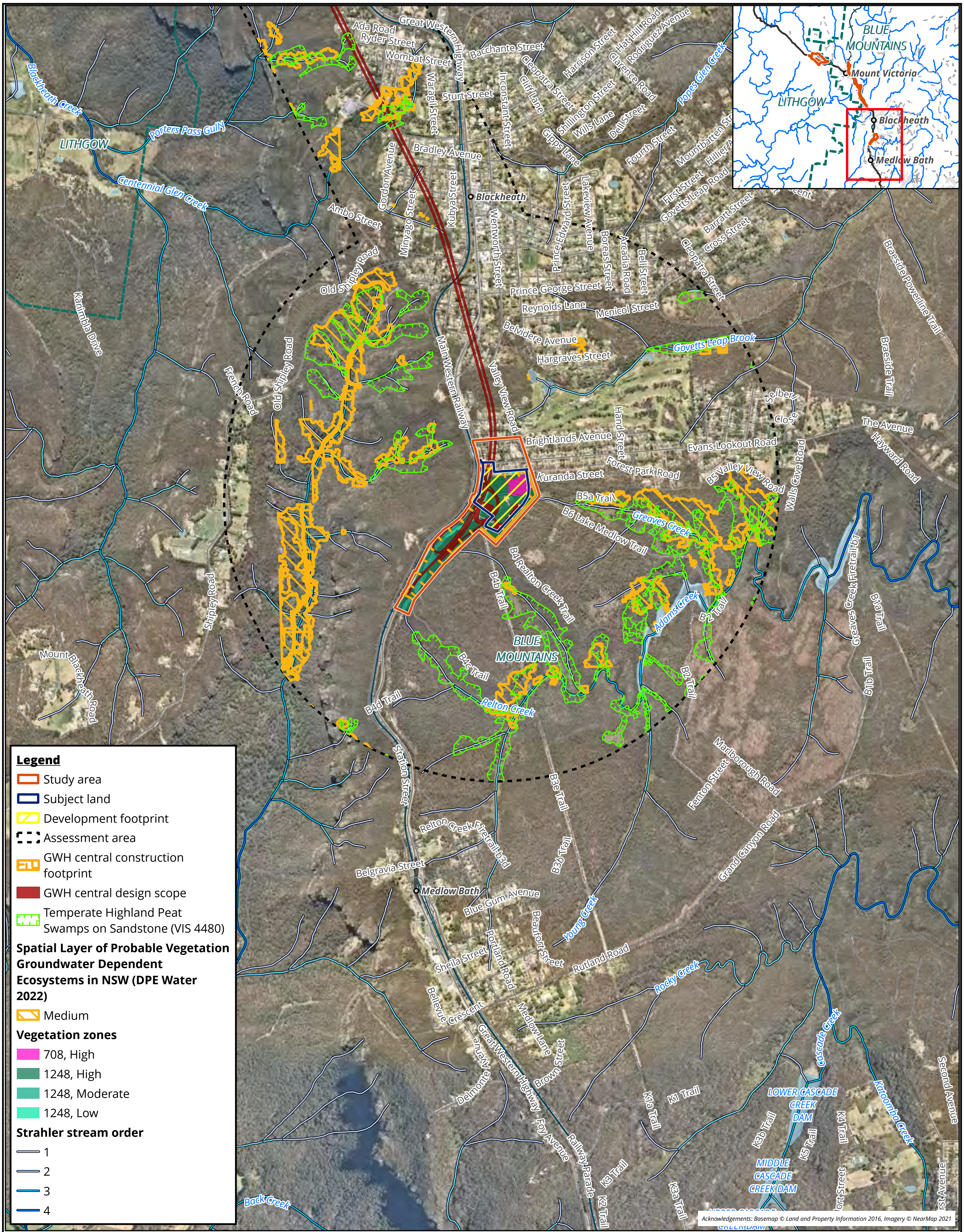


**Figure 4-5 Groundwater dependent ecosystems**
**Page 1 of 3**

biosis.

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Date: 26 October 2022 ,
Prepared for: MH, Prepared by: AM, Last edited by: lharley
Layout: 35727_BDAR_F4-5_GDE
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Metres
Scale 1:20,000 @ A3
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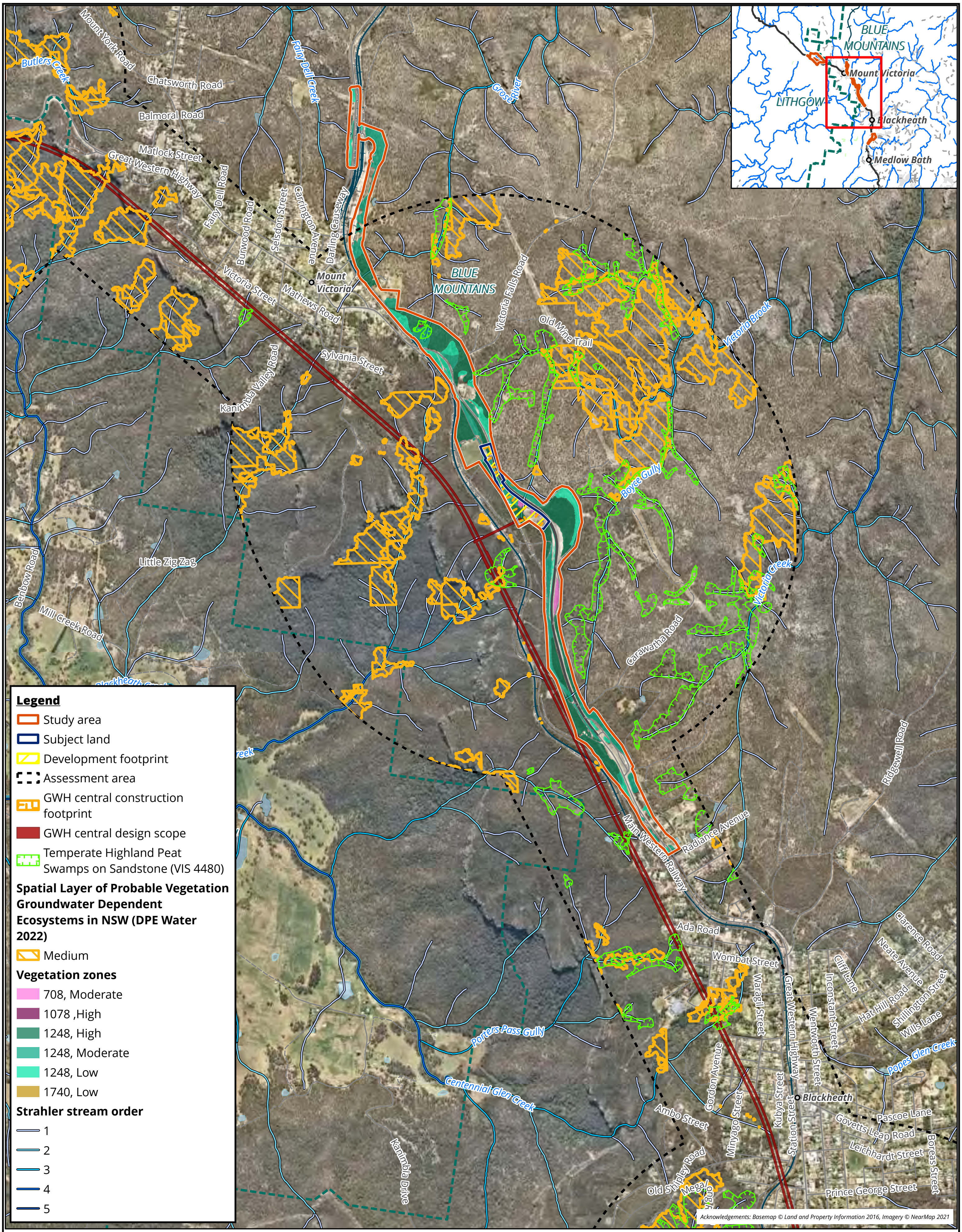


Figure 4-5 Groundwater dependent ecosystems
Page 2 of 3

biosis

Matter: 35727,
Date: 26 October 2022 ,
Prepared for: MH, Prepared by: AM, Last edited by: lharley
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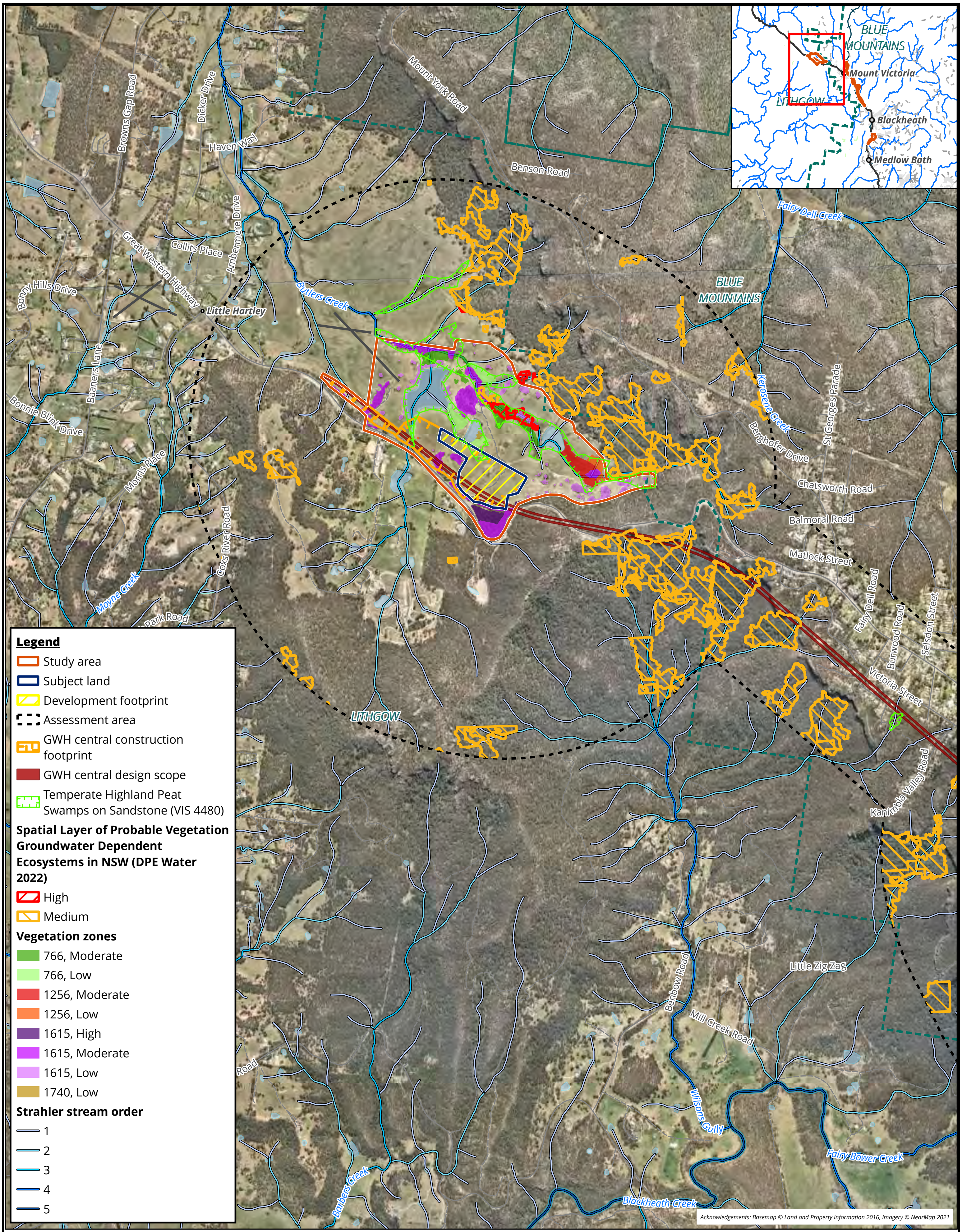


**Figure 4-5 Groundwater dependent ecosystems**
**Page 3 of 3**



Scale 1:20,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

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Matter: 35727,
Date: 26 October 2022 ,
Prepared for: MH, Prepared by: AM, Last edited by: lharley
Layout: 35727_BDAR_F4-5_GDE
Project: P:\35700s\35727\Mapping\
35727_BDAR_portrait.aprx

## 4.5 Other vegetation

No scattered trees or planted native vegetation, as defined by Appendix B and Appendix D of the BAM respectively, are present within the study area. Therefore, no streamlined assessment modules have been applied.

Areas of urban exotics and weeds, or where a PCT could not reliably be assigned due to a high degree of disturbance, have been mapped as non-native vegetation. No areas of non-native vegetation containing native trees occur within the subject land. As such there are no native trees that need to captured under the Transport for NSW Tree and hollow replacement guidelines (TfNSW 2022).

# 5 Threatened species

Similar to the native vegetation assessment, the assessment of threatened species undertaken for this BDAR was originally designed based on the broader study area, with field investigation being undertaken prior to the refinement of the project's final construction footprint. This chapter details the background research and methods undertaken in order to determine the threatened species that were assessed within the study area as part of this BDAR, as well as the methods and results of the threatened species surveys. Finally this section outlines the impacts to threatened species likely to occur within the refined development footprint as a result of the project.

## 5.1 Background research

Existing information from the following databases and information sources was reviewed to prepare a list of potential threatened and migratory species for survey:

- Biodiversity Assessment Calculator (BAM-C) – case numbers 00028460/BAAS18134/21/00028461 (Wollemi subregion) and 00028460/BAAS18134/21/00029156 (Burragorang subregion)
- BioNet - the website for the Atlas of NSW Wildlife and Threatened Biodiversity Data Collection (TBDC) (DPE 2022b)
- Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool (DCCEEW 2022a)
- NSW Biodiversity Values Map and Threshold Tool (DPE 2022c)
- Important Area Maps (DPE 2022d)
- relevant vegetation mapping including:
    - Southeast NSW Native Vegetation Classification and Mapping – SCIVI. VIS_ID 2230 (DPE 2010a)
    - State Vegetation Type Map: Central Tablelands Region Version 1.0. VIS_ID 4778 (DPE 2018)
- existing project reports including:
    - Great Western Highway East – Katoomba to Blackheath Review of Environmental Factors (Transport for NSW 2022a)
    - Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) Review of Environmental Factors (Transport for NSW 2021a)
    - Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) Biodiversity Addendum Report (Transport for NSW 2022b)
    - Great Western Highway Upgrade – Medlow Bath Review of Environmental Factors (Transport for NSW 2021b)
    - Great Western Highway, Blackheath to Little Hartley Scoping Report (Transport for NSW 2021c)
    - Great Western Highway Upgrade, Katoomba to Lithgow – Preliminary Environmental Investigation – September 2020 (Transport for NSW 2020).

## 5.2 Threatened species habitat assessment

### 5.2.1 Habitat suitability for species that can be predicted by habitat surrogates (ecosystem credit species)

A list of predicted species (ecosystem credit species) expected to occur within the development footprint was generated as per Section 5 of the BAM (DPIE 2020a). Impacts to these species require assessment, however targeted survey is not required as these species are assumed to occur, based on the occurrence of the PCTs, habitat constraints, native vegetation cover in the landscape and calculated patch sizes. These species are identified as ecosystem credit species in the Threatened Biodiversity Data Collection (TBDC) (DPE 2022b).

A list of ecosystem credit species was generated for both the IBRA subregions within which the development footprint occurs (Burragorang and Wollemi). These lists were generated through the two BAM-C cases which were set up to separately process the native vegetation impacts occurring within each subregion. Ecosystem credit species that matched all relevant criteria for inclusion as part of this assessment were automatically populated into these lists by the BAM-C. Table 5-1 provides the full list of ecosystem credit species that were included by the BAM-C. None of the ecosystem credit species included on this list could be discounted, based on geographical restrictions or a lack of suitable habitat, from using the subject land on occasion. As such, no ecosystem credit species generated by the BAM-C were excluded from this assessment.

These species were considered when prescribing management and mitigation measures for the project, and a number have been specifically considered as part of the assessment under the Commonwealth EPBC Act.

Table 5-1: Summary of predicted ecosystem credit species assessed

| Species name | Common name | IBRA subregion | Sensitivity to gain |
|---|---|---|---|
| *Artamus cyanopterus cyanopterus* | Dusky Woodswallow | Burragorang, Wollemi | Moderate |
| *Callocephalon fimbriatum* | Gang-gang Cockatoo (foraging) | Wollemi | Moderate |
| *Calyptorhynchus lathami* | Glossy Black-Cockatoo (foraging) | Wollemi | High |
| *Circus assimilis* | Spotted Harrier | Burragorang | Moderate |
| *Climacteris picumnus victoriae* | Brown Treecreeper (eastern subspecies) | Wollemi | High |
| *Daphoenositta chrysoptera* | Varied Sittella | Burragorang, Wollemi | Moderate |
| *Dasyurus maculatus* | Spotted-tailed Quoll | Burragorang, Wollemi | High |
| *Epthianura albifrons* | White-fronted Chat | Burragorang | Moderate |
| *Falsistrellus tasmaniensis* | Eastern False Pipistrelle | Wollemi | High |
| *Glossopsitta pusilla* | Little Lorikeet | Wollemi | High |
| *Hieraaetus morphnoides* | Little Eagle (foraging) | Burragorang, Wollemi | Moderate |
| *Hirundapus caudacutus* | White-throated Needletail | Burragorang, Wollemi | High |

| Species name | Common name | IBRA subregion | Sensitivity to gain |
|---|---|---|---|
| *Hoplocephalus bungaroides* | Broad-headed Snake (foraging) | Wollemi | High |
| *Lophoictinia isura* | Square-tailed Kite (foraging) | Wollemi | Moderate |
| *Micronomus norfolkensis* | Eastern Coastal Free-tailed Bat | Wollemi | High |
| *Miniopterus australis* | Little Bent-winged Bat (foraging) | Wollemi | High |
| *Miniopterus orianae oceanensis* | Large Bent-winged Bat (foraging) | Wollemi | High |
| *Neophema pulchella* | Turquoise Parrot | Wollemi | High |
| *Ninox connivens* | Barking Owl (foraging) | Burragorang, Wollemi | High |
| *Ninox strenua* | Powerful Owl (foraging) | Wollemi | High |
| *Petaurus australis* | Yellow-bellied Glider | Wollemi | High |
| *Petroica boodang* | Scarlet Robin | Burragorang, Wollemi | Moderate |
| *Petroica phoenicea* | Flame Robin | Burragorang, Wollemi | Moderate |
| *Pseudomys novaehollandiae* | New Holland Mouse | Wollemi | High |
| *Pteropus poliocephalus* | Grey-headed Flying-fox (foraging) | Wollemi | High |
| *Saccolaimus flaviventris* | Yellow-bellied Sheathtail-bat | Burragorang | High |
| *Scoteanax rueppellii* | Greater Broad-nosed Bat | Wollemi | High |
| *Tyto novaehollandiae* | Masked Owl (foraging) | Wollemi | High |
| *Tyto tenebricosa* | Sooty Owl (foraging) | Wollemi | High |
| *Varanus rosenbergi* | Rosenberg's Goanna | Wollemi | High |

### 5.2.2 Habitat suitability for species that cannot be predicted by habitat surrogates (species credit species)

Species credit species are threatened species for which vegetation surrogates and/or landscape features cannot reliably predict the likelihood of their occurrence, or components of their habitat. These candidate species are identified as species credit species in the TBDC (DPE 2022b). A targeted survey or an expert report is required to confirm the presence of these species within the subject land, or alternatively the species can be assumed to be present (DPIE 2020a).

Annexure E provides the lists of species predicted to occur within the development footprint based on the two IBRA subregions (Burragorang and Wollemi) on which the project occurs, the native vegetation cover present within the assessment area, the PCTs present within the development footprint, and the patch sizes listed in Table 4-26. Originally the list of candidate species credit species was generated based on the broader study area, which included a larger subset of PCTs. As such additional species were included in the threatened species surveys undertaken for this assessment than those that are detailed in the final list of candidate species. These additional species are listed in Section 5.2.2.2 and they are also included in Annexure E where they are noted as being “not identified by BAM-C as a BAM candidate species”.

The potential for a species to occur within the development footprint was also assessed in accordance with Section 5.2 of the BAM which allows for refinement of the list of threatened species credit species required to be assessed based on geographical restrictions and habitat constraints detailed within the BAM-C. A detailed assessment of potential for occurrence, and potential for impact, for all species credit species predicted to occur within the subject land is provided in Annexure E. Species credit species considered to potentially occur within the subject land, and thus considered ‘candidate species credit species’ have been either assumed present within areas identified as potential habitat, subject to an expert report, or are the target of threatened species surveys. For species where their associated geographical restrictions and habitat constraints were not met, further assessment in the form of targeted survey or expert report was not required.

A summary of the habitat suitability assessment undertaken for fauna species is included below.

#### 5.2.2.1 Habitat suitability assessment

To assist with determining the candidate threatened fauna species requiring further assessment, a fauna habitat suitability assessment was undertaken to determine whether the vegetation within the study area contained microhabitats suitable to support the predicted species credit species outlined in Annexure E.

Habitat within the majority of the study area comprises of relatively intact native vegetation containing a variety of microhabitat suitable for threatened fauna species. Eucalyptus species such as; Sydney Peppermint, Blue Mountains Ash and Monkey Gum provide foraging resources for a range nectivorous fauna species when in flower such as; Grey-headed Flying-fox *Pteropus poliocephalus*, Eastern Pygmy-possum *Cercartetus nanus*, Squirrel Glider *Petaurus norfolcensis* and Greater Glider *Petauroides volans*, while the leaves also represent potential foraging resources for Greater Glider and Koala *Phascolarctos cinereus*. Similarly, the *Banksia* species (Hairpin Banksia, Heath-leaved Banksia and Silver Banksia *Banksia marginata*) along with the *Acacia* species (including Sunshine Wattle, Hickory Wattle *Acacia implexa* and Blackwood) also represent potential foraging resources for nectivorous fauna when in flower.

Trees containing hollows provide shelter and nesting habitat for a number of species. Within the study area there are a variety of hollow sizes and types, providing suitable habitat for a number of threatened species including; Southern Myotis *Myotis macropus*, Glossy-black Cockatoo *Calyptorhynchus lathami*, Gang-gang Cockatoo *Callocephalon fimbriatum*, Eastern Pygmy Possum, Squirrel Glider, Greater Glider and up to four species of large forest owls. The study area provides suitable foraging and potential nesting habitat for predatory birds including Little Eagle *Hieraaetus morphnoides* and Square-tailed Kite *Lophoictinia isura*. A habitat assessment and searches for signs of old or current nests was conducted to detect signs of breeding within the study area, with no suitably sized nests to support these species detected.

Microhabitat present within the broader assessment area included rocky outcrops and cliffs which provide possible habitat for Brush-tailed Rock-wallaby *Petrogale penicillata* or Broad-headed Snake *Hoplocephalus bungaroides*. While these features were limited within the study area, efforts were made to survey this habitat where it occurred adjacent to the study area.

The study area also provides ephemeral and permanent streams with sandy substrate and / or sandstone outcropping providing suitable potential habitat for; Giant Burrowing Frog *Heleioporus australiacus*, Stuttering Frog *Mixophyes balbus*, Littlejohn's Tree Frog *Litoria littlejohni* and Red-crowned Toadlet *Pseudophryne australis*. Dams and streams containing emergent and fringing vegetation also provide potential habitat for some of these threatened frogs as well as a variety of common frog species.

Rocky outcrops within two kilometres containing potential caves, large overhangs and crevices represent potential habitat for cave-roosting microbat species such as; Large Bent-winged Bat *Miniopterus orianae oceanensis*, Little Bent-winged Bat *Miniopterus australis* and Large-eared Pied Bat *Chalinolobus dwyeri*. Dams and open waterways also provide foraging habitat for Southern Myotis, while the majority of the study area and adjacent vegetated areas in the wider locality also provides suitable habitat for foraging by both threatened microbats listed as ecosystem credit species, and more common microbat species.

Shrubby heath vegetation providing a high level of canopy cover, as well as isolated patches of dense ferns or weedy ground cover represented potential marginal habitat for Southern Brown Bandicoot *Isoodon obesulus obesulus.* Large areas of more in-tact vegetation adjoins the study area within areas of the adjacent Blue Mountains National Park, representing greater habitat potential for this species.

#### 5.2.2.2 Candidate species excluded from or added to the assessment

Twelve predicted species credit species have been excluded from occurring within the subject land based on habitat constraints, a lack of required microhabitat features and/or having never been recorded within the locality. These species are listed in Table 5-2 along with a summary of the reason the species has been excluded from further assessment. The full exclusion justifications for these species are included in Annexure E.

Table 5-2: Summary of candidate species excluded from further assessment

| Species name | Common name | EPBC Act | BC Act | Reason for exclusion |
|---|---|---|---|---|
| **Flora** | | | | |
| *Grevillea evansiana* | Evans Grevillea | V | V | Study area outside species known area of occurrence |
| *Leionema lachnaeoides* | | E | E | Habitat constraints (Narrabeen Group sandstone cliffs, pagodas, platforms shelves and/or terraces or within 200 m) are not present in the subject land |
| *Leionema sympetalum* | Rylstone Bell | V | V | Habitat constraints (Pagoda formations in Triassic Narrabeen Sandstone or within 50 m) are not present in subject land. Study area is outside species' area of occurrence. |
| *Leucopogon exolasius* | Woronora Beard-heath | V | V | Study area is outside the species' area of occurrence. Microhabitats for supporting the species not present. |
| *Pultenaea* sp. *Olinda* | | - | E | Habitat constraints (Ledges and crevices associated with pagoda formations on Narrabeen sandstone of within 50 m) are not present in subject land. Study area is outside species' area of occurrence. |
| *Tetratheca glandulosa* | | - | V | Study area outside species known area of occurrence. |
| *Velleia perfoliata* | | V | V | Study area outside species known area of occurrence. |

| Species name | Common name | EPBC Act | BC Act | Reason for exclusion |
|---|---|---|---|---|
| **Amphibians** | | | | |
| *Litoria aurea* | Green and Golden Bell Frog | E | V | Microhabitats within study area too degraded to support species. |
| *Litoria booroolongensis* | Booroolong Frog | E | E | Microhabitats to support the species not present in study area. Advice from species expert is species habitat is not present. |
| **Fungi** | | | | |
| *Hygrocybe anomala* var. *ianthinomarginata* | | - | V | Study area is outside known occurrence for the species. Microhabitats are not present in subject land. Advice from species expert for multiple flora species is that habitat is not present. |
| *Hygrocybe aurantipes* | | - | V | Study area is outside known occurrence for the species. Microhabitats are not present in subject land. Advice from species expert for multiple flora species is that habitat is not present. |
| *Hygrocybe reesiae* | | - | V | Study area is outside known occurrence for the species. Microhabitats are not present in subject land. Advice from species expert for multiple flora species is that habitat is not present. |
| *Key: CE = Critically Endangered, E = Endangered, V = Vulnerable* | | | | |

The threatened species surveys were originally designed based on the native vegetation and habitats present within the broader study area. As such, additional threatened species were originally included as potential candidates which, following the finalisation of the development footprint, are now no longer associated with any areas of native vegetation directly impacted by the project. Fourteen such species credit species were therefore included in the threatened species surveys and are included in the assessment of habitat suitability in Annexure E. However, as these species are not considered candidates based on the final development footprint, they have not added to the final BAM-C cases. These species are:

- Deane's Boronia *Boronia deanei*
- Megalong Valley Bottlebrush *Callistemon megalongensis*
- Broad-leaved Sally *Eucalyptus aquatica*
- Paddys River Box, Camden Woollybutt *Eucalyptus macarthurii*
- Wingecarribee Gentian *Gentiana wingecarribiensis*
- Narrow-leaf Finger Fern *Grammitis stenophylla*
- White-bellied Sea-Eagle *Haliaeetus leucogaster*
- Evans Sedge *Lepidosperma evansianum*
- Southern Myotis *Myotis macropus*
- Dwarf Mountain Pine *Pherosphaera fitzgeraldii*

- Slaty Leek Orchid *Prasophyllum fuscum*
- Long-nosed Potoroo *Potorous tridactylus*
- Elusive Bush-pea *Pultenaea elusa*
- *Zieria covenyi.*

#### 5.2.2.3 Candidate threatened flora species requiring further assessment

Following the exclusion of candidate species credit species under Section 5.2.2.2, a final list of the candidate flora species credit species requiring further assessment was generated. This list is included in Table 5-3 along with each species' required survey period and the relevant method of assessment. Further detail of the targeted surveys undertaken are provided in Section 5.3.1 below. Details for expert reports are included in Section 5.4.

Table 5-3: Candidate flora species requiring further assessment

| Species name | Common name | IBRA subregion | Method of assessment |
|---|---|---|---|
| *Acacia baueri* subsp. *aspera* | - | Wollemi | Targeted survey |
| *Acacia bynoeana* | Bynoe's Wattle | Wollemi | Targeted survey |
| *Acacia flocktoniae* | Flockton Wattle | Wollemi | Expert report |
| *Acacia gordonii* | - | Wollemi | Targeted survey |
| *Acacia meiantha* | - | Wollemi | Expert report |
| *Astrotricha crassifolia* | Thick-leaf Star-hair | Wollemi | Targeted survey |
| *Baloskion longipes* | Dense Cord-rush | Burragorang | Targeted survey |
| *Caesia parviflora* var. *minor* | Small Pale Grass-lily | Wollemi | Targeted survey |
| *Carex klaphakei* | Klaphake's Sedge | Burragorang | Targeted survey |
| *Darwinia peduncularis* | - | Wollemi | Targeted survey |
| *Epacris hamiltonii* | - | Wollemi | Targeted survey |
| *Eucalyptus aggregata* | Black Gum | Burragorang | Targeted survey |
| *Eucalyptus cannonii* | Capertee Stringybark | Wollemi | Targeted survey |
| *Eucalyptus copulans* | - | Wollemi | Targeted survey |
| *Euphrasia bowdeniae* | Blue Mountains Cliff Eyebright | Wollemi | Targeted survey |
| *Isopogon fletcheri* | Fletcher's Drumsticks | Wollemi | Targeted survey |
| *Kunzea cambagei* | Cambage Kunzea | Wollemi | Targeted survey |
| *Persoonia acerosa* | Needle Geebung | Wollemi | Targeted survey |
| *Persoonia hindii* | - | Wollemi | Targeted survey |

| Species name | Common name | IBRA subregion | Method of assessment |
|---|---|---|---|
| *Persoonia hirsuta* | Hairy Geebung | Wollemi | Targeted survey |
| *Persoonia marginata* | Clandulla Geebung | Wollemi | Targeted survey |
| *Prasophyllum pallens* | Musty Leek Orchid | Wollemi | Targeted survey |
| *Prostanthera cryptandroides* subsp. *cryptandroides* | Wollemi Mint-bush | Wollemi | Targeted survey |
| *Pultenaea glabra* | Smooth Bush-Pea | Wollemi | Targeted survey |
| *Veronica blakelyi* | - | Burragorang<br>Wollemi | Targeted survey |
| *Xanthosia scopulicola* | - | Wollemi | Targeted survey |
| *Zieria murphyi* | Velvet Zieria | Wollemi | Targeted survey |

#### 5.2.2.4 Candidate threatened fauna species requiring further assessment

A final list of the candidate fauna species credit species requiring further assessment was generated. This list is provided in Table 5-4 along with each species' required survey period and the relevant method of assessment. Several species were subject to habitat surveys which were undertaken throughout the threatened fauna targeted survey program. Where potential habitat was found, species presence has been assumed. One species (Littlejohn's Tree Frog) was subject to assessment by expert report. Further detail of the targeted surveys undertaken are provided in Section 5.3.2 below.

Table 5-4: Candidate fauna species requiring further assessment

| Species name | Common name | IBRA subregion | Method of assessment |
|---|---|---|---|
| *Callocephalon fimbriatum* | Gang-gang Cockatoo (Breeding) | Wollemi | Targeted survey |
| *Calyptorhynchus lathami* | Glossy Black-Cockatoo (Breeding) | Wollemi | Targeted survey |
| *Cercartetus nanus* | Eastern Pygmy-possum | Wollemi | Targeted survey |
| *Chalinolobus dwyeri* | Large-eared Pied Bat | Wollemi | Targeted survey |
| *Eulamprus leuraensis* | Blue Mountains Water Skink | Wollemi | Targeted survey |
| *Heleioporus australiacus* | Giant Burrowing Frog | Wollemi | Targeted survey |
| *Hieraaetus morphnoides* | Little Eagle (Breeding) | Burragorang<br>Wollemi | Habitat survey |
| *Hoplocephalus bungaroides* | Broad-headed Snake (Breeding) | Wollemi | Habitat survey |
| *Isoodon obesulus obesulus* | Southern Brown Bandicoot (eastern) | Wollemi | Targeted survey |

| Species name | Common name | IBRA subregion | Method of assessment |
|---|---|---|---|
| *Litoria littlejohni* | Littlejohn's Tree Frog | Wollemi | Expert report |
| *Lophoictinia isura* | Square-tailed Kite (Breeding) | Wollemi | Habitat survey |
| *Miniopterus australis* | Little Bent-winged Bat (Breeding) | Wollemi | Targeted survey |
| *Miniopterus orianae oceanensis* | Large Bent-winged Bat (Breeding) | Wollemi | Targeted survey |
| *Mixophyes balbus* | Stuttering Frog | Wollemi | Targeted survey |
| *Ninox connivens* | Barking Owl (Breeding) | Burragorang<br>Wollemi | Targeted survey |
| *Ninox strenua* | Powerful Owl (Breeding) | Wollemi | Targeted survey |
| *Paralucia spinifera* | Purple Copper Butterfly, Bathurst Copper Butterfly | Wollemi | Habitat survey |
| *Petalura gigantea* | Giant Dragonfly | Wollemi | Targeted survey |
| *Petauroides volans* | Greater Glider | Wollemi | Targeted survey |
| *Petaurus norfolcensis* | Squirrel Glider | Wollemi | Targeted survey |
| *Petrogale penicillata* | Brush-tailed Rock-wallaby | Wollemi | Habitat survey |
| *Phascolarctos cinereus* | Koala | Burragorang<br>Wollemi | Targeted survey |
| *Pseudophryne australis* | Red-crowned Toadlet | Wollemi | Targeted survey |
| *Pteropus poliocephalus* | Grey-headed Flying-fox (Breeding) | Wollemi | Habitat survey |
| *Tyto novaehollandiae* | Masked Owl (Breeding) | Wollemi | Targeted survey |
| *Tyto tenebricosa* | Sooty Owl (Breeding) | Wollemi | Targeted survey |

## 5.3 Threatened species survey

Targeted threatened species surveys of the study area were undertaken within the relevant timeframes as provided in BioNet. Targeted surveys were undertaken for species identified as requiring survey in Table 5-3 (flora) and Table 5-4 (fauna). As detailed in Section 5.2, these surveys were designed based on the broader study area, prior to the refinement of the project’s development footprint. A summary of the survey method, survey dates and weather observations during the targeted flora and fauna surveys are included in Table 5-5. Detailed survey methodologies for the targeted surveys are included in Sections 5.3.1 (flora) and 5.3.2 (fauna). Fauna survey was conducted under approval CSB 17/892 from the NSW Animal Care and Ethics Committee (expiry date 31 January 2023).

Table 5-5: Survey dates and weather observations during targeted flora and fauna surveys (Blackheath, NSW)

| Survey undertaken | Survey date | Temp. (°C) | | Daily rainfall (mm) |
|---|---|---|---|---|
| | | Min. | Max. | |
| Targeted flora, Native Blackthorn survey | 24/11/2021 | 10.8 | - | 2.0 |
| Targeted flora, Native Blackthorn survey | 25/11/2021 | -- | 20.7 | 7.0 |
| Targeted flora, Native Blackthorn survey | 26/11/2021 | 9.9 | 12.5 | 39.0 |
| Targeted flora, Native Blackthorn survey, habitat assessment, hollow-bearing tree survey, raptor nest survey, bush rock survey, remote camera deployment, bat detector deployment | 29/11/2021 | - | 17.0 | 2.0 |
| Targeted flora, Native Blackthorn survey, habitat assessment, hollow-bearing tree survey, raptor nest survey, bush rock survey, remote camera deployment, bat detector deployment | 30/11/2021 | 6.9 | -- | 0.0 |
| Habitat assessment, hollow-bearing tree survey, raptor nest survey, bush rock survey, remote camera deployment, bat detector deployment | 1/12/2021 | -- | 21.0 | 1.0 |
| Habitat assessment, hollow-bearing tree survey, raptor nest survey, bush rock survey, remote camera deployment, bat detector deployment | 2/12/2021 | 11.9 | 24.0 | 0.0 |
| Habitat assessment, hollow-bearing tree survey, raptor nest survey, bush rock survey, remote camera deployment, bat detector deployment | 3/12/2021 | 13.9 | 27.0 | 3.0 |
| Targeted frog, Giant Dragonfly and Blue Mountains Water Skink surveys. Gang-gang Cockatoo hollow dusk stag watches | 13/12/2021 | 9.2 | 23.0 | 0.0 |
| Targeted frog, Giant Dragonfly and Blue Mountains Water Skink surveys. Gang-gang Cockatoo hollow dusk stag watches | 14/12/2021 | 10.3 | 24.6 | 0.0 |
| Targeted frog, Giant Dragonfly and Blue Mountains Water Skink surveys. Gang-gang Cockatoo hollow dusk stag watches | 15/12/2021 | 13.6 | 27.0 | 0.0 |
| Targeted frog, Giant Dragonfly and Blue Mountains Water Skink surveys. Gang-gang Cockatoo hollow dusk stag watches | 16/12/2021 | 13.7 | 21.7 | 1.0 |
| Targeted frog, Giant Dragonfly and Blue Mountains Water Skink surveys. Gang-gang Cockatoo hollow dusk stag watches | 17/12/2021 | 10.1 | 22.8 | 2.0 |
| Targeted flora surveys, targeted frog surveys, remote camera collection, bat detector collection | 17/01/2022 | 15.4 | 28.4 | 0.0 |
| Targeted flora surveys, targeted frog surveys, remote camera collection, bat detector collection | 18/01/2022 | 16.4 | 19.0 | 3.0 |

| Survey undertaken | Survey date | Temp. (°C) | | Daily rainfall (mm) |
|---|---|---|---|---|
| | | Min. | Max. | |
| Targeted flora surveys, targeted frog surveys, remote camera collection, bat detector collection | 19/01/2022 | 12.0 | 13.4 | 39.0 |
| Targeted flora surveys, targeted frog surveys, remote camera collection, bat detector collection | 20/01/2022 | 10.6 | 14.0 | 8.0 |
| Targeted flora surveys, targeted frog surveys | 21/01/2022 | 10.0 | 16.5 | 9.0 |
| Microbat harp trapping | 31/01/2022 | 14.1 | 26.0 | 0.0 |
| Microbat harp trapping | 01/02/2022 | 16.0 | 28.4 | 13.0 |
| Microbat harp trapping | 02/02/2022 | 16.3 | 17.2 | 8.0 |
| Microbat harp trapping | 03/02/2022 | 10.1 | - | 5.0 |
| Microbat harp trapping | 04/02/2022 | - | 16.0 | 0.0 |
| Targeted owl surveys, mammal spotlighting, remote camera deployment | 02/05/2022 | 7.6 | - | 1.0 |
| Targeted owl surveys, mammal spotlighting, remote camera deployment | 03/05/2022 | - | 19.6 | 0.0 |
| Targeted owl surveys, mammal spotlighting | 04/05/2022 | 7.9 | 18.3 | 0.0 |
| Targeted owl surveys, mammal spotlighting | 05/05/2022 | 11.2 | 17.7 | 6.0 |
| Targeted owl surveys, mammal spotlighting | 09/05/2022 | 4.6 | 10.0 | 37.0 |
| Targeted owl surveys, mammal spotlighting | 10/05/2022 | 7.6 | 12.2 | 8.0 |
| Targeted owl surveys, mammal spotlighting | 11/05/2022 | 8.3 | 12.2 | 14.0 |
| Targeted owl surveys, mammal spotlighting | 12/05/2022 | 10.1 | 13.3 | 26.0 |

Information from the Australia Government Bureau of Meteorology website (Katoomba station 063039).

### 5.3.1 Threatened flora surveys

Twenty-five threatened flora species were subject to targeted surveys, the methods and effort employed were in accordance with Surveying threatened plants and their habitats NSW survey guide for the Biodiversity Assessment Method (DPIE 2020b). That is, parallel field traverses of 5 to 10 metre widths (determined by density of vegetation and life form of the target species) were undertaken in areas of suitable habitat by Biosis ecologists. During each survey the parallel traverses were walked by a minimum of two experienced botanists working systematically across all areas of potential habitat across the study area, following predetermined transect lines (start/end point) loaded onto tablet computers. The threatened flora survey program is summarised in Table 5-6. The completed survey effort is shown on Figure 5-1.

Table 5-6 Targeted threatened candidate flora survey details

| Species name | Common name | Associated PCTs in the development footprint | Required survey period | Minimum survey requirements | Survey time completed | Survey completed |
|---|---|---|---|---|---|---|
| *Acacia baueri* subsp. *aspera* | - | 708; 1248 | January, February, March, April, September, October, November, December | 10-15 m wide parallel field traverses in suitable habitat | January 2022 | 5-10 m wide parallel field traverses in suitable habitat |
| *Acacia bynoeana* | Bynoe's Wattle | 1248 | All year | 10-15 m wide parallel field traverses in suitable habitat | January 2022 | 5-10 m wide parallel field traverses in suitable habitat |
| *Acacia gordonii* | - | 708; 1248 | All year | 10-15 m wide parallel field traverses in suitable habitat | January 2022 | 5-10 m wide parallel field traverses in suitable habitat |
| *Astrotricha crassifolia* | Thick-leaf Star-hair | 1248 | July, August, September, October, November; December | 10-15 m wide parallel field traverses in suitable habitat | November 2021 | 5-10 m wide parallel field traverses in suitable habitat |
| *Baloskion longipes* | Dense Cord-rush | 766 | All year | 10-15 m wide parallel field traverses in suitable habitat | November 2021, January 2022 | 5-10 m wide parallel field traverses in suitable habitat |
| *Caesia parviflora* var. *minor* | Small Pale Grass-lily | 1248 | January, February, October, November, December | 10-15 m wide parallel field traverses in suitable habitat | November 2021, January 2022 | 5-10 m wide parallel field traverses in suitable habitat |
| *Carex klaphakei* | Klaphake's Sedge | 766 | January, February, November, December | 5-10 m wide parallel field traverses in suitable habitat | November 2021, January 2022 | 5-10 m wide parallel field traverses in suitable habitat |
| *Darwinia peduncularis* | - | 708; 1248 | All year | 10-15 m wide parallel field traverses in suitable habitat | November 2021, January 2022 | 5-10 m wide parallel field traverses in suitable habitat |

| Species name | Common name | Associated PCTs in the development footprint | Required survey period | Minimum survey requirements | Survey time completed | Survey completed |
|---|---|---|---|---|---|---|
| *Epacris hamiltonii* | - | 708; 1248 | September, October, November, December | 10-15 m wide parallel field traverses in suitable habitat | November 2021 | 5-10 m wide parallel field traverses in suitable habitat |
| *Eucalyptus aggregata* | Black Gum | 766 | All year | 20-40 m wide parallel field traverses in suitable habitat | November 2021 | 5-10 m wide parallel field traverses in suitable habitat |
| *Eucalyptus cannonii* | Capertee Stringybark | 1248 | All year | 20-40 m wide parallel field traverses in suitable habitat | November 2021, January 2022 | 5-10 m wide parallel field traverses in suitable habitat |
| *Eucalyptus copulans* | - | 708; 1248 | All year | 20-40 m wide parallel field traverses in suitable habitat | November 2021, January 2022 | 5-10 m wide parallel field traverses in suitable habitat |
| *Euphrasia bowdeniae* | Blue Mountains Cliff Eyebright | 708; 1248 | October, November | 5-10 m wide parallel field traverses in suitable habitat | November 2021 | 5-10 m wide parallel field traverses in suitable habitat |
| *Isopogon fletcheri* | Fletcher's Drumsticks | 1248 | October, November, December | 10-15 m wide parallel field traverses in suitable habitat | November 2021 | 5-10 m wide parallel field traverses in suitable habitat |
| *Kunzea cambagei* | Cambage Kunzea | 708; 1248 | October, November | 10-15 m wide parallel field traverses in suitable habitat | November 2021 | 5-10 m wide parallel field traverses in suitable habitat |
| *Persoonia acerosa* | Needle Geebung | 708 | All year | 10-15 m wide parallel field traverses in suitable habitat | January 2022 | 5-10 m wide parallel field traverses in suitable habitat |
| *Persoonia hindii* | - | 708; 1248 | All year | 10-15 m wide parallel field traverses in suitable habitat | January 2022 | 5-10 m wide parallel field traverses in suitable habitat |

| Species name | Common name | Associated PCTs in the development footprint | Required survey period | Minimum survey requirements | Survey time completed | Survey completed |
|---|---|---|---|---|---|---|
| *Persoonia hirsuta* | Hairy Geebung | 708; 1248 | All year | 10-15 m wide parallel field traverses in suitable habitat | January 2022 | 5-10 m wide parallel field traverses in suitable habitat |
| *Persoonia marginata* | Clandulla Geebung | 1248 | January, February, March | 10-15 m wide parallel field traverses in suitable habitat | January 2022 | 5-10 m wide parallel field traverses in suitable habitat |
| *Prasophyllum pallens* | Musty Leek Orchid | 708 | November, December | 5-10 m wide parallel field traverses in suitable habitat | November 2021 | 5-10 m wide parallel field traverses in suitable habitat |
| *Prostanthera cryptandroides* subsp. *cryptandroides* | Wollemi Mint-bush | 708; 1248 | September, October, November | 5-10 m wide parallel field traverses in suitable habitat | November 2021 | 5-10 m wide parallel field traverses in suitable habitat |
| *Pultenaea glabra* | Smooth Bush-Pea | 708; 1248 | September, October, November | 10-15 m wide parallel field traverses in suitable habitat | November 2021 | 5-10 m wide parallel field traverses in suitable habitat |
| *Veronica blakelyi* | - | 1248; 1615 | January; February; December | 5-10 m wide parallel field traverses in suitable habitat | January 2022 | 5-10 m wide parallel field traverses in suitable habitat |
| *Xanthosia scopulicola* | - | 1248 | January, November, December | 5-10 m wide parallel field traverses in suitable habitat | November 2021, January 2022 | 5-10 m wide parallel field traverses in suitable habitat |
| *Zieria murphyi* | Velvet Zieria | 708; 1248 | September, October, November | 10-15 m wide parallel field traverses in suitable habitat | November 2021 | 5-10 m wide parallel field traverses in suitable habitat |

### Survey personnel and relevant experience

Targeted flora surveys were undertaken by the Biosis ecologists outlined in Table D-0-1. At all times survey teams consisted of a minimum of one senior botanical specialist staff member, paired on occasion with a botanical specialist with less experience in undertaking targeted flora surveys.

### Incidental surveys

In addition to the candidate species listed above, 13 threatened flora species have been listed as "Not a Candidate Species" within the habitat suitability assessment table included in Annexure E. The species are:

- Deane's Boronia
- Megalong Valley Bottlebrush
- Broad-leaved Sally
- Camden Woollybutt
- Wingecarribee Gentian
- Narrow-leaf Finger Fern
- Evans Grevillea
- Evans Sedge
- Dwarf Mountain Pine
- Slaty Leek Orchid
- Elusive Bush-pea
- *Tetratheca glandulosa*
- *Zieria covenyi.*

These species are not associated with the final PCTs that were confirmed present in the development footprint. However, they do have some small potential to occur within the development footprint, based on proximity of records or broadly similar habitat requirements and were thus considered as a precaution during the threatened flora surveys undertaken. These species are noted as being subject to 'incidental surveys', as they were not the main species targeted during the survey work, however their potential presence within the study area was considered during all appropriately timed surveys, and were not recorded.

### Results

No threatened flora individuals were detected during the targeted surveys undertaken as part of this assessment. As no threatened flora individuals were detected during the targeted surveys, no species polygons are required for direct impacts to threatened flora species.

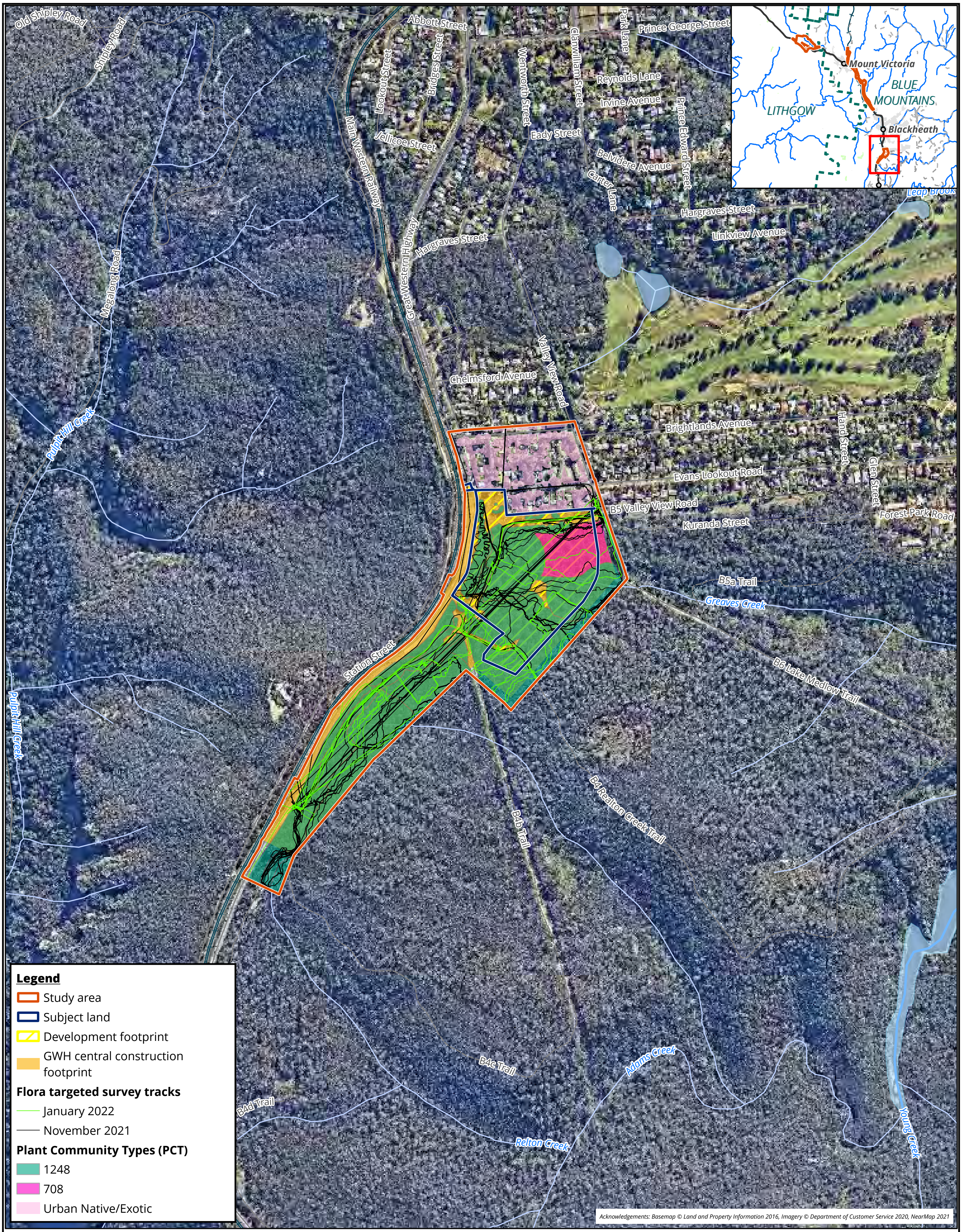


**Figure 5-1 Threatened species surveys - flora**
**Page 1 of 5**


**Figure 5-1 Threatened species surveys - flora**
**Page 2 of 5**

biosis

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Date: 19 October 2022 ,
Prepared for: MH, Prepared by: AM, Last edited by: amackegard
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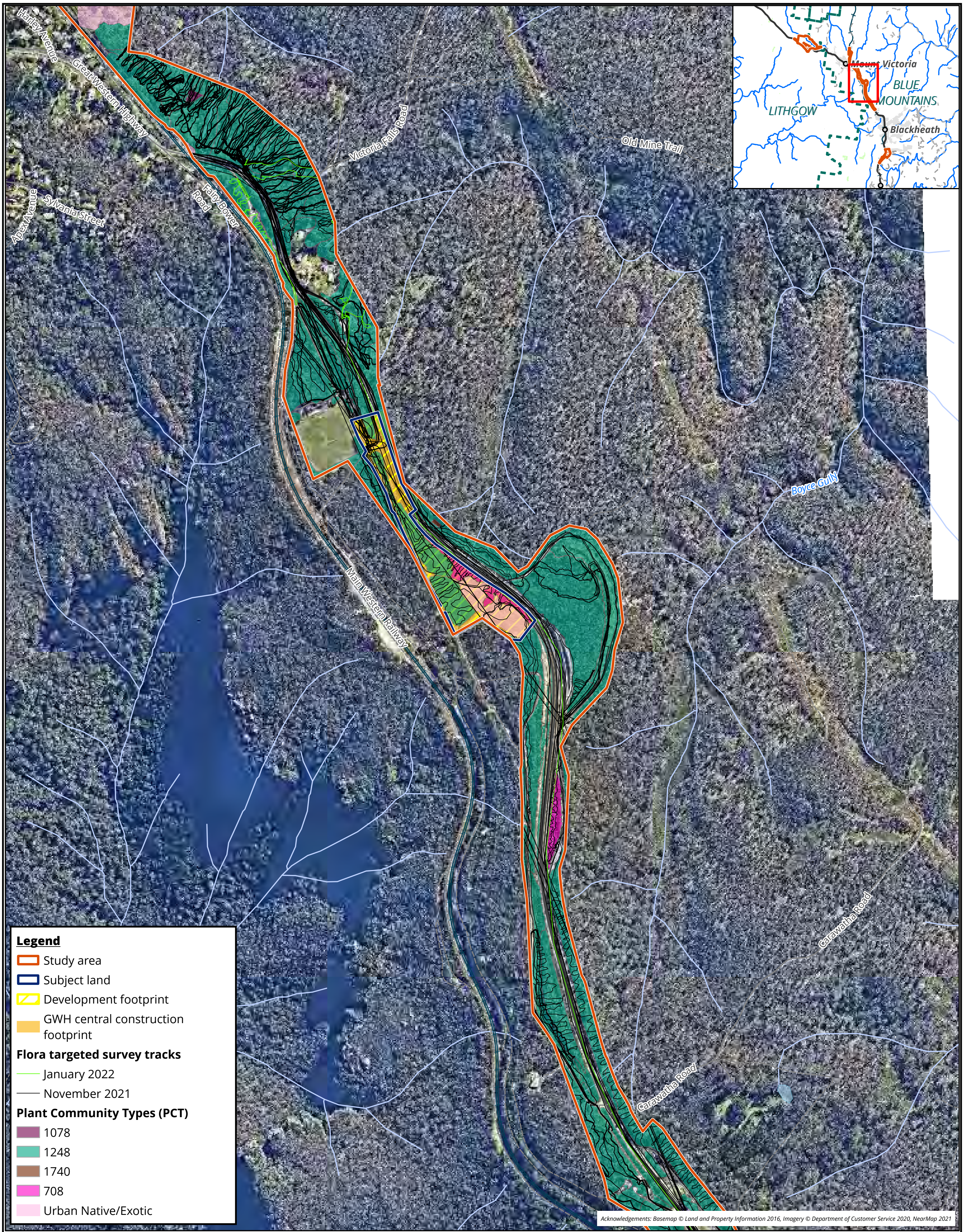


**Figure 5-1 Threatened species surveys - flora**
**Page 3 of 5**

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Scale 1:7,500 @ A3
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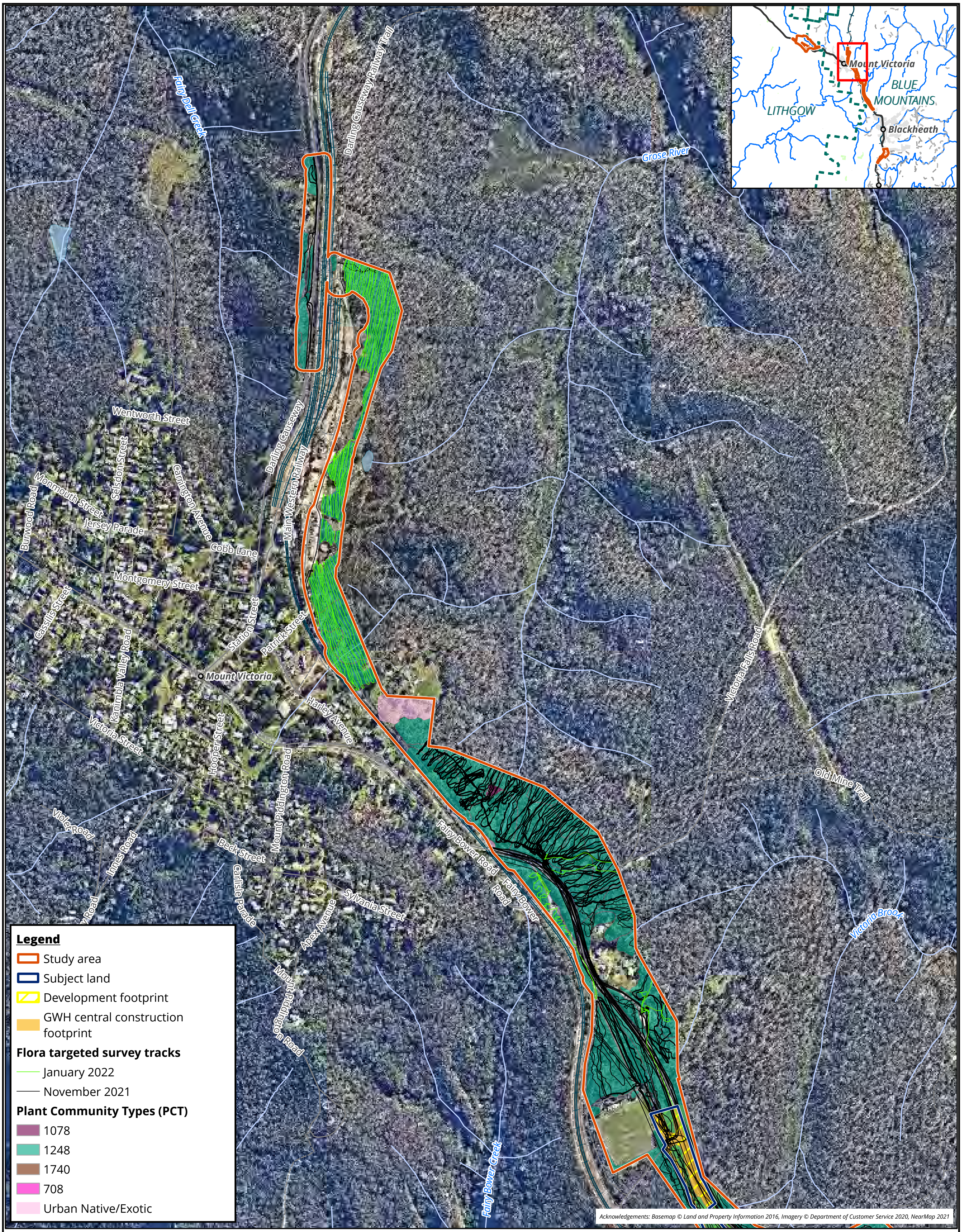


**Figure 5-1 Threatened species surveys - flora**
**Page 4 of 5**

biosis.

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Prepared for: MH, Prepared by: AM, Last edited by: amackegard
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Project: P:\35700s\35727\Mapping\35727_BDAR_portrait.aprx

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Metres
Scale 1:7,500 @ A3
Coordinate System: GDA 1994 MGA Zone 56
N

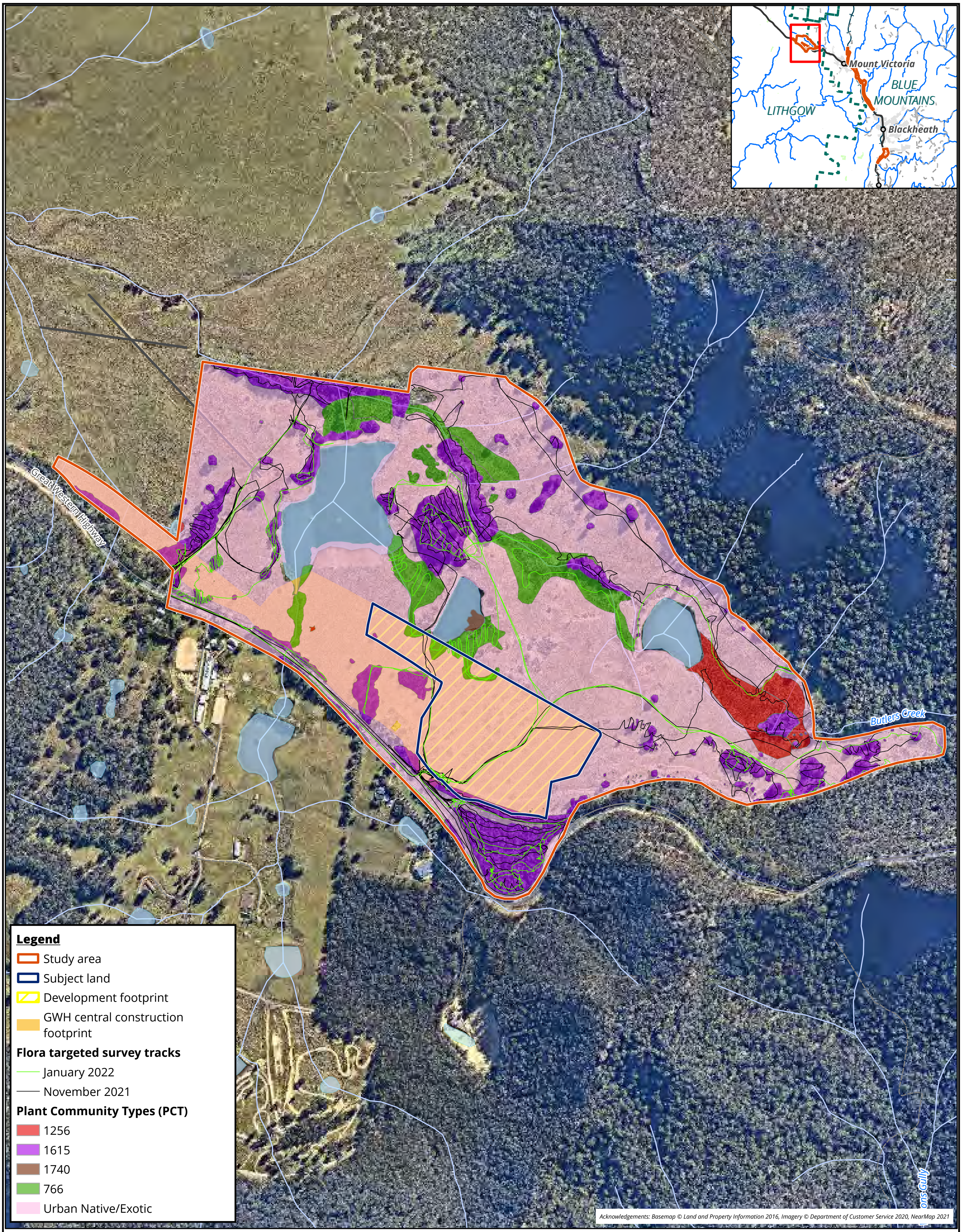


**Figure 5-1 Threatened species surveys - flora**
**Page 5 of 5**

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Matter: 35727,
Date: 19 October 2022 ,
Prepared for: MH, Prepared by: AM, Last edited by: amackegard
Layout: 35727_BDAR_F5-1_Flora
Project: P:\35700s\35727\Mapping\
35727_BDAR_portrait.aprx

### 5.3.2 Threatened fauna surveys

Twenty threatened fauna species were subject to targeted surveys based on the potential for supporting habitat within the development footprint. A further five were assessed via habitat assessment. The threatened fauna survey program is summarised in Table 5-7.

In addition to the candidate species listed in Table 5-7, White-bellied Sea Eagle *Haliaeetus leucogaster*, Southern Myotis *Myotis macropus* and Long-nosed Potoroo *Potorous tridactylus* have been listed as “Not identified by BAM-C as a BAM candidate species” within the habitat suitability assessment table included in Annexure E. These species are not associated with the final PCTs that were confirmed present in the development footprint (within the Burragorang subregion with which they are associated). These species were considered as a precaution during the threatened fauna surveys undertaken.

Table 5-7: Targeted threatened candidate fauna survey details

| Species name | Common name | Associated PCTs in the development footprint | Required survey period | Minimum survey requirements | Survey time completed | Survey completed |
|---|---|---|---|---|---|---|
| *Callocephalon fimbriatum* | Gang-gang Cockatoo (Breeding) | 708, 1248 | January, October, November, December | Identification of signs of breeding including lone males in breeding season and occupied nests. Identification of potential and actual nest trees if signs of breeding detected.[1] | December 2021 | Dusk surveys completing transects searching for individuals in areas containing suitable hollows over four afternoons/evenings. |
| *Calyptorhynchus lathami* | Glossy Black-Cockatoo (Breeding) | 708, 1248 | January, February, March, April, May, June, July, August, September | Identification of signs of breeding including breeding pairs, begging chicks or lone males. Identification of potential and actual nest trees is signs of breeding detected.[1] | May 2022 | Dusk surveys completing transects searching for individuals in areas containing suitable hollows over four afternoons/evenings. |
| *Cercartetus nanus* | Eastern Pygmy-possum | 708, 1248 | January, February, March, October, November, December | Spotlight search of 1 km habitat over one hour repeated twice (up to 200 ha of stratification unit).[2] | November 2021 to January 2022 (remote cameras)<br>May 2022 (spotlighting) | 857 remote camera trap nights.<br>Two nights spotlighting at three locations, total of 11 person hours. |

| Species name | Common name | Associated PCTs in the development footprint | Required survey period | Minimum survey requirements | Survey time completed | Survey completed |
|---|---|---|---|---|---|---|
| *Chalinolobus dwyeri* | Large-eared Pied Bat | 708, 1248 | January, November, December | Harp traps and acoustic detectors 16 trap nights over a minimum 4 nights.[3] | November 2021 to January 2022 (acoustic detectors)<br><br>January to February 2022 (harp trapping) | Acoustic survey over 377 detector nights.<br><br>Harp trapping, 17 trap nights across four nights. |
| *Eulamprus leuraensis* | Blue Mountains Water Skink | 708, 1248 | January, February, March, October, November, December | None specified in TBDC.<br><br>30-minute searches targeting specific habitat on two separate days per stratification unit (up to 100 ha). Basking individuals can be identified by sigh (if not cryptic)[2] | December 2021 | Transect searches of suitable habitat, 105 minutes over four days (210 person minutes). |
| *Heleioporus australiacus* | Giant Burrowing Frog | 708, 1248 | January, February, March, April, May, September, October, November, December | 500 m aural-visual transect survey per 1 km of suitable habitat repeated over eight nights survey (960 minutes total per transect).[4] | December 2021 and January 2022 | Aural-visual survey across two areas (960 minutes total) over eight nights. Survey effort pro-rata split across available potential habitat. |

| Species name | Common name | Associated PCTs in the development footprint | Required survey period | Minimum survey requirements | Survey time completed | Survey completed |
|---|---|---|---|---|---|---|
| *Hieraaetus morphnoides* | Little Eagle (Breeding) | 708, 766, 1248, 1256 | August, September, October | Searches for signs of breeding (large old trees within suitable vegetation and the presence of a male and female; or female with nesting material; or an individual on a large stick nest in the top half of the tree canopy).[1] | November and December 2021 | Searches for stick nests. |
| *Hoplocephalus bungaroides* | Broad-headed Snake (Breeding) | 708, 1248 | August, September | Not applicable, targeted surveys not undertaken. Species to be assumed present in areas of potential habitat. | November and December 2021 | Habitat survey and mapping across the alignment. |
| *Isoodon obesulus obesulus* | Southern Brown Bandicoot (eastern) | 708 | All year | Spotlight search of 1 km habitat over one hour repeated twice (up to 200ha of stratification unit).[2] | May 2022 (remote cameras and spotlighting) | Total 116 baited remote camera trap nights.<br>Spotlight survey of four locations over 6 nights, 22 person hours. |
| *Lophoictinia isura* | Square-tailed Kite (Breeding) | 1078 | January, September, October, November, December | Searches for signs of breeding (large old trees within suitable vegetation and the presence of a male and female; or female with nesting material; or an individual on a large stick nest in the top half of the tree canopy).[1] | November and December 2021 | Searches for stick nests. |

| Species name | Common name | Associated PCTs in the development footprint | Required survey period | Minimum survey requirements | Survey time completed | Survey completed |
|---|---|---|---|---|---|---|
| *Miniopterus australis* | Little Bent-winged Bat (Breeding) | 1248 | January, February, December | Harp traps 8 trap nights over a minimum 4 nights.[3] | November 2021 to January 2022 (acoustic detectors)<br>January to February 2022 (harp trapping) | Acoustic survey over 377 detector nights.<br>Harp trapping, 17 trap nights across four nights. |
| *Miniopterus orianae oceanensis* | Large Bent-winged Bat (Breeding) | 708, 1248 | January, February, December | Harp traps and acoustic detectors 16 trap nights over a minimum 4 nights.[3] | November 2021 to January 2022 (acoustic detectors)<br>January to February 2022 (harp trapping) | Acoustic survey over 377 detector nights.<br>Harp trapping, 17 trap nights across four nights. |
| *Mixophyes balbus* | Stuttering Frog | 708 | January, February, March, September, October November, December | 500 m aural-visual transect survey per 1 km of suitable habitat repeated over four nights survey (480 minutes total per transect).[4] | January 2022 | Aural-visual survey across two areas (480 minutes total) over four nights. Survey effort pro-rata split across available potential habitat. |

| Species name | Common name | Associated PCTs in the development footprint | Required survey period | Minimum survey requirements | Survey time completed | Survey completed |
|---|---|---|---|---|---|---|
| *Ninox connivens* | Barking Owl (Breeding) | 1248, 1615 | May, June, July, August, September, October, November, December | Signs of breeding (suitable habitat and presence of male and female; or calling to each other (duetting); or find nest.[1]<br>Call playback over a minimum 5 nights.[2] | May 2022 | Call playback over 5 nights at 3 locations across study area. |
| *Ninox strenua* | Powerful Owl (Breeding) | 1248 | May, June, July August | Call playback over a minimum 5 nights.[2] | May 2022 | Call playback over 5 nights at 3 locations across study area. |
| *Paralucia spinifera* | Purple Copper Butterfly, Bathurst Copper Butterfly | 1248 | September, October, December | Not applicable, targeted surveys not undertaken. Species to be assumed present in areas of potential habitat. | November and December 2021 | Habitat mapping of Native Blackthorn. |
| *Petalura gigantea* | Giant Dragonfly | 708, 1248 | January, December | Requires surveying within the swamp.[1]<br>Searches of suitable habitat for exuviae and adults flying. | December 2021 | Transect searches of suitable habitat, 105 minutes over four days (210 person minutes). |
| *Petauroides volans* | Greater Glider | 1248 | All year | Spotlight search of 1 km habitat over one hour repeated twice (up to 200 ha of stratification unit).[2] | May 2022 (spotlighting) | Two nights spotlighting at three locations, total of 11 person hours. |
| *Petaurus norfolcensis* | Squirrel Glider | 1248 | All year | Spotlight search of 1 km habitat over one hour repeated twice (up to 200 ha of stratification unit).[2] | November 2021 to January 2022 (remote cameras)<br>May 2022 (spotlighting) | 857 remote camera trap nights.<br>Two nights spotlighting at three locations, total of 11 person hours. |

| Species name | Common name | Associated PCTs in the development footprint | Required survey period | Minimum survey requirements | Survey time completed | Survey completed |
|---|---|---|---|---|---|---|
| *Petrogale penicillata* | Brush-tailed Rock-wallaby | 708, 1248 | All year | Not applicable, targeted surveys not undertaken. Species to be assumed present in areas of potential habitat. Remote cameras were deployed as supportive measure only. | November and December 2021 | Habitat survey and mapping across the alignment.<br>184 baited remote camera trap nights were undertaken within potential habitat areas. |
| *Phascolarctos cinereus* | Koala | 708, 1248, 1615 | All year | Spotlight search of 1 km habitat over one hour repeated twice (up to 200ha of stratification unit).[2] | May 2022 | Two nights spotlighting across three locations, 11 person hours. |
| *Pseudophryne australis* | Red-crowned Toadlet | 708, 1248 | All year | 500 m aural-visual transect survey per 1 km of suitable habitat repeated over four nights survey (480 minutes total per transect).[4] | December 2021 | Aural-visual survey across two areas (480 minutes total) over four nights. Survey effort pro-rata split across available potential habitat. |
| *Pteropus poliocephalus* | Grey-headed Flying-fox (Breeding) | 708, 1248 | October, November, December | Day-time camp survey for flying-fox camps.[3] | November and December 2021 | Habitat survey and mapping across the alignment. |
| *Tyto novaehollandiae* | Masked Owl (Breeding) | 1248 | May, June, July, August | Call playback over a minimum 8 nights.[2] | May 2022 | Call playback over 8 nights at 3 locations. |
| *Tyto tenebricosa* | Sooty Owl (Breeding) | 1248 | April, May, June, July, August | Call playback over a minimum 6 nights.[2] | May 2022 | Call playback over 6 nights at 3 locations. |

[1] Threatened Biodiversity Data Collection (DPE 2022b)

[2] Threatened Biodiversity Survey and Assessment: Guidelines for Development and Activities (DEC 2004)

[3] 'Species credit' threatened bats and their habitats: NSW survey guide for the Biodiversity Assessment Method (OEH 2018)

[4] NSW Survey Guide for Threatened Frogs: A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method (DPIE 2020c)

#### 5.3.2.1 Microbats

**Survey method and effort**

Threatened species survey for microbats included use of acoustic detectors and harp traps to determine the presence of threatened microbats and the presence of breeding bats within the study area.

Eight acoustic detectors were deployed between 30 November 2021 and 18 January 2022 in potential habitat across the study area. Four detectors were deployed for a total of 48 nights, one detector was set for 47 nights and three detectors were set for 46 nights, resulting in a total of 377 detector nights.

Harp trap surveys were conducted in the westernmost portion of the study area from 31 January to 4 February 2022. Harp trap surveys were undertaken at this location due to the proximity of cliff-lines (representing potential breeding habitat for cave-dwelling bats) to the Little Hartley study area. Three traps were deployed the first night, four traps on the second night, five traps on the third night, and five traps on the fourth night for a total of 17 trap nights. Two traps were moved during the course of the survey to prevent re-capture of lactating female *Nyctophilus* sp. Areas targeted by harp traps focused on flyways provided by remnant vegetation adjacent to farm dams and within remnant vegetation along waterways, as close as possible to potentially suitable breeding habitat for cave dwelling bats. Harp traps were set up in the hour prior to sunset, checked once through the night in case release of lactating or pregnant females was required, and again at dawn.

Survey effort and trap locations are shown on Figure 5-2.

**Acoustic analysis**

Calls were recorded from dusk until dawn using seven Wildlife Acoustics Songmeter SM4BAT acoustic recorders and one Anabat express unit fitted with omnidirectional microphones. Default settings for trigger, sensitivity, sampling rate and minimum / maximum frequency were used.

Units were located in areas of potential habitat for target threatened microbat species. Units were located to allow space in front and around the microphone so as to minimize echoes from hard surfaces, call attenuation from surrounding vegetation, and ensure adequate flight space around the microphone.

Files were recorded in full spectrum format. Data was downloaded and viewed using Anabat Insight (version 2.0.1 (licensed), Titley Scientific).

No reference calls were collected during the survey. Call identification was assisted by the following resources:

- Bat calls of NSW (Pennay, Law, & Reinhold 2004) including sample call files downloaded from https://www.environment.nsw.gov.au/topics/animals-and-plants/surveys-monitoring-and-records/bat-calls-of-nsw
- Key to the bat calls of south-east Queensland and north-east New South Wales (Reinhold et al. 2001).

A total of 8,541 call sequences were recorded at the eight sites over 377 detector nights.

Species identification was first refined by using known species geographic distributions (Churchill 2008, Australasian Bat Society 2022) to generate a list of species with potential to occur at the site.

Files not containing bat calls (noise files) were first filtered out using a standard “allbats” filter in Anabat Insight. Remaining files were passed through a custom decision tree to group into potential species or species groups. Calls were then manually reviewed and identified to species level where possible based on characteristic call parameters, with a focus on species-credit threatened species.

Calls recorded during the field survey were identified by visually comparing the spectrogram and call characteristics (e.g. characteristic frequency and call shape) with reference calls and descriptions from available reference materials (Reinhold et al. 2001, Pennay, Law, & Reinhold 2004). A call (pass) was defined as a sequence of three or more consecutive pulses of similar frequency and shape. Sequences with less than three defined consecutive pulses were not identified to species.

The focus of call analysis was to generate a list of species present, with a focus on threatened species, rather than analyse species activity. Species identification was therefore not attempted for all files recorded. Given the volume of data, it was not possible to manually review every file. The sampling effort and stratified analysis (using filters, decision trees and manual review) is assumed to have been sufficient to maximise detection of species present at the site.

Due to variability in the quality of calls and difficulty in distinguishing some species a conservative approach was taken when analysing calls and assigning an identification. The identification of each call was assigned a confidence rating (Duffy et al. 2000) as summarized in the table below (Table 5-8).

Table 5-8: Confidence ratings assigned to microbat calls during analysis (Duffy et al. 2000)

| Identification | Description |
|---|---|
| D- Definite | Call characteristics diagnostic, matching those described in reference material, including species reference calls. Call sequence contains three or more consecutive pulses of similar frequency and shape. |
| PR – Probable | Call most likely to represent a particular species, but there exists a low probability of confusion with species of similar call type or frequency, or call lacks sufficient detail (e.g call quality) to be definite. |
| SG – Species Group | Call characteristics (e.g frequency, shape) overlap with other species or call lacks sufficient detail (e.g. call quality) making it too difficult to distinguish between species. |

### Timing of survey

Microbat acoustic detectors were deployed from between 30 November 2021 and 18 January 2022, and harp trapping was undertaken in January and early February 2022. The surveys were therefore undertaken in accordance with the survey timing provided in BioNet for these species.

### Survey personnel and relevant experience

Acoustic detector deployment, harp trapping and bat call analysis were undertaken by the Biosis ecologists outlined in Table D-0-1. At all times survey teams consisted of a minimum of one senior zoological specialist staff member, paired on occasion with a zoological specialist with less experience in undertaking targeted fauna surveys. In addition, examples of species calls identified were cross-checked through internal quality assurance by both staff members involved in the bat call analysis to ensure identification was as consistent and accurate as possible.

### Results

Table 5-9 provides a summary of the microbat species that were detected via auditory detector surveys. Six threatened microbat species were detected via call analysis, including three species credit species; Large-eared Pied Bat, Large Bent-winged Bat and a species group which included Southern Myotis. As Southern Myotis could not be excluded from this species group, it has been included as being detected as a precaution. Little Bent-winged Bat was not detected via call analysis. No threatened species were recorded during the harp trap surveys. One lactating female *Vespadelus* sp. was recorded during harp trapping.

Table 5-10 provides a summary of the results of the microbat surveys completed and the requirements for species polygons due to direct impacts to species credit habitat. A species polygon is only required for Large-eared Pied Bat.

While Large Bent-winged Bat was detected via call detection, harp trapping did not detect the presence of any breeding individuals. Furthermore, no breeding habitat (including caves or other such features used for breeding) occur within 100 metres of the development footprint. Therefore, no species polygon is required for this species. Southern Myotis was also recorded however no native vegetation associated with the species (as detailed in the TBDC) is being impacted and as such the species is not included as a candidate species. There are also no watercourses or waterbodies of appropriate size at the Soldiers Pinch and Blackheath subject lands to be utilised by the species. As such a species polygon is not required. A full list of fauna species recorded during field surveys is provided in Annexure C.

Table 5-9: Microbat species detected via auditory detector surveys

| Species name | Common name | BC Act status | EPBC Act status | Identification |
|---|---|---|---|---|
| *Austronomus australis* | White-striped Free-tailed Bat | - | - | D |
| *Chalinolobus dwyeri* | Large-eared Pied Bat | Vulnerable | Vulnerable | D |
| *Chalinolobus gouldii* | Gould's Wattled Bat | - | - | D |
| *Chalinolobus morio* | Chocolate Wattled Bat | - | - | D |
| *Falsistrellus tasmaniensis* | Eastern False Pipistrelle | Vulnerable | - | PR |
| *Miniopterus orianae oceanensis* | Large Bent-winged Bat | Vulnerable | - | D |
| *Myotis macropus* | Southern Myotis | Vulnerable | - | SG |
| *Nyctophilus geoffroyi* | Lesser Long-eared Bat | - | - | SG |
| *Nyctophilus gouldi* | Gould's Long-eared Bat | - | - | SG |
| *Ozimops ridei* | Ride's Free-tailed Bat | - | - | D |
| *Rhinolophus megaphyllus* | Eastern Horseshoe Bat | - | - | D |
| *Scoteanax rueppellii* | Greater Broad-nosed Bat | Vulnerable | - | D |
| *Scotorepens orion* | South-eastern Broad-nosed Bat | - | - | PR |
| *Vespadelus darlingtoni* | Large Forest Bat | - | - | D |
| *Vespadelus regulus* | Southern Forest Bat | - | - | D |
| *Vespadelus troughtoni* | Eastern Cave Bat | Vulnerable | - | SG |
| *Vespadelus vulturnus* | Little Forest Bat | - | - | SG |

Table 5-10: Targeted microbat survey results

| Species name | Common name | Survey method | Survey results | Species polygon requirement |
|---|---|---|---|---|
| *Chalinolobus dwyeri* | Large-eared Pied Bat | Acoustic detection and harp trapping | Species detected during call analysis | Species polygon required |
| *Miniopterus australis* | Little Bent-winged Bat | Acoustic detection and harp trapping | Not detected during targeted survey | Not required |
| *Miniopterus orianae oceanensis* | Large Bent-winged Bat | Acoustic detection and harp trapping | Species detected during call analysis however no breeding individuals detected in harp trapping | Not required |
| *Myotis macropus* | Southern Myotis | Acoustic detection and harp trapping | Species detected during call analysis however no associated PCTs (as per TBDC) are impacted. | Not required |

#### 5.3.2.2 Diurnal birds

**Survey method and effort**

Diurnal bird surveys consisted of thorough habitat assessment across the study area to assess the locations of potential suitable nesting hollows, followed by stag watches and area searches at potential nesting trees. In addition, near-constant aural/visual surveys during all diurnal fauna surveys were also undertaken within the study area.

Targeted diurnal area search surveys were undertaken in December 2021 and May 2022 in the hour prior to sunset for Gang-gang Cockatoo (breeding season October to January) and Glossy Black-Cockatoo (breeding season April to August). Area searches were conducted where potential suitable nesting hollows and foraging resources were located. Four afternoons of stag watches/area searches were undertaken during each survey period for each of the Cockatoo species.

Where individual Gang-gang Cockatoo or Glossy Black-Cockatoo individuals were detected foraging, the survey would aim to observe and follow the birds at sunset when possible, to determine whether roosting or nesting was occurring within the study area.

The presence of large stick nests and potential breeding habitat for Square-tailed Kite, Little Eagle and White-bellied Sea-Eagle with the study area was assessed during hollow-bearing tree surveys in November and December 2021. While this survey was carried out outside of the survey season for the Little Eagle, such structures would persist in the environment at the end of the breeding season. As no stick nests were detected it is considered reasonable to conclude that no breeding habitat was detected within the study area.

Survey effort and transect locations are shown on Figure 5-2.

**Justification of survey method and effort**

Survey method and effort for both Cockatoo species was adapted from the Commonwealth Guidelines for the federally listed threatened Kangaroo Island population of Glossy Black-Cockatoo (DEWHA 2010c), with reference to the breeding habitat requirements identified for both species in the TBDC (DPE 2022b).

Survey involved area searches for signs of breeding or foraging individuals throughout areas of suitable foraging habitat and areas with the highest densities of suitable breeding hollows. If individuals were located during area searches, opportunistic survey was to be undertaken which involved following to determine the direction in which individual birds were travelling immediately following sunset (where possible). Surveys of potential tree hollows and nest trees throughout the study area were undertaken in accordance with the TBDC (DPE 2022b).

**Timing of survey**

Diurnal bird survey was undertaken in December 2021 (Gang-gang Cockatoo) and May 2022 (Glossy Black-cockatoo), and thus in accordance with the survey timing provided in BioNet for these species.

**Survey personnel and relevant experience**

Diurnal bird surveys were undertaken by the Biosis ecologists outlined in Table D-0-1. At all times survey teams consisted of a minimum of one senior zoological specialist staff member, paired on occasion with a zoological specialist with less experience in undertaking targeted fauna surveys.

**Results**

No threatened species were detected within breeding habitats during diurnal bird survey.

Table 5-11 provides a summary of the results of the diurnal bird surveys completed and the requirements for any species polygons for capturing direct impacts to species credit habitat. As no threatened species were detected, no species polygons are required for direct impacts to diurnal bird habitat. A full list of fauna species recorded is provided in Annexure C.

Table 5-11: Targeted diurnal bird survey results

| Species name | Common name | Survey method | Survey results | Species polygon |
|---|---|---|---|---|
| *Callocephalon fimbriatum* | Gang-gang Cockatoo (Breeding) | Area searches through suitable breeding habitat within one hour of sunset.<br>Ongoing searching for the species during all fauna survey. | Breeding individuals not detected during survey. | Not required |
| *Calyptorhynchus lathami* | Glossy Black-Cockatoo (Breeding) | Area searches through suitable breeding habitat within one hour of sunset.<br>Ongoing searching for the species during all fauna survey. | Breeding individuals not detected during survey. | Not required |
| *Haliaeetus leucogaster* | White-bellied Sea-Eagle (Breeding) | Habitat assessment including survey for stick nests throughout study area. | No breeding habitat detected during survey. Species not recorded. | Not required |
| *Hieraaetus morphnoides* | Little Eagle (Breeding) | Habitat assessment including survey for stick nests throughout study area. | No breeding habitat detected during survey. Species not recorded. | Not required |
| *Lophoictinia isura* | Square-tailed Kite (Breeding) | Habitat assessment including survey for stick nests throughout study area. | No breeding habitat detected during survey. Species not recorded. | Not required |

### 5.3.2.3 Nocturnal birds

**Survey method and effort**

Targeted survey was undertaken for Powerful Owl, Masked Owl, Sooty Owl and Barking Owl within the study area. Targeted survey included call playback for the owl species across three survey locations with the study area, over a total of eight nights across two separate weeks. One call playback point was deployed in the west, centre and the southern sections of the study area. As such, call playback points were separated by over two kilometres and were considered sufficiently separated to be targeting distinct areas of the study area.

Survey effort and call-playback locations are shown on Figure 5-2.

**Justification of survey method and effort**

Survey was undertaken in accordance with methodology outlined in the NSW Threatened Biodiversity Survey and Assessment: Guidelines for development and activities (working draft) (DEC 2004) which included five nights each for Powerful Owl and Barking Owl, six nights for Sooty Owl, and eight nights for Masked Owl. Reference was also made to the breeding habitat requirements listed in the TBDC (DPE 2022b). As no potential nest trees were detected with individuals displaying breeding behaviour, surveys to confirm breeding as outlined in the TBDC were not required.

**Timing of survey**

Nocturnal bird survey was undertaken in May 2022, and thus in accordance with the survey timing provided in BioNet for the four target owl species.

**Survey personnel and relevant experience**

Nocturnal bird surveys were undertaken by the Biosis ecologists outlined in Table D-0-1. At all times survey teams consisted of a minimum of one senior zoological specialist staff member, paired on occasion with a zoological specialist with less experience in undertaking targeted fauna surveys.

**Results**

No threatened species were detected during call playback survey. During spotlighting surveys a Sooty Owl individual was heard calling to the west of Browntown Oval however no breeding individuals were identified.

Table 5-12 provides a summary of the results of the nocturnal bird surveys completed and the requirements for any species polygons for capturing direct impacts to species credit habitat. As no breeding individuals were detected during the targeted surveys, no species polygons are required for direct impacts to threatened owl breeding habitat. A full list of fauna species recorded is provided in Annexure C.

Table 5-12: Targeted nocturnal bird survey results

| Species name | Common name | Survey method | Survey results | Species polygon |
|---|---|---|---|---|
| *Ninox connivens* | Barking Owl (Breeding) | 5 nights call playback in three locations. | Species not recorded during surveys. | Not required |
| *Tyto novaehollandiae* | Masked Owl (Breeding) | 8 nights call playback in three locations. | Species not recorded during surveys. | Not required |
| *Ninox strenua* | Powerful Owl (Breeding) | 5 nights call playback in three locations. | Species not recorded during surveys. | Not required |
| *Tyto tenebricosa* | Sooty Owl (Breeding) | 6 nights call playback in three locations. | Species recorded during surveys however no breeding individuals identified. | Not required – no breeding habitat identified within 100 m of the development footprint. |

### 5.3.2.4 Mammals

**Survey method and effort**

Threatened mammal survey included the use of baited infra-red camera traps to lure and photograph fauna, as well as spotlighting surveys. Cameras were baited with universal bait (peanut butter, honey and oats) while spotlight surveys were conducted by two observers walking a transect through suitable habitat.

A total of four separate spotlight transects were completed across the study area, each transect was completed on two nights by two observers, resulting in a total of 11 hours survey (22 person hours). Transects were completed in vegetation representative of the study area and included PCTs 766, 1248, 1256 and 1615. Spotlighting was undertaken to target Koala, Greater Glider, Long-nosed Potoroo and Southern Brown Bandicoot (eastern). Spotlighting was also considered suitable for detecting presence of Eastern Pygmy-possum and Squirrel Glider (supported by remote camera surveys).

A total of 18 arboreal baited remote cameras were set and functional between 30 November 2021 and 20 January 2022. Not all cameras were deployed for the total period, the minimum number of nights any individual camera was deployed for at a single location was 46 nights, with one camera being set for 49 nights at a single location. Arboreal cameras were set up to target Eastern Pygmy-possum and Squirrel Glider. These cameras were set up in native vegetation considered likely to support the species, including areas containing flowering Banksia species. The total arboreal trap nights completed by the arboreal baited remote cameras was 857 trap nights. An additional five arboreal cameras had been set for 47 to 48 nights, however these cameras failed to function and have been excluded from the survey effort.

A total of 12 terrestrial remote cameras were set in habitat suitable for targeting Southern Brown Bandicoot and Long-nosed Potoroo. Terrestrial cameras were deployed from the 2 to 3 May 2022 and retrieved on the 13 May 2022 allowing for a total of 116 trap nights for Long-nosed Potoroo and Southern Brown Bandicoot.

Four terrestrial remote cameras were also set from 2 December 2021 to 18 January 2022, targeted Brush-tailed Rock-wallaby in locations as close to cliffs and rock outcropping as possible. These cameras were set for a total of 184 trap nights. These cameras were set to gather supporting data only, the species was primarily assessed via habitat assessment with the species to be precautionarily assumed present in any such identified areas.

Survey effort, trap locations and spotlighting transects are shown on Figure 5-2.

**Justification of survey method and effort**

Survey followed the NSW Threatened Biodiversity Survey and Assessment: Guidelines for development and activities (working draft) (DEC 2004).

**Timing of survey**

Survey timing was conducted in accordance with the relevant guidelines (DEC 2004) and the survey timing provided in BioNet (DPE 2022b).

**Survey personnel and relevant experience**

Mammal surveys were undertaken by the Biosis ecologists outlined in Table D-0-1. At all times survey teams consisted of a minimum of one senior zoological specialist staff member, paired on occasion with a zoological specialist with less experience in undertaking targeted fauna surveys.

**Results**

No threatened mammal species were detected during camera trapping surveys. Spotlighting surveys detected the EPBC Act listed Greater Glider at both the eastern (Blackheath) and western (Little Hartley) extents of the study area (Figure 5-2).

Table 5-13 provides a summary of the results of the mammal surveys completed and the requirements for any species polygons for capturing direct impacts to species credit habitat. A species polygon is required for direct impacts to EPBC Act threatened species Greater Glider. This is to assist with the assessment of this species under the EPBC Act only, no offset obligations under the BOS need to be calculated for this species. Further discussion of this species is included in Section 7.5. A full list of fauna species recorded is provided in Annexure C.

Table 5-13: Targeted arboreal mammal survey

| Species name | Common name | Survey method | Survey results | Species polygon |
|---|---|---|---|---|
| *Cercartetus nanus* | Eastern Pygmy-possum | 857 baited remote camera trap nights, Spotlight over 6 nights, total of 22 person hours. | Species not recorded during surveys. | Not required |
| *Petauroides volans* | Greater Glider | Spotlight over 6 nights, total of 22 person hours. | Species recorded during surveys. | Areas of PCT 1248 containing hollow-bearing trees. |
| *Phascolarctos cinereus* | Koala | Spotlight over 6 nights, total of 22 person hours. | Species not recorded during surveys. | Not required |
| *Petaurus norfolcensis* | Squirrel Glider | 857 baited remote camera trap nights, Spotlight over 6 nights, total of 22 person hours. | Species not recorded during surveys. | Not required |
| *Petrogale penicillata* | Brush-tailed Rock-wallaby | 184 baited remote camera trap nights. | Species not recorded during surveys, habitat present outside of the study area only. | Not required |
| *Potorous tridactylus* | Long-nosed Potoroo | 116 baited remote camera trap nights, Spotlight over 6 nights, total of 22 person hours. | Species not recorded during surveys. | Not required |
| *Isoodon obesulus obesulus* | Southern Brown Bandicoot (eastern) | 116 baited remote camera trap nights, Spotlight over 6 nights, total of 22 person hours. | Species not recorded during surveys. | Not required |

### 5.3.2.5 Frogs

**Survey method and effort**

A total of eight nights of targeted frog survey were undertaken, over two weeks in summer 2021/22 (December and January). Survey was conducted along three transects, one of approximately 210 metres length in the Little Hartley study area and two of approximately 85 metres and 330 metres length in the Blackheath study area. There is no supporting habitat within the Soldiers Pinch development footprint so survey at this location was not required. Surveys were conducted by a team of two experienced zoologists and consisted of call playback followed by active searches. Transects were located within permanent and ephemeral watercourses across the study area, and the following methodology was implemented during each transect survey:

- an initial five minute period of passive listening at the start of the transect to detect and identify calling frogs present at the site
- at each 50 metre interval along the transect a five minute passive listening period was completed followed by two minutes of call broadcast and an additional two minutes of listening for each of the species

- each interval was followed by a slow walking visual inspection for five minutes where suitable habitat was searched with torches combined with active searching
- all frog species heard or observed during the surveys were recorded.

Survey effort and call-playback locations are shown on Figure 5-2.

**Justification of survey method and effort**

Survey followed the *NSW Survey Guide for Threatened Frogs* (DPIE 2020c) guidelines developed for the survey of species credit frog species in accordance with the BAM. Reference sites were not used as part of this assessment due to logistical complications arising from access restrictions. These restrictions required condensed survey period windows, scheduled over one month in advance of survey, which did not allow for travel between reference sites and survey sites, or for postponement of planned surveys.

**Timing of survey**

Survey timing was conducted in accordance with the relevant guidelines (DPIE 2020c) and the survey timing provided in BioNet (DPE 2022b).

**Survey personnel and relevant experience**

Frog surveys were undertaken by the Biosis ecologists outlined in Table D-0-1. At all times survey teams consisted of a minimum of one senior zoological specialist staff member, paired on occasion with a zoological specialist with less experience in undertaking targeted fauna surveys. Identification of calls was further assisted through submission of call recordings to the Australian Museum through the FrogID App.

**Results**

No threatened fauna were recorded during targeted survey. This is despite multiple common frog species calling throughout the completed targeted frog surveys. Surveys were also undertaken under optimal meteorological conditions with the weeks preceding survey recording moderate rainfall. The December surveys (undertaken from 13 – 17 December) followed a week of moderate rainfall with 30.9 millimetres recorded at the Katoomba weather station (station 063039) in the preceding seven-day period. The January surveys (undertaken from 17 – 21 January) followed a week of heavy rainfall with 49.8 millimetres recorded at the Katoomba weather station in the preceding seven-day period (BOM 2022).

Table 5-14 provides a summary of the results of the frog surveys completed and the requirements for any species polygons for capturing direct impacts to species credit habitat. As no threatened frog individuals were detected during the targeted surveys, no species polygons are required for direct impacts to threatened frog habitat. A full list of fauna species recorded is provided in Annexure C.

Table 5-14: Targeted frog survey results

| Species name | Common name | Survey method | Survey results | Species polygon |
|---|---|---|---|---|
| *Heleioporus australiacus* | Giant Burrowing Frog | Threatened species habitat assessment, aural-visual survey of suitable habitat on two transects, one 211 m long in the western study area and two sections comprising a total of 414 m long in the south study area. Surveys undertaken over 8 nights (960 minutes total). | Species not recorded during surveys. | Not required |

| Species name | Common name | Survey method | Survey results | Species polygon |
|---|---|---|---|---|
| *Mixophyes balbus* | Stuttering Frog | Threatened species habitat assessment, aural-visual survey of suitable habitat on two transects, one 211 m long in the western study area and two sections comprising a total of 414 m long in the south study area. Surveys undertaken over 4 nights (480 minutes total). | Species not recorded during surveys. | Not required |
| *Pseudophryne australis* | Red-crowned Toadlet | Threatened species habitat assessment, aural-visual survey of suitable habitat on two transects, one 211 m long in the western study area and two sections comprising a total of 414 m long in the south study area. Surveys undertaken over 4 nights (480 minutes total). | Species not recorded during surveys. | Not required |

#### 5.3.2.6 Invertebrates and reptiles

**Survey method and effort**

Searches for Giant Dragonfly and Blue Mountains Water Skink were undertaken as targeted transects along suitable habitat associated with waterways including Greaves Creek in the Blackheath study area and Butlers Creek in the Little Hartley study area. Surveys were undertaken in December 2021. These surveys were undertaken concurrently due to the shared swamp habitat within which these species inhabit.

A total of four transects were completed in the two locations across four days for a total of four person hours. Transects consisted of timed diurnal active searches for both Giant Dragonfly and Blue Mountains Water Skink. In addition to adult Giant Dragonfly individuals, searches for exuviae were also undertaken.

Mapping of potential habitat areas for Broad-headed Snake and Purple Copper Butterfly were also undertaken across the study area in November and December 2021. This included searches for rocky outcrops, escarpments and pagodas representing potential breeding habitat for Broad-headed Snake as well as mapping occurrences of Native Blackthorn which represents potential habitat for Purple Copper Butterfly. Where these habitats were mapped, species presence has been assumed within these areas.

Survey effort and transect locations are shown on Figure 5-2.

**Justification of survey method and effort**

Survey for Blue Mountains Water Skink was undertaken in accordance with the time transect approach outlined in the NSW *Threatened Biodiversity Survey and Assessment: Guidelines for Development and Activities (working draft)* (DEC 2004). Giant Dragonfly surveys followed a similar method with surveys occurring within and around swamp habitats for dispersing individuals, as detailed in the TBDC (DPE 2022b).

**Timing of survey**

Survey timing was conducted in accordance with the survey timing provided in BioNet (DPE 2022b) for Blue Mountains Water Skink and Giant Dragonfly.

### Survey personnel and relevant experience

Transect surveys for Giant Dragonfly and Blue Mountains Water Skink were undertaken by the Biosis ecologists outlined in Table D-0-1. At all times survey teams consisted of a minimum of one senior zoological specialist staff member, paired on occasion with a zoological specialist with less experience in undertaking targeted fauna surveys. Observers undertaking Giant Dragonfly survey were experienced in identification and detection of exuviae and adult Giant Dragonfly.

### Results

No threatened invertebrates or reptiles were recorded during targeted survey. Survey was undertaken in weather ideal for reptile and Giant Dragonfly activity.

Table 5-15 provides a summary of the results of the reptile and invertebrate surveys completed and the requirements for any species polygons for capturing direct impacts to species credit habitat. As no individuals were detected during the targeted surveys, no species polygons are required for direct impacts to threatened reptile habitat or Giant Dragonfly habitat. As surveys could not be undertaken for Purple Copper Butterfly, potential habitat areas have been identified, impacts to which will require offsets. A full list of fauna species recorded in provided in Annexure C.

Table 5-15: Targeted invertebrate and reptile survey results

| Species name | Common name | Survey method | Survey results | Species polygon |
|---|---|---|---|---|
| *Eulamprus leuraensis* | Blue Mountains Water Skink | Transect searches through potential habitat areas. | No individuals were detected during targeted surveys. | Not required |
| *Hoplocephalus bungaroides* | Broad-headed Snake (Breeding) | Habitat assessment including survey for potential breeding habitat. | No breeding habitat was detected within the study area. | Not required |
| *Paralucia spinifera* | Purple Copper Butterfly, Bathurst Copper Butterfly | Habitat assessment including survey of *Bursaria spinosa.* | Areas of potential habitat (represented by Native Blackthorn in associated PCTs) were mapped within the study area. | Species polygon required |
| *Petalura gigantea* | Giant Dragonfly | Transect searches through potential habitat areas (targeting adults and exuviae). | No individuals were detected during targeted surveys. | Not required |

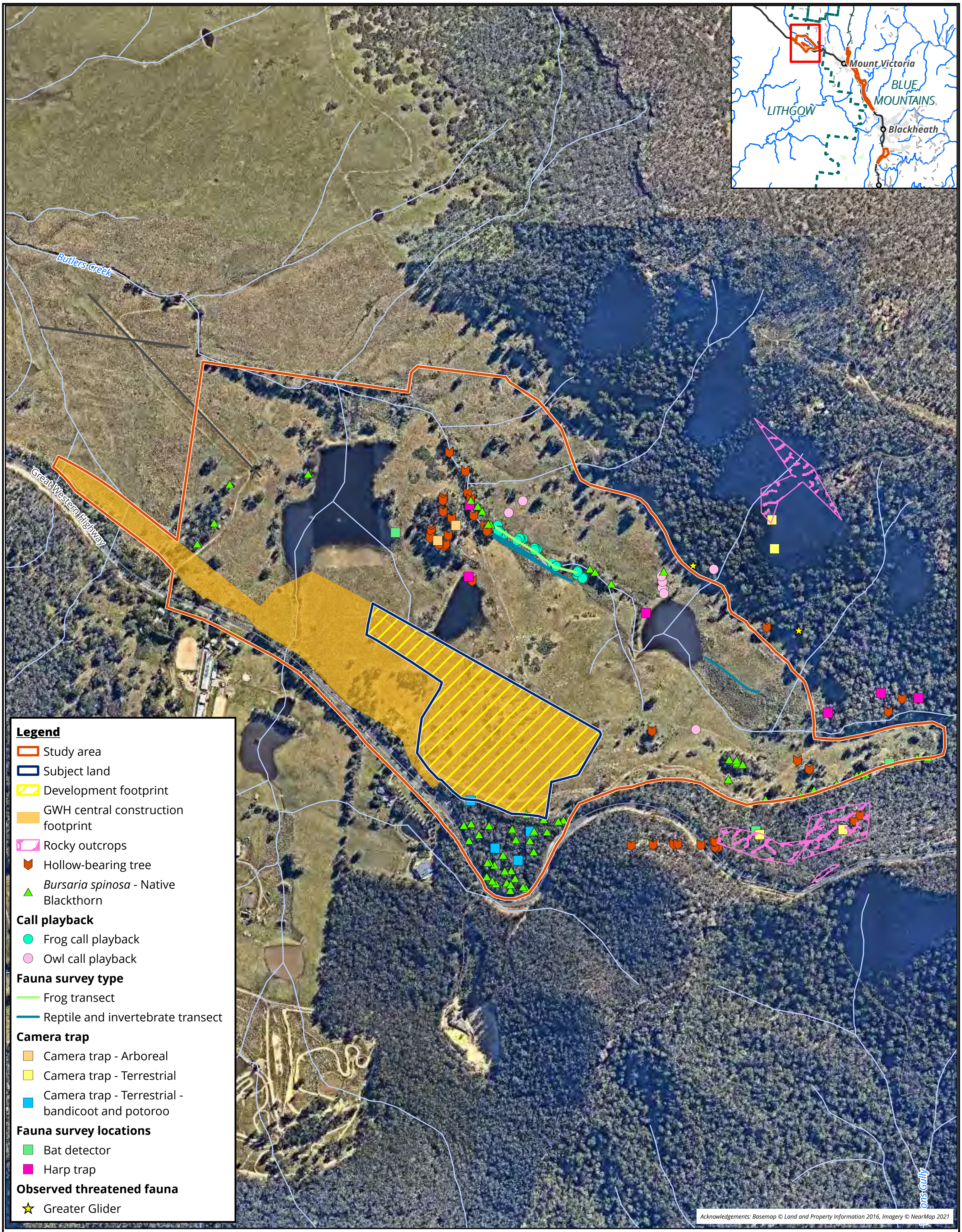


**Figure 5-2 Threatened species surveys - fauna**

**Page 1 of 5**

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Prepared for: MH, Prepared by: AM, Last edited by: lharley
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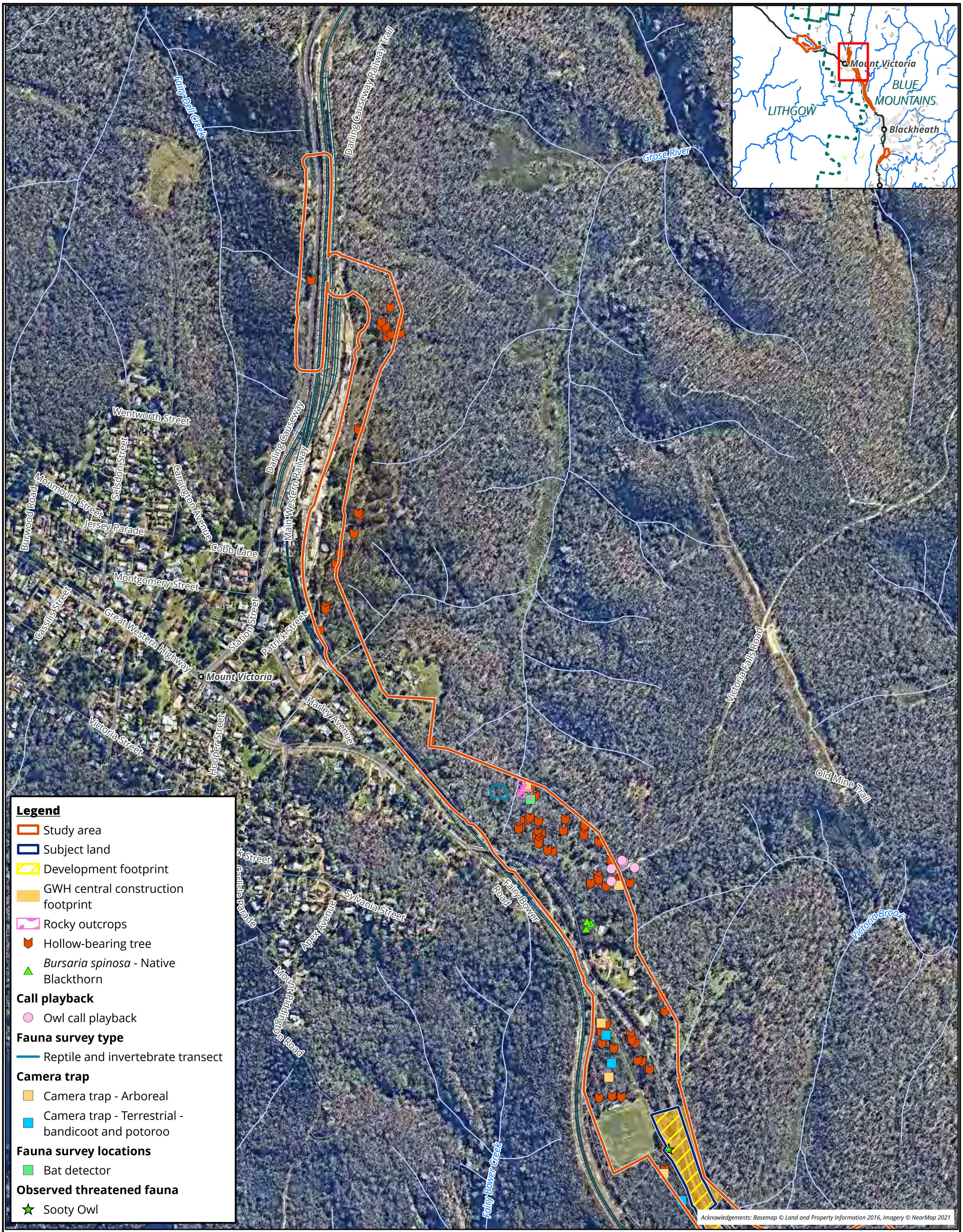


**Figure 5-2 Threatened species surveys - fauna**
**Page 2 of 5**

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Date: 12 December 2022 ,
Prepared for: MH, Prepared by: AM, Last edited by: lharley
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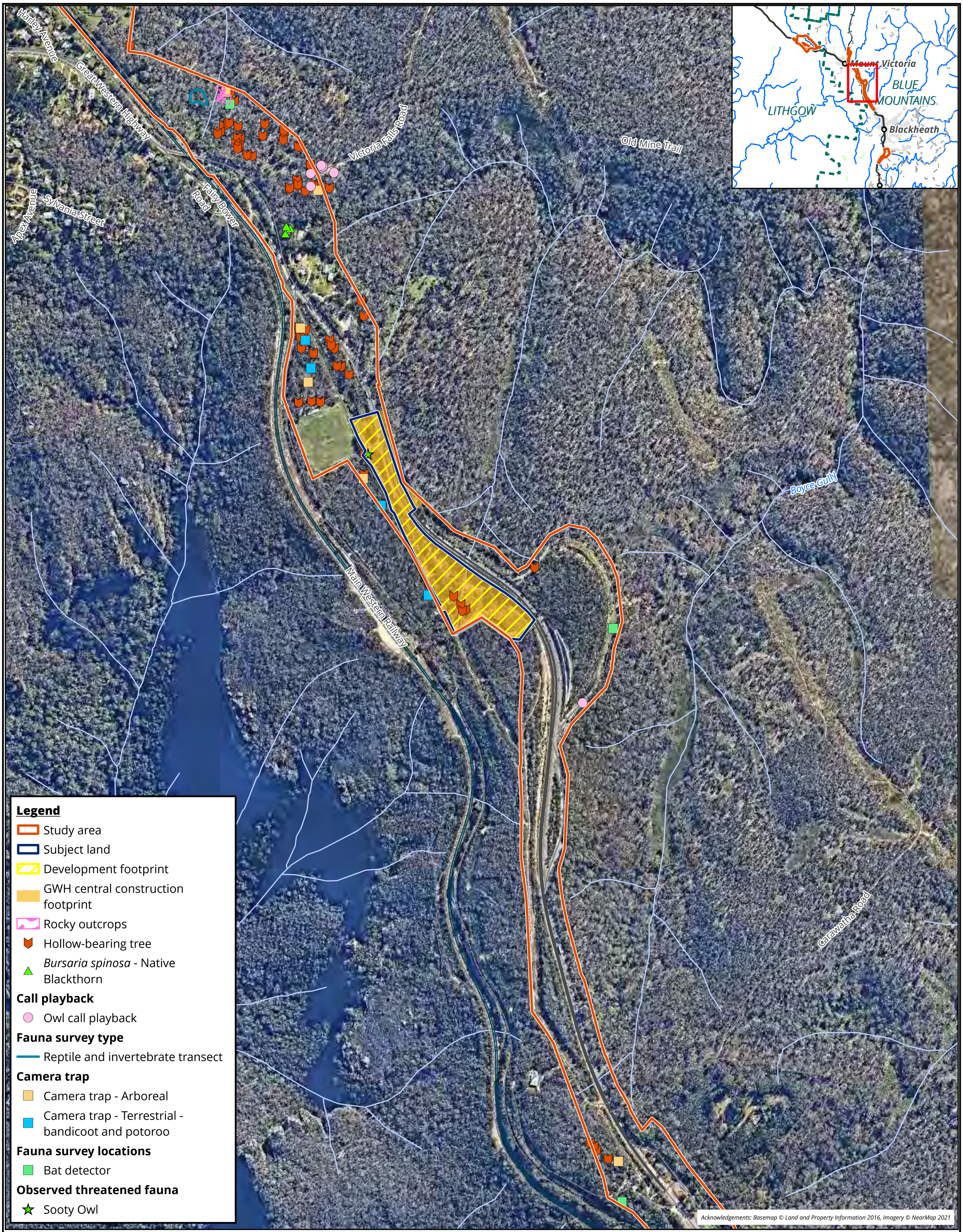

Acknowledgements: Basemap © Land and Property Information 2016, Imagery © NearMap 2021

**Figure 5-2 Threatened species surveys - fauna**
**Page 3 of 5**

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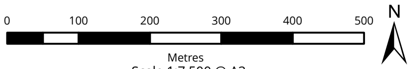
**Figure 5-2 Threatened species surveys - fauna**
**Page 4 of 5**

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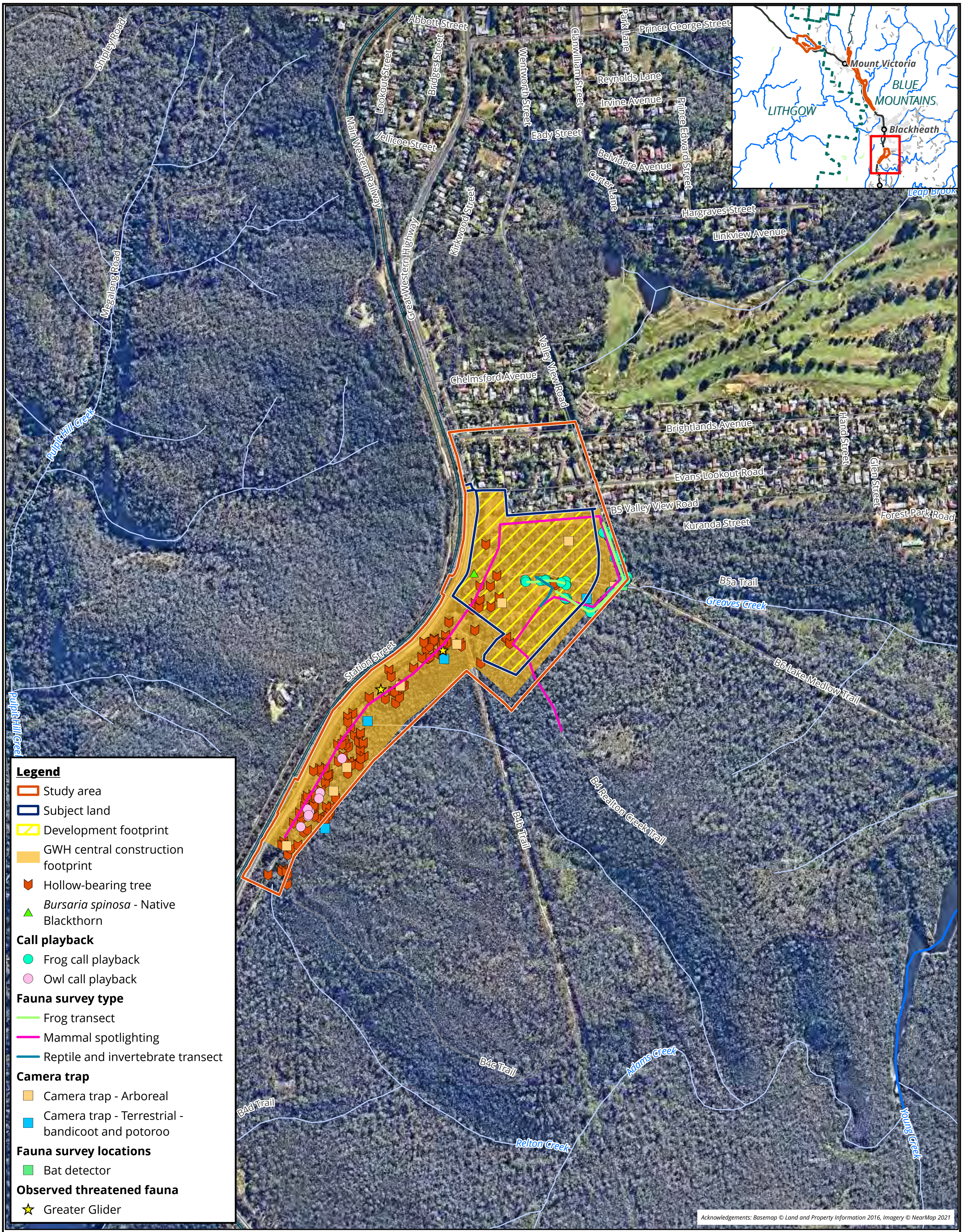


**Figure 5-2 Threatened species surveys - fauna**
**Page 5 of 5**

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Metres
Scale 1:7,500 @ A3
Coordinate System: GDA 1994 MGA Zone 56

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### 5.3.3 Limitations

#### 5.3.3.1 Microbats

Microbat surveys for breeding bats are limited by the successful trap rate of Harp traps which is generally considered to be low (Berry et al. n.d.). Harp trapping was also limited by the location and access to suitable flyways, within proximity of target habitat and within land forming part of the study area.

Acoustic sampling is associated with a number of limitations. Detectability of bats relates to the intensity of their calls, their flight characteristics and the structure of the surrounding vegetation, all of which influence the distance over which a bat can be detected. Differences in the probability of detection may result in reduced likelihood of recording and therefore reduced likelihood of positively identifying some species as present within a site.

Manual call analysis is also associated with limitations including the sometimes arbitrary selection of useable calls and subjectivity of the observer. Definitions as to which calls are assigned to each species have been provided to improve the consistency at which calls were attributed to a species.

It was assumed that individuals would have access to a site for foraging even if they could not roost there.

Example time versus frequency graphs from calls recorded during the survey are included in Annexure F, calls are displayed in compressed mode unless otherwise stated.

Acoustic and harp trap surveys were undertaken across periods of suitable weather for microbat species.

#### 5.3.3.2 Diurnal and nocturnal birds

Detectability of birds heavily relied upon visual observation in many parts of the study area, but primarily in the Blackheath study area, due to consistent loud noise provided by the adjacent Great Western Highway. Transect survey aimed to stop and listen periodically during periods of lulls in the traffic, particularly in this area. Similarly, owl call playback survey aimed to include at least three periods of lessened traffic per species.

Staff undertaking the survey were familiar with the calls of threatened birds and if calls were heard that were not immediately identified due to the surrounding noise, these were investigated further.

Weather conditions were considered suitable for survey of the target species, avoiding heavy rain and wind.

#### 5.3.3.3 Mammals

As habitat for Brush-tailed Rock Wallaby was located outside of the study area, this species was primarily targeted by baited remote cameras placed within the study area and near to rocky outcrops. As no habitat was mapped within the development footprint, the project is unlikely to impact directly on habitat for this species and survey was considered sufficient to assess potential indirect impacts.

Remote cameras deployed for the remainder of mammal species were baited with universal bait and left in place for an extended period (approximately 48 days). Baits were not replaced during this period which may have limited the bait attractiveness over time. However, it is noted that the moist conditions throughout this period kept the bait sufficiently hydrated to remain odorous. Upon collection of the remote cameras and bait stations it was noted that all bait stations still held moist bait.

Survey was undertaken in suitable weather conditions for mammal activity, including spotlight survey being undertaken during pauses in rain.

## 5.4 Expert reports

Section 5.3 of the BAM outlines that an expert report may be obtained instead of undertaking a species survey for a project. An expert report must be prepared by a person who, in the opinion of the Environment Agency Head, possesses specialised knowledge based on training, study or experience to provide an expert opinion in relation to the biodiversity values to which an expert report relates.

Species experts were utilised where survey requirements could not be met, due to seasonal survey requirements. Species experts were used for the assessment of presence, and potential impacts to, three threatened species as part of the current assessment. Species subject to expert report, and details of the species experts who prepared the assessments are outlined in Table 5-16. Each of the species experts used for the project has been approved to provide expert reports for the subject species by the Secretary of DPE.

Table 5-17 provides a summary of the findings of the expert reports, including the areas of habitat considered likely to be impacted by the project. Each expert report is included in its entirety in Annexure G.

Table 5-16: Species subject to assessment by experts

| Threatened species | Threatened species expert |
|---|---|
| Flockton Wattle *Acacia flocktoniae* | Dr Steven Douglas |
| *Acacia meiantha* | Dr Steven Douglas |
| Littlejohn's Tree Frog *Litoria littlejohni* | Dr Francis Lemckert |

Table 5-17: Threatened species expert report summaries

| Key findings | Species habitat mapped (ha) |
|---|---|
| **Flockton Wattle *Acacia flocktoniae*** | |
| **Assessment of species' presence**<br>• there are no records of the species occurring in or near the study area<br>• the nearest spatially refined database records (including herbarium specimens) are from the SW footslope of Mount Victoria and from Blackheath Glen Reserve<br>• the available evidence is that the subject species is associated with only one of the PCTs mapped in the study area (PCT 1615). and that association is questionable and may be an artefact of PCT classification and association issues<br>• patches of the potentially associated PCT are relatively small and are well surveyed based on track logs and BAM plot locations. Some patches of this PCT are in low to moderate condition and may not be able to support the species because it is very likely palatable to livestock, and grazing is the dominant land use in that area. It is concluded that the species is not present in the study area (ESP 2022a).<br>**Assessment of suitable habitat**<br>• most of the study area does not comprise credible habitat for the subject species. The only potential habitat is below the escarpment, and this area is mostly cleared of native vegetation and is subject to livestock grazing that is likely to have destroyed any remnants of the species. Some patches are not grazed but these are outside the area of proposed clearing<br>• there are no known occurrences of the species that could be destroyed by works in the study area, and it is not predicted that there are potential occurrences in that area | 0 |

| Key findings | Species habitat mapped (ha) |
|---|---|
| • species habitat polygons for the subject species in the study area are not required as the area is not considered to be suitable potential habitat for the species (ESP 2022a). | |
| ***Acacia meiantha*** | |
| **Assessment of species' presence**<br>• there are no records of the species occurring in or close to the study area<br>• the nearest database records (including herbarium specimens) are from Clarence to the north<br>• the Clarence population is considered atypical and may be a naturalisation of the species or a paleo-climatic relic. However, if this population were natural, there is one PCT (967) that is credibly associated with it and that could also occur in the study area but is not mapped within it. However, the species has never been recorded in or near the study area, including after targeted surveys for it and other threatened flora species, along with collection of vegetation survey plots<br>• while dense shrub cover could obscure the species from those surveys, the habitat is not considered to be suitable for a natural occurrence of this species, especially given the available evidence that it is far more strongly associated with different PCTs, a different climate, a different bioregion, and different lithologies well to the west of the assessment area (ESP 2022b).<br>**Assessment of suitable habitat**<br>• the study area does not comprise known or significantly credible habitat for the subject species<br>• there are no known occurrences of the species that could be destroyed by works in the study area, and it is not predicted that there are potential occurrences in that area<br>• species habitat polygons for the subject species in the study area are not required as the area is not considered to be suitable potential habitat for the species (ESP 2022b). | 0 |
| **Littlejohn's Tree Frog *Litoria littlejohni*** | |
| **Assessment of species presence**<br>• the main consideration in determining the presence of the species is whether there are suitable water bodies for breeding that are located embedded within areas of relatively intact native vegetation of the type used by this species<br>• the species does not exist in locations where native vegetation is absent, indicating a dependence on elements of native vegetation for their ongoing survival<br>• water bodies need to have a long enough hydroperiod to allow for the tadpoles to be able to reach metamorphosis, and this is longer than for other species of a similar size<br>• waterbodies should be free of the Plague Minnow *Gambusia holbrooki* and likely other introduced fish that will prey on the eggs and tadpoles (Eco Logical 2022).<br>Assessment of species presence within the impact area:<br>• there are no locations within the study area that would be used by the species<br>• none of the ponds or streams observed provided a suitable environment such that the species is expected to be present<br>• the streams that occurred within areas of intact native vegetation and that occurred within the footprint or within 300 metres of the footprint were not of sufficient size to provide a regular enough water flow and pools with long enough hydroperiods to expect the frog to use the streams and so the surrounding areas<br>• all of the other ponds located were isolated in lands that were essentially cleared of native vegetation and so the species cannot be expected to use those ponds, or any | 0 |

| Key findings | Species habitat mapped (ha) |
|---|---|
| vegetation found on or within 300 metres of either of the three development footprints<br>• as the species is not considered to be present on or within 300 metres of either of the three development footprints, there is no impact and no requirement for an offset (Eco Logical 2022).<br><br>**Assessment of suitable habitat**<br>• the development footprints and broader study areas for all three separated development locations contain at least some suitably intact native vegetation identified as being used by the species, with the majority of the study area surrounding the Blackheath and Soldiers Pinch development footprints providing relatively continuous foraging and sheltering habitat through most of their lengths<br>• the Little Hartley development footprint contains suitable habitat only within the southern portion of the footprint, however suitable habitat occurs on the surrounding slopes that are included in the 300 metre buffer (which represents the distance of which the Littlejohn's Tree Frog is considered likely to move away from breeding habitat) (DPIE 2020c). Hence there are significant areas of suitable foraging and shelter habitat present, and these are continuous with areas of the adjacent Blue Mountains National Park<br>• however, no suitable breeding habitat was detected within the study area. Streams present were not large and permanent enough and the ponds all occurred within cleared pastures<br>• the Plague Minnow is known to be widespread within the stream systems of the area and was observed in all water bodies able to be accessed in the site visit. All streams and any pools occurring on floodplains areas, and any associated swamplands, are severely reduced in value as breeding habitat where the Plague Minnow is present, as they eat the eggs and tadpoles of frogs (Eco Logical 2022). | |

## 5.5 Threatened species summary and polygons

Table 5-18 provides details of threatened species impacted by the project and outlines the attributes that comprise their associated threatened species polygons. The presence of threatened species impacted by the project is illustrated on Figure 5-3.

Table 5-18: Threatened species credit (candidate) species survey results

| Threatened species | Impact (ha) | Habitat cond. (VI score) | Unit of measure | Biodiversity risk weighting | Polygon attributes |
|---|---|---|---|---|---|
| Large-eared Pied Bat<br>*Chalinolobus dwyeri* | 9.13 | 708 High: 86.8<br>708 Moderate: 47.0<br>1248 High: 77.3<br>1248 Moderate: 51.2<br>1248 Low: 34.3 | Area | 3.00 | Species polygon boundary aligns with PCTs 708 and 1248 that are within two km of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two km of old mines or tunnels. The geological features (i.e. cliff tops) upon which these polygons are based are shown on Figure 3-2. |
| Purple Copper Butterfly<br>*Paralucia spinifera* | 0.35 | 1248 High: 77.3<br>1248 Low: 34.3 | Area | 2.00 | Species polygon boundary aligns with areas of *Bursaria spinosa* or within 40 metres of *Bursaria spinosa* within PCT 1248. Species presence has been assumed in this location. |
| Greater Glider<br>*Petauroides volans* | 7.33 | 1248 High: 77.3<br>1248 Moderate: 51.2<br>1248 Low: 34.3 | Area | 2.00 | Species polygon boundary aligns with all areas of PCT 1248 that occur within the subject land where these areas also contain, or are directly connected to, patches of native vegetation which contain hollow-bearing trees. This species polygon is only used for impact assessment under the EPBC Act and no credit obligation is required to be generated under the BOS. |

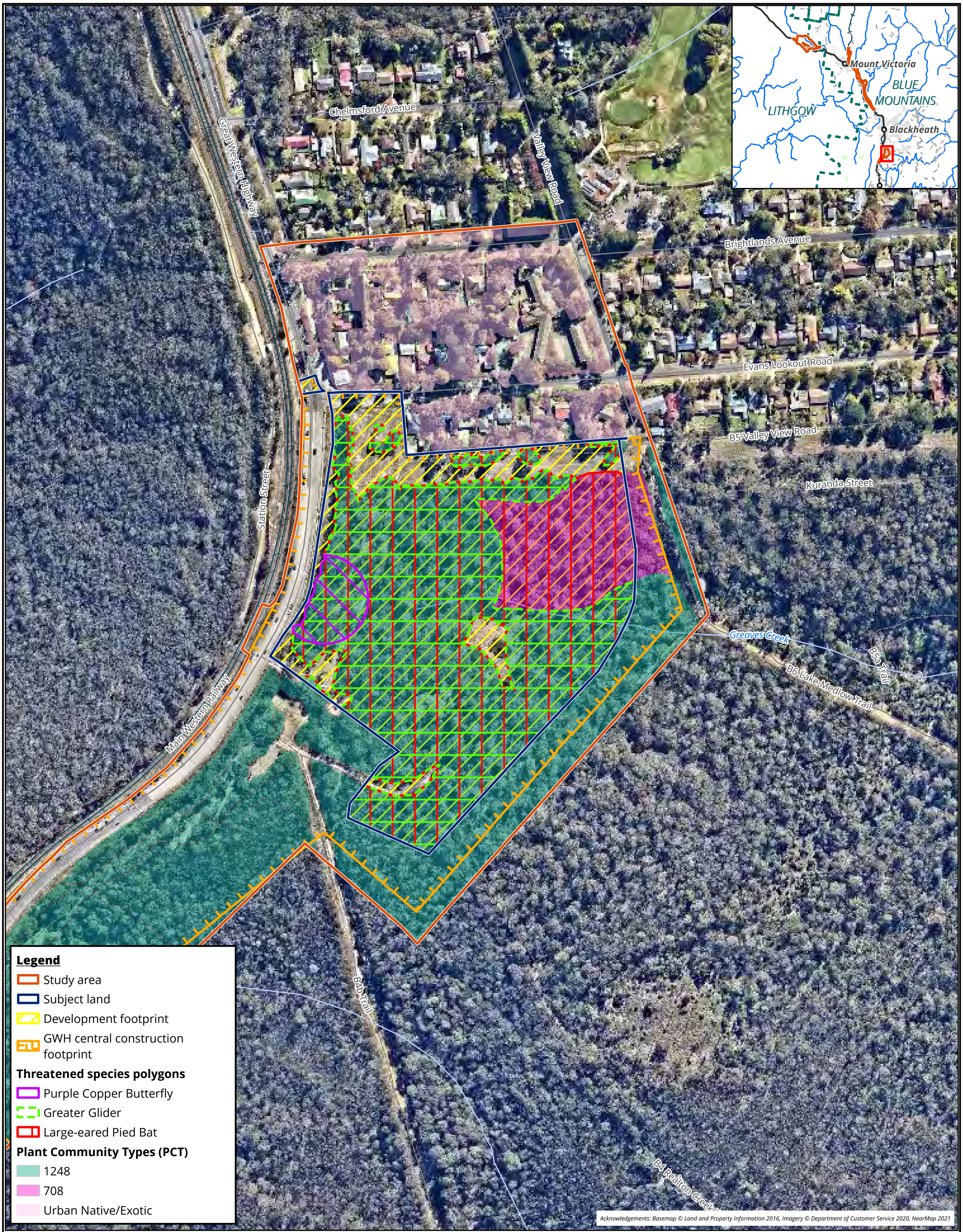


**Figure 5-3 Threatened species polygons**
**Page 1 of 3**

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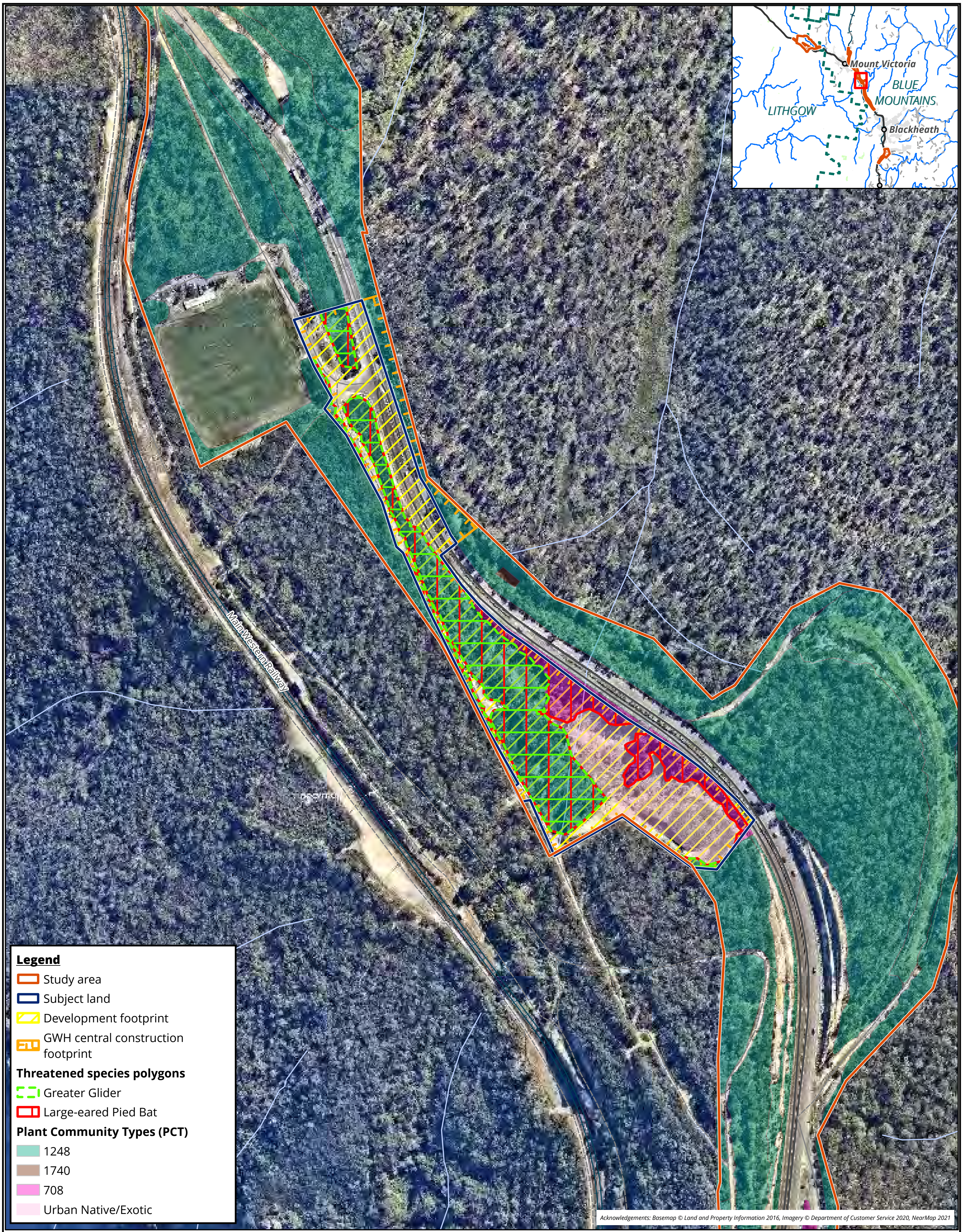


**Figure 5-3 Threatened species polygons**
**Page 2 of 3**

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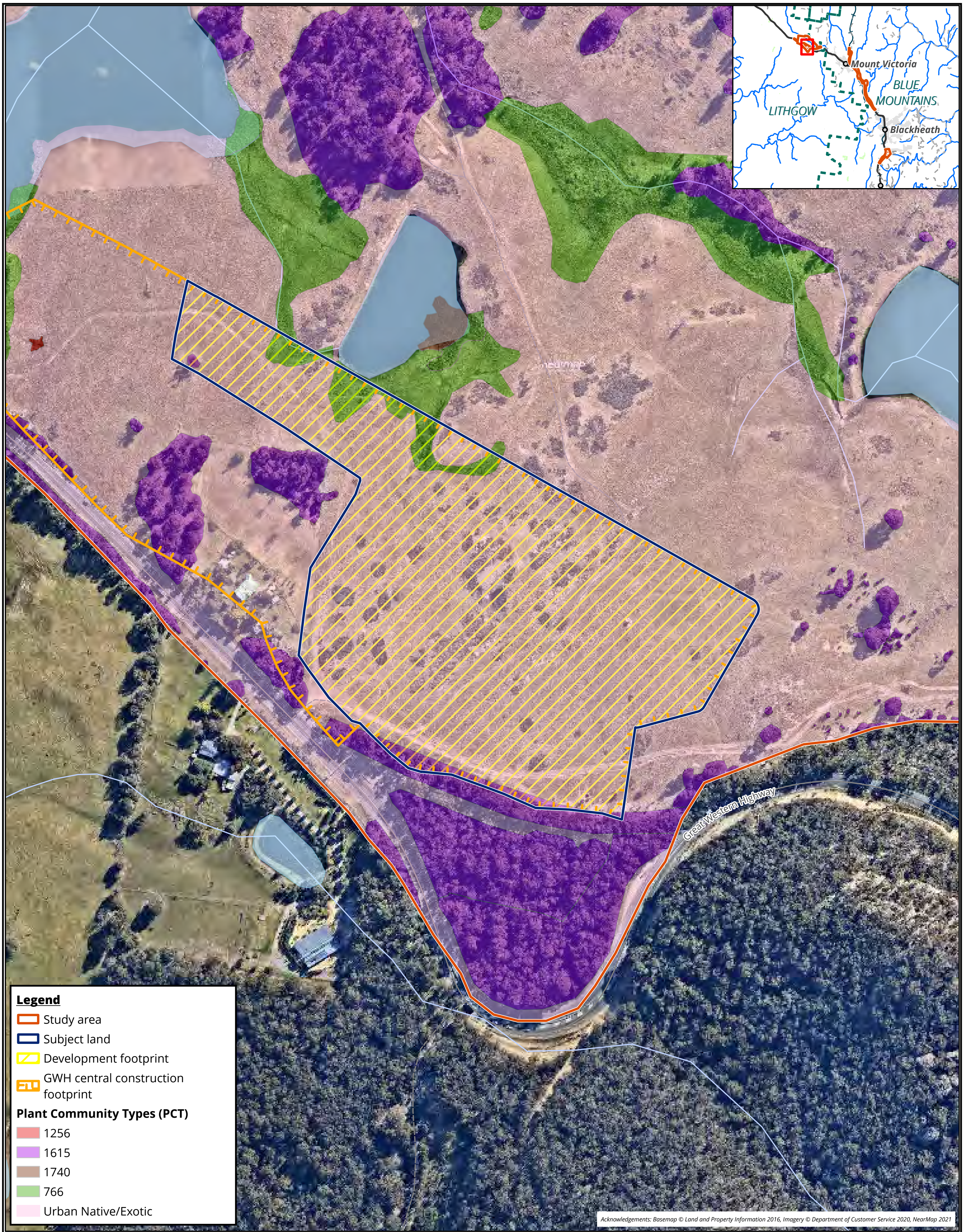


**Figure 5-3 Threatened species polygons**
**Page 3 of 3**

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Metres
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Coordinate System: GDA 1994 MGA Zone 56
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## 5.6 Aquatic habitat and threatened species

The aquatic ecology assessment for this project was completed by Habitat Innovation and is included in Annexure H of this BDAR. A summary of the findings of this assessment has been included below.

For the aquatic ecology report (Annexure H), a desktop review of the following resources was undertaken to determine threatened species presence, current condition of the aquatic and riparian ecosystems within study area, and to understand constraints and pressures associated with the project. A combination of spatial data, database search, monitoring data and specialist reports were reviewed which included:

- NSW Statewide Topographic Mapping – to determine Strahler stream ordering
- NSW Key Fish Habitat Mapping
- Freshwater threatened species distribution
- NSW Statewide Vegetation Mapping
- Matters of National Environmental Significance (MNES) – Protected Matters Search Tool
- Species Profile and Threats Database (SPRAT)
- Groundwater Dependent Ecosystem Atlas of Australia
- Great Western Highway Blackheath to Little Hartley – Appendix J – Technical Report – Surface Water and Flooding
- Great Western Highway Blackheath to Little Hartley – Appendix I – Technical Report – Groundwater
- Peat Swamps Information – Water Quality Memo
- Biodiversity Assessment Report (BDAR) (select map sets).

### 5.6.1 Assessment methodology

A field based aquatic assessment was undertaken to validate the presence of aquatic and riparian ecosystem constraints identified by the desktop review and to provide condition assessments of aquatic and riparian habitats. The methodology included:

- Stralher stream order and waterway validation
- Key fish habitat
- Threatened Fish Species and Matters of National Environmental Significance
- Riparian Vegetation and Waterway Channel Condition
- Groundwater Dependent Ecosystems
- Water Quality
- Aquatic Macroinvertebrates
- Benthic diatoms
- Platypus eDNA Testing.

### 5.6.2 Results

Results of the assessment of riparian vegetation and creek channel condition using the Rapid Riparian Appraisal (RRA) indicate the condition of the creeks surveyed in this study ranged from ‘poor’ to ‘excellent’.

In Butlers Creek, and the tributaries of Butlers Creek, the surrounding landuse varied from natural bushland to pasture / grassland. The combination of a naturally vegetated catchment and low disturbance resulted in the two upper most sites of Butlers Creek graded as being in ‘excellent’ ecological condition. Further downstream, the landuse changes on Butlers Creek from natural bushland to pasture. Pasture grassland is not as effective as natural bushland at buffering rainfall events nor at stabilising stream geomorphology. This reduced buffering capacity and reduced geomorphic stability causes increased erosion and loss if instream habitat, which was graded as ‘poor’.

Blackheath Creek, a tributary of the Cox’s River, to the south of Butlers Creek is outside of the development footprint with the RRA condition assessed below the junction of Fairy Bower Creek. The majority of the catchment of upstream Blackheath Creek is naturally vegetated, with limited agricultural activities. This lack of disturbance is reflected in the ‘excellent’ nature of the assessed reach of Blackheath Creek. Blackheath Creek is categorised by the presence of overhanging vegetation, natural bed detritus, snags greater than 300 millimetres in diameter or three metres in length, instream rocks and gravel beds, the presence of native aquatic plants and likely permeant flow regime.

Fairy Bower Creek, a tributary of Blackheath Creek was graded as ‘excellent’ at all three sites. This was awarded due to the intact nature of the riparian zone, abundant habitat and natural features and lack of weeds. The sandstone bedrock and bank has insulated Fairy Bower Creek to adverse erosion, which prevents stream simplification. As volume of water increases, permanent pools and flowing water become a feature. These included presence of overhanging vegetation and natural bed detritus at upper Fairy Bower Creek and overhanging vegetation presence, natural bed detritus, snags greater than 300 millimetres in diameter or three metres in length, instream rocks, the presence of native aquatic plants and permanent flow at middle and lower Fairy Bower Creek.

Pulpit Hill Creek, a tributary of the Coxs River, to the east of Fairy Bower Creek was graded as ‘excellent’ at all three sites. This was awarded due to the intact nature of the riparian zone, abundant habitat and natural features and lack of weeds. As the gradient of Pulpit Hill Creek reduces and the volume of water increases, cobbled riffle zones become a feature. This high classification was awarded due to the presence of overhanging vegetation, natural bed detritus, snags greater than 300 millimetres in diameter or three metres in length, instream rocks, the presence of native aquatic plants and the permanency of water at middle and lower Pulpit Hill Creek.

Greaves Creek recorded RRA condition scores of ‘excellent’ at all three sites. This was awarded due to the intact nature of the riparian zone, abundant habitat and natural features and lack of weeds. As volume of water increases, permanent pools and flowing water become a feature. Upper Greaves Creek had an ephemeral nature with no permanent refuge and a lack of native aquatic vegetation. Although not mapped as Key Fish Habitat (KFH), the middle and lower site both had a presence of overhanging vegetation, natural bed detritus, snags greater than 300 millimetres in diameter or three metres in length, instream rocks, and the presence of native aquatic plants, as well as permanent stream hydrology.

Adams Creek, at the eastern end of the study area and a tributary of Greaves Creek recorded an RRA grade of ‘very good’ at the upstream site and grades of ‘excellent’ at the middle and lower sections. The upper section of Adams Creek, while predominantly naturally vegetated receives stormwater input from residential Medlow Bath. This is reflected in the lower RRA score, compared with to the downstream sections.

By the middle and lower sections of Adams Creek, this stormwater impact is not apparent, and the stream returns to ‘excellent’ condition. The middle Adams Creek site was awarded a Type 2, Class two due to it containing overhanging vegetation, natural bed detritus and snags greater than 300 millimetres in diameter or three metres in length. lower Adams Creek was awarded a Type 1, Class 1 due to the increased size and volume of the stream as well as the presence of overhanging vegetation, natural bed detritus, snags greater than 300 millimetres in diameter or three metres in length, instream rocks, the presence of native aquatic plants and the permanency of water hydrology.

Relton Creek, a tributary of Adams Creek recorded RRA condition scores of 'excellent' at all three sites. This was due to the intact nature of the riparian zone, abundant habitat and natural features and lack of weeds. As volume of water increases, permanent pools and flowing water become a feature. All three Relton Creek sites were not mapped as KFH, although habitat features such as overhanging vegetation, natural bed detritus, snags over three metres in length and the presence of native macrophytes were evident at the middle and lower sites.

Young Creek recorded RRA condition scores of 'excellent' at all three sites. This was awarded due to the intact nature of the riparian zone, lack of erosion, abundant habitat and natural features and lack of weeds. As volume of water increases, permanent pools and flowing water become a feature. All three Young Creek sites were not mapped as KFH. Upper Young Creek showed an ephemeral nature with no permanent refuge and a lack of native aquatic vegetation, while middle and lower Young Creek both contained habitat features such as presence of overhanging vegetation, natural bed detritus, snags over three metres in length, native macrophytes, in-stream habitat rocks and a permanent water hydrology.

Results of water quality sampling shows that dissolved oxygen was often below the WQO, i.e. default ANZECC Water Quality Guidelines (ANZECC). Fifteen of the 22 sites had dissolved oxygen below the ANZECC Guideline with the majority of these being in close proximity to the lower guideline.

Electrical conductivity was compliant at most sites with 16 of the 22 sites being within the ANZECC range, and the six sites that were not within this range were below the lower limit, however this is not of concern as the ANZECC guideline does not accurately reflect the true geochemical nature of Blue Mountains streams which are typically dilute and can often have conductivity below 100 micro Siemens / centimetre (µS/cm).

Results of pH testing showed 20 of the 22 streams sampled had pH below the lower limit of the ANZECC guidelines, with only two sites having pH that was within the ANZECC guideline. However as with EC, the ANZECC guidelines do not reflect the naturally acidic nature of Blue Mountains streams and results such as this are typical of Blue Mountains creeks with minimally disturbed catchments.

Turbidity the sites monitored was generally low turbidity, with 18 of the 22 sites being within the ANZECC guideline ranges. The four sites that were not within the guideline range were below the lower limit, which is no cause for alarm and reflects the relatively clear and dilute sandstone derived waters.

Flow velocity of the sites sampled was typically between <0.1 and 0.3 metres / second (m/s) at the slow-flowing sites, and 1.2 m/s in the fast-flowing sites. This difference is due to the size and shape of the channel, the volume of water within the channels, and the different stream gradients of where the sites were located. The faster flowing sites were typically the middle and lower sites which is attributed to the larger channels that allowed a higher volume of water to pass through them.

A likely disturbance of the upper reaches of the streams studied is apparent in the Total Suspended Solids results. The upper or middle sites of most streams showed an increase in TSS compared to most lower sites which show undetectable readings. The exception to this is the reaches of Butlers Creek which shows an increasing trend in the downstream from below the limit of detection in the upper most site 17000 micro grams / Litre (µg/L) and 97000 µg/L in the lower and tributary sites. These results reflect the land use change between the upper and lower reaches of the creek which transitions from minimally disturbed upper reach to an agricultural land use.

#### 5.6.2.1 Threatened species

To determine the potential impacts to species listed as threatened under the FM Act and EPBC Act a broad scale desktop survey was undertaken.

Results show that the waterways within the study area are not considered habitat for threatened species or endangered populations listed under the FM Act and there are no records for threatened aquatic species. Likewise, no aquatic MNES listed under the EPBC Act were mapped within the study area or in downstream receiving waters and the catchment is not considered habitat for any species listed under this Act. The waterways present in the study area flow either into the Grose River or the Coxs River. These rivers are part of the wider Hawkesbury / Nepean River system. The Grose River and Coxs River are mapped as habitat for the Macquarie Perch *Macquaria australasica* (Endangered, EPBC Act and FM Act). Hence, the aquatic report assesses whether there is a significant impact to the Macquarie Perch.

### 5.6.3 Conclusion

The proposed upgrade of the Great Western Highway from Blackheath to Little Hartley has potential to cause impacts to aquatic and riparian ecosystems including NSW and Commonwealth listed Peat Swamps.

Associated with the projects are water quality and groundwater driven impacts which include alteration of surface water quality, erosion and sedimentation and short-term groundwater drawdown during the construction phase and surface water quality, erosion and reduction in groundwater base flows.

With appropriate mitigation measures the risk of impacts driven by surface water quality and quantity and groundwater quantity to the aquatic and riparian ecosystems are lessened however there will be requirement to apply best practice when it comes to addressing potential impacts associated with inorganic nutrients and ionic pollution.

Results of this assessment conclude that predicted impacts to waterways within the study and the threatened Macquarie Perch are negligible. The exception is Greaves Creek where there is potential for a material reduction in baseflow due to groundwater drawdown from the project during dry years, with associated impacts to THPSS along the watercourse. It is recommended that further investigations be carried out, including update groundwater modelling taking into account ongoing surface water, groundwater and ecological monitoring. Where updated groundwater modelling confirms the likelihood of material impacts on Greaves Creek baseflows, then further consideration should be given to design-related mitigation measures with a focus on reducing groundwater drawdown around the Blackheath portals.

The water supply pipeline is the only project scope that would cross waterways. As outlined in Chapter 5 (Construction) of the EIS, a less intrusive methodology (for example underboring or attachment to bridges) would be adopted. Therefore the project is not expected to have any direct impact on riparian corridors or Key Fish Habitat.

# Stage 2 – Impact assessment (biodiversity values)

# 6 Avoid and minimise impacts

This section demonstrates the efforts made to avoid and minimise impacts on biodiversity values associated with the project in accordance with BAM, including direct impacts, indirect impacts and prescribed impacts, and provides an analysis of each action along with its timing and relevant biodiversity values impacted and associated responsibilities.

## 6.1 Strategic alternatives

During the development of the project, a number of strategic alternatives were considered as part of the broader upgrades required for the Great Western Highway. These strategic alternatives included:

- doing nothing
- upgrading Bells Line of Road
- upgrading the Main Western Railway Line (rail)
- upgrading Great Western Highway (Blackheath to Little Hartley).

The merits of each of these options are discussed in full as part of Chapter 4 (Project alternatives and options) of the EIS. From a biodiversity perspective, both the Bells Line of Road upgrade and the Main Western Railway Line (rail) upgrade would have required significant impacts to the Greater Blue Mountains National Park and the surrounding World Heritage Area, with extensive native vegetation clearance also likely to be required for the railway line. By comparison the Great Western Highway Upgrade Program (proposed) allowed for minimisation of impacts to the Greater Blue Mountains National Park and World Heritage Area by utilising the existing road corridor associated with the Great Western Highway. While the do nothing approach represented the lowest level of biodiversity impacts, this was discarded as it failed to deliver on the identified future transport needs. Selection of the Great Western Highway Upgrade Program therefore allowed for minimisation of impacts to biodiversity values associated with the Greater Blue Mountains National Park and World Heritage Area, while also still progressing with the necessary transport upgrades.

## 6.2 Project options

After the Great Western Highway Upgrade Program was identified as the preferred strategic alternative, four project options were considered:

- a minimum scope option, focused on targeted minor road upgrades and intersection work
- surface roads upgrade option, including full surface upgrade to two lanes in each direction
- two tunnel option, incorporating tunnel bypasses at Blackheath and Mount Victoria
- single tunnel option, incorporating a long tunnel from Blackheath to Little Hartley.

The merits of each of these options are discussed in full as part of Chapter 4 (Project alternatives and options) of the EIS. Of these four options, the single tunnel option between Blackheath and Little Hartley (i.e. the project), represents the lowest impact to native vegetation while still delivering on the necessary transport improvements. This is achieved as removal of vegetation is only required at two tunnel portal locations instead of four with a reduced number of associated construction sites.

Similarly, there is a reduced impact to groundwater dependant ecosystems given shallower tunnelling is only required at two portal locations, not four. These tunnels would be “tanked” (excavation/cavern constructed using TBMs with an impermeable casing/membrane that minimises groundwater inflows to negligible rates) progressively during construction using precast concrete segmental lining rings to inhibit groundwater ingress. The mid-tunnel access shaft located at Soldiers Pinch would be tanked from ground surface to the Mount York Claystone, recognised to be an aquitard, to inhibit groundwater ingress to the shaft from the Banks Wall Sandstone. The remaining depth interval of the access shaft (within the underlying Burra-Moko Head Sandstone) would be drained. As such the selection of the proposed single tunnel project option and the proposed tunnel methodology has resulted in avoidance and minimisation of impacts to native vegetation and groundwater dependent ecosystems.

Following identification of the preferred project option, design development has been progressed, guided by preliminary environmental assessments, which have resulted in further avoidance and minimisation of impacts to biodiversity values. The specific avoidance and minimisation of direct and indirect impacts that have been achieved as part of project design are discussed in Section 6.3. Avoidance and minimisation of prescribed impacts are discussed in Section 6.4.

## 6.3 Avoidance and minimisation of impacts on native vegetation, threatened species, threatened ecological communities and their habitat

The principal means to reduce impacts on biodiversity values within the development site is to avoid and/or minimise the removal of native vegetation and fauna habitat. Mitigation measures have been recommended to address the remaining residual impacts. These measures are included in Section 8.

Table 6-1 summarises the refinements that have been made during the development of the project which have resulted in direct and indirect impacts to biodiversity values being avoided or minimised.

Table 6-1: Refinements that have avoided and/or minimised impacts

| Aspect | Options considered | Rational for refinement |
|---|---|---|
| **Direct impacts** | | |
| Ancillary construction site | Blackheath tip site | An ancillary construction site was proposed for development at the Blackheath tip site off Ridgewell Road. This site is likely to have required clearing of native vegetation consistent with PCTs 1248 and 1078, which at present are in high condition. Due to the condition of PCT 1078 in this area it is likely that to have satisfied the condition thresholds of the associated EPBC Act and BC Act TECs. This area also represented potential habitat for Gang-gang Cockatoo and Blue Mountains Water Skink. This construction site was not included as part of the EIS design. |
| Tunnel excavation method | Two and four tunnel boring machine (TBM) options | The project considered both two and four TBM methods for the construction of the tunnel. A four TBM method would have required launch of two TBMs from each of the two portal ends (i.e. Little Hartley and Blackheath) meeting at the mid-tunnel point. This would have required a larger construction footprint at the Blackheath construction footprint to support the launch of TBMs and to incorporate a supporting power supply. This would have required a larger clearing footprint resulting in a greater direct impact to native vegetation.<br><br>Consideration was also given to launching TBMs from the Soldiers Pinch construction site, however this would have similarly required a larger footprint at this location which would have encroached into the |

| Aspect | Options considered | Rational for refinement |
|---|---|---|
| | | Greater Blue Mountains National Park and the World Heritage Area.<br>The selected two TBM method has allowed for the smallest construction footprint and therefore the smallest direct impact to native vegetation. |
| Design and location of the construction footprint | Little Hartley construction footprint | The preliminary footprint provided for the project encompassed an area of approximately 106 hectares within the Little Hartley study area. This included areas of native vegetation consistent with PCTs 1256 and 1615 as well large area of exotic pasture grassland. The EIS development footprint in this area has been reduced to 10.74 ha, the majority of which is located within area mapped as exotic grassland. |
| Design and location of the construction footprint | Blackheath construction footprint<br>Little Hartley construction footprint | Both the Blackheath and Little Hartley construction footprints were partially located within the construction footprints of the eastern and western projects that form part of the broader Upgrade Program. By partially locating these two construction footprints within areas cleared under the Great Western Highway East - Katoomba to Blackheath and Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) projects, further impacts to native vegetation have been avoided. A total of 10.58 hectares of native vegetation that will be cleared for the eastern and western projects occurs within the EIS central construction footprint. |
| **Indirect impacts** | | |
| Tunnel excavation method | TBM and roadheader methods | Both TBMs and roadheaders were considering as part of the project design. TBMs were selected as the preferred tunnelling machinery as they are able to install precast impermeable tunnel linings progressively as they excavate (i.e. tanked structures which limit groundwater entering the structure but do not actively drain groundwater), thereby minimising impacts to groundwater and groundwater dependent ecosystems.<br>The final selection of the tunnelling method would be undertaken to minimise impacts to groundwater and indirect impacts to groundwater dependent ecosystems wherever possible. |

## 6.4 Avoidance and minimisation of prescribed impacts

Table 6-2 summarises the refinements that have been made during the development of the project design which have resulted in prescribed impacts to biodiversity values being avoided or minimised.

Table 6-2: Design refinements that have avoided and/or minimised prescribed impacts

| Prescribed impacts | Rational for design |
|---|---|
| Karst, caves, crevices, cliffs, rocks and other geological features of significance | Geological features of significance within the assessment area include cliffs, crevices and rocky outcrops which represent potential habitat for threatened microbats, Brush-tailed Rock-wallaby and Broad-headed Snake. The three construction footprint locations (Blackheath, Soldiers Pinch and Little Hartley) have been placed such that they avoid direct impacts to these geological features of significance. The project therefore avoids direct impacts to these habitat features. |
| Human-made structures or non-native vegetation | Removal of human-made structures that may provide potential fauna habitat is not required for the project. Impacts to these features are therefore avoided.<br>Non-native vegetation is required to be removed, particularly within the area of the Little Hartley construction footprint. In the case of the Little Hartley construction footprint, the footprint has been purposefully located within areas of non-native vegetation in order to avoid impacts to native vegetation. This vegetation does not represent significant habitat for fauna. |
| Habitat connectivity | The Blackheath and Little Hartley construction footprints maximise usage of existing cleared areas (especially in the case of the Little Hartley construction footprint) or are situated in areas that have been previously disturbed (in the case of the Blackheath construction footprint).This includes partially locating the footprints within areas that will be cleared as part of the Great Western Highway East – Katoomba to Blackheath and Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) projects that form part of the broader Upgrade Program. In addition, construction footprints have also been sited adjacent to the existing Great Western Highway. Locating the footprints in accordance with the above will minimise native vegetation fragmentation effects.<br>The originally proposed construction footprint at the Blackheath tip off Ridgewell Road would have required clearing of native vegetation consistent with PCTs 1248 and 1078, which at present are in high condition. This area is also located within a more intact patch of remnant bushland, set back from the Great Western Highway. Therefore, clearing in this area is likely to have resulted in some loss to habitat connectivity. By comparison, the Soldiers Pinch construction footprint is located adjacent to the Great Western Highway and within the cleared areas associated with Browntown Oval. The decision to remove Blackheath tip as a construction site has therefore resulted in avoidance of potential losses to native vegetation and its associated habitat connectivity. |
| Water bodies, water quality and hydrological processes | The Little Hartley construction footprint is situated such that it avoids direct impacts to the three large dams located within the locality, although impacts will occur to fringing vegetation around the central dam. The construction footprint also avoids impacts to the Strahler order 3 named watercourse, Butlers Creek that occurs in the area.<br>The proposed tunnel excavation method (utilising two TBMs), will minimise impacts to groundwater by allowing for the progressive installation of precast impermeable tunnel linings during excavation (i.e. tanked structures which limit groundwater from entering the excavated tunnel but do not actively drain groundwater). This proposed method of excavation minimise impacts to groundwater as well as groundwater dependent ecosystems compared to the roadheader excavation method.<br>It is anticipated that tunnel seepage water quality is likely to be saline and more alkaline. As such a water treatment plan has been designed as part of the project which would treat water prior to discharge. This system will be designed to ensure that any water discharges satisfy the Neutral or Beneficial Effect on |

| Prescribed impacts | Rational for design |
|---|---|
| | Water Quality Assessment Guideline (WaterNSW 2021) (NorBE) for Sydney Drinking Water Catchments.<br><br>Changes to surface water runoff as a result of the project are likely to result in potential impacts to water quality, runoff rate and runoff volume. These impacts have been addressed as part of project design and the following impact minimisation strategies will be implemented:<br><br>• Bioretention systems sized to treat runoff such that there is no increase in the pollutant loads discharged from the project (a requirement to satisfy NorBE). Includes usage of engineered filter media and native plantings to encourage peat build up, to assist with converting more alkaline pH waters to more acidic pH's to suit the associated receiving waters and peat swamp vegetation communities downstream.<br>• Flood retarding basins will be provided where required to ensure peak flow rates do not increase for events from the 1 event/year to the one per cent annual exceedance probability event (around 1 in 100 year annual recurrence internal).<br>• Flow spreaders will be utilised to create sheet flow conditions upstream of peat swamps.<br>• Energy dissipation such as rip-rap on stormwater outlets to reduce the potential for erosion. |
| Vehicle strikes | By its design, the project represents an opportunity to reduce the incidence of vehicle strikes. The proposed tunnel will result in the reduction of road traffic from the Great Western Highway between Blackheath and Little Hartley which will decrease the rate of vehicle strikes during operation. Fauna fencing around the portal entrances (to be determined through future design development) will also decrease the incidence of vehicle strikes around portal entrances. |

# 7 Impact assessment

An assessment of direct and indirect impacts that are unable to be avoided has been undertaken in accordance with the BAM (DPIE 2020a). The following sections provides a summary and assessment of unavoidable direct, indirect and prescribed impacts expected to occur as a result of the project.

## 7.1 Impacts associated with the removal of native vegetation, threatened ecological communities, threatened species and their habitat

Direct impacts arising from the project include:

- Removal of native vegetation and flora and fauna habitats.
- Removal of known habitat for threatened fauna species.

Assessment of the above impacts are provided in the following sections. These impacts would be permanent and will occur from the outset of the project. Mitigation measures detailed in Section 8 will help to minimise the severity of these impacts to biodiversity values.

The direct impacts detailed in the sections below are likely to contribute to the following key threatening processes identified under Schedule 4 of the BC Act:

- Bushrock removal.
- Clearing of native vegetation.
- Loss of hollow-bearing trees.
- Removal of dead wood and dead trees.

They are also likely to contribute to the land clearance key threatening process identified under the EPBC Act.

### 7.1.1 Direct impacts on native vegetation and threatened ecological communities

The direct impact on native vegetation within the Blackheath construction footprint are partially assessed by the adjacent Katoomba to Blackheath Upgrade project. Similarly, the direct impacts on native vegetation within the Little Hartley construction footprints are partially assessed by the adjacent Little Hartley to Lithgow Upgrade project. This is occurring as the construction footprints are located within areas of native vegetation that would first be cleared to allow for construction of the adjacent projects. By locating the construction footprints in these areas the project is able to avoid additional clearance of native vegetation. As some areas of native vegetation within the construction footprints would have already been cleared as part of the adjacent projects, only those remaining areas would require offsetting under the current BDAR. These are the areas that are covered by the development footprint. Table 7-1 provides a summary of the direct impacts native vegetation arising from the project.

Table 7-1: Summary of impacts to native vegetation

| Veg zone | PCT | TEC | Area to be impacted (ha) | Change (loss) in VI score |
|---|---|---|---|---|
| 708_High | PCT 708 Blue Mountains Mallee Ash - Dwarf Casuarina heath of the upper Blue Mountains, Sydney Basin Bioregion | - | 1.30 | -86.8 |
| 708_Moderate | | - | 0.50 | -47.0 |

| Veg zone | PCT | TEC | Area to be impacted (ha) | Change (loss) in VI score |
|---|---|---|---|---|
| 766_Low | PCT 766 Carex sedgeland of the slopes and tablelands | *Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions* | 0.43 | -24.1 |
| 1248_High | PCT 1248 Sydney Peppermint - Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin Bioregion | - | 6.10 | -77.3 |
| 1248_Moderate | | - | 0.86 | -51.2 |
| 1248_Low | | - | 0.33 | -34.3 |
| 1615_Moderate | PCT 1615 Monkey Gum - Eucalyptus blaxlandii shrubby open forest on basalt of the Sydney Basin | - | 0.18 | -62.2 |
| 1615_Low | | - | 0.01 | -30.77 |
| | | **Total native vegetation** | **9.71** | |

The removal of 9.71 hectares of native vegetation includes 7.40 hectares of vegetation in high condition, 1.54 hectares in moderate condition and 0.77 hectares in low condition. At least 20 hollow-bearing trees will also be removed from the development footprint. These impacts will occur following all efforts that have been made to avoid and minimise impacts to native vegetation outlined in Section 6. Offsets will ensure No Net Loss to the ecosystems present within the development footprint as a result of the project.

The removal of 9.71 hectares of native vegetation should be viewed in the context of the retained areas within the study area and broader assessment area, known and predicted to support the same native vegetation and TECs. Within the study area a total of 87.71 hectares of native vegetation occurs which was considered as part of the project footprint. The broader locality also includes large areas covered by the existing Blue Mountains National Park and associated World Heritage Area which would not be directly impacted by the project (however indirect impacts may occur as a result of altered hydrological regimes as outlined in Section 7.4.4).

Direct impacts will occur to 0.43 hectares of low condition *Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions* as a result of the project. No direct impacts will occur to mapped areas of *Blue Mountains Swamps in the Sydney Basin Bioregion* or *Temperate Highland Peat Swamps on Sandstone* within the study area.

### 7.1.2 Direct impacts to threatened species

Table 7-2 provides a summary of the direct impacts threatened species credit species arising from the project.

Table 7-2: Summary of direct impacts on threatened species credit species

| Species name | Common name | EPBC Act | BC Act | Sensitivity to gain class | SAII* entity ? | Habitat or individuals to be impacted |
|---|---|---|---|---|---|---|
| *Chalinolobus dwyeri* | Large-eared Pied Bat | Vulnerable | Vulnerable | Very high | Yes | 9.13 ha |
| *Paralucia spinifera* | Purple Copper Butterfly | Vulnerable | Endangered | High | No | 0.35 ha |
| *Petauroides volans* | Greater Glider | Endangered | - | High | No | 7.33 ha |

* Serious and irreversible impact (SAII)

## 7.2 Indirect impacts

Indirect impacts occur when the project affects native vegetation, threatened ecological communities, threatened species and their habitats beyond the subject land (direct impact area). Indirect impacts are detailed below in Table 7-3 and shown on Figure 7-1.

Table 7-3: Indirect impacts specified by the BAM

| Indirect impact | Relevance to the project |
|---|---|
| Inadvertent impacts on adjacent habitat or vegetation | Indirect impacts to adjacent vegetation have the potential to occur during the construction and operational phase as a result of non-target vegetation clearance. This can be prevented or minimised through appropriate mitigation measures such as exclusion fencing and implementation of a Construction Environmental Management Plan (CEMP) detailing best practice environmental protection measures. |
| Reduced viability of adjacent habitat due to edge effects | Adjacent habitats are currently subject to a high degree of edge effects due to their close proximity to the Great Western Highway. An increase in edge effects is not expected to occur to the remnant vegetation surrounding the subject land, as a result of the project, with the exception of potential for weed spread (addressed further below). This can be prevented or minimised through appropriate mitigation measures outlined in a CEMP detailing best practice environmental protection measures.<br><br>Remaining areas of native vegetation within a 50 metre buffer surrounding the development have also been assessed for their potential to be impacted by edge effects. Areas of vegetation that will become isolated patches (i.e. less than 0.25 hectares in size), or which are currently unfragmented or undisturbed and will be subsequently impacted by a new edge, have had an offset credit calculated and included under Section 9.1. These areas are also shown on Figure 7-1. The full process of calculating these offset credits for indirect credits is detailed in Annexure I. |
| Reduced viability of adjacent habitat due to noise, dust or light spill | It is predicted that habitats adjacent to the project will be impacted by noise, dust and light spill during construction within the subject land.<br><br>The subject land is currently located adjacent to the existing Great Western Highway, where light and noise pollution is moderate. Between Blackheath and Little Hartley, this will likely not substantially |

| Indirect impact | Relevance to the project |
|---|---|
| | increase due to the project, but rather may decrease adjacent to the subject land as use of the underground tunnels increases and surface traffic is reduced.<br><br>Noise and light from construction may act as attractants for microbats. Construction footprints would be lit to enable night works plus task lighting around the project to enable traffic switches, oversize deliveries, etc. The following lighting impacts are anticipated:<br><br>• At the Blackheath construction footprint lighting will be required including task lighting early in program, then security of works (around buildings), around cut and cover area and site sheds to enable nightworks once TBM's breakthrough<br>• At the Soldiers Pinch construction footprint lighting is required to allow safe works in area as needed. This may include temporary lighting at the Browntown Oval intersection depending on road safety review<br>• At the Little Hartley construction footprint lighting is required throughout the site footprint area and accessway 24/7 to enable safe methods of work.<br><br>Any potential indirect impacts in relation to light spill during construction and operation can be mitigated by ensuring any lighting is directed towards the project, rather than towards the adjacent retained habitats, as well as through the installation of light shields, timer switchers (when possible), and appropriate wavelength selection.<br><br>Vehicle movements are likely to generate the most dust, particularly during the earthworks for the proposed surface road upgrade work (allowing for the integration of the new tunnel to the road network), spoil handling, stockpiling and during the transportation of tunnel spoil. Dust emissions can be mitigated through the implementation of erosion and sediment controls and appropriate dust suppression mitigation measures such as road watering and ensuring loads are adequately covered. These indirect impacts will be managed via best practice mitigation measures outlined in a CEMP. |
| Transport of weeds and pathogens from the site to adjacent vegetation | Increased transport of pathogens and weeds is unlikely to occur as the subject land already occurs adjacent to the Great Western Highway, however this indirect impact will be managed by biosecurity mitigation measures outlined in the CEMP. |
| Increased risk of starvation, exposure and loss of shade or shelter | The habitat present in the development footprint represents potential habitat for native species, including three species credit species; Large-eared Pied Bat, Purple Copper Butterfly and Greater Glider. The project will not result in an increased risk of starvation, exposure and loss of shade or shelter to native species, due to the small area of threatened species habitat proposed for removal for the project as well as the very large amount of commensurate habitat available in areas directly adjacent to the project. |
| Loss of breeding habitats | Breeding habitat for Greater Glider will be impacted by the project. Retained vegetation in adjacent lots provides higher quality habitat and will not be reduced by the project. |

| Indirect impact | Relevance to the project |
|---|---|
| Trampling of threatened flora species | No threatened flora species were found, or are considered likely to occur, within the subject land, and thus trampling of threatened flora species is unlikely. |
| Inhibition of nitrogen fixation and increased soil salinity | Any future excavations or soil disturbance at a surface level resulting from construction of the project would be restricted to the construction footprints. It is not considered likely that the project would result in substantial changes to the level of nitrogen fixation in the locality.<br>Underground excavations as part of the tunnel network would be conducted at up to 200 metres depth, which is unlikely to affect surface nitrogen fixation.<br>There is the potential that changes to groundwater could lead to impacts on soil salinity. Groundwater seepage into the tunnel as a result of the project will be redirected to a treatment plant.<br>Surface water will be redirected to eight discharge points which will include bioretention filtration. |
| Fertiliser drift | No fertiliser is proposed to be used and therefore there are no indirect impacts proposed from fertiliser drift. |
| Rubbish dumping | Standard environmental controls for the project would ensure potential rubbish dumping is minimised. Works during construction would follow an approved Waste Management Plan.<br>The subject land already occurs adjacent to the Great Western Highway, where rubbish dumping from passing traffic is most likely moderate. This will likely not substantially increase due to the project, but rather may decrease adjacent to the subject land between Blackheath and Little Hartley as use of the underground tunnels increases and surface traffic is reduced. Therefore the project may result in a decline in rubbish dumping adjacent to native vegetation along the Great Western Highway between Blackheath and Little Hartley. |
| Wood collection | Construction of the project within the subject land is unlikely to increase access to any retained vegetation, beyond current access capacity. Based on the future use of the subject land, members of the public are not expected to be likely to undertake wood collection within the retained vegetation and landscaping around portal entrances. If wood collection does occur adjacent to portal entrances, it is unlikely to occur at a level that will have a detrimental effect. |
| Bush rock removal and disturbance | Bush rock may be removed within the construction footprints to facilitate the project. Removal of bush rock will be managed via best practice mitigation measures outlined in a CEMP, including re use of bush rock, where possible. |
| Increase in predatory species populations | Portions of the subject land (such as at Blackheath) already occur within a semi-urbanised setting with pets, such as dogs and cats, currently occurring within the locality. The vegetation clearance proposed by the project, and proposed land use, is unlikely to exacerbate predatory species populations.<br>There may be temporary effects to predatory species such as Red Fox *Vulpes vulpes* associated with construction, if rubbish is not |

| Indirect impact | Relevance to the project |
|---|---|
| | adequately controlled. This indirect impact can be managed through appropriate mitigation measures (as detailed above).<br>There is potential for lighting during construction and operation of the project to attract predators and/or prey, however it is not expected that this will occur to a level that is detrimental. Light spill during construction and operation can be mitigated by ensuring any lighting is directed towards the project, rather than towards the adjacent retained habitats. This may also prevent attraction of fauna from adjacent habitats at portal entrances during operation. The use of roadside fencing around portal entrances, could prevent and minimise this impact for terrestrial species. |
| Increase in pest animal populations | Pest animals such as Black Rat and European Rabbit *Oryctolagus cuniculus* are widely spread within the locality. Post-construction, the vegetation clearance proposed by the project, and proposed land use will not result in an increase in available habitat for these species and is unlikely to lead to an increase in pest animal populations.<br>There is potential for an increase in pest animal populations during construction if general rubbish is not adequately controlled around construction footprints. Suitable waste disposal implemented during and post construction will reduce the resources available for pest species, preventing an increase in these species. |
| Increased risk of fire | Portions of the subject land (such as Blackheath) already occur within a semi-urbanised setting. Appropriate asset protection zones and fire mitigation systems will be implemented for the project.<br>The project may result in an increased risk of fire during construction due to an increase in use of machinery within the subject land.<br>During operation of the project, the risk of fire may decrease adjacent to the subject land as use of the underground tunnels increases and surface traffic is reduced adjacent to retained native vegetation. The use of fire prevention and control systems during and post-construction will minimise the risk of fire. |
| Emissions | The project includes the installation of tunnel ventilation systems which allow for the ventilation of car emissions into the surrounding environment. Options for ventilation alternatives are provided in the EIS with two options currently under consideration (AECOM 2022a):<br>• ventilation outlet at each portal (ventilation outlet option)<br>• portal emissions (portal emissions option)<br>Mitigation measures are outlined in a CEMP, including the use of emissions management systems, to minimise this impact on the environment. These emissions systems are considered unlikely to impact biodiversity in the locality. |
| Disturbance to specialist breeding and foraging habitat, e.g. beach nesting for shorebirds. | Mapped habitat for Large-eared Pied Bat pertains to foraging habitat. No breeding habitat for the assessed species credit species occurs within the subject land. It is unlikely that the project will result in indirect impacts to breeding habitat for threatened species, such as Purple Copper Butterfly and Greater Glider. |
| Fragmentation of movement corridors | Movement corridors are currently not restricted in width and availability through the locality, as there are large tracts of intact vegetation adjacent to sections of the Great Western Highway. The project will result in the removal of native vegetation from the subject |

| Indirect impact | Relevance to the project |
|---|---|
| | land that fringes retained native vegetation, to allow for the construction footprints. The removal of vegetation is unlikely to fragment movement corridors, as extensive remnant vegetation adjacent to the subject land will remain intact and not be fragmented. |

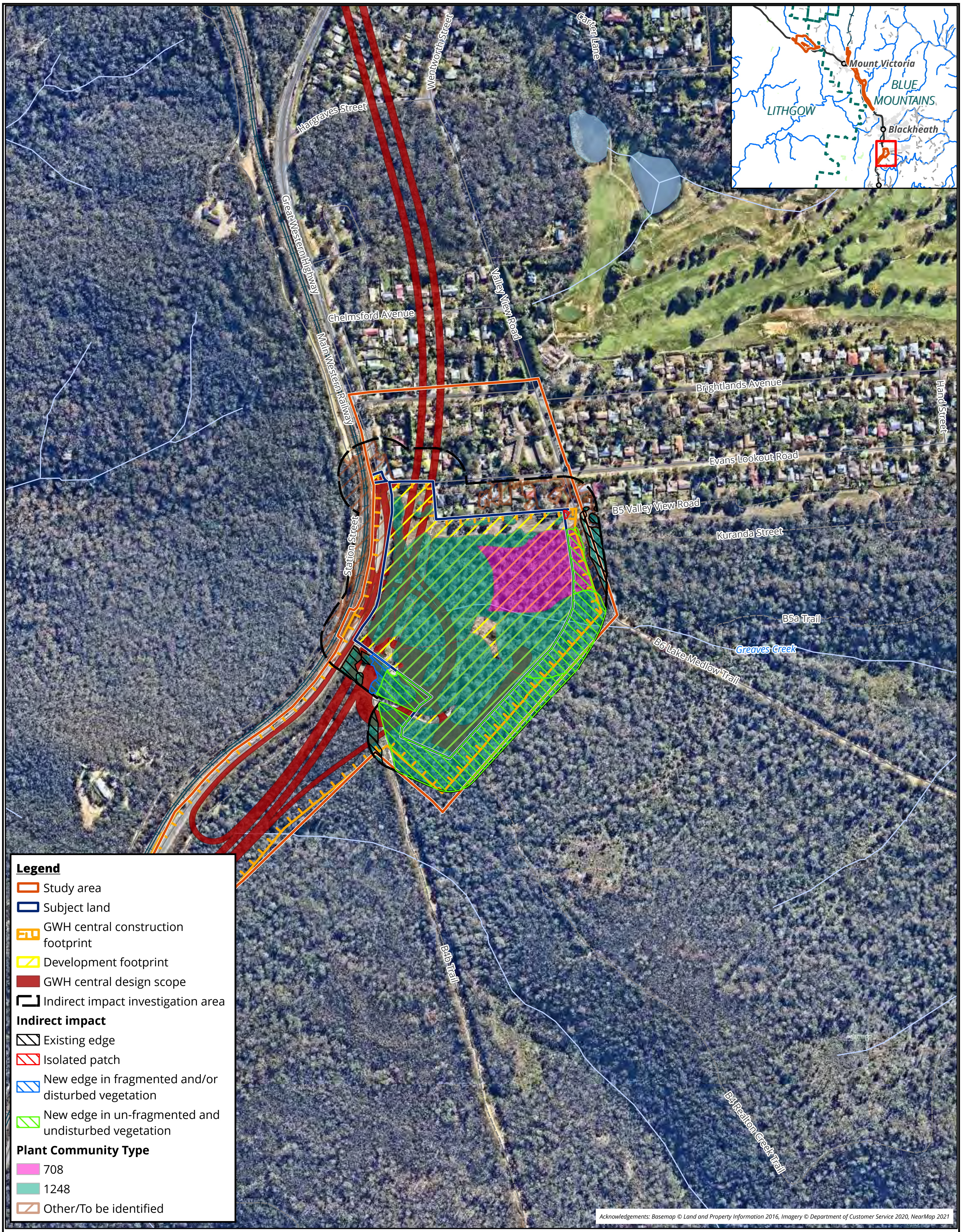


**Figure 7-1 Estimated zones of indirect impact for the project**
**Page 1 of 3**

biosis

Matter: 35727,
Date: 07 October 2022 ,
Prepared for: MH, Prepared by: AM, Last edited by: lharley
Layout: 35727_BDAR_F7-1_IndirectImpacts
Project: P:\35700s\35727\Mapping\
35727_BDAR_portrait.aprx

0 50 100 150 200 250
Metres
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Coordinate System: GDA 1994 MGA Zone 56

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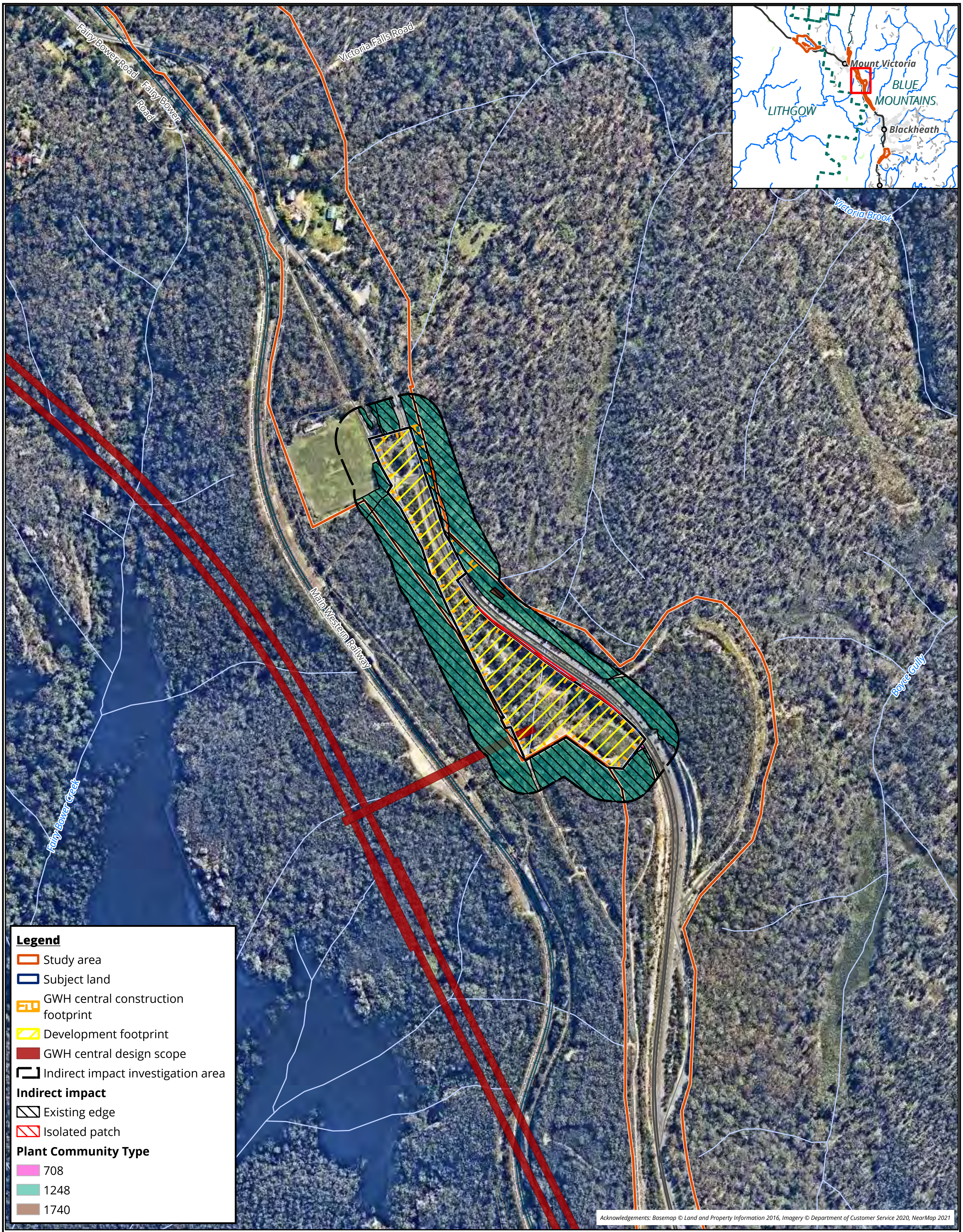


**Figure 7-1 Estimated zones of indirect impact for the project**
**Page 2 of 3**

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Matter: 35727,
Date: 07 October 2022 ,
Prepared for: MH, Prepared by: AM, Last edited by: lharley
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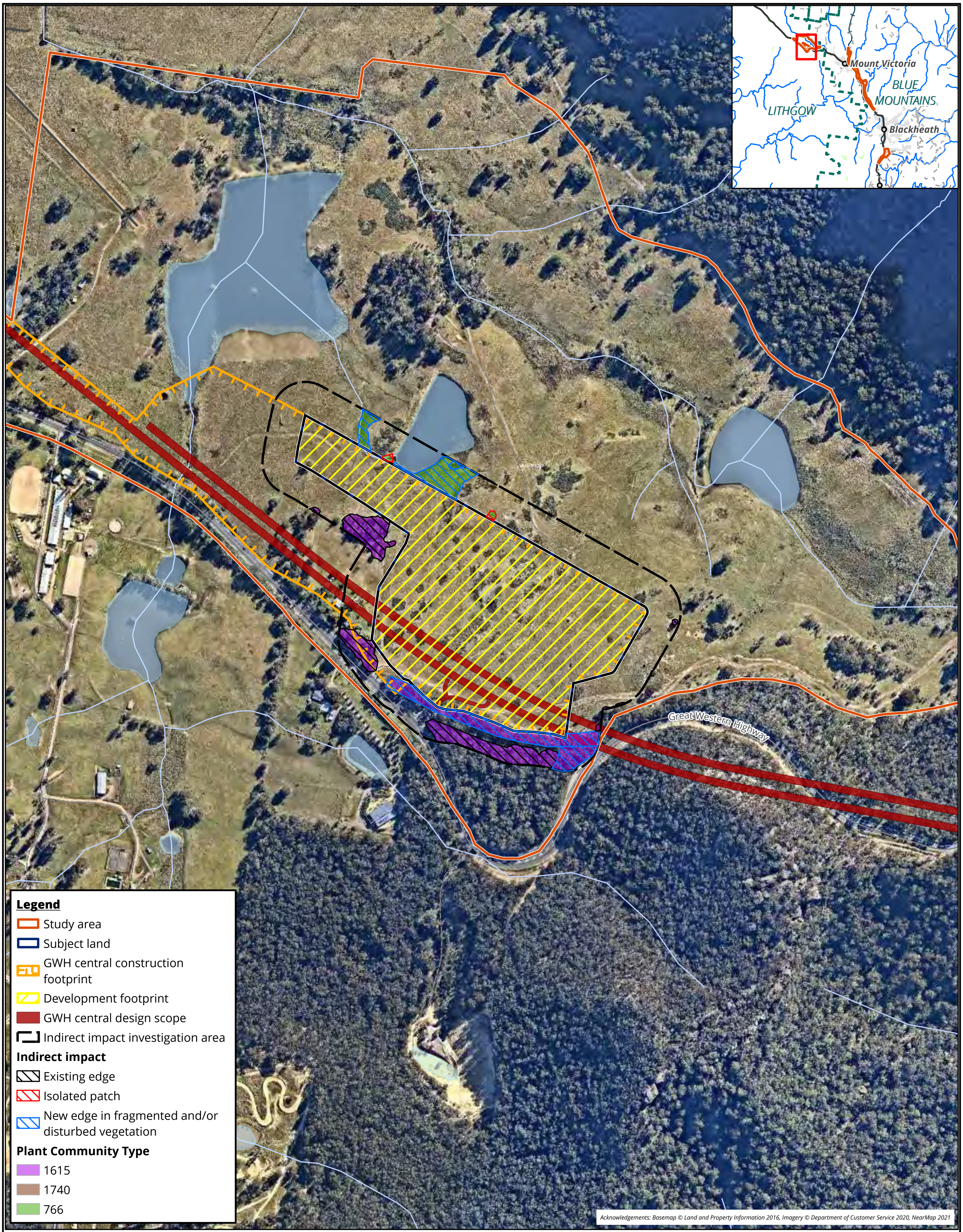


**Figure 7-1 Estimated zones of indirect impact for the project**
**Page 3 of 3**

biosis.

Matter: 35727,
Date: 07 October 2022 ,
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0 50 100 150 200 250
Metres
Scale 1:5,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

## 7.3 Serious and irreversible impacts

In accordance with Clause 6.7 of the BC Regulation an impact is to be regarded as serious and irreversible if it is likely to contribute significantly to the risk of a threatened species or ecological community becoming extinct because:

- *a) Principle 1: It will cause a further decline of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline.*
- *b) Principle 2: It will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size.*
- *c) Principle 3: It is an impact on the habitat of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution.*
- *d) Principle 4: The impacted species or ecological community is unlikely to respond to measures to improve its habitat and vegetation integrity and therefore its members are not replaceable.*

One species, Large-eared Pied Bat, has been identified as a potential SAII entity in the TBDC as it is considered to meet the above principles. Specifically, this classification is related to the breeding habitat for the species, with the TBDC (DPE 2022b) noting that *any impact on breeding habitat used by this species could be considered potentially serious and* irreversible. This is supported by the 'Species credit' threatened bats and their habitats BAM survey guideline which also states SAII are in relation to breeding habitat identified for the species, and where breeding habitat is not present then the proposed impact is not a potential SAII (OEH 2018). Potential breeding habitat for the species is defined under the TBDC as PCTs associated with the species within 100 metres of rocky areas containing caves, or overhangs or crevices, cliffs or escarpments, or old mines, tunnels, culverts, derelict concrete buildings. As there is no potential breeding habitat present within the subject land, there are no mapped areas of SAII for this species and inclusion of further impact assessment provisions in accordance with Section 9.1.1 of the BAM (DPIE 2020a) is not required.

## 7.4 Prescribed biodiversity impacts

An assessment of prescribed biodiversity impacts in accordance with Section 8.3 of the BAM is in the subsections below. The assessment of prescribed biodiversity impacts has been undertaken within the assessment area, which includes the land within 1500 metres of each of the three development footprints (Blackheath, Soldiers Pinch and Little Hartley) as well as the area within 500 metres from the centre line of the proposed tunnel alignment, as defined in Section 2.3. This area has been designed to adequately cover the areas potentially impacted by prescribed biodiversity impacts.

Prescribed biodiversity impacts are impacts on biodiversity values in addition to, or instead of, impacts from clearing vegetation and/or loss of habitat. This can include impacts on geological features (karst, caves, cliffs, etc.), human-made structures, connectivity of habitat, water quality and hydrological processes, and vehicle strike.

All prescribed impacts identified are presented in Figure 7-2 below.

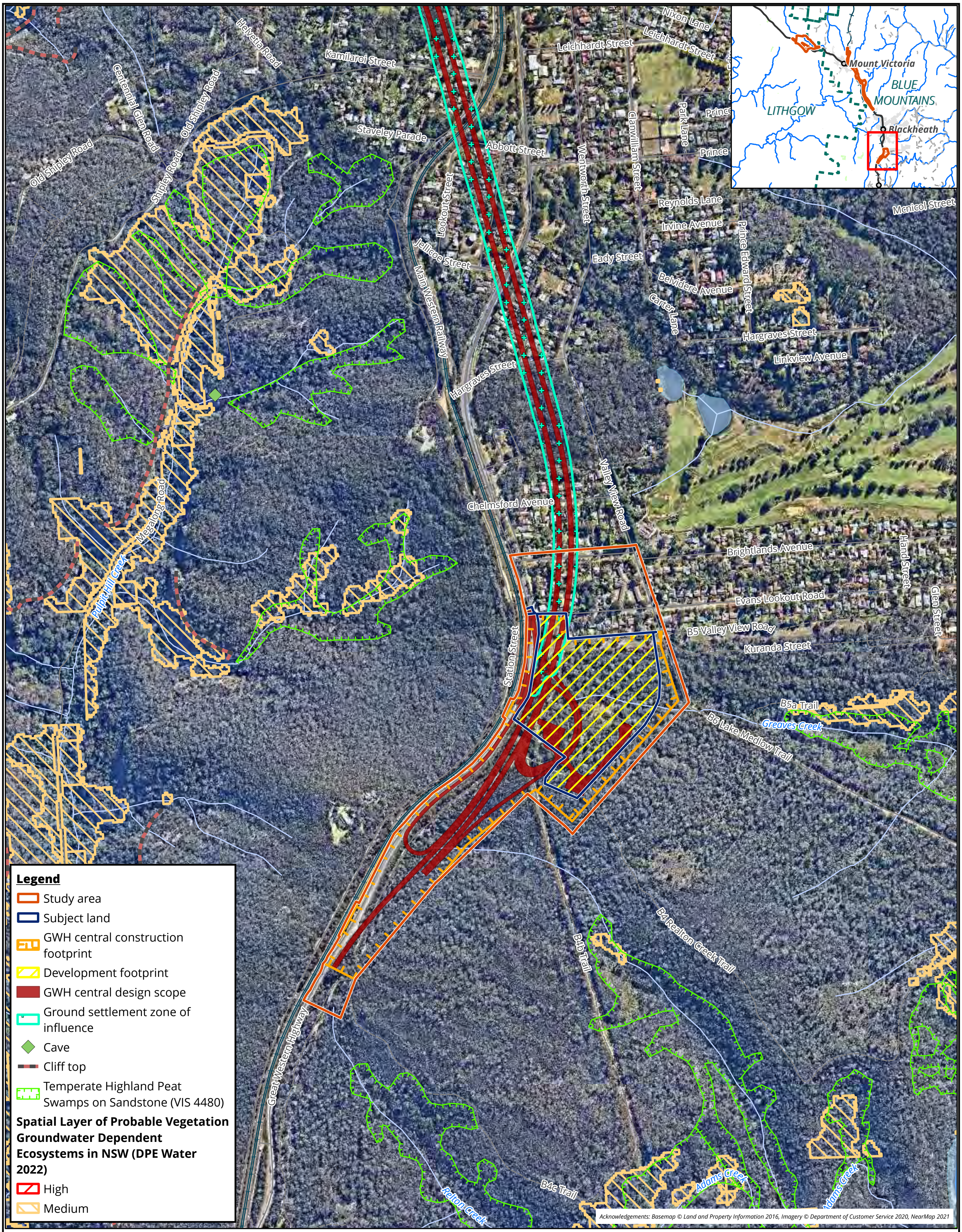


**Figure 7-2 Areas associated with prescribed biodiversity impacts**
**Page 1 of 7**

biosis

Matter: 35727,
Date: 12 December 2022 ,
Prepared for: MH, Prepared by: AM, Last edited by: lharley
Layout: 35727_BDAR_F7-2_BiodiversityImpacts
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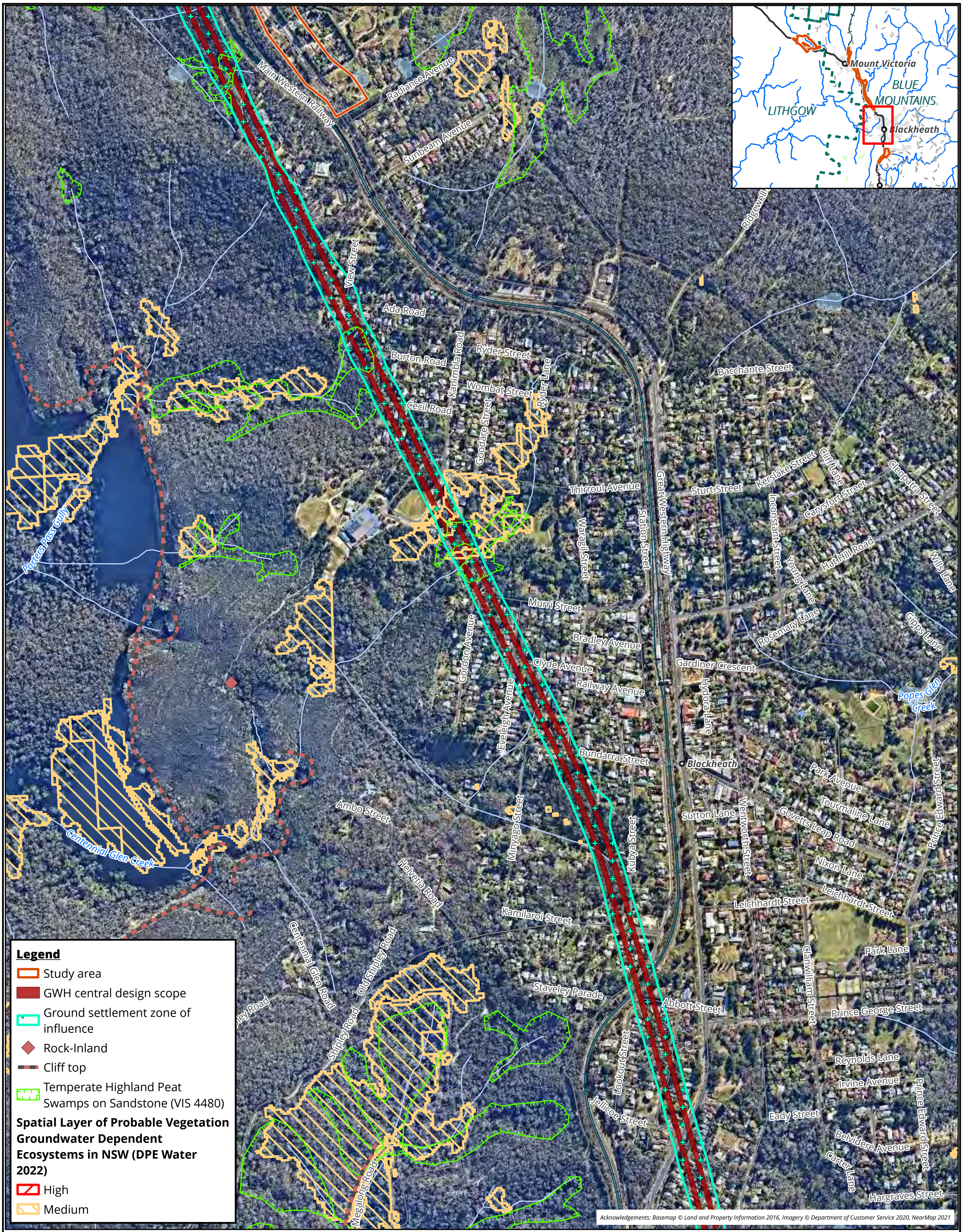


**Figure 7-2 Areas associated with prescribed biodiversity impacts**
**Page 2 of 7**

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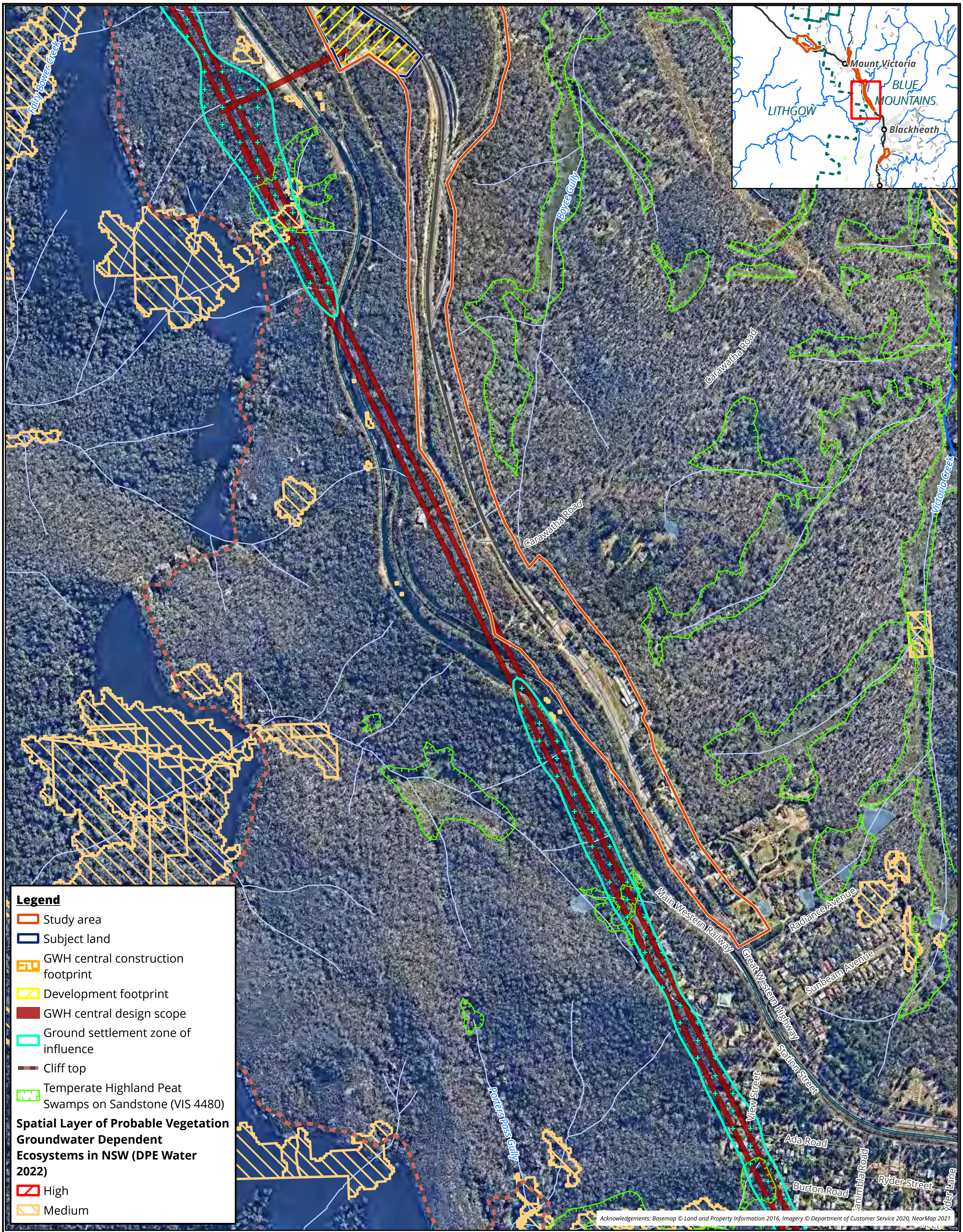


**Figure 7-2 Areas associated with prescribed biodiversity impacts**
**Page 3 of 7**

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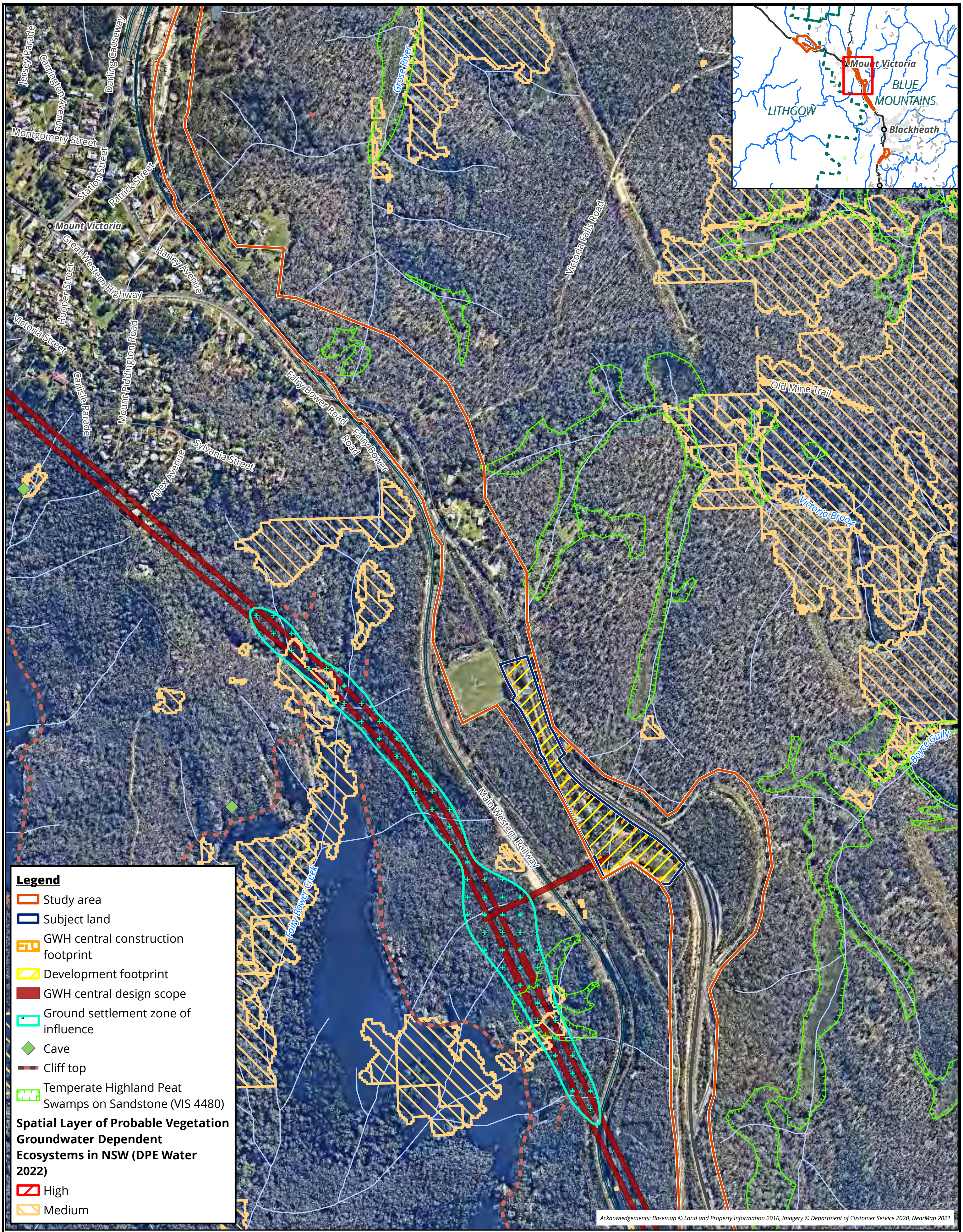


**Figure 7-2 Area associated with prescribed biodiversity impacts**
**Page 4 of 7**

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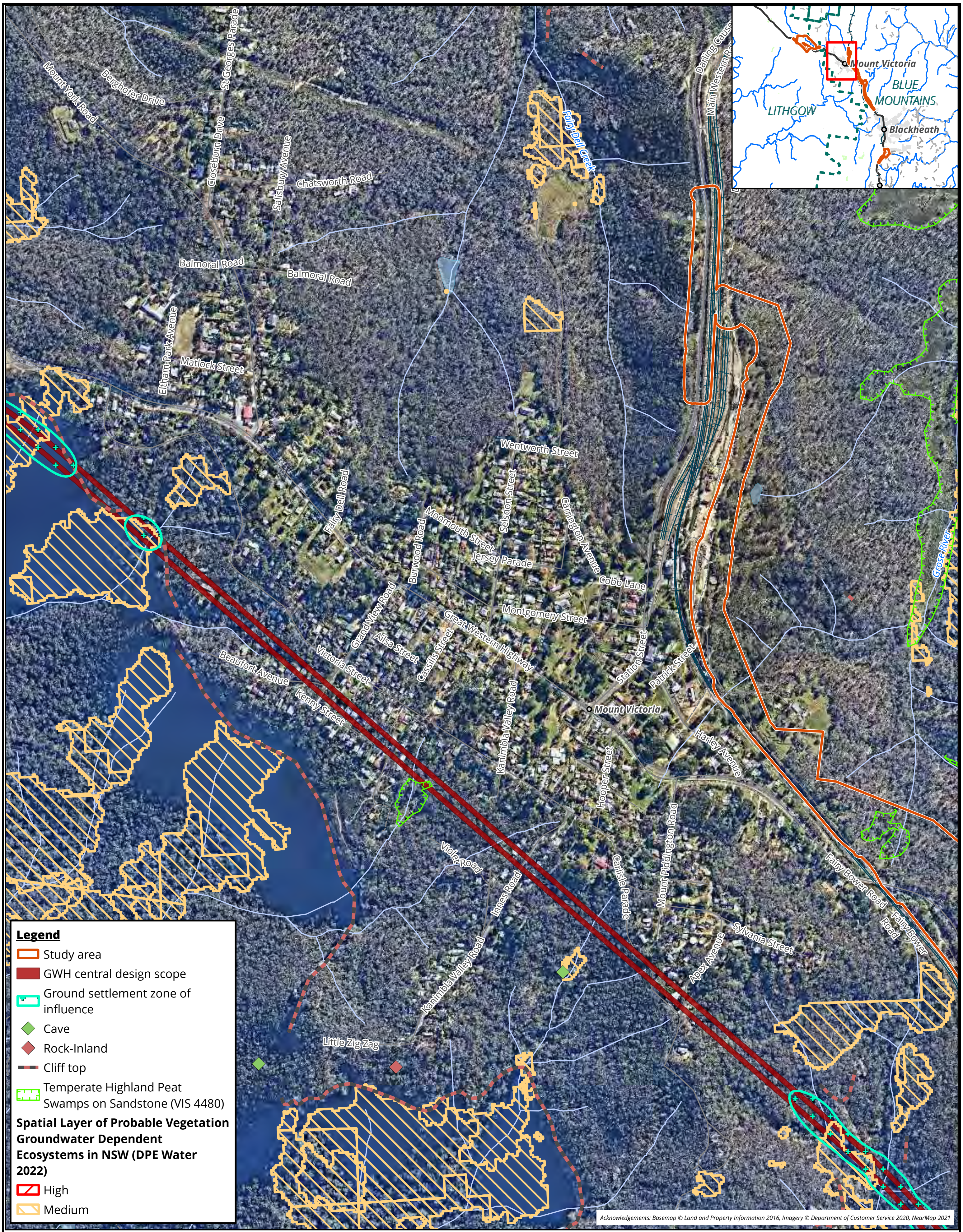


**Figure 7-2 Area associated with prescribed biodiversity impacts**
**Page 5 of 7**

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Date: 12 December 2022 ,
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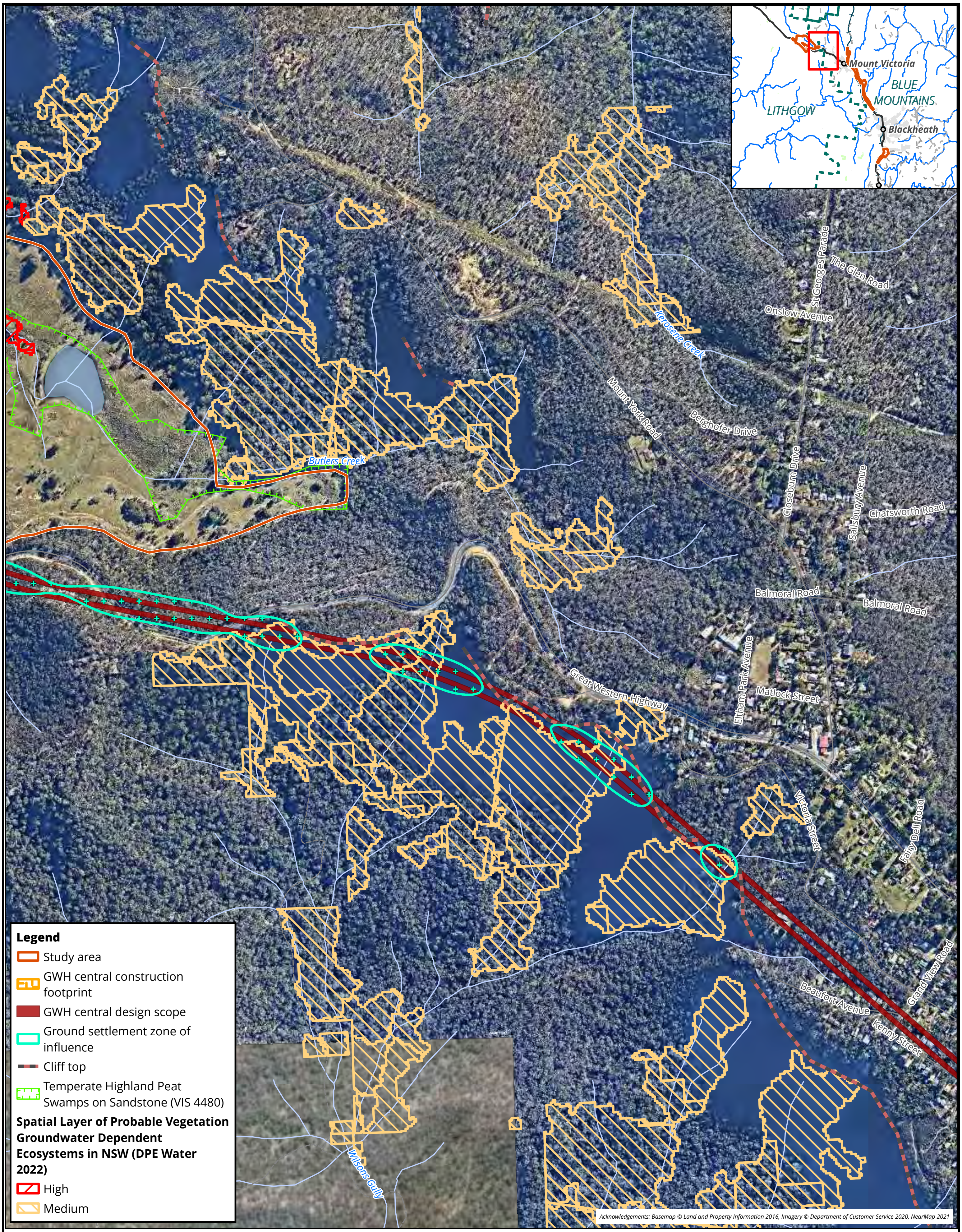


**Figure 7-2 Areas associated with prescribed biodiversity impacts**
**Page 6 of 7**

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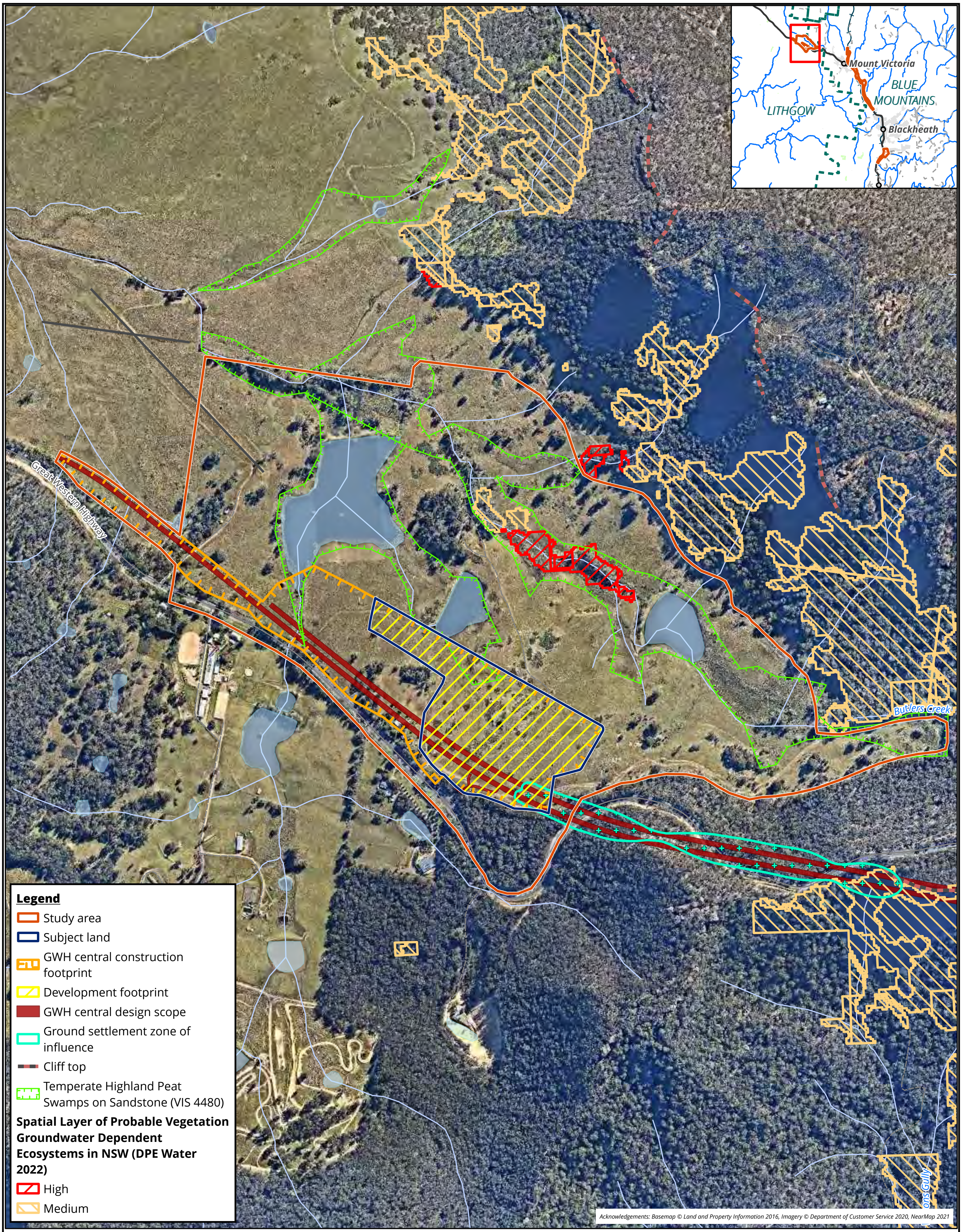


**Figure 7-2 Areas associated with prescribed biodiversity impacts**

**Page 7 of 7**

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0 100 200 300 400 500
Metres
Scale 1:7,500 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

### 7.4.1 Areas of geological significance

Areas of geological significance that occur within the assessment area include cliff lines and crevices within the rocky mountainous region of the Greater Blue Mountains. These areas represent potential habitat for a native fauna, particularly native microbats who utilise these features as breeding and roosting habitat. Other rocky habitats including rocky outcrops represent potential habitat for Brush-tailed Rock Wallaby and potential breeding habitat for Broad-headed Snake. None of these areas of geological significance are being directly impacted as a result of the project.

Indirect impacts to areas of geological significance may occur within the areas directly above the tunnel alignment. Settlement as a result of the tunnel construction has been modelled and is expected to occur within a zone of influence above the tunnel excavation which is defined by a 5 millimetre contour line shown on Figure 7-2. Figure 7-2 also shows cliff lines and areas of mapped GDEs (BoM, 2017), which indicate that:

- there is one cliff line to the south of the Soldiers Pinch construction footprint that crosses into the modelled settlement zone of influence and may be affected by settlement in excess of 5 millimetres (refer to Figure 7-2 page 4 of 7). Modelling for railway crossings in this area of the project indicate settlement of up to around 16 millimetres, and it is expected that the cliff line at this location would experience settlement around 16 millimetres given it is located further away from the tunnel than the railway crossing
- there are three cliff lines that cross above the tunnel alignment near Victoria pass, but are located outside the modelled settlement zone of influence (refer to Figure 7-2 page 6 of 7)
- five areas of mapped GDEs are located above the tunnel alignment near Victoria pass, including the very small area of the modelled settlement zone of influence in this location (refer to Figure 7-2 page 6 of 7). This very small area of mapped GDE may be affected by settlement in excess of 5 millimetres.

Updated settlement modelling will be carried out based on further design development, to confirm the anticipated levels of settlement beneath areas of geological significance (including cliff lines and GDEs). Where updated modelling indicates settlement may be more than 20 millimetres (consistent with the settlement threshold applied to sensitive structures), a before after control impact (BACI) design monitoring program is recommended within these areas to detect and mitigate impacts accordingly (refer to Section 8.4.1).

### 7.4.2 Human-made structures and non-native vegetation

No human made structures providing habitat to threatened or non-threatened fauna species occur within the development footprint.

Approximately 11.02 hectares (53 per cent) of the project’s direct impact to vegetation have been located in non-native vegetation. These areas of non-native vegetation provided negligible habitat opportunities for native fauna species beyond foraging opportunities for common kangaroo and wallaby species. No areas of non-native vegetation have been determined to constitute habitat for threatened species in accordance with Section 5.2.6 of the BAM. As such further assessment of non-native vegetation in accordance with Section 6.1.2 of the BAM (Prescribed Impacts) is not required.

### 7.4.3 Habitat connectivity

Movement corridors are currently not restricted in width and availability throughout the locality, as there are large tracts of intact vegetation adjacent to sections of the Great Western Highway. The project will result in the removal of native vegetation from the subject land to allow for the construction footprints, including:

- Blackheath construction footprint – Native vegetation is present and widespread within the development footprint, located to the east of the Great Western Highway. The vegetation proposed for removal is directly adjacent to the Great Western Highway, and south of urban development that contains Urban Native/Exotic vegetation and therefore is fringing disconnected native vegetation that occurs to the south, west and east.

- Soldiers Pinch construction footprint – Vegetation within the development footprint is directly adjacent to the Great Western Highway and therefore is fringing disconnected native vegetation that occurs between two carriageways of traffic.
- Little Hartley construction footprint – Native vegetation is present within the development footprint fringing a dam to the north-east, as well as fringing the Great Western Highway to the south. The majority of the development footprint consists of Urban Native/Exotic vegetation, with limited patches of remnant vegetation and scattered trees. Vegetation within the development footprint is highly fragmented.

Areas where native vegetation is proposed to be removed the fringe native vegetation to be retained include:

- Blackheath construction footprint – Vegetation to the south, west and east of the subject land and Great Western Highway provides good quality intact native vegetation for fauna of various mobility levels. The subject land and development footprint fringes movement corridors that are present within the locality for fauna.
- Soldiers Pinch construction footprint – Vegetation to the east and west of the Great Western Highway and Main Western Railway provides good quality intact native vegetation patches for fauna of various mobility levels. The subject land and development footprint does not provide suitable habitat as a movement corridor for less mobile fauna and fringes movement corridors that are present within the locality for more mobile fauna.
- Little Hartley construction footprint – Large tracts of native vegetation will be retained to the south and east of the subject land. The development footprint does not contain native vegetation that would be suitable for less mobile fauna due to existing fragmentation of the landscape, and the subject land and development footprint fringes movement corridors that would be present within the locality for more mobile fauna.

The removal of vegetation is unlikely to fragment movement corridors for threatened fauna, as extensive remnant vegetation adjacent to the subject land will remain intact and not be fragmented.

### 7.4.4 Water bodies, water quality and hydrological processes

The project sits within the wider Hawkesbury-Nepean River Catchment. The Blackheath and Soldiers Pinch construction footprints would be located within the Grose River sub-catchment and the Little Hartley construction footprint would be located within the Coxs River sub-catchment. The Blackheath construction footprint would also be located within the Blue Mountains Catchment. The Coxs River sub-catchment and the Blue Mountains Catchment are part of the Sydney Drinking Water Catchment. Therefore, the Blackheath and Little Hartley areas of the project have been assessed (refer to Appendix J (Technical report - Surface water and flooding) of the EIS) to demonstrate that a neutral or beneficial effect (NorBE) on water quality can be achieved.

Changes in water quality, groundwater drawdown and changes in surface water flows can be detrimental to the natural environment as they can:

- result in increased erosion and scouring in downstream environments due to increased rate and volume of discharged surface water
- result in impacts to water quality due to inadequate treatment of discharges which may contain sediments and other mobilised pollutants
- reduce the area of available habitat for sensitive fauna (such as native frogs species)
- cause structural changes in creek lines, swamps and wetland ecosystems due to alterations in peat deposition from altered surface flows

- cause alterations in the floristic diversity (e.g. change in species density and vegetation community structural composition, increases in exotic species due to water quality changes etc.)
- cause changes to the water chemistry due to:
  - o increased surface water run-off from hard surfaces, which is likely to be higher in alkalinity and associated ionic components, particularly Bicarbonate ($HCO_3$) and Calcium (Ca) due to increased concreted areas, causing changes in the pH of receiving waterways (which tend to be more acidic in the Blue Mountains catchments)
  - o discharges of groundwater tunnel seepage, which are likely to be more saline than surface waters, causing changes to the salinity of surface waters (which tend to be low in salinity in the Blue Mountains
- result in reduced groundwater availability which can lead to the drying out of the fringes of waterways or swamps which can alter the plant community type extent and floristic structure and associated aquatic habitat
- diversion of existing flow paths leading to increased velocity and ponding
- increased susceptibility to bushfires. Wet peat material is likely resistant to bushfire. Dry peat material could burn, resulting in permanent loss of some of the swamp, likely followed by erosion in subsequent rainfall, and resulting in potentially catastrophic failure of the integrity of the swamp.

Groundwater seepage would occur during tunnel excavation as a result of temporary drawdown in groundwater levels around the tunnel face. If groundwater seepage is not minimised, GDEs can be negatively impacted if the groundwater table decreases such that plants can no longer access groundwater. In addition, groundwater seepage would occur within many of the cross-passages linking the two mainline tunnels. Cross-passages would be located every 120 metres of the tunnel alignment. The proposed method of tunnel excavation (utilising TBMs) allows for an impermeable lining to be installed progressively, during excavation. While groundwater seepage would still occur at the tunnel face, the membrane will limit excess water from entering the tunnel. However, the cross-passages would be excavated using roadheader. As such, these cross-passages would be drained for a short period (likely to be two to three months), and during this period groundwater seepage and drawdown would occur at these locations. After construction, these features would be ‘tanked’ and no longer cause drawdown.

The exception to this is that the two portals, at Little Hartley and Blackheath, and the mid-tunnel cavern (or mid-point enlargement) are currently assumed to be permanently ‘drained’ features. As such, these would allow groundwater inflow and cause drawdown in the surrounding groundwater systems.

The numerical groundwater modelling, included as an annexure to Appendix I of the EIS (Technical report – Groundwater), predicted a potential reduction in baseflow to some surface water catchments during construction and in the post-construction or operational periods. These results indicate that ongoing dewatering is predicted to have the largest proportional impact on baseflow reduction at Greaves Creek which is located immediately east of the Blackheath portal and flows east towards Lake Greaves. Reductions in spring flows may also occur within areas of hanging swamps associated with the Fairy Bower and Mt Boyce groups.

The following reductions in baseflow are predicted for Greaves Creek near the Blackheath portal as the drawdown cone from the portal develops during construction and in the operational period:

- a reduction in baseflow during a dry year of 15.5% (50th percentile) and 17.0% (95th percentile) following construction of the project
- a reduction in baseflow during an average year of 0.5% (50th percentile) and 1.0% (95th percentile) following construction of the project

- a reduction in baseflow during a wet year of 0.2% (50th percentile) and 0.4% (95th percentile) following construction of the project.

Therefore, sufficient moisture is likely to be available to the peat swamps in average/wet weather years. However, in drier years, baseflow would supply the higher proportion of water to the peat swamps. A reduction in baseflows during dry years on Greaves Creek could lead to; drying of the swamp margins and changes to plant community type and structure, increased susceptibility to erosion from surface/stream flows following dry periods, and increased susceptibility to bushfire.

Groundwater seepage will need to be pumped out of the tunnel for discharge/re-use to prevent tunnel flooding. Due to the potential for saline groundwater within the project locality, groundwater may need to be treated prior to discharge/re-use to ensure there are no negative impacts to receiving environments. The project therefore includes construction and operation of a water treatment plant which will treat the groundwater seepage to ensure water has an adequate salinity and conductivity prior to discharge or re-use.

Appendix J (Technical report - Surface water and flooding) of the EIS outlines a range of measures to mitigate surface water quality impacts. These stormwater treatment measures were developed with the health of surrounding waterways being the key priority. The stormwater treatment opportunities include:

- flow splitters
- Gross Pollutant Traps
- bioretention basins or filtration devices
- vegetated buffers and swales
- bioretention systems
- scour protection, energy dissipation devices and/or flow spreaders.

In order to manage the rate of flooding and surface water flows, stormwater treatment devices (bioretention systems) have been integrated into the design to meet the requirement for Neutral or Beneficial Effect (NorBE) on runoff water quality. This allows the projects to meet the requirements of Section 8.8 of the Biodiversity and Conservation SEPP and the NSW Water Quality Objectives. In order to manage the volume of runoff the bioretention systems would be unlined to allow infiltration of treated stormwater runoff directly into the surrounding soils. Flow spreaders at the discharge locations would be designed to create flat, low energy environments to further encourage infiltration. An operational water treatment plant would also be constructed for the project to treat wastewater and groundwater inflows to levels consistent with water quality requirements before being discharged. An operational environmental management plan would be developed to manage water-related incidents such as spills, with spill response and management procedures (Technical report - Surface water and flooding, included as Appendix J of the EIS).

Surface water quality control basins would be appropriately sized to manage and mitigate the pollutants generated and convey flow volumes during the construction and operation of the Katoomba to Blackheath Upgrade and Little Hartley to Lithgow Upgrade, as well as the construction and operation of this project, meeting the required criteria for all projects.

It is understood that the surface water runoff from the project is likely to impact water quality, runoff rate, and runoff volume. In particular, inundation of the medium priority GDEs (as shown on Figure 4-5) surrounding the largest of the three dams in the Little Hartley study area is likely to occur as a result of increased runoff volumes in that area.

Further investigation into the impacts of baseflow reductions on watercourses and swamps will be undertaken during design development. Future investigations would include field hydrogeological investigations to provide more accurate, site-specific parameters that can be used in predictive groundwater modelling. Modelling would then be revised for this catchment to enable more accurate predictions of the likely impact of the Blackheath portal on baseflow reductions.

If revised modelling determines that a reduction in baseflow to the valley floor infill swamps of Greaves Creek is likely and that there is a risk of detrimental impacts to these ecosystems as a result, then further mitigation measures would be investigated. Performance outcomes for the mitigation measures would be developed and agreed upon by subject matter experts, and mitigation actions including design responses such as lining the Blackheath tunnel portal would be assessed for their effectiveness in addressing the risk.

In the instance that residual risk is predicted monitoring would continue during construction for the hydrogeology, geomorphology and vegetation community likely to be impacted. Observations would be assessed against set triggers, trigger thresholds, and responses for observed impacts. Monitoring methods would be developed with reference to supporting justification including the recommendations of Commonwealth of Australia (2014) where appropriate.

Swamp extent and PCT mapping would be carried out for the BC Act and EPBC Act listed peat swamps (GDEs) on Greaves Creek and Butlers Creek prior to construction commencement, followed by seasonal swamp extent mapping and species composition assessment to assess change in swamp dynamics for a 24 month period.

### 7.4.5 Protected animals that may use proposed wind farm development site as a flyway or migration route

There are no wind turbines involved in this project.

### 7.4.6 Vehicle strike

#### Construction changes to vehicle traffic

The project has the potential to result in increased vehicle, in particular heavy vehicle, movements (and therefore the potential for increased vehicle strikes) during the construction phase of the project. Across the three construction footprints, the construction works are expected to generate up to 4,160 vehicle movements per day including 1,805 heavy vehicles movements (in and out). This includes passenger, commercial and heavy vehicles, including spoil haulage, segment deliveries and tunnel fit out vehicles. These estimates assume that the peak activity will occur at the same time across the three construction footprints and are therefore expected to be conservative (AECOM 2022b). The majority of this would occur within the construction footprint however excess spoil that cannot be reused within the project or for the other components of the Upgrade Program would be loaded directly into trucks and removed from site for appropriate reuse. Section 6.5.1 of the EIS outlines several off-site spoil reuse sites that are being investigated for the project. All identified locations are to the west of the study area. Therefore, all haulage activity would travel to and from the footprints and locations west of the study area (AECOM 2022b).

Traffic speed zones would also be adjusted to enhance safety around the construction work where required. The posted speed limit on the Great Western Highway would be reduced from 80 kilometres per hour to 60 kilometres per hour or lower in the vicinity of the construction footprints to enhance safety around the construction work where required. The full extent and durations of the speed reductions are not currently known and would be confirmed by the construction contractor when appointed (AECOM 2022b).

These vehicle movements will occur on the edges of native vegetation patches rather than through patches of habitat and therefore the risk of vehicle strike will occur when fauna seeks to move between vegetation patches. The potential for vehicle strikes will be reduced via construction of fauna exclusion fencing around the construction site, combined with driver awareness training on the potential for fauna related vehicle incidents to occur, as well as on-site measures such as reduced speed limits and signage. Ongoing monitoring of the condition of fencing should occur with regular and reactive maintenance to ensure the fences remain in working order.

#### Operation changes to vehicle traffic

The potential for vehicle strikes will decease following construction as traffic volumes on the existing Great Western Highway alignment through Blackheath and Mount Victoria are projected to decrease due to the operation of the tunnel. Using 2018 vehicle count data, the projected number of vehicles per day in 2030 and 2040 through Blackheath and Mount Victoria could reach 25,000 and 20,000 on public holidays if the project was not constructed. Typical weekday vehicles per day is expected to reach 20,000 (Blackheath) and over 15,000 (Mount Victoria) without the project. By comparison, once the tunnel is operational the number of vehicles on public holidays is expected to reduce to 11,000 (Blackheath) and 5,000 (Mount Victoria) vehicles per day while weekday travel is expected to reduce to around 7,000 vehicles per day in Blackheath and under 5,000 vehicle per day in Mount Victoria (AECOM 2022b).

The existing Great Western Highway is bordered by large patches of remnant native vegetation bordering the Blue Mountains National Park, and as such fauna related vehicle strikes from passing traffic is most likely moderate to high. Due to the decreased number of vehicles using the existing Great Western Highway alignment post construction, it is likely that the project will result in a decline in the number vehicle strikes currently associated with the Great Western Highway. Risk of vehicle strike remains outside of the tunnel areas, particularly around the Blackheath and Little Hartley tunnel portals which are likely to see large volumes of traffic in areas directly adjacent to native vegetation. As such mitigation measure are recommended for the installation of fauna exclusion fencing around these portals to mitigate against vehicle strike.

Based on the above, the project is not expected to result in any substantial or significant impacts associated with vehicle strikes.

### Impacts to native fauna

The project will result in an increase in the likelihood of vehicle strikes to native fauna both within the study area, as well as to native fauna in the broader locality (i.e. outside of the assessed study area) as vehicles move in and out of the construction footprint. However, these effects are expected to be greatest in areas directly within and adjacent to the construction footprint. The threatened fauna species within the locality (both within the subject land and broader assessment area) which are considered to be potentially impacted by the increased construction traffic have been identified in Table 7-4, along with the estimated strike rate and consequence of impact. These potential impacts to native fauna will primarily occur during the construction phase of the project as a result of increased vehicle traffic volumes. The potential for vehicle strike along the existing Great Western Highway between Blackheath and Little Hartley is expected to decrease during operation as vehicle traffic switches to the completed tunnel and surface level traffic between Blackheath and Little Hartley decreases.

Table 7-4: Potential impacts of vehicle strikes on threatened fauna or on any fauna species that are part of a TEC

| Species at risk of vehicle strike | Existing likelihood of vehicle strike | Estimated vehicle strike rates | Consequences of the impacts for the local and bioregional persistence of the species |
|---|---|---|---|
| **Birds** | | | |
| Barking Owl | Low | Low (during construction). Species is highly mobile and unlikely to be struck at significant volumes. Species is nocturnal and will be active outside of the main construction hours which would be associated with the increased traffic volume. There may be a small increase in vehicle strike rate from vehicle movements associated with night works during construction, particularly if any increase in road carrion is not cleared regularly. | Negligible impacts to highly mobile species as a result of increased construction traffic. |

| Species at risk of vehicle strike | Existing likelihood of vehicle strike | Estimated vehicle strike rates | Consequences of the impacts for the local and bioregional persistence of the species |
|---|---|---|---|
| | | Low (during operation). Vehicle traffic expected to decrease significantly during operation. Will further reduce likelihood of vehicle strike for this species. | |
| Gang-gang Cockatoo | Low | Low (during construction). Species is highly mobile and unlikely to be struck at significant volumes.<br>Low (during operation). Vehicle traffic expected to decrease significantly during operation. Will further reduce likelihood of vehicle strike for this species. | Negligible impacts to highly mobile species as a result of increased construction traffic. |
| Glossy Black-Cockatoo | Low | Low (during construction). Species is highly mobile and unlikely to be struck at significant volumes.<br>Low (during operation). Vehicle traffic expected to decrease significantly during operation. Will further reduce likelihood of vehicle strike for this species. | Negligible impacts to highly mobile species as a result of increased construction traffic. |
| Little Eagle | Low | Low (during construction). Species is highly mobile and unlikely to be struck at significant volumes. There may be a small increase in vehicle strike rate during construction as a result of the increased traffic volume, particularly if any increase in road carrion is not cleared regularly.<br>Low (during operation). Vehicle traffic expected to decrease significantly during operation. Will further reduce likelihood of vehicle strike for this species. | Negligible impacts to highly mobile species as a result of increased construction traffic. |
| Little Lorikeet | Low | Low (during construction). Species is highly mobile and unlikely to be struck at significant volumes.<br>Low (during operation). Vehicle traffic expected to decrease significantly during operation. Will further reduce likelihood of vehicle strike for this species. | Negligible impacts to highly mobile species as a result of increased construction traffic. |
| Masked Owl | Low | Low (during construction). Species is highly mobile and unlikely to be struck at | Negligible impacts to highly mobile species as a result of increased construction traffic. |

| Species at risk of vehicle strike | Existing likelihood of vehicle strike | Estimated vehicle strike rates | Consequences of the impacts for the local and bioregional persistence of the species |
|---|---|---|---|
| | | significant volumes. Species is nocturnal and will be active outside of the main construction hours which would be associated with the increased traffic volume. There may be a small increase in vehicle strike rate from vehicle movements associated with night works during construction, particularly if any increase in road carrion is not cleared regularly.<br><br>Low (during operation). Vehicle traffic expected to decrease significantly during operation. Will further reduce likelihood of vehicle strike for this species. | |
| Powerful Owl | Low | Low (during construction). Species is highly mobile and unlikely to be struck at significant volumes. Species is nocturnal and will be active outside of the main construction hours which would be associated with the increased traffic volume. There may be a small increase in vehicle strike rate from vehicle movements associated with night works during construction, particularly if any increase in road carrion is not cleared regularly.<br><br>Low (during operation). Vehicle traffic expected to decrease significantly during operation. Will further reduce likelihood of vehicle strike for this species. | Negligible impacts to highly mobile species as a result of increased construction traffic. |
| Sooty Owl | Low | Low (during construction). Species is highly mobile and unlikely to be struck at significant volumes. Species is nocturnal and will be active outside of the main construction hours which would be associated with the increased traffic volume. There may be a small increase in vehicle strike rate from vehicle movements associated with night works during construction, particularly if any increase in road carrion is not cleared regularly.<br><br>Low (during operation). Vehicle traffic expected to decrease | Negligible impacts to highly mobile species as a result of increased construction traffic. |

| Species at risk of vehicle strike | Existing likelihood of vehicle strike | Estimated vehicle strike rates | Consequences of the impacts for the local and bioregional persistence of the species |
|---|---|---|---|
| | | significantly during operation. Will further reduce likelihood of vehicle strike for this species. | |
| Square-tailed Kite | Low | Low (during construction). Species is highly mobile and unlikely to be struck at significant volumes. There may be a small increase in vehicle strike rate during construction as a result of the increased traffic volume, particularly if any increase in road carrion is not cleared regularly.<br><br>Low (during operation). Vehicle traffic expected to decrease significantly during operation. Will further reduce likelihood of vehicle strike for this species. | Negligible impacts to highly mobile species as a result short term increased construction traffic. |
| White-bellied Sea-Eagle | Low | Low (during construction). Species is highly mobile and unlikely to be struck at significant volumes. Species primary foraging habitats unlikely to adjacent to areas experiencing increased traffic volumes. There may be a small increase in vehicle strike rate during construction as a result of the increased traffic volume, particularly if any increase in road carrion is not cleared regularly.<br><br>Low (during operation). Vehicle traffic expected to decrease significantly during operation. Will further reduce likelihood of vehicle strike for this species. | Negligible impacts to highly mobile species as a result of increased construction traffic. |
| **Mammals** | | | |
| Brush-tailed Rock Wallaby | High<br><br>According to a 2008 study, approximately nine million kangaroos and wallabies are killed on Australian roads each year (Burgin & Brainwood 2008). | High (during construction). Species is likely already subject to vehicle related mortality which is expected to increase during construction (if left unmitigated) as a result of the additional construction related traffic.<br><br>Low (during operation). Number of vehicles per day, and therefore number of vehicle strikes, is expected to decrease significantly from pre-construction levels due to the | Roads are known to negatively impacts some macropod populations (e.g., Brush-tailed Rock Wallabies) because of proportionately high road deaths and population fragmentation, and unless effective road mitigation measures are taken, populations may continue to decline (Bond & Darryl 2014).<br><br>Vehicle strikes expected to increase during the construction period if left unmitigated. |

| Species at risk of vehicle strike | Existing likelihood of vehicle strike | Estimated vehicle strike rates | Consequences of the impacts for the local and bioregional persistence of the species |
|---|---|---|---|
| | | reduction in above-ground vehicle traffic. | Mitigation measures including construction driver awareness training, signage, project speed limits and fauna exclusion fencing around construction facilities will help reduce this impact.<br>During operation the project may have a positive impact on the species with the number of vehicle strikes likely to decrease. |
| Eastern Pygmy-possum | High | High (during construction). Species is likely already subject to vehicle related mortality which is expected to increase during construction (if left unmitigated) as a result of the additional construction related traffic.<br>Low (during operation). Number of vehicles per day, and therefore number of vehicle strikes, is expected to decrease significantly from pre-construction levels due to the reduction in above-ground vehicle traffic. | Vehicle strikes expected to increase during the construction period if left unmitigated. Mitigation measures including construction driver awareness training, signage, project speed limits and fauna exclusion fencing around construction facilities will help reduce this impact.<br>During operation the project may have a positive impact on the species with the number of vehicle strikes likely to decrease. |
| Greater Glider | High | High (during construction). Species is likely already subject to vehicle related mortality which is expected to increase during construction (if left unmitigated) as a result of the additional construction related traffic.<br>Low (during operation). Number of vehicles per day, and therefore number of vehicle strikes, is expected to decrease significantly from pre-construction levels due to the reduction in above-ground vehicle traffic. | Vehicle strikes expected to increase during the construction period if left unmitigated. Mitigation measures including construction driver awareness training, signage, project speed limits and fauna exclusion fencing around construction facilities will help reduce this impact.<br>During operation the project may have a positive impact on the species with the number of vehicle strikes likely to decrease. |
| Koala | High<br>One of the most frequently reported causes of injury and death for | High (during construction). Species is likely already subject to vehicle related mortality which is expected to increase during construction as a result of the additional construction related traffic. | Vehicle strikes expected to increase during the construction period if left unmitigated. Mitigation measures including construction driver awareness training, signage, project speed limits and fauna exclusion fencing around construction |

| Species at risk of vehicle strike | Existing likelihood of vehicle strike | Estimated vehicle strike rates | Consequences of the impacts for the local and bioregional persistence of the species |
|---|---|---|---|
| | koalas is vehicle strikes (DPIE 2020e). | Low (during operation). Number of vehicles per day, and therefore number of vehicle strikes, is expected to decrease significantly from pre-construction levels due to the reduction in above-ground vehicle traffic. | facilities will help reduce this impact.<br>During operation the project may have a positive impact on the species with the number of vehicle strikes likely to decrease. |
| Long-nosed Potoroo | High | High (during construction). Species is likely already subject to vehicle related mortality which is expected to increase during construction as a result of the additional construction related traffic.<br>Low (during operation). Number of vehicles per day, and therefore number of vehicle strikes, is expected to decrease significantly from pre-construction levels due to the reduction in above-ground vehicle traffic. | Vehicle strikes expected to increase during the construction period if left unmitigated. Mitigation measures including construction driver awareness training, signage, project speed limits and fauna exclusion fencing around construction facilities will help reduce this impact.<br>During operation the project may have a positive impact on the species with the number of vehicle strikes likely to decrease. |
| Southern Brown Bandicoot | High<br>Studies have shown that road collisions are one of the leading causes of adult mortality in a number of bandicoot species (Dufty 1991, Taylor & Goldingay 2004, Scott, Hume, & Dickman 1999) | High (during construction). Species is likely already subject to vehicle related mortality which is expected to increase during construction as a result of the additional construction related traffic.<br>Low (during operation). Number of vehicles per day, and therefore number of vehicle strikes, is expected to decrease significantly from pre-construction levels due to the reduction in above-ground vehicle traffic. | Vehicle strikes expected to increase during the construction period if left unmitigated. Mitigation measures including construction driver awareness training, signage, project speed limits and fauna exclusion fencing around construction facilities will help reduce this impact.<br>During operation the project may have a positive impact on the species with the number of vehicle strikes likely to decrease. |
| Spotted-tailed Quoll | High<br>Collision with vehicles led to local extinction of the Eastern Quoll *Dasyurus viverrinus* in a Tasmanian National Park when a road was widened | High (during construction). Species is likely already subject to vehicle related mortality which is expected to increase during construction as a result of the additional construction related traffic.<br>Low (during operation). Number of vehicles per day, and therefore number of vehicle strikes, is expected to decrease significantly from pre-construction levels due to the | Vehicle strikes expected to increase during the construction period if left unmitigated. Mitigation measures including construction driver awareness training, signage, project speed limits and fauna exclusion fencing around construction facilities will help reduce this impact.<br>During operation the project may have a positive impact on the species with the number of |

| Species at risk of vehicle strike | Existing likelihood of vehicle strike | Estimated vehicle strike rates | Consequences of the impacts for the local and bioregional persistence of the species |
|---|---|---|---|
| | and sealed (Jones 2000). | reduction in above-ground vehicle traffic. | vehicle strikes likely to decrease. |
| Squirrel Glider | High<br>A study by McCall et al. 2010) found that Squirrel Gliders living adjacent to the Hume Freeway in Victoria had a survival rate around 60% less than those living more than 5 km away. | High (during construction). Species is likely already subject to vehicle related mortality which is expected to increase during construction as a result of the additional construction related traffic.<br>Low (during operation). Number of vehicles per day, and therefore number of vehicle strikes, is expected to decrease significantly from pre-construction levels due to the reduction in above-ground vehicle traffic. | Vehicle strikes expected to increase during the construction period if left unmitigated. Mitigation measures including construction driver awareness training, signage, project speed limits and fauna exclusion fencing around construction facilities will help reduce this impact.<br>During operation the project may have a positive impact on the species with the number of vehicle strikes likely to decrease. |
| Yellow-bellied Glider | High | High (during construction). Species is likely already subject to vehicle related mortality which is expected to increase during construction as a result of the additional construction related traffic.<br>Low (during operation). Number of vehicles per day, and therefore number of vehicle strikes, is expected to decrease significantly post construction. | Vehicle strikes may increase during the construction period. Mitigation measures including construction driver awareness training, signage, and fauna exclusion fencing around construction facilities will help reduce this impact.<br>During operation the project may have a positive impact on the species with the number of vehicle strikes likely to decrease. |
| **Amphibians** | | | |
| Giant Burrowing Frog | Low | Low (during construction). Species mostly active at night, spending the rest of its time burrowed underground. Most likely to be active outside of the main construction hours which would be associated with the increased traffic volume.<br>Low (during operation). Vehicle traffic expected to decrease significantly during operation. Will further reduce likelihood of vehicle strike for this species. | Negligible impacts to species as a result of increased construction traffic. |
| Littlejohn's Tree Frog | Low | Low – species mostly active at night. Most likely to be active outside of the main construction hours which would be | Negligible impacts to species as a result of increased construction traffic. |

| Species at risk of vehicle strike | Existing likelihood of vehicle strike | Estimated vehicle strike rates | Consequences of the impacts for the local and bioregional persistence of the species |
|---|---|---|---|
| | | associated with the increased traffic volume.<br><br>Low (during operation). Vehicle traffic expected to decrease significantly during operation. Will further reduce likelihood of vehicle strike for this species. | |
| Red-crowned Toadlet | Low | Low – unlike other frog species, this species has the potential to be active during the day, particularly in the late afternoon. However, the species is unlikely to disperse far from its habitat and is unlikely to be traversing main roads utilised by construction traffic in significant numbers.<br><br>Low (during operation). Vehicle traffic expected to decrease significantly during operation. Will further reduce likelihood of vehicle strike for this species. | Negligible impacts to species as a result of increased construction traffic. |
| Stuttering Frog | Low | Low – species mostly active at night. Most likely to be active outside of the main construction hours which would be associated with the increased traffic volume.<br><br>Low (during operation). Vehicle traffic expected to decrease significantly during operation. Will further reduce likelihood of vehicle strike for this species. | Negligible impacts to species as a result of increased construction traffic. |
| **Reptiles** | | | |
| Blue Mountains Water Skink | Negligible | Negligible (during construction). Species is restricted to swamp areas isolated from road traffic.<br><br>Negligible (during operation). Species is restricted to swamp areas isolated from road traffic. | Negligible impacts to species as a result of increased construction traffic. |
| Broad-headed Snake | Moderate | Moderate (during construction). Species likes to use road surfaces for basking in the morning, increased risk of vehicle strike during construction associated with increase construction traffic.<br><br>Low (during operation). Number of vehicles per day, and therefore number of vehicle | Negligible impacts to species as a result short term increased construction traffic. |

| Species at risk of vehicle strike | Existing likelihood of vehicle strike | Estimated vehicle strike rates | Consequences of the impacts for the local and bioregional persistence of the species |
|---|---|---|---|
| | | strikes, is expected to decrease significantly post construction. | |

## 7.5 Matters of national environmental significance

The EPBC Act is the Australian Government's key piece of environmental legislation. The EPBC Act applies to developments and associated activities that have the potential to significantly impact on matters of national environmental significance (MNES) protected under the Act. There are nine MNES identified under the EPBC Act:

- world heritage properties
- national heritage places
- wetlands of international importance (also known as 'Ramsar' wetlands)
- nationally threatened species and ecological communities
- migratory species.
- Commonwealth marine areas
- The Greater Barrier Reef Marine Park
- nuclear actions (including uranium mining)
- a water resource, in relation to coal seam gas development and large coal mining development.

Under the EPBC Act, activities that have potential to result in significant impacts on MNES must be referred to the DCCEEW for assessment. In addition to MNES, if an action is proposed that is either situated on, or which may impact upon, Commonwealth land, an assessment against Significant impact guidelines 1.2: Actions on, or impacting upon, Commonwealth land and actions by Commonwealth agencies (CoA 201AD) is required. As Commonwealth land is not impacted upon, further consideration of guideline 1.2 is not required.

MNES relevant to the current project include nationally threatened species and ecological communities, migratory species, Ramsar wetlands, world heritage places and national heritage places.

An assessment of the impacts of the project on MNES relevant to the project, in accordance with the MNES significant impact guidelines (Commonwealth of Australia 2013) was prepared to determine whether referral of the project to the Commonwealth Minister for the Environment is required. This includes the completion of Significant Impact Criteria (SIC) assessments for threatened species and TECs (included in Annexure J). The results of this assessment are detailed in Table 7-5.

Table 7-5: Assessment of the project against MNES under the EPBC Act

| MNES | Project specifics | Potential for significant impacts |
|---|---|---|
| Threatened species | Two threatened fauna species listed under the EPBC Act have been recorded (Large-eared Pied Bat and Greater Glider) and a further eight are considered likely to have potential habitat within the subject land (as per the habitat assessment included in Annexure E): | SIC assessments have been completed for six of the ten species and are included in Annexure J. Species for which a SIC assessment has been completed area:<br>• Large-eared Pied Bat |

| MNES | Project specifics | Potential for significant impacts |
|---|---|---|
| | • Regent Honeyeater *Anthochaera phrygia* (Critically Endangered, EPBC Act).<br>• Gang-gang Cockatoo *Callocephalon fimbriatum* (Endangered, EPBC Act).<br>• Large-eared Pied Bat *Chalinolobus dwyeri* (Vulnerable, EPBC Act).<br>• Spotted-tailed Quoll *Dasyurus maculatus* (Endangered, EPBC Act).<br>• Broad-headed Snake *Hoplocephalus bungaroides* (Vulnerable, EPBC Act).<br>• Swift Parrot *Lathamus discolor* (Critically Endangered, EPBC Act).<br>• Purple Copper Butterfly *Paralucia spinifera* (Vulnerable, EPBC Act).<br>• Greater Glider *Petauroides volans* (Endangered, EPBC Act).<br>• Koala *Phascolarctos cinereus* (Endangered, EPBC Act).<br>• Grey-headed Flying-fox *Pteropus poliocephalus* (Vulnerable, EPBC Act).<br>No threatened flora species listed under the EPBC Act have been recorded or are considered likely to occur within the subject land (as per the habitat assessment included in Annexure E). | • Spotted-tailed Quoll<br>• Broad-headed Snake<br>• Purple Copper Butterfly<br>• Greater Glider<br>• Koala<br>These assessments found that no significant impact is likely to result for these six species as a result of the project.<br>SIC assessment have not been undertaken for the remaining four species (Regent Honeyeater, Gang-gang Cockatoo, Swift Parrot and Grey-headed Flying-fox) as these species are considered to be highly mobile within the locality, transient species with the potential habitat areas impacted representing foraging habitat only. |
| TECs | There is one EEC listed under the EPBC Act within the study area, *Temperate Highland Peat Swamps on Sandstone* (Endangered Ecological Community, EPBC Act). | No potential for direct impact. Indirect impacts may occur due to changes in hydrology.<br>A SIC assessment has been completed for this EEC which is included in Annexure J. This assessment concluded that no significant impact is likely to occur to this EEC as a result of the project. |
| Migratory species | The subject land has the potential to support migratory species however there are no areas that are considered significant habitat for migratory species. | No direct impact is expected to any migratory listed species. |
| National heritage places | The Greater Blue Mountains area is one of the largest most intact tracts of protected bushland in Australia and is included on Australia's National Heritage List. The closest part of the central construction footprint to the national heritage place is the Blackheath construction footprint, which is located approximately 2 kilometres west of the mapped Greater Blue Mountains world heritage area boundary.<br>However, the Blackheath construction footprint does occur within an area mapped as The Greater Blue Mountains Area – Additional Value which is under consideration for inclusion on the National Heritage List (CoA 2022). | Impacts need to be assessed. Referral is recommended. |

| MNES | Project specifics | Potential for significant impacts |
|---|---|---|
| World heritage areas | The Greater Blue Mountains area is one of the largest most intact tracts of protected bushland in Australia and is included on Australia's World Heritage List. The closest part of the central construction footprint to the world heritage area is the Blackheath construction footprint, which is located approximately 2 kilometres west of the mapped Greater Blue Mountains world heritage area boundary.<br><br>As such, no direct impact will occur as a result of the project. Potential indirect impacts may occur as a result of surface water discharge points, including one proposed location along Greaves Creek, which flows into the world heritage area. | No potential for direct impact. Indirect impacts may occur due to changes in hydrology. A referral is therefore recommended. |
| Wetlands of international importance (Ramsar sites) | No wetlands of international significance occur within the subject land or broader assessment area. | No potential for impact. |

The project is considered likely to result in potential impacts to species or communities listed under the EPBC Act (as detailed in Table 7-5). Direct impacts are also proposed to native vegetation within The Greater Blue Mountains Area – Additional Value area which is currently under consideration for inclusion on the National Heritage List (CoA 2022). Indirect impacts also have the potential to occur within the Greater Blue Mountains world heritage area (and national heritage place) as a result of altered hydrological processes associated with proposed surface water discharge points around the Blackheath construction footprint. As such a referral to the Minister for the Environment and Water for these impacts has been prepared and submitted for consideration.

## 7.6 Threatened aquatic impacts

Results show that the waterways within the study area are not considered habitat for threatened species or endangered populations listed under the FM Act and there are no records for threatened aquatic species. In addition, no aquatic MNES listed under the EPBC Act were mapped within the study area or in downstream receiving waters and the catchment is not considered habitat for any species listed under this Act. The waterways present in the study area flow either into the Grose River or the Coxs River. The Grose River and Coxs River are mapped as habitat for the Macquarie Perch *Macquaria australasica* (Endangered, FM Act and EPBC Act). The aquatic ecology report found that there were no significant impacts likely to occur for the Macquarie Perch (Annexure H).

## 7.7 Groundwater dependent ecosystems

As detailed in Section 4.4, the GDE assessment of the subject land undertaken in accordance with Kuginis et al. (2016) determined that all recorded PCTs were either low probability GDEs or alternate water source non-GDEs. Impacts to low probability GDEs include PCT 708, PCT 1248 and PCT 1615. Impacts to alternate water source non-GDEs include PCT 766 and PCT 1740.

Medium probability GDEs have also been mapped to the east of the Blackheath study area, associated with Adams Creek. Based on the groundwater report, impacts to Medium probability GDEs are associated with EPBC Act and BC Act listed Temperate Highland Peat Swamps on Sandstone which occur in the Greaves Creek area (Figure 4-5). These peat swamps fall outside the study area for this BDAR however are associated with prescribed impacts as a result of the changes to groundwater drawdown and surface water as a result of the project. Based on groundwater and surface water modelling, peat swamps are at risk from reduced baseflows (especially during dry times) and changes to surface water flows, which could result in drying out or damage to the swamps as follows:

- shallow peat swamp margins would be more prone to drying as there is less peat material to retain moisture
- exotics are likely to establish when moisture regime changes and conditions favour these plants over native species
- the drying of the swamp margins can lead to changed floristic structure and species dominance, effecting aquatic habitats and PCT extent
- peat within the swamps could be eroded and lost during high surface water flows, peat cannot be recovered once lost
- greater susceptibility to bushfire, in a swamp that has lost moisture and changed in its composition
- higher risk of erosion in a sandy substrate as peat integrity is compromised by scour, which creates preferential flow paths through the peat, and drying is therefore exacerbated
- the preferential flow path continues to expand and deepen, further exacerbating the dryness
- the base of the channel formed in the peat acts as a drain to reduce the level of the water retained within the peat material.

A summary of these processes as they relate to the Blackheath portal area and Greaves Creek are shown in the schematic included in Annexure K.

Medium probability GDEs have also been mapped in scattered patches along the length of the proposed tunnel alignment. As the tunnel would be fully tanked (with lining occurring during construction), there should be no detectable changes in groundwater drawdown at surface level. As such these GDEs are unlikely to be impacted by the project.

Separately, high probability GDEs have been mapped by DPE (2022e) to the north of the subject land within the Little Hartley study area and outside the study area within the Greaves Creek catchment (Figure 4-5). As these areas are located outside of the development footprint there are no direct impacts to these areas. However, prescribed impacts have the potential to occur as a result of changes to water quality and hydrological processes, as outlined in Section 7.4.4. In particular, the changes to the runoff water chemistry, rate and volume within the area may impact the GDEs in the study area and surrounding downstream environments.

## 7.8 Cumulative impacts

Cumulative impacts arise from projects that are spatially (and temporally) relevant to the proposed project. The following projects are considered to be relevant for inclusion as part of a cumulative impacts assessment with the Great Western Highway Blackheath to Little Hartley project:

- Great Western Highway Upgrade – Katoomba to Blackheath (Katoomba to Blackheath Upgrade)
- Great Western Highway Upgrade – Medlow Bath (Medlow Bath Upgrade)
- Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) (Little Hartley to Lithgow Upgrade)

A description of each of these projects is included in Table 7-6. A summary of the ecological impacts associated with each is provided in Table 7-7.

Table 7-6: Description of projects included in cumulative impact assessment

| Project name | Description |
|---|---|
| Great Western Highway Upgrade – Katoomba to Blackheath (Katoomba to Blackheath Upgrade) | The Katoomba to Blackheath Upgrade is located immediately east of the project along the Great Western Highway.<br>The Katoomba to Blackheath Upgrade involves widening of around 5.3 km of the existing Great Western Highway between Rowan Lane, Katoomba and Tennyson Road, Blackheath from one to two lanes in each direction. Construction is expected to commence in 2023 and conclude in the first quarter of 2027.<br>Quantifiable biodiversity values impacted include:<br>• Native vegetation.<br>• Hollow-bearing trees. |
| Great Western Highway Upgrade – Medlow Bath (Medlow Bath Upgrade) | The Medlow Bath Upgrade is located three kilometres east of the project and involves upgrade of a 1.2 km section of the existing Great Western Highway at Medlow Bath to a four-lane divided carriageway as part of the Great Western Highway Upgrade Program – Katoomba to Lithgow (the Upgrade Program). Construction is expected to commence in mid-2022.<br>Quantifiable biodiversity values impacted include:<br>• Native vegetation.<br>• Hollow-bearing trees. |
| Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) (Little Hartley to Lithgow Upgrade) | Located immediately west of the project on the existing Great Western Highway alignment.<br>Construction is expected to commence in 2022 and concluded in the fourth quarter of 2026.<br>Upgrade of the Great Western Highway between Little Hartley and Lithgow. The project includes upgrade of about 14 kilometres of highway to a four lane divided highway.<br>Quantifiable biodiversity values impacted include:<br>• Native vegetation.<br>• Hollow-bearing trees. |

Table 7-7: Summary of biodiversity impacts of the projects included in the cumulative impact assessment

| Project | Biodiversity value impacted | Impacts |
|---|---|---|
| Great Western Highway Upgrade – Katoomba to Blackheath<br>and<br>Great Western Highway Upgrade – Medlow Bath | TECs | The Katoomba to Blackheath Upgrade involves indirect impacts to 0.12hectares of Blue Mountains Swamp TEC (PCT 1078), listed under the BC Act and EPBC Act.<br>The Medlow Bath Upgrade does not propose to impact on TECs listed under the BC Act and EPBC Act. |
| | Water quality | Katoomba to Blackheath Upgrade – Surface water quality impacts from sediment laden runoff or accidental leaks and spills. In addition, the project may result in localised interception of groundwater which could impact on the groundwater quality. During operation, the increased impervious surface area of the upgraded Great Western Highway would result in increased stormwater runoff |

| Project | Biodiversity value impacted | Impacts |
|---|---|---|
| | | volume, frequency and rate and associated increases in pollutant loading to receiving waterways. The drainage design of the project includes several gross pollutant traps, water quality basins and swales to retain and treat stormwater runoff before release into the surrounding environment. Water quality modelling carried out for the project identified that these treatments would result in a net beneficial effect on water quality compared to the existing scenario.<br><br>Medlow Bath Upgrade – Earthworks and other ground disturbing activities that would increase the risk of sedimentation either through vehicle movements, or wind/water runoff. |
| | Threatened species habitat | Katoomba to Blackheath Upgrade – Removal of 47.56hectares of habitat for the following species:<br>• Needle Geebung<br>• Large-eared Pied Bat<br>• Koala<br>• Grey-headed Flying fox<br>• Gang-gang Cockatoo<br>• Spotted-tailed Quoll<br>• Rosenberg's Goanna<br>• Eastern Pygmy Possum<br>• Greater Glider<br>• Squirrel Glider<br>• Threatened hollow-dependant bats (Eastern Coastal Free-tailed Bat, Greater Broad-nosed Bat, Yellow-bellied Sheath-tailed Bat, Eastern False Pipistrelle)<br>• Threatened cave-dependant bats (Little Bent-winged Bat, Large Bent-winged Bat, Eastern Cave Bat)<br>• Threatened woodland birds (Brown Treecreeper eastern subspecies, Varied Sittella, Diamond Firetail, Gilbert's Whistler, Black-chinned Honeyeater, Little Lorikeet, Flame Robin, Scarlet Robin, Hooded Robin)<br>Medlow Bath Upgrade – Removal of 0.32hectares of habitat for the following species:<br>• Littlejohn's Tree Frog<br>• Giant Burrowing Frog<br>• Red-crowned Toadlet<br>• Fork-tailed Swift<br>• White-throated Needletail<br>• Dusky Woodswallow<br>• Gang-gang Cockatoo<br>• Varied Sittella<br>• Scarlet Robin<br>• Flame Robin<br>• Little Lorikeet<br>• Barking Owl<br>• Powerful Owl<br>• Eastern Pygmy-possum |

| Project | Biodiversity value impacted | Impacts |
| --- | --- | --- |
| | | • Spotted-tailed Quoll<br>• New Holland Mouse<br>• Southern Brown Bandicoot (eastern)<br>• Koala<br>• Greater Glider<br>• Grey-headed Flying-fox<br>• Large-eared Pied Bat<br>• Little Bentwing-bat<br>• Large Bent-winged Bat<br>• Hairy Geebung<br>• *Persoonia marginata*<br>• *Zieria murphyi* |
| Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) | TECs | Direct impacts to 17.59 hectares of Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregion, listed as Endangered under the BC Act; and 5.82 hectares of *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 BC Act. |
| | Water quality | Earthworks have the potential to impact soil and surface water quality through erosion and sedimentation. |
| | Threatened species habitat | Removal of 75.19 hectares of habitat for the following threatened species:<br>• 4.3 ha of specialist habitat (*Bursaria spinosa* subsp. *lasiophylla*) of the Purple Copper Butterfly.<br>• Squirrel Glider<br>• Greater Glider<br>• Large-eared Pied Bat.<br>Ecosystem credit species, including:<br>• Gang-gang Cockatoo<br>• Glossy Black-Cockatoo<br>• Large-eared Pied Bat<br>• Little Bent-winged Bat<br>• Large Bent-winged Bat<br>• Koala<br>• Grey-headed Flying-fox<br>• Diurnal Raptors (Square-tailed Kite, White-bellied Sea-Eagle, Little Eagle)<br>• Large forest owls (Masked Owl, Powerful Owl, Barking Owl, Sooty Owl)<br>• Brown Treecreeper<br>• Scarlet Robin<br>• Eastern False Pipistrelle<br>• Greater Broad-nosed Bat |

In order to reduce impacts to native vegetation, portions of the central construction footprint have been located within areas that will first be cleared as part of the Great Western Highway Upgrade – Katoomba to Blackheath  and Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) projects. The breakdown of how the native vegetation included within the central construction footprint is assessed is outlined in Table 7-8. The overlap between the central construction footprint and the Great Western Highway Upgrade – Katoomba to Blackheath and Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) construction footprints are shown in Figure 2-4.

Table 7-8: Assessment of native vegetation within the project's construction footprint

| Vegetation zone | Impact area (ha) | Project impacting vegetation |
|---|---|---|
| 708_High | 0.20 | Great Western Highway Upgrade – Katoomba to Blackheath |
| 708_High | 1.29 | Blackheath to Little Hartley BDAR |
| 708_Moderate | 0.50 | Blackheath to Little Hartley BDAR |
| 766_Low | 0.35 | Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) |
| 766_Low | 0.43 | Blackheath to Little Hartley BDAR |
| 1248_High | 6.38 | Great Western Highway Upgrade – Katoomba to Blackheath |
| 1248_High | 6.14 | Blackheath to Little Hartley BDAR |
| 1248_Moderate | 1.35 | Great Western Highway Upgrade – Katoomba to Blackheath |
| 1248_Moderate | 0.86 | Blackheath to Little Hartley BDAR |
| 1248_Low | 0.59 | Great Western Highway Upgrade – Katoomba to Blackheath |
| 1248_Low | 0.33 | Blackheath to Little Hartley BDAR |
| 1256_Low | 0.01 | Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) |
| 1615_Moderate | 1.50 | Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) |
| 1615_Moderate | 0.17 | Blackheath to Little Hartley BDAR |
| 1615_Low | 0.20 | Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) |
| 1615_Low | 0.01 | Blackheath to Little Hartley BDAR |

An analysis of the contribution of the current project to cumulative ecological impacts has been undertaken which takes into account the overall impact of the full Great Western Highway upgrade. This assessment considered impacts to native vegetation (Table 7-9) and hollow-bearing trees (Table 7-10).

Table 7-9: Cumulative impacts to native vegetation

| **PCT and condition** | **Area impacted (ha)** | | | | |
|---|---|---|---|---|---|
| | **Current project** | **Great Western Highway Upgrade – Katoomba to Blackheath** | **Great Western Highway Upgrade – Medlow Bath** | **Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section)** | **Total cumulative impact** |
| PCT 708 Moderate | 0.50 | - | - | - | **0.50** |
| PCT 708 High | 1.30 | - | - | - | **1.30** |
| PCT 731 Good | - | - | - | 12.44 | **12.44** |
| PCT 731 Variant - good | - | - | - | 3.08 | **3.08** |
| PCT 731 Moderate | - | - | - | 14.61 | **14.61** |
| PCT 732 Moderate | - | - | - | 6.42 | **6.42** |
| PCT 766 Low | 0.43 | - | - | - | **0.43** |
| PCT 963 Good | - | - | - | 1.20 | **1.20** |
| PCT 967 Low | - | 0.70 | - | - | **0.70** |
| PCT 967 Moderate | - | 0.06 | - | - | **0.06** |
| PCT 1103 Disturbed | - | - | - | 1.71 | **1.71** |
| PCT 1103 Low-Moderate | - | - | - | 4.79 | **4.79** |
| PCT 1103 Moderate | - | - | - | 6.2 | **6.2** |

| PCT and condition | Area impacted (ha) | | | | |
|---|---|---|---|---|---|
| | Current project | Great Western Highway Upgrade – Katoomba to Blackheath | Great Western Highway Upgrade – Medlow Bath | Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) | Total cumulative impact |
| PCT 1103 Good | - | - | - | 10.72 | **10.72** |
| PCT 1155 Moderate | - | - | - | 9.72 | **9.72** |
| PCT 1248 Poor | - | - | 0.02 | - | **0.02** |
| PCT 1248 Low | 0.33 | 19.06 | - | - | **19.39** |
| PCT 1248 Moderate | 0.86 | 27.74 | 0.34 | - | **28.94** |
| PCT 1248 High | 6.10 | - | - | - | **6.10** |
| PCT 1615 Low | 0.01 | - | - | - | **0.01** |
| PCT 1615 Moderate | 0.18 | - | - | - | **0.18** |
| **Total native vegetation** | **9.71** | **47.56** | **0.36** | **70.89** | **128.52** |

Table 7-10: Cumulative impacts to hollow-bearing trees

| Biodiversity value impacted | Count | | | | |
|---|---|---|---|---|---|
| | Current project | Katoomba to Blackheath upgrade | Medlow Bath upgrade | Little Hartley to Lithgow upgrade | Total cumulative impact |
| Hollow-bearing trees | 20 | 207 | 0 | 142 | **369** |

# 8 Mitigation

## 8.1 Performance outcomes

Performance outcomes have been developed that are consistent with the SEARs for the project. The performance outcomes for the project are summarised below in Table 8-1 and identify measurable, performance-based standards for environmental management.

Table 8-1: Performance outcomes for the project - Biodiversity

| Desired performance outcome | Project performance outcome | Timing |
|---|---|---|
| **2. Biodiversity** | | |
| The project design considers all feasible measures to avoid and minimise impacts on terrestrial and aquatic biodiversity. | Design the project to minimise adverse impacts on native terrestrial and aquatic flora and fauna. | Design |
| The offsets and/or biodiversity conservation actions are assured and are equivalent to any residual impacts of project construction and operation. | Secure a biodiversity offset and/ or carry out a conservation action equivalent to no less than the impacts of the detailed design of the project on biodiversity as assessed using the NSW Biodiversity Assessment Method (BAM) (2020). | Construction and operation |

## 8.2 Mitigation measures

Identification of measures to mitigate or manage impacts has been undertaken in accordance with the BAM (DPIE 2020a), including considerations such as:

- techniques, timing, frequency and responsibility
- identification of measures for which there is risk of failure
- evaluation of the risk and consequence of any residual impacts
- documentation of any adaptive management strategy proposed.

Identification of measures for mitigating impacts related to:

- displacement of resident fauna
- indirect impacts on native vegetation and habitat
- mitigating prescribed biodiversity impacts
- details of the adaptive management strategy proposed to monitor and respond to impacts on biodiversity values that are uncertain.

The identified measure to mitigate and manage these impacts are detailed in Table 8-2. Many of these mitigation measures have been taken from the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a).

Table 8-2: Mitigation measures

| ID | Environmental mitigation measure | Timing | Likely efficacy of mitigation | Outcome | Responsibility |
|---|---|---|---|---|---|
| B1 | The project will be designed and implemented to minimise the removal of native vegetation and to minimise impacts to threatened species and their habitats. | Design and construction | Effective | Direct impacts to native vegetation are avoided/minimised.<br>Remaining residual impacts will need to be offset as per Section 8. | Design team and construction contractor |
| B2 | The project will be designed and constructed to minimise disturbance and impacts, including indirect impacts, to watercourses, riparian areas, aquatic habitats and threatened aquatic species, where feasible and reasonable. | Design and construction | | | |
| B3 | A Construction Flora and Fauna Management Plan (CFFMP) will be prepared as part of the Construction Environmental Management Plan (CEMP) in consultation with DPE. The CFFMP will be prepared in accordance with Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects (RTA 2011b) and Policy and Guidelines for Fish Habitat Conservation and Management Update 2013 (DPI 2013), including:<br>• a procedure for planning and carrying out clearing, including preclearance surveys, management of vegetation clearance, removal of bush rock and other habitat features, and a specific protocol for the identification and removal of hollow-bearing trees<br>• delineation of the construction footprint and areas within it where vegetation will be retained in accordance with Guide 2 of the Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects (RTA 2011b)<br>• procedures for establishing and maintaining tree protection zones, including with reference to Australian Standard 4970-2009 Protection of Trees on Development Sites<br>• procedures for managing and appropriately handling fauna that may be located within the construction footprint or affected by construction activities, and protocols for managing injured fauna in accordance with Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011b)<br>• requirements for the installation of traffic signage and construction driver education on the risk of fauna related vehicle strikes, and procedures for removal of road carrion | Construction | Effective | Mitigates non-target impacts to native vegetation, TECs and threatened species habitat through development of appropriate protocols.<br>Reduced impacts to resident fauna during vegetation clearing. | Construction contractor |

| ID | Environmental mitigation measure | Timing | Likely efficacy of mitigation | Outcome | Responsibility |
|---|---|---|---|---|---|
| | • measures for managing the presence of unexpected threatened species<br>• procedures for re-establishing native vegetation, taking into account ecological values, opportunities to enhance habitat connectivity and landscaping requirements of the project, and replacing or re-installing habitat features such as woody debris, bushrock, and tree hollows<br>• protocols for managing weeds and pathogens in accordance with Guide 6: Weed management and Guide 7: Pathogen management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011b)<br>• measures to protect aquatic habitat and riparian areas, including runoff and water quality management (refer to measure SW1), in accordance with Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011b) and section 3.3.2 Standard precautions and mitigation measures of the Policy and guidelines for fish habitat conservation and management (DPI 2013). | | | | |
| B4 | Rehabilitation and landscaping of the construction footprint following completion of construction will seek to maximise the use of locally endemic native species and to enhance habitat connectivity across the Great Western Highway corridor where feasible and reasonable, consistent with the landscape plan for the project. | Design and construction | Effective | Rehabilitation of the project area following vegetation removal to aid in vegetation cover, aesthetics, reduction in erosion and noise control. | Construction contractor |
| B5 | Consideration will be given to the design of culverts under surface roads to act as potential fauna crossing points and habitat resources for microbat species. | Design | Effective | Enhanced connectivity for fauna, reduction in fauna mortality. | Construction contractor |
| B6 | Native vegetation cleared from the construction footprint will be mulched and reused in site rehabilitation, stabilisation and landscaping where appropriate. | Construction | Effective | No further degradation to retained vegetation and habitats. | Construction contractor |

| ID | Environmental mitigation measure | Timing | Likely efficacy of mitigation | Outcome | Responsibility |
|---|---|---|---|---|---|
| B7 | Potential lighting/ overshadowing effects from the project on flora and fauna will be minimised where reasonable and feasible, including design and implementation of lighting during construction and operation taking into account:<br>• minimum lighting requirements and design standards to maintain safety during construction and safety for operational traffic<br>• guidance on the management of obtrusive lighting effects in AS4282-1997: Control of the Obtrusive Effects of Outdoor Lighting<br>• guidance on good lighting principles provided in Part 4 of Dark Sky Planning Guideline (DPE 2016b). | Design and construction | Effective | Mitigate impacts to resident fauna. | Construction contractor |
| B8 | Opportunities to minimise the risk of fauna strikes during construction and operation of the project will be considered during further design development and construction planning. This may include the installation of temporary fencing or other barriers near construction sites. | Design and construction | Effective | Mitigates impacts to resident fauna. | Construction contractor |
| B9 | The Biodiversity Assessment Method (BAM) will be used to review and update biodiversity offset requirements based on the final detailed design for the project. Biodiversity offsets for the project will be secured in accordance with the NSW Biodiversity Offset Scheme (BOS). | Design | Effective | Direct impact to threatened species are avoided/minimized.<br>Remaining residual impacts will need to be offset as per Section 8. | Design team |
| B10 | Based on the updated numerical groundwater model for the project (refer to environmental mitigation measure GW1), and groundwater and surface water monitoring data (refer to environmental mitigation measures GW2 and SW2), further consideration of the potential impacts of the project on groundwater dependent ecosystems along Greaves Creek as a consequence of groundwater drawdown and/ or reduction in watercourse baseflow will be carried out during further design development. Subject to the outcomes, options to avoid and/ or minimise anticipated impacts will be identified, and implemented if reasonable and feasible. | Design | Effective | Minimises impacts to GDEs. | Design team |

| ID | Environmental mitigation measure | Timing | Likely efficacy of mitigation | Outcome | Responsibility |
|---|---|---|---|---|---|
| B11 | Swamp extent and PCT mapping will be carried out for the *Biodiversity Conservation Act 2016* (NSW) and *Environmental Protection and Biodiversity Conservation Act 1999* listed peat swamps (GDEs) on Greaves Creek and Butlers Creek prior to the commencement of construction, followed by seasonal swamp extent mapping and species composition assessment to assess change in swamp dynamics for a period of two years post-construction. | Design and operation | Effective | Minimises impacts to GDEs. | Design team |
| B12 | Ground settlement predictions will be considered based on further design development. If cliff top areas are identified as potentially experiencing settlement of 20 millimetres or more, monitoring and management measures will be identified based on a Before After Control Impact (BACI) approach. | Design, construction and operation | Effective for detecting impact | | Construction contractor |
| B13 | Interruptions to water flows associated with groundwater dependent ecosystems will be minimised through the use of design features such as bioretention systems and flow spreaders. | Design | Effective | Minimises impacts to GDEs. | Design team |
| B14 | Bioretention systems will be unlined to allow infiltration of treated stormwater directly into the surrounding soils and will also include usage of engineered filter media augmented with organic carbon to provide appropriate pH buffering. The bioretention system will be planted with native flora species that are representative of the surrounding PCTs. | Design | Effective | Minimises impacts to surrounding environment by reducing chemical changes in water discharges | Design team |

## 8.3 Additional related mitigation measures

Additional mitigation measures related to biodiversity are included within Appendix I (Technical report – Groundwater), Appendix J (Technical report - Surface water and flooding), Appendix M (Technical report - Non-Aboriginal heritage) and Appendix N (Technical report – Urban design, landscape and visual). Those mitigation measures that are relevant to biodiversity have been included below in Table 8-3.

Table 8-3: Additional relevant mitigation measures

| ID | Environmental mitigation measure | Timing |
|---|---|---|
| **Groundwater and geology** | | |
| GW1 | The numerical groundwater model for the project will be updated as part of ongoing design development, will consider the construction schedule and methodology, and will take into account relevant additional geotechnical and groundwater monitoring data. Anticipated groundwater impacts will be confirmed and if required inform the development of detailed groundwater mitigation and management measures.<br>The updated numerical groundwater numerical model will be calibrated against groundwater monitoring data collected during the construction phase. If observed groundwater level responses identified through monitoring markedly differ from predictions made by the updated numerical groundwater model, including extent of drawdown and timing, the model will be further refined and calibrated against the observed groundwater conditions. | Design |
| GW2 | Where the updated groundwater model predicts groundwater impacts or related baseflow reductions in surface water resources that markedly differ from predictions presented in the EIS, further environmental mitigation measures and/or design responses will be identified and applied where feasible and reasonable.<br>Design responses could include the review of tanked or drained infrastructure elements, pre-grouting of cross-passages and/or the treatment and discharge of treated groundwater into the affected creeks to address baseflow reductions. | Design |
| GW3 | As part of detailed design, the existing groundwater monitoring network will be reviewed and maintained in consultation with relevant government agencies, and monitoring data will be made available to those agencies upon request, to:<br>• continue to gather representative groundwater monitoring data to inform ongoing project design development, and the updated numerical groundwater model for the project<br>• characterise the hydrogeological environment along and around Greaves Creek and associated groundwater dependent ecosystems in more detail<br>• monitor groundwater prior to, during, and after construction of the project<br>• complement the surface water monitoring network for the project (refer to environmental mitigation measure SW2).<br>A suitably qualified person, such as a hydrogeologist and/or an environmental scientist will undertake periodic reviews of the groundwater monitoring data, and advise on potential groundwater impacts and appropriate mitigation and management measures prior to, during and after construction of the project for up to two years. | Construction and operation |

<table>
<tr><th>ID</th><th>Environmental mitigation measure</th><th>Timing</th></tr>
<tr><td>GW4</td><td>Registered groundwater bores identified as being potentially impacted by two or more metres of drawdown in the updated numerical groundwater model, will be inspected in consultation with the relevant groundwater licence holders. The inspection will aim to confirm the current viability of the bores. If the bores are identified to be viable, they will be monitored and if a material loss of yield occurs as a consequence of the project, make good provisions will be offered to the relevant groundwater licence holders.</td><td>Construction</td></tr>
<tr><td colspan="3">Surface water and flooding</td></tr>
<tr><td>SW1</td><td>A Construction Soil and Water Management Plan (CSWMP) will be prepared as part of the Construction Environmental Management Plan (CEMP) in consultation with relevant government agencies and local councils. The CSWMP will be prepared and implemented to detail measures to minimise erosion and sedimentation, manage surface water and flooding, and protect local water quality during construction, including the potential impacts of high risk construction activities to the Sydney Drinking Water Catchment and the Blue Mountains Special Area. The CSWMP will include:
<ul>
<li>erosion and sediment control measures prepared by or in consultation with a soil conservationist to be applied to each construction site, consistent with the guidance in Managing Urban Stormwater – Soils and Construction (4th Edition) (Landcom 2004). Specific control measures may include:
<ul>
<li>diversion of runoff from undisturbed areas of the catchment around project disturbance areas</li>
<li>diversion of existing drainage lines disturbed by construction, or establishment of an alternative drainage line</li>
<li>construction and commissioning of sediment and water quality basins before major earthworks. Where projects overlap, the sizing of basins would account for the concurrent construction catchments and common discharge locations shared between the east, central and west projects, and sizing would be modified as required to accommodate the construction catchments.</li>
<li>use of sediment management devices such as fencing, sandbags, coir logs and graded or lined earth or sandbag diversion bunds and banks</li>
<li>measures to divert or capture and filter water prior to discharge, such as drainage diversion channels to flush and sediment sumps or traps</li>
<li>scour protection and energy dissipaters at locations of high erosion risk</li>
<li>location and storage of construction materials, fuels, and chemicals, including controls where possible to minimise the risk of leaks, spills and other unintended releases</li>
<li>storage of materials clear of frequently flooded low-lying areas</li>
<li>stabilisation of the surface of batters and drains, including temporary works and diversions</li>
<li>regular inspections and responsive adaptive management to improve erosion and sedimentation control practices as required to achieve the outcomes of the Blue Book. This will include inspections at regular intervals and after large rainfall events</li>
</ul></li>
<li>planning and management of stockpile areas in accordance with Stockpile Site Management Guideline (RTA 2011c).</li>
</ul></td><td>Construction</td></tr>
</table>

| ID | Environmental mitigation measure | Timing |
|---|---|---|
| | • progressive and timely stabilisation and rehabilitation of disturbed areas, taking into account the ultimate requirements of the Place Design and Landscape Plan (PDLP) for the project (refer to environmental mitigation measure LV1)<br>• a spill management procedure to minimise the risk of release of construction materials, fuels, and chemicals from construction sites. The procedure will include:<br>  o management of chemicals, fuels and potentially polluting materials<br>  o any specialised containment, security and bunding requirements (refer to environmental mitigation measure HR02)<br>  o maintenance of plant and equipment<br>  o emergency management, including notification, response, and clean-up procedures<br>• measures to manage construction activities in areas prone to flooding or inundation, particularly around Rosedale Creek, including:<br>  o daily monitoring of weather conditions, including rainfall forecasts, to provide advance warning of potential flooding or inundation<br>  o cessation of relevant works and site security and stabilisation requirements in the event of a severe weather warning<br>  o site clean-up and recovery measures in the event of flooding or inundation<br>• measures to manage acid sulfate rock, consistent with the Acid Sulfate Rock Management Plan (ASRMP) for the project (refer to environmental mitigation measure SC3). | |
| SW2 | A surface water monitoring network will be maintained for the project to:<br>• continue to gather baseline surface water monitoring data to inform ongoing design development, and the updated numerical groundwater model for the project<br>• characterise the hydrological environment along and around Greaves Creek and associated groundwater dependent ecosystems<br>• monitor surface water, including surface water quality, prior to, during and for two years after completion of construction of the project<br>• complement the groundwater monitoring network for the project (refer to environmental mitigation measure GW3).<br>The surface monitoring network will be developed in consultation with relevant government agencies, and monitoring data will be made available to those agencies upon request.<br>A qualified hydrologist or environmental scientist or equivalently experienced professional will be engaged to periodically review surface water monitoring data, and to advise on potential surface water impacts and appropriate mitigation and management measures prior to, during and after construction of the project. | Design and construction |
| SW3 | Batters constructed as part of the project will be designed and implemented to minimise risk of exposure, instability, and erosion, and to support long-term, on-going best practice management, in accordance with *Guideline for Batter Surface Stabilisation using Vegetation* (RMS 2015). | Design and construction |

| ID | Environmental mitigation measure | Timing |
|---|---|---|
| SW4 | Construction wastewater, including water from each construction site and groundwater ingress collected during tunnel works, will be treated to a suitable standard prior to reuse and/ or discharge to the environment. Water quality criteria for discharges to the environment will be developed in consultation with the relevant government agencies and will be based on the need to achieve a neutral or beneficial effect on sensitive receiving waters and drinking water catchments. | Construction |
| SW5 | Operational wastewater will be treated via a mix of water quality control basins and a wastewater treatment plant at Little Harley to a suitable standard prior to reuse and/ or discharge to the environment as part of routine operations. Water quality criteria for discharges to the environment will be developed in consultation with relevant government agencies, and will be based on the need to achieve a neutral or beneficial effect on sensitive waters and drinking water catchments. | Operation |
| **Landscape and visual** | | |
| LV2 | As part of further design development, opportunities to visually integrate the project into the landscape, will be considered and will reflect the landscape and revegetation requirements identified in environmental mitigation measures for biodiversity and non-Aboriginal heritage. This will consider measures including:<br>• retention and protection of existing trees where reasonable and feasible, particularly along the unaltered edges of the existing Great Western Highway<br>• avoidance of formal rows of trees or blocks of shrub and grass plantings as these would be uncharacteristic within both the Blackheath and Little Hartley landscape settings<br>• reinstatement of cleared native vegetation to achieve a net increase in tree numbers and canopy in proximity to the project that will not be covered by a biodiversity offset strategy<br>• strategic placement and planting of vegetation in line with the surrounding landscape character zone(s)<br>• sourcing locally endemic native species<br>• carrying out appropriate soil analysis and identification of soil preparation requirements for landscaping treatments to inform the PDLP and vegetation management in accordance with the Batter Surface Stabilisation Guideline (RMS 2015). | Design |
| **Non-Aboriginal heritage** | | |
| NAH2 | Opportunities to minimise the extent of native vegetation clearing within the footprint of the Greater Blue Mountains Area (Additional Values) National Heritage List nomination will be considered during further design development (refer to environmental mitigation measure B4). In areas where clearing native vegetation cannot be avoided, locally endemic native species will be used in landscaping to reflect the ecological heritage values in the nomination (refer to environmental mitigation measure LV2). | Design |

## 8.4 Adaptive management for uncertain impacts

Construction and operational management plans will contain an adaptive management component in order to address potential impacts that are infrequent or difficult to measure (in accordance with the BAM Section 8.5). Adaptive management strategies will be receptive to any new and relevant data that may arise through ongoing assessment and monitoring and are key to the successful implementation of crucial objectives yet also allow flexibility to respond to changing dynamics and ongoing feedback and results. This will include measures to monitor predicted and uncertain impacts which will trigger adaptive management actions and allow for effective and quick responses.

As detailed in Section 7.4.1 and 7.4.4, where further modelling indicates an exceedance of threshold levels, adaptive management measures are recommended within areas of geological significance and upland (peat) swamps that occur within the zone of influence associated with the tunnel construction. These adaptive management measures could be detailed in the Construction Environmental Management Plan(s) for the project, or a separate and associated sub-plan or monitoring program.

### 8.4.1 Geology adaptive management measures

Updated settlement modelling will be carried out based on further detailed design. Based on the updated settlement modelling, areas of geological significance that may be subject to settlement in excess of 5 millimetres (zone of influence) and in excess of 20 millimetres (zone of adaptive management) will be identified. Specific consideration will be given to the cliff lines near the Soldiers Pinch construction footprint and near Victoria Pass identified in Section 7.4.1.

For areas of geological significance identified as likely to be affected by settlement in excess of 20 millimetres (zone of adaptive management), the following measures will be developed and applied:

- a BACI design monitoring program to assess the settlement zone of influence around tunnel works as construction of the project progresses. The scope and frequency of the monitoring program will be developed based on further design development and will reflect the level of certainty in settlement predictions, local geological conditions and data collected on settlement from tunnelling as it progresses. The monitoring program will be applied during tunnel boring activities to determine and inform if subsidence, causing material direct and/or indirect impacts, is occurring
- thresholds or triggers to indicate when settlement in the zone of influence approaches, reaches and exceeds 20 millimetres, i.e., indicating that a prescribed impact has the potential to occur. Any such exceedances will trigger the implementation of adaptive management actions
- a suite of potential adaptive management actions to be implemented during tunnelling to minimise settlement and/ or protect potentially affected areas of geological significance.

In developing and applying adaptive management measures, the following will be considered where appropriate:

- relevant literature to inform and guide adaptive management and support predictions about short-term and long-term settlement
- whether, based on updated settlement modelling and data collected during tunnel construction, the monitoring program and the implementation of management actions needs to extend beyond the conclusion of tunnel construction
- measures to address the residual prescribed impacts on threatened species or TECs that may be associated with areas of geological significance.

### 8.4.2 Upland Swamp adaptive management measures

A groundwater monitoring program and a surface water monitoring program will be developed and applied to gather additional groundwater and surface water around the project and to inform updated groundwater modelling based on further design development. Further details of these monitoring programs and updated groundwater modelling are provided in Appendix I (Technical report – Groundwater), Appendix J (Technical report - Surface water and flooding) of the EIS.

Based on additional groundwater and surface water monitoring data, and updated groundwater modelling, the spatial extent of potential prescribed impacts on BC Act and EPBC Act listed peat swamps (GDEs) as a result of the project will be reviewed and confirmed. This will include potential impacts associated with changes in water quality, water volume (surface water discharges or reductions in watercourse baseflow) and groundwater drawdown, and will focus on Butlers Creek, Greaves Creek and associated areas of Medium Priority GDEs (refer to mapping in Figure 4-5).

Unless a review of the spatial extent of potential prescribed impacts on BC Act and EPBC Act listed peat swamps (GDEs) based on further design development identifies the avoidance of impacts, the following measures will be developed and applied to Butlers Creek, Greaves Creek and associated areas of Medium Priority GDEs:

- mapping of the swamp extents and PCT mapping for the BC Act and EPBC Act listed peat swamps (GDEs) on Greaves Creek and Butlers Creek prior to construction commencement, followed by seasonal swamp extent mapping and species composition assessment to assess change in swamp dynamics for a 24-month period
- protection of water quality and consistency of flow volumes relative to each season based on available information, including additional surface water and groundwater monitoring data
- a BACI design monitoring program to assess the areas upstream and downstream of the swamps, and the swamp quality, diversity and extents. The scope and frequency of the monitoring program will be developed based on further design development, updated groundwater modelling, available field data (surface water, groundwater and mapping of swamp extents and PCTs) and other relevant factors, including the timing and intensity of storm events
- thresholds or triggers to indicate when a material prescribed impact on BC Act and EPBC Act listed peat swamps (GDEs) is being approached, reached or exceeded
- a suite of potential adaptive management actions to be implemented to minimise prescribed impacts and/ or protect potentially affected areas of BC Act and EPBC Act listed peat swamps (GDEs) especially along Greaves Creek and Butlers Creek.

In developing and applying adaptive management measures, the following will be considered where appropriate:

- relevant literature to inform and guide adaptive management and support predictions about short-term and long-term surface water/groundwater drawdown related impacts related to peat swamp impacts
- whether, based on monitoring data collected prior to and during construction, the monitoring program and the implementation of management actions needs to extend beyond the conclusion of construction
- measures to address the residual prescribed impacts on threatened species or TECs that may be associated with areas of GDEs.

# 9 Offsetting

As outlined in the sections above the residual unavoidable impact to biodiversity values as a result of the project will require biodiversity offsets to be secured in accordance with the NSW BOS. Residual impacts to MNES, as detailed in Section 7.5 will be offset in accordance with the requirements of the NSW BOS, as per the Commonwealth's endorsement of the BOS and Biodiversity Conservation Fund for major projects in 2020.

Under the BOS the Proponent has three main avenues for securing biodiversity offsets for the project, those being:

- payment to the Biodiversity Conservation Fund managed by the Biodiversity Conservation Trust.
- purchase (transfer) and retire credits from existing credit holders.
- establish a Biodiversity Stewardship Site to generate credits required by the project.

Details of the proponent's strategy to secure and retire the required number and type of biodiversity credits to offset the project's residual unavoidable impacts is included in the sections below.

## 9.1 Ecosystem credits

As outlined in Section 9.2.1 of the BAM (DPIE 2020a) the assessor must determine an offset for all impacts of projects on PCTs that are associated with a vegetation zone that has a vegetation integrity score of:

- ≥15, where the PCT is representative of an EEC or a CEEC.
- ≥17, where the PCT is associated with threatened species habitat (as represented by ecosystem credits) or represents a vulnerable ecological community.
- ≥20, where the PCT does not represent a TEC and is not associated with threatened species habitat.

On this basis, offsets are required for all vegetation impacted by the project. The offset requirement for the project has been calculated using the BAM Calculator. Table 9-1 provides a summary of the project's ecosystem credits offsets required for impacts to native vegetation and TECs. Table 9-2 provide a summary of the project's ecosystem credit offsets required for indirect impacts to native vegetation, as detailed in Section 7.2 and Annexure I. A biodiversity credit report is included in Annexure L.

Table 9-1: Ecosystem credits for impacts to native vegetation and TECs which require an offset

| Veg zone | Area (ha) | VI score | Offset required | TEC | HBTs | IBRA subregion | Credit requirement |
|---|---|---|---|---|---|---|---|
| 708_High | 1.30 | 86.8 | Yes | No | No | Wollemi | 42 |
| 708_Moderate | 0.50 | 47.0 | Yes | No | No | Wollemi | 9 |
| 766_Low | 0.43 | 24.1 | Yes | Yes | No | Burragorang | 5 |
| 1248_High | 6.10 | 77.3 | Yes | No | Yes | Wollemi | 178 |
| 1248_Moderate | 0.86 | 51.2 | Yes | No | Yes | Wollemi | 17 |
| 1248_Low | 0.33 | 34.3 | Yes | No | No | Wollemi | 4 |

| Veg zone | Area (ha) | VI score | Offset required | TEC | HBTs | IBRA subregion | Credit requirement |
|---|---|---|---|---|---|---|---|
| 1615_Moderate | 0.18 | 62.2 | Yes | No | Yes | Burragorang | 4 |
| 1615_Low | 0.01 | 30.77 | Yes | No | No | Burragorang | 1 |

Table 9-2: Ecosystem credits for indirect impacts to native vegetation and TECs which require an offset

| Veg zone | Area (ha) | VI score | Future VI score | Offset required | IBRA subregion | Credit requirement |
|---|---|---|---|---|---|---|
| 708_High-indirect-edge | 0.22 | 86.8 | 69.4 | Yes | Wollemi | 1 |
| 708_Mod-indirect-patch | 0.08 | 47.0 | 0 | Yes | Wollemi | 1 |
| 766_Low-indirect-patch | 0.03 | 24.1 | 0 | Yes | Burragorang | 1 |
| 1248_High-indirect-edge | 2.65 | 77.3 | 61.88 | Yes | Wollemi | 15 |
| 1248_Low-indirect-patch | 0.01 | 34.3 | 0 | Yes | Wollemi | 1 |

## 9.2 Species credits

As outlined in Section 9.2.2 of the BAM (DPIE 2020a) an offset is also required for the impacts of the project on threatened species that require species credits.

The offset requirement for the project was calculated using the BAM-C. Table 9-3 provides a summary of the project's offset requirements for impacts to threatened species credit species. A biodiversity credit report is included in Annexure L.

Table 9-3: Species credits for impacts to threatened species

| Species | Habitat condition (VI score) loss | Area (ha) | Biodiversity risk weighting | IBRA subregion | Species credits required |
|---|---|---|---|---|---|
| Large-eared Pied Bat | 708_High: 86.8 | 1.30 | 3.00 | Wollemi | 84 |
| | 708_Moderate: 47.0 | 0.50 | 3.00 | Wollemi | 18 |
| | 1248_High: 77.3 | 6.10 | 3.00 | Wollemi | 356 |
| | 1248_Moderate: 51.2 | 0.86 | 3.00 | Wollemi | 33 |
| | 1248_Low: 34.3 | 0.33 | 3.00 | Wollemi | 8 |
| Purple Copper Butterfly | 1248_High: 77.3 | 0.23 | 2.00 | Wollemi | 9 |
| | 1248_Low: 34.3 | 0.12 | 2.00 | Wollemi | 2 |

## 9.3 Credits matching the 'like-for-like' and credit variation rules

Clause 6.2 of the BC Regulation establishes the offset rules ('like-for-like' and variation). To satisfy the like-for-like rule, the BAM allows for impacts to PCTs and threatened species to be offset by other different PCTs and threatened species (respectively) that share the same attributes from a class of credits, which form an offset trading group. The credit class and corresponding offset trading group can be found in the biodiversity credit report (like-for-like) produced by the BAM-C. The BAM also puts restrictions on where (IBRA region) credits can be sourced and whether hollow-bearing trees must be present at the offset site.

Where like-for-like credits cannot be sourced, the BAM also allows for other credit types to be sourced subject to the variation rules contained in the BC Regulations.

The like-for-like and variation offset options for ecosystem credits are listed in Table 9-4 and Table 9-5. The like-for-like and variation offset options for species credits are listed in Table 9-6.

Table 9-4: Like-for-like offset options for ecosystem credits

| Veg zone | Class | Trading group | HBT | IBRA region |
|---|---|---|---|---|
| 708_High<br>708_Moderate | Sydney Montane Heaths<br>This includes PCT's: 636, 662, 708, 709, 814, 816, 844, 1665 | Sydney Montane Heaths - < 50% cleared group (including Tier 4 or higher threat status). | No | Wollemi, Bathurst, Burragorang, Capertee Uplands, Capertee Valley, Cumberland, Hill End, Inland Slopes, Kerrabee and Yengo.<br>OR<br>Any IBRA subregion that is within 100 km of the outer edge of the impacted site. |
| 766_Low | *Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions*<br>This includes PCT's:<br>518, 607, 637, 665, 681, 766, 788, 939, 1188, 1200, 1256, 1270, 1287, 1298, 1743, 1744, 1745 | - | No | Burragorang, Bathurst, Bungonia, Cumberland, Ettrema, Kanangra, Moss Vale, Sydney Cataract and Wollemi.<br>OR<br>Any IBRA subregion that is within 100 km of the outer edge of the impacted site. |

| Veg zone | Class | Trading group | HBT | IBRA region |
|---|---|---|---|---|
| 1248_High<br>1248_Moderate | Sydney Montane Dry Sclerophyll Forests<br>This includes PCT's: 966, 967, 1152, 1247, 1248, 1249, 1630 | Sydney Montane Dry Sclerophyll Forests - < 50% cleared group (including Tier 4 or higher threat status). | Yes | Wollemi, Bathurst, Burragorang, Capertee Uplands, Capertee Valley, Cumberland, Hill End, Inland Slopes, Kerrabee and Yengo.<br>OR<br>Any IBRA subregion that is within 100 km of the outer edge of the impacted site. |
| 1248_Low | Sydney Montane Dry Sclerophyll Forests<br>This includes PCT's: 966, 967, 1152, 1247, 1248, 1249, 1630 | Sydney Montane Dry Sclerophyll Forests - < 50% cleared group (including Tier 4 or higher threat status). | No | Wollemi, Bathurst, Burragorang, Capertee Uplands, Capertee Valley, Cumberland, Hill End, Inland Slopes, Kerrabee and Yengo.<br>OR<br>Any IBRA subregion that is within 100 km of the outer edge of the impacted site. |
| 1615_Moderate | Southern Escarpment Wet Sclerophyll Forests<br>This includes PCT's: 706, 742, 743, 744, 878, 929, 943, 963, 968, 969, 1107, 1144, 1254, 1301, 1615, 1616 | Southern Escarpment Wet Sclerophyll Forests - < 50% cleared group (including Tier 4 or higher threat status). | Yes | Burragorang, Bathurst, Bungonia, Cumberland, Ettrema, Kanangra, Moss Vale, Sydney Cataract and Wollemi.<br>OR<br>Any IBRA subregion that is within 100 km of the outer edge of the impacted site. |
| 1615_Low | Southern Escarpment Wet Sclerophyll Forests<br>This includes PCT's: 706, 742, 743, 744, 878, 929, 943, 963, 968, 969, 1107, 1144, 1254, 1301, 1615, 1616 | Southern Escarpment Wet Sclerophyll Forests - < 50% cleared group (including Tier 4 or higher threat status). | No | Burragorang, Bathurst, Bungonia, Cumberland, Ettrema, Kanangra, Moss Vale, Sydney Cataract and Wollemi.<br>OR<br>Any IBRA subregion that is within 100 km of the outer edge of the impacted site. |

Table 9-5: Variation offset options for ecosystem credits

| Veg zone | Formation | Trading group | HBT | IBRA region |
|---|---|---|---|---|
| 708_High<br>708_Moderate | Heathlands | Tier 4 or higher threat status | No | IBRA Region: Sydney Basin.<br>OR<br>Any IBRA subregion that is within 100 km of the outer edge of the impacted site. |
| 766_Low | Freshwater Wetlands | Tier 3 or higher threat<br>status | No | IBRA Region: Sydney Basin,<br>OR<br>Any IBRA subregion that is within 100 km of the outer edge of the impacted site. |
| 1248_High<br>1248_Moderate | Dry Sclerophyll Forests (Shrubby sub-formation) | Tier 4 or higher threat status | Yes (including artificial) | IBRA Region: Sydney Basin.<br>OR<br>Any IBRA subregion that is within 100 km of the outer edge of the impacted site. |
| 1248_Low | Dry Sclerophyll Forests (Shrubby sub-formation) | Tier 4 or higher threat status | No | IBRA Region: Sydney Basin.<br>OR<br>Any IBRA subregion that is within 100 km of the outer edge of the impacted site. |
| 1615_Moderate | Wet Sclerophyll Forests (Shrubby sub-formation) | Tier 4 or higher threat status | Yes (including artificial) | IBRA Region: Sydney Basin.<br>OR<br>Any IBRA subregion that is within 100 km of the outer edge of the impacted site. |
| 1615_Low | Wet Sclerophyll Forests (Shrubby sub-formation) | Tier 4 or higher threat status | No | IBRA Region: Sydney Basin.<br>OR<br>Any IBRA subregion that is within 100 km of the outer edge of the impacted site. |

Table 9-6: Like-for-like and variation offset options for species credits

| Species | Like-for-like offset options | Variation rule offset options | | |
|---|---|---|---|---|
| | | Kingdom | Any species with same or higher category of listing under Part 4 of the BC Act shown below | IBRA region |
| Large-eared Pied Bat | Species: Large-eared Pied Bat | Fauna | Vulnerable | Wollemi, Bathurst, Burragorang, Capertee Uplands, Capertee |

| Species | Like-for-like offset options | Variation rule offset options | | |
|---|---|---|---|---|
| | | Kingdom | Any species with same or higher category of listing under Part 4 of the BC Act shown below | IBRA region |
| | *Chalinolobus dwyeri*<br>IBRA region: Any in NSW | | | Valley, Cumberland, Hill End, Inland Slopes, Kerrabee and Yengo.<br>OR<br>Any IBRA subregion that is within 100 km of the outer edge of the impacted site. |
| Purple Copper Butterfly | Species: Purple Copper Butterfly *Paralucia spinifera*<br>IBRA region: Any in NSW | Fauna | Endangered | Wollemi, Bathurst, Burragorang, Capertee Uplands, Capertee Valley, Cumberland, Hill End, Inland Slopes, Kerrabee and Yengo.<br>OR<br>Any IBRA subregion that is within 100 km of the outer edge of the impacted site. |

## 9.4 Offsetting strategy

There are three primary offsetting options available to the project in order to satisfy its credit obligation. These are:

- identifying the required 'like for like' credits (as outlined in Section 9.3) in the market through the BOS public registers, then purchasing the appropriate number of credits using BOS transaction forms
- generating the required number of credits from a suitable Biodiversity Stewardship Site
- utilising the offsets payment calculator to determine the cost of the credit obligation and paying this amount into the Biodiversity Conservation Fund. The Biodiversity Conservation Trust is then responsible for identifying and securing the credit obligation.

Credit reports have been generated as part of this BDAR which detail the credit obligation that is required to be satisfied by the project. These reports are included in Annexure L.

It is understood that a staged offset approach may be available for the project, whereby credits could be purchased in a sequential manner (e.g. first purchased for the Wollemi IBRA sub-region and then later purchased for the Burragorang sub-region). However, it is understood that all three sections of the project (i.e. the Blackheath construction footprint, the Little Hartley construction footprint and the Soldiers Pinch construction footprint) will be developed concurrently and as such staged offsetting is not appropriate.

Transport is currently investigating its preferred offsetting strategy.

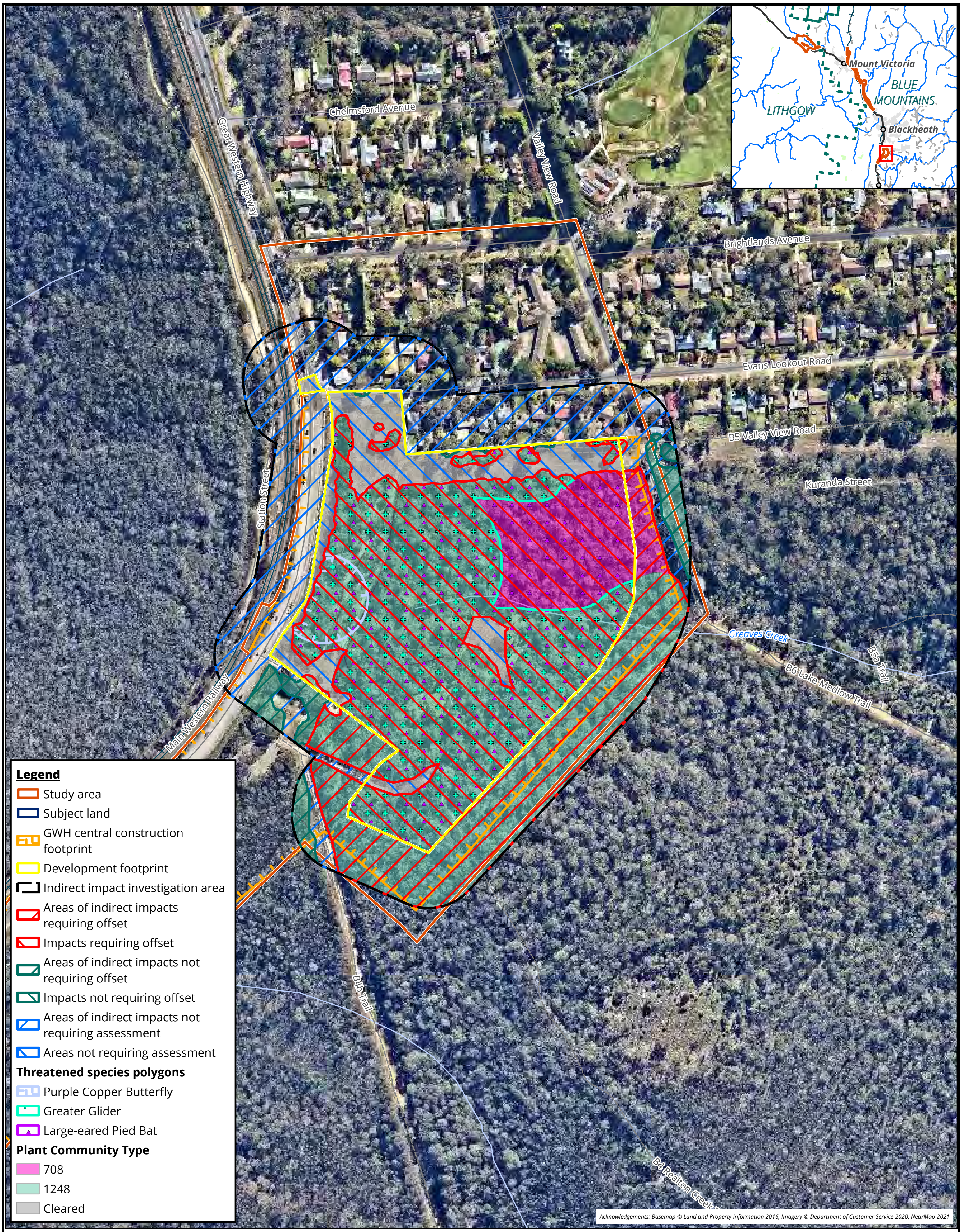


**Figure 9-1 Impacts requiring offsets, impacts not requiring offsets and areas not requiring assessment**
**Page 1 of 3**

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Metres
Scale 1:3,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

biosis

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Date: 05 October 2022 ,
Prepared for: MH, Prepared by: AM, Last edited by: amackegard
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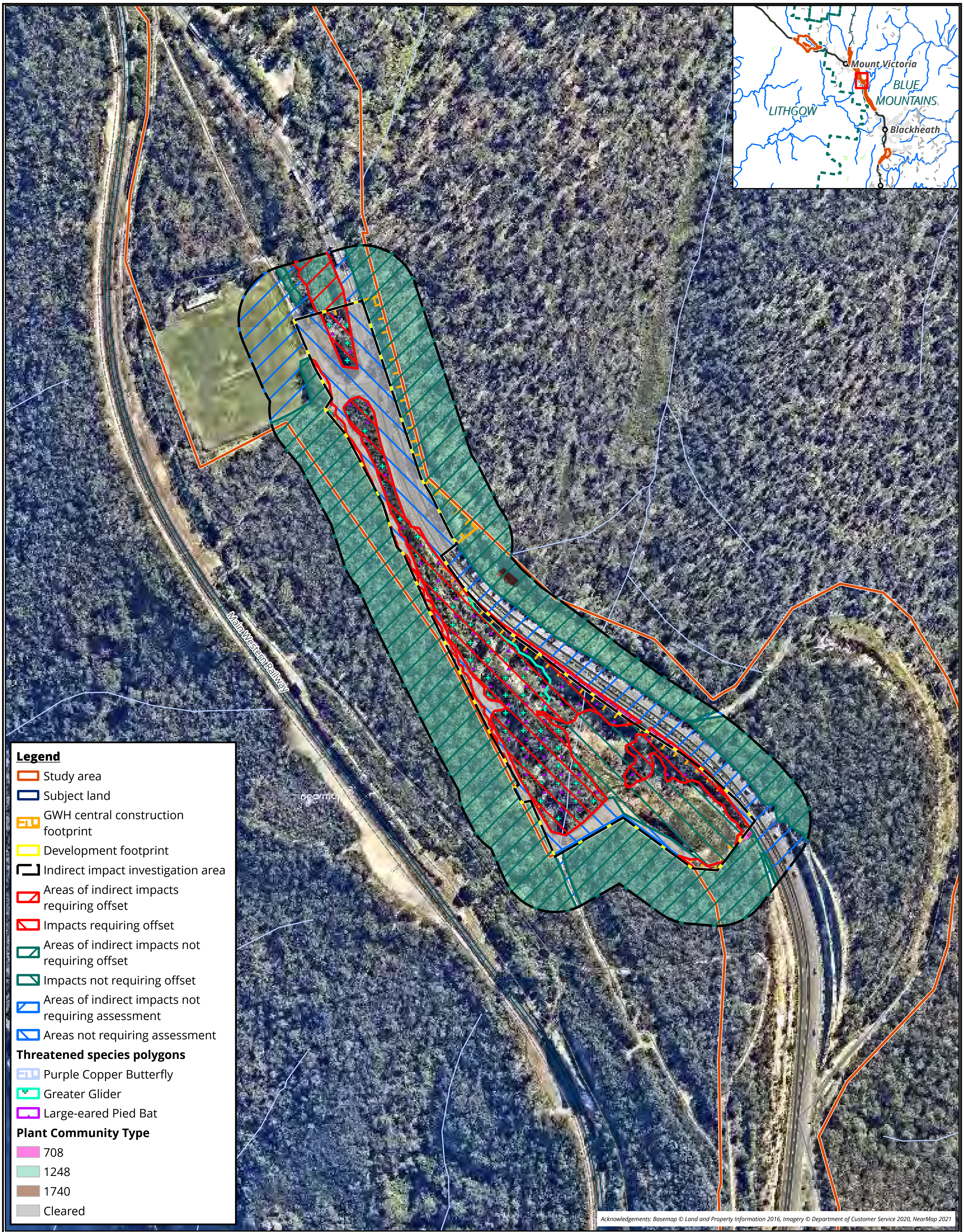


**Figure 9-1 Impacts requiring offsets, impacts not requiring offsets and areas not requiring assessment**
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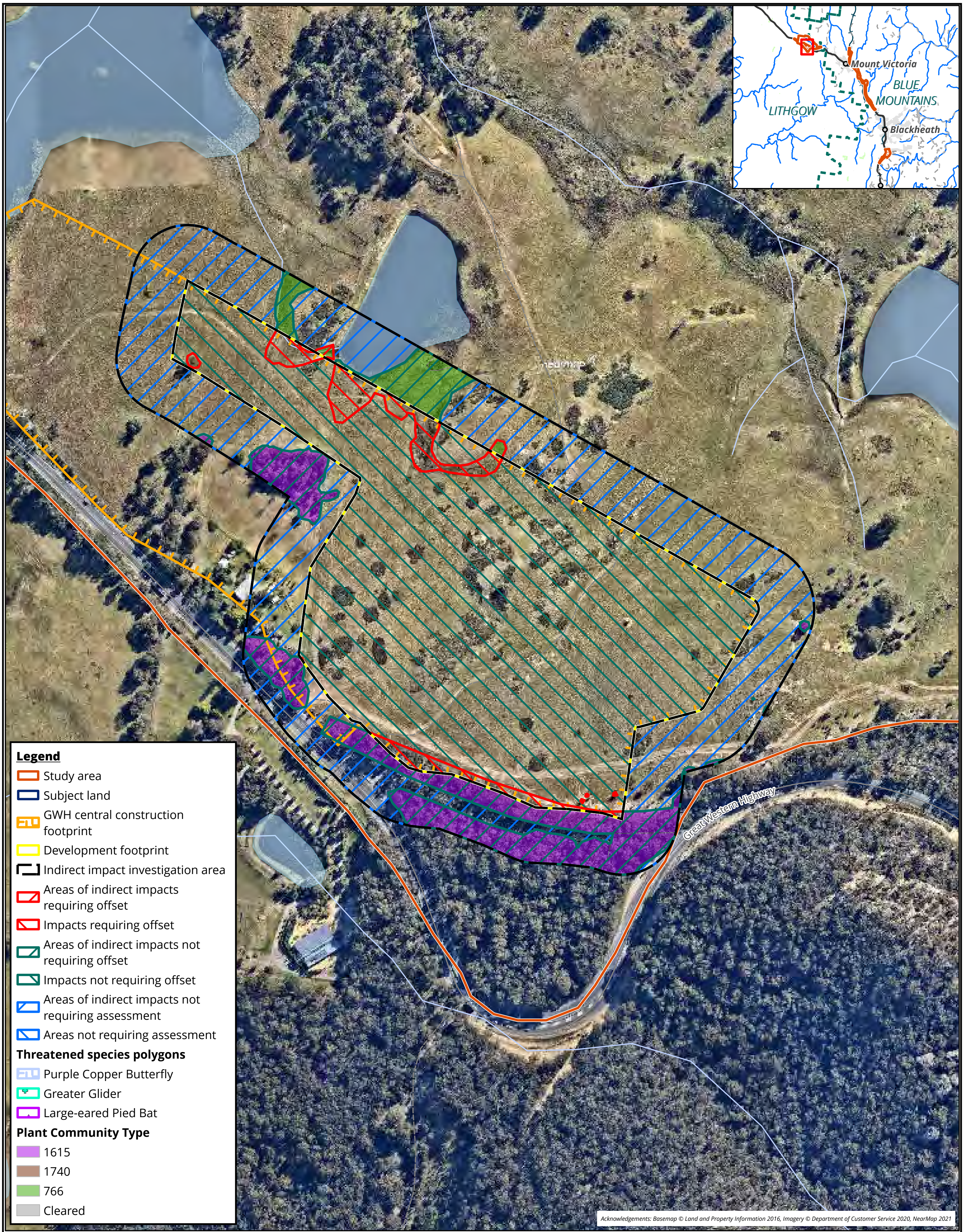


**Figure 9-1 Impacts requiring offsets, impacts not requiring offsets and areas not requiring assessment**
**Page 3 of 3**

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Date: 05 October 2022 ,
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35727_BDAR_portrait_part2.aprx

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Metres
Scale 1:3,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

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# Annexure A – Minimum information requirements for the Biodiversity Development Assessment Report

| BDAR section | BAM ref. | BAM requirement | | Page reference(s) in the BDAR |
|---|---|---|---|---|
| **Introduction** | **Chapters 2 and 3** | **Information** | | |
| | | Introduction to the biodiversity assessment including: | | |
| | | ☒ | brief description of the proposal | Section 1.1 and Section 2.1 |
| | | ☒<br>☒<br>☒ | identification of subject land boundary, including:<br>operational footprint<br>development footprint indicating clearing associated with temporary/ancillary construction facilities and infrastructure | Section 2.3 |
| | | ☒ | general description of the subject land | Section 3.1 |
| | | ☒ | sources of information used in the assessment, including reports and spatial data | Section 1.4 |
| | | ☒ | identification and justification for entering the BOS | Table 1-1 |
| | | **Maps and tables** | | |
| | | ☒ | Map of the subject land boundary showing the final proposal footprint, including the construction footprint for any clearing associated with temporary/ancillary construction facilities and infrastructure | Figure 2-4 |
| **Landscape** | **Sections 3.1 and 3.2, Appendix E** | **Information** | | |
| | | Identification of site context components and landscape features, including: | | |
| | | ☒ | general description of subject land topographic and hydrological setting, geology and soils | Section 3.3 |
| | | ☒ | per cent native vegetation cover in the assessment area (as described in BAM Section 3.2) | Section 3.3 |
| | | ☒ | IBRA bioregions and subregions (as described in BAM Subsection 3.1.3(2.)) | Section 3.3 |
| | | ☒ | rivers and streams classified according to stream order (as described in BAM Subsection 3.1.3(3.) and Appendix E) | Section 3.3 |
| | | ☒ | wetlands within, adjacent to and downstream of the site (as described in BAM Subsection 3.1.3(3.)) | Section 3.3 |
| | | ☒ | connectivity of different areas of habitat (as described in BAM Subsection 3.1.3(5–6.)) | Section 3.3 |
| | | ☒ | karst, caves, crevices, cliffs, rocks and other geological features of significance and for vegetation clearing proposals, soil hazard features (as described in BAM Subsections 3.1.3(7.) and 3.1.3(12.)) | Section 3.3 |
| | | ☒ | areas of outstanding biodiversity value occurring on the subject land and assessment area (as described in BAM Subsection 3.1.3(8–9.)) | Section 3.3 |

| BDAR section | BAM ref. | BAM requirement | Page reference(s) in the BDAR |
|---|---|---|---|
| | | ☐ any additional landscape features identified in any SEARs for the proposal **(Not applicable – no additional areas requested)** | N/A |
| | | ☒ NSW (Mitchell) landscape on which the subject land occurs | Section 3.3 |
| | | ☒ details of field reconnaissance undertaken to confirm the extent and condition of landscape features and native vegetation cover (as described in Operational Manual Stage 1 Section 2.4) | Section 4 |
| | | **Maps and tables** | |
| | | ☒ Site Map<br>☐ Property boundary **(Not applicable – no property boundary for project)**<br>☒ Boundary of subject land<br>☒ Cadastre of subject land (including labelling of Lot and DP or section plan if relevant)<br>☒ Landscape features identified in BAM Subsection 3.1.3 | Figure 3-1 |
| | | ☒ Location Map<br>☒ Digital aerial photography at 1:1,000 scale or finer<br>☒ Boundary of subject land<br>☒ Assessment area (i.e. the subject land and either 1500 m buffer area or 500 m buffer for linear development)<br>☒ Landscape features identified in BAM Subsection 3.1.3<br>☒ Additional detail (e.g. local government area boundaries) relevant at this scale | Figure 3-2 |
| | | Landscape features identified in BAM Subsection 3.1.3 and to be shown on the Site Map and/or Location Map include: | |
| | | ☒ IBRA bioregions and subregions<br>☒ rivers, streams and estuaries<br>☒ wetlands and important wetlands<br>☒ connectivity of different areas of habitat<br>☒ karst, caves, crevices, cliffs, rocks and other geological features of significance and if required, soil hazard features<br>☐ areas of outstanding biodiversity value occurring on the subject land and assessment area **(Not applicable – no areas within assessment area)**<br>☐ any additional landscape features identified in any SEARs for the proposal **(Not applicable – no additional areas requested)**<br>☒ NSW (Mitchell) landscape on which the subject land occurs | Figure 3-1<br>Figure 3-2 |
| | | **Data** | |
| | | ☒ All report maps as separate jpeg files | |
| | | Individual digital shape files of: | |
| | | ☒ subject land boundary | |

| BDAR section | BAM ref. | BAM requirement | | Page reference(s) in the BDAR |
|---|---|---|---|---|
| | | ☒ | assessment area (i.e. subject land and 1500 m buffer area) boundary | |
| | | ☒ | cadastral boundary of subject land | |
| | | ☒ | areas of native vegetation cover | |
| | | ☒ | landscape features | |
| **Native vegetation** | **Chapter 4, Appendix A and Appendix H** | **Information** | | |
| | | ☒ | Identify native vegetation extent within the subject land, including cleared areas and evidence to support differences between mapped vegetation extent and aerial imagery (as described in BAM Section 4.1(1–3.) and Subsection 4.1.1) | Section 4.1.2 |
| | | ☒ | Provide justification for all parts of the subject land that do not contain native vegetation (as described in BAM Subsection 4.1.2) | Section 4.1.5 |
| | | ☒ | Review of existing information on native vegetation including references to previous vegetation maps of the subject land and assessment area (described in BAM Section 4.1(3.) and Subsection 4.1.1) | Section 4.1 |
| | | ☒ | Describe the systematic field-based floristic vegetation survey undertaken in accordance with BAM Section 4.2 | Section 4.1.3 |
| | | ☒ | Where relevant, describe the use of more appropriate local data, provide reasons that support the use of more appropriate local data and include the written confirmation from the decision-maker that they support the use of more appropriate local data (as described in BAM Subsection 1.4.2 and Appendix A) | Section 4.1.4 |
| | | For each PCT within the subject land, describe: | | |
| | | ☒ | PCT name and ID | Section 4.2 |
| | | ☒ | vegetation class | Section 4.2 |
| | | ☒ | extent (ha) within subject land | Section 4.2 |
| | | ☒ | evidence used to identify a PCT including any analyses undertaken, references/sources, existing vegetation maps (BAM Section 4.2(1–3.)) | Section 4.2 |
| | | ☒ | plant species relied upon for identification of the PCT and relative abundance of each species | Section 4.2 and Annexure B |
| | | ☒ | if relevant, TEC status including evidence used to determine vegetation is the TEC (BAM Subsection 4.2.2(1–2.)) | Section 4.2 |
| | | ☒ | estimate of per cent cleared value of PCT (BAM Subsection 4.2.1(5.)) | Section 4.2 |
| | | Describe the vegetation integrity assessment of the subject land, including: | | |
| | | ☒ | identification and mapping of vegetation zones (as described in BAM Subsection 4.3.1) | Section 4.3.1 |
| | | ☒ | description of vegetation zones within the subject land (as described in Operational Manual Stage 1 Table 2 and Subsection 3.3.2) | Section 4.3 |
| | | ☒ | area (ha) of each vegetation zone | Section 4.3.1 |
| | | ☒ | assessment of patch size (as described in BAM Subsection 4.3.2) | Section 4.3.1 |

| BDAR section | BAM ref. | BAM requirement | | Page reference(s) in the BDAR |
|---|---|---|---|---|
| | | ☒ | survey effort (i.e. number of vegetation integrity survey plots) as described in BAM Subsection 4.3.4(1–2.) | Section 4.3.2 |
| | | ☒ | use of relevant benchmark data from BioNet Vegetation Classification (as described in BAM Subsection 4.3.3(5.)) | Section 4.3.2 |
| | | Where use of more appropriate local benchmark data is proposed (as described in BAM Subsection 1.4.2, BAM Subsection 4.3.3(5.) and BAM Appendix A): **(Not applicable – local benchmark data not used)** | | |
| | | ☐<br>☐<br><br>☐ | identify the PCT or vegetation class for which local benchmark data will be applied<br>identify published sources of local benchmark data (if benchmarks obtained from published sources)<br>describe methods of local benchmark data collection (if reference plots used to determine local benchmark data) | |
| | | ☐ | provide justification for use of local data rather than BioNet Vegetation Classification benchmark values | |
| | | ☐ | provide written confirmation from the decision-maker that they support the use of local benchmark data | |
| | | **Maps and tables** | | |
| | | ☒ | Map of native vegetation extent within the subject land at scale not greater than 1:10,000 including identification of all areas of native vegetation including areas that are ground cover only, cleared areas (as described in BAM Section 4.1(1–3.)) and all parts of the subject land that do not contain native vegetation (BAM Subsection 4.1.2) | Figure 3-3 |
| | | ☒ | Map of PCTs within the subject land (as described in BAM Section 4.2(1.)) | Figure 4-1 |
| | | ☒ | Map of vegetation zones within the subject land (as described in BAM Subsection 4.3.1) | Figure 4-3 |
| | | ☒ | Map the location of floristic vegetation survey plots and vegetation integrity survey plots relative to PCT boundaries | Figure 4-3 |
| | | ☒ | Map of TEC distribution on the subject land and table of TEC listing, status and area (ha) | Figure 4-2 |
| | | ☒ | Map of patch size locations for each native vegetation zone and table of patch size areas (as described in BAM Subsection 4.3.2) | Figure 4-4 |
| | | Table of current vegetation integrity scores for each vegetation zone within the site and including: | | |
| | | ☒<br>☒<br>☒<br>☒ | composition condition score<br>structure condition score<br>function condition score<br>presence of hollow bearing trees | Section 4.3.3 |
| | | **Data** | | |
| | | ☒ | All report maps as separate jpeg files | Not applicable |
| | | ☒ | Plot field data (MS Excel format) | Not applicable |
| | | ☒ | Plot field datasheets | Not applicable |

| BDAR section | BAM ref. | BAM requirement | Page reference(s) in the BDAR |
|---|---|---|---|
| | | Digital shape files of: | |
| | | ☒ PCT boundaries within subject land | Not applicable |
| | | ☒ TEC boundaries within subject land | Not applicable |
| | | ☒ vegetation zone boundaries within subject land | Not applicable |
| | | ☒ floristic vegetation survey and vegetation integrity plot locations | Not applicable |
| **Threatened species** | **Chapter 5** | **Information** | |
| | | Identify ecosystem credit species likely to occur on the subject land, including: | |
| | | ☒ list of ecosystem credit species derived from the BAM-C (as described in BAM Subsection 5.1.1 and Section 5.2(1.)) | Section 5.2.1 |
| | | ☐ justification and supporting evidence for exclusion of any ecosystem credit species based on geographic limitations, habitat constraints or vagrancy (as described in BAM Subsections 5.2.1 and 5.2.2) **(Not applicable – no ecosystem species have been excluded)** | |
| | | ☐ justification for addition of any ecosystem credit species to the list **(Not applicable – no additions have been made)** | |
| | | Identify species credit species likely to occur on the subject land, including: | |
| | | ☒ list of species credit species derived from the BAM-C (as described in BAM Subsection 5.1.1) | Section 5.2.2 and Annexure E |
| | | ☒ justification and supporting evidence for exclusions based on geographic limitations, habitat constraints or vagrancy (as described in BAM Subsections 5.2.1 and 5.2.2) | Section 5.2.2 and Annexure E |
| | | ☒ justification and supporting evidence for exclusions based on degraded habitat constraints and/or microhabitats on which the species depends (as described in BAM Subsection 5.2.2) | Section 5.2.2 and Annexure E |
| | | ☐ justification for addition of any species credit species to the list **(Not applicable – no additions have been made)** | |
| | | From the list of candidate species credit species, identify: | |
| | | ☒ species assumed present within the subject land (if relevant) (as described in BAM Subsection 5.2.4(2.a.))<br>☐ species present within the subject land on the basis of being identified on an important habitat map for a species (as described in BAM Subsection 5.2.4(2.d.)) **(Not applicable – no important habitat maps have been generated for the candidate species credit species)**<br>☒ species for which targeted surveys are to be completed to determine species presence (BAM Subsection 5.2.4(2.b.))<br>☒ species for which an expert report is to be used to determine species presence (BAM Subsection 5.2.4(2.c.)) | Section 5.2.2.4, and Annexure E |
| | | Present the outcomes of species credit species assessments from: | |
| | | ☒ threatened species survey (as described in BAM Section 5.2.4) | Section 5.3 |
| | | ☒ expert reports (if relevant) including justification for presence of the species and information used | Section 5.4 |

| BDAR section | BAM ref. | BAM requirement | Page reference(s) in the BDAR |
|---|---|---|---|
| | | to make this determination (as described in BAM Subsection 5.2.4, Section 5.3, Box 3) | |
| | | Where survey has been undertaken include detailed information on: | |
| | | ☒ survey method and effort (as described in BAM Section 5.3) | Sections 5.3.1 (flora) and 5.3.2 (fauna) |
| | | ☒ justification of survey method and effort (e.g. citation of peer-reviewed literature) if approach differs from the department's taxa-specific survey guides or where no relevant guideline has been published | Sections 5.3.1 (flora) and 5.3.2 (fauna) |
| | | ☒ timing of survey in relation to requirements in the TBDC or the department's taxa-specific survey guides. Where survey was undertaken outside these guides include justification for the timing of surveys | Sections 5.3.1 (flora) and 5.3.2 (fauna) |
| | | ☒ survey personnel and relevant experience | Sections 5.3.1 (flora) and 5.3.2 (fauna) |
| | | ☒ describe any limitations to surveys and how these were addressed/overcome | Section 5.3.3 |
| | | Where an expert report has been used in place of survey (as described in BAM Section 5.3, Box 3), include: | |
| | | ☒ justification of the use of an expert report<br>☒ identify the expert, provide evidence of their expert credentials and departmental approval of expert status<br>☒ all requirements of Box 3 have been addressed in the expert report | Section 5.4 |
| | | Where use of local data is proposed (BAM Subsection 1.4.2): **(Not applicable – use of local data is not proposed)** | |
| | | ☐ identify relevant species<br>☐ identify data to be amended<br>☐ identify source of information for local data, e.g. published literature, additional survey data, etc.<br>☐ justify use of local data in preference to VIS Classification or TBDC data | |
| | | ☐ provide written confirmation from the decision-maker that they support the use of local data | |
| | | Species polygon completed for species credit species present within the subject land (assumed present or determined on the basis of survey, expert report or important habitat map) ensuring that: | |
| | | ☒ the unit of measure for each species is documented | Table 5-18 |
| | | for species assessed by area: | |
| | | ☒ the polygon includes the extent of suitable habitat for the target species within the subject land (as described in BAM Subsection 5.2.5) | Table 5-18 |
| | | ☒ a description of, and evidence-based justification for, the habitat constraints, features or microhabitats used to map the species polygon including reference to information in the TBDC | Table 5-18 |

| BDAR section | BAM ref. | BAM requirement | | Page reference(s) in the BDAR |
|---|---|---|---|---|
| | | | for that species and any buffers applied | |
| | | for species assessed by counts of individuals: **(Not applicable – no count species require species polygons)** | | |
| | | ☐ | the number of individual plants present on the subject land (as described in BAM Subsection 5.2.5(3.)) | |
| | | ☐ | the method used to derive this number (i.e. threatened species survey or expert report) and evidence-based justification for the approach taken | |
| | | ☐ | the polygon includes all individuals located on the subject land with a buffer of 30 m around the individuals or groups of individuals on the subject land | |
| | | ☐ | Identify the biodiversity risk weighting for each species credit species identified as present within the subject land (as described in BAM Section 5.4) | |
| | | **Maps and tables** | | |
| | | ☒ | Table showing ecosystem credit species in accordance with BAM Subsection 5.1.1, and identifying: | Table 5-1 |
| | | ☐ | the ecosystem credit species removed from the list **(Not applicable – no species removed)** | |
| | | ☒ | the sensitivity to gain class of each species | Section 5.2 |
| | | ☒ | Table detailing species credit species in accordance with BAM Section 5.2 and identifying: | Annexure E |
| | | ☒ | the species credit species removed from the list of species because the species is considered vagrant, out of geographic range or the habitat or microhabitat features are not present | Annexure E |
| | | ☒ | the candidate species credit species not recorded on the subject land as determined by targeted survey, expert report or important habitat map | Annexure E |
| | | ☒ | Table detailing species credit species recorded or assumed as present within the subject land, habitat constraints or microhabitats associated with the species, counts of individuals (flora)/extent of suitable habitat (flora and fauna) (as described in BAM Subsection 5.2.6) and biodiversity risk weighting (BAM Section 5.4) | Annexure E |
| | | ☒ | Map indicating the GPS coordinates of all individuals of each species recorded within the subject land and the species polygon for each species (as described in BAM Subsection 5.2.5) | Figure 5-3 |
| | | **Data** | | |
| | | ☒ | Digital shape files of suitable habitat identified for survey for each candidate species credit species | Not applicable |
| | | ☒ | Survey locations including GPS coordinates of any plots, transects, grids | Not applicable |
| | | ☒ | Digital shape files of each species polygon including GPS coordinates of located individuals | Not applicable |
| | | ☒ | Species polygon map in jpeg format | Not applicable |
| | | ☒ | Expert reports and any supporting data used to support conclusions of the expert report | Not applicable |
| | | ☒ | Field datasheets detailing survey information including prevailing conditions, date, time, equipment used, etc. | Annexure B |

| BDAR section | BAM ref. | BAM requirement | | Page reference(s) in the BDAR |
|---|---|---|---|---|
| **Prescribed impacts** | **Chapter 6** | **Information** | | |
| | | Identify potential prescribed biodiversity impacts on threatened entities, including: | | |
| | | ☒ | karst, caves, crevices, cliffs, rocks and other geological features of significance (as described in BAM Subsection 6.1.1) | Section 7.4 |
| | | ☒ | occurrences of human-made structures and non-native vegetation (as described in BAM Subsection 6.1.2) | |
| | | ☒ | corridors or other areas of connectivity linking habitat for threatened entities (as described in BAM Subsection 6.1.3) | |
| | | ☒ | waterbodies or any hydrological processes that sustain threatened entities (as described in BAM Subsection 6.1.4) | |
| | | ☐ | protected animals that may use the proposed wind farm development site as a flyway or migration route (as described in BAM Subsection 6.1.5) **(Not applicable – development is not a windfarm)** | |
| | | ☒ | where the proposed development may result in vehicle strike on threatened fauna or on animals that are part of a threatened ecological community (as described in BAM Subsection 6.1.6) | Section 7.4.6 |
| | | ☒ | Identify a list of threatened entities that may be dependent upon or may use habitat features associated with any of the prescribed impacts | Section 7.4.6 |
| | | ☐ | Describe the importance of habitat features to the species including, where relevant, impacts on life cycle or movement patterns (e.g. Subsection 6.1.3) **(Not applicable for vehicle strike species list)** | |
| | | Where the proposed development is for a wind farm: **(Not applicable – development is not a windfarm)** | | |
| | | ☐ | identify a candidate list of protected animals that may use the development site as a flyway or migration route, including: resident threatened aerial species, resident raptor species and nomadic and migratory species that are likely to fly over the proposal area (as described in BAM Subsection 6.1.5) | |
| | | ☐ | provide details of targeted survey for candidate species of wind farm developments undertaken in accordance with BAM Subsection 6.1.5(2–3.) | |
| | | ☐ | predict the habitual flight paths for nomadic and migratory species likely to fly over the subject land and map the likely habitat for resident threatened aerial and raptor species (BAM Subsection 6.1.5(4.)) | |
| | | Where the proposal may result in vehicle strike: | | |
| | | ☒ | identify a list of threatened fauna or protected fauna species that are part of a TEC and at risk of vehicle strike due to the proposal | Section 7.4.6 |
| | | **Maps and tables** | | |
| | | ☒ | Map showing location of any prescribed impact features (i.e. karst, caves, crevices, cliffs, rocks, human-made structures, etc.) | Figure 7-2 |

| BDAR section | BAM ref. | BAM requirement | | Page reference(s) in the BDAR |
|---|---|---|---|---|
| | | ☒ | Map showing location of potential vehicle strike locations | Figure 7-2 |
| | | ☐ | Maps of habitual flight paths for nomadic and migratory species likely to fly over the site and maps of likely habitat for threatened aerial species resident on the site (for wind farm developments only) **(Not applicable – not a wind farm development)** | |
| | | **Data** | | |
| | | ☒ | Digital shape files of prescribed impact feature locations | Not applicable |
| | | ☒ | Prescribed impact features map in jpeg format | Not applicable |
| **Avoid and minimise impacts** | **Chapter 7** | **Information** | | |
| | | Demonstration of efforts to avoid and minimise impacts on biodiversity values (including prescribed impacts) associated with the proposal location in accordance with Chapter 7, including an analysis of alternative: | | |
| | | ☒ | modes or technologies that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed mode or technology | Section 6 |
| | | ☒ | routes that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed route | Section 6 |
| | | ☒ | alternative locations that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed location | Section 6 |
| | | ☒ | alternative sites within a property on which the proposal is located that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed site | Section 6 |
| | | ☒ | Describe efforts to avoid and minimise impacts (including prescribed impacts) to biodiversity values through proposal design (as described in BAM Sections 7.1 and 7.2) | Section 6 |
| | | ☒ | Identification of any other site constraints that the proponent has considered in determining the location and design of the proposal (as described in BAM Subsection 7.2.1(3.)) | Section 6 |
| | | ☒ | Detail measures or options considered but not implemented because they are not feasible and/or practical (e.g. due to site constraints) | Section 6 |
| | | **Maps and tables** | | |
| | | ☒ | Table of measures to be implemented to avoid and minimise the impacts of the proposal, including action, outcome, timing and responsibility | Table 8-2 |
| | | ☒ | Map of alternative footprints considered to avoid or minimise impacts on biodiversity values; and of the final proposal footprint, including construction and operation | Figure 2-2<br>Figure 2-3<br>Figure 2-4 |
| | | ☒ | Maps demonstrating indirect impact zones where applicable | Figure 7-2 |
| | | **Data** | | |
| | | Digital shape files of: | | |
| | | ☒ | alternative and final proposal footprint | Not applicable |
| | | ☒ | direct and indirect impact zones | Not applicable |

| BDAR section | BAM ref. | BAM requirement | Page reference(s) in the BDAR |
|---|---|---|---|
| | | ☒ Maps in jpeg format | Not applicable |
| **Assessment of impacts** | **Chapter 8, Sections 8.1 and 8.2** | **Information** | |
| | | ☒ Determine the impacts on native vegetation and threatened species habitat, including a description of direct impacts of clearing of native vegetation, threatened ecological communities and threatened species habitat (as described in BAM Section 8.1) | Section 7.1 |
| | | Assessment of indirect impacts on vegetation and threatened species and their habitat including (as described in BAM Section 8.2): | |
| | | ☒ description of the nature, extent, frequency, duration and timing of indirect impacts of the proposal | Section 7.2 |
| | | ☒ documenting the consequences to vegetation and threatened species and their habitat including evidence-based justifications | Section 7.1 |
| | | ☒ reporting any limitations or assumptions, etc. made during the assessment | Section 5.3.3 |
| | | ☒ identification of the threatened entities and their habitat likely to be affected | Section 7.2 |
| | | Assessment of prescribed biodiversity impacts (as described in BAM Section 8.3) including: | |
| | | assessment of the nature, extent frequency, duration and timing of impacts on the habitat of threatened species or ecological communities associated with: | |
| | | ☒ karst, caves, crevices, cliffs, rocks and other features of geological significance | Section 7.4.1 |
| | | ☒ human-made structures | Section 7.4.2 |
| | | ☒ non-native vegetation | Section 7.4.2 |
| | | ☒ connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range | Section 7.4.3 |
| | | ☒ movement of threatened species that maintains their life cycle | Section 7.4.3 |
| | | ☒ water quality, waterbodies and hydrological processes that sustain threatened species and threatened ecological communities | Section 7.4.4 |
| | | ☐ assessment of the impacts of wind turbine strikes on protected animals **(Not applicable – not a wind farm)** | |
| | | ☒ assessment of the impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC | Section 7.4.6 |
| | | ☒ evaluate the consequences of prescribed impacts | Section 7.4 |
| | | ☒ describe impacts that are uncertain | Section 8.4 |
| | | ☒ document limitations to data, assumptions and predictions | Section 5.3.3 |
| | | **Maps and tables** | |
| | | ☒ Table showing change in vegetation integrity score for each vegetation zone as a result of identified impacts | Table 7-1 |
| | | **Data** | |
| | | N/A | |

| BDAR section | BAM ref. | BAM requirement | Page reference(s) in the BDAR |
|---|---|---|---|
| **Mitigation and management of impacts** | **Chapter 8, Sections 8.4 and 8.5** | **Information** | |
| | | Identification of measures to mitigate or manage impacts in accordance with the recommendations in BAM Sections 8.4 and 8.5 including: | |
| | | ☒ techniques, timing, frequency and responsibility<br>☒ identify measures for which there is risk of failure<br>☒ evaluate the risk and consequence of any residual impacts | Section 8 |
| | | ☒ document any adaptive management strategy proposed | Section 8 |
| | | Identification of measures for mitigating impacts related to: | |
| | | ☒ displacement of resident fauna (as described in BAM Subsection 8.4.1(2.))<br>☒ indirect impacts on native vegetation and habitat (as described in BAM Subsection 8.4.1(3.))<br>☒ mitigating prescribed biodiversity impacts (as described in BAM Subsection 8.4.2) | Section 8 |
| | | ☒ Details of the adaptive management strategy proposed to monitor and respond to impacts on biodiversity values that are uncertain (BAM Section 8.5) | Section 8 |
| | | **Maps and tables** | |
| | | ☒ Table of measures to be implemented before, during and after construction to mitigate and manage impacts of the proposal, including action, outcome, timing and responsibility | Table 8-2 |
| | | **Data** | |
| | | N/A | |
| **Impact summary** | **Chapter 9** | **Information** | |
| | | Identification and assessment of impacts on TECs and threatened species that are at risk of a serious and irreversible impacts (SAII, in accordance with BAM Section 9.1) including **(Not applicable – no impacts are considered potential SAIIs)** | |
| | | ☐ addressing all criteria in Subsection 9.1.1 for each TEC listed as at risk of an SAII present on the subject land | |
| | | ☐ for each TEC, report the extent of the TEC in NSW | |
| | | ☐ addressing all criteria in Subsection 9.1.2 for each threatened species at risk of an SAII present on the subject land | |
| | | ☐ for each threatened species, report the population size in NSW | |
| | | ☐ documenting assumptions made and/or limitations to information<br>☐ documenting all sources of data, information, references used or consulted<br>☐ clearly justifying why any criteria could not be addressed | |
| | | ☐ Identification of impacts requiring offset in accordance with BAM Section 9.2 | |
| | | ☐ Identification of impacts not requiring offset in accordance with BAM Subsection 9.2.1(3.) | |
| | | ☐ Identification of areas not requiring assessment in accordance with BAM Section 9.3 | |
| | | **Maps and tables** | |

| BDAR section | BAM ref. | BAM requirement | Page reference(s) in the BDAR |
| --- | --- | --- | --- |
| | | ☐ Map showing the extent of TECs at risk of an SAII within the subject land | |
| | | ☐ Map showing location of threatened species at risk of an SAII within the subject land | |
| | | Map showing location of: | |
| | | ☐ impacts requiring offset | |
| | | ☐ impacts not requiring offset | |
| | | ☐ areas not requiring assessment | |
| | | **Data** | |
| | | Digital shape files of: | |
| | | ☐ extent of TECs at risk of an SAII within the subject land | |
| | | ☐ location of threatened species at risk of an SAII within the subject land | |
| | | ☐ boundary of impacts requiring offset | |
| | | ☐ boundary of impacts not requiring offset | |
| | | ☐ boundary of areas not requiring assessment | |
| | | ☐ Maps in jpeg format | |
| **Impact summary** | **Chapter 10** | **Information** | |
| | | Ecosystem credits and species credits that measure the impact of the development on biodiversity values, including: | |
| | | ☒ future vegetation integrity score for each vegetation zone within the subject land (Equation 25 and Equation 26 in BAM (Appendix H)<br>☒ change in vegetation integrity score (BAM Subsection 8.1.1)<br>☒ number of required ecosystem credits for the direct impacts of the proposal on each vegetation zone within the subject land (BAM Subsection 10.1.2) | Section 9.1 |
| | | ☒ biodiversity risk weighting for each | Section 9.2 |
| | | ☒ number of required species credits for each candidate threatened species that is directly impacted on by the proposal (BAM Subsection 10.1.3) | Section 9.2 |
| | | **Maps and tables** | |
| | | ☒ Table of PCTs requiring offset and the number of ecosystem credits required | Table 9-1 |
| | | ☒ Table of threatened species requiring offset and the number of species credits required | Table 9-3 |
| | | **Data** | |
| | | ☒ Submitted proposal in the BAM Calculator | Not applicable |
| **Biodiversity credit report** | **Chapter 10** | **Information** | |
| | | ☒ Description of credit classes for ecosystem credits and species credits at the development or clearing site or land to be biodiversity certified (BAM Section 10.2) | Section 9.3 |
| | | ☒ BAM credit report in pdf format | Annexure L |
| | | **Maps and tables** | |

| BDAR section | BAM ref. | BAM requirement | | Page reference(s) in the BDAR |
|---|---|---|---|---|
| | | ☒ | Table of credit class and matching credit profile | Table 9-4 |
| | | **Data** | | |
| | | ☒ | BAM credit report in pdf format | |

# Annexure B – Vegetation integrity plot field data sheets

## Recorded flora

| Family | Scientific name | Common name | B2L.01 | | B2L.02 | | B2L.03 | | B2L.04 | | B2L.05 | | B2L.06 | | B2L.07 | | B2L.08 | | B2L.09 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| **Native species** | | | | | | | | | | | | | | | | | | | | |
| Anthericaceae | *Thysanotus tuberosus* | Common Fringe-lily | | | | | | | | | | | 0.1 | 7 | 0.1 | 10 | | | | |
| Anthericaceae | *Sowerbaea juncea* | Vanilla Plant | | | | | 1 | 30 | | | | | | | | | | | | |
| Anthericaceae | *Tricoryne elatior* | Yellow Autumn-lily | | | | | | | | | | | | | | | | | | |
| Apiaceae | *Hydrocotyle hirta* | Hairy Pennywort | | | | | | | | | | | | | | | | | | |
| Apiaceae | *Platysace linearifolia* | None | | | 0.2 | 50 | | | | | 0.1 | 4 | | | | | | | | |
| Apiaceae | *Platysace lanceolata* | Shrubby Platysace | | | | | | | | | | | | | | | | | | |
| Apiaceae | *Xanthosia stellata* | Star Xanthosia | | | | | | | | | | | | | | | | | | |
| Apiaceae | *Hydrocotyle laxiflora* | Stinking Pennywort | | | | | | | | | | | | | | | | | | |
| Apiaceae | *Xanthosia pilosa* | Woolly Xanthosia | | | | | | | | | 0.2 | 20 | 0.1 | 10 | | | | | | |
| Apocynaceae | *Parsonsia straminea* | Common Silkpod | 5 | 30 | | | | | 0.1 | 5 | | | | | | | | | | |
| Araliaceae | *Polyscias sambucifolia* | Elderberry Panax | | | | | | | 1 | | | | | | | | | | 0.1 | 5 |
| Asteraceae | *Euchiton* spp. | A Cudweed | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Coronidium scorpioides* | Button Everlasting | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Lagenophora stipitata* | Common Lagenophora | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Senecio* spp. | Groundsel, Fireweed | | | | | | | 0.5 | 20 | | | | | | | | | | |
| Asteraceae | *Senecio hispidulus* | Hill Fireweed | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Cassinia denticulata* | None | | | | | 0.1 | 1 | | | | | | | | | | | | |
| Asteraceae | *Cassinia sifton* | None | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Cassinia* spp. | None | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Euchiton japonicus* | None | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Senecio pinnatifolius* | None | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Xerochrysum* spp. | None | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Lagenophora gracilis* | Slender Lagenophora | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Cassinia uncata* | Sticky Cassinia | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Ozothamnus diosmifolius* | White Dogwood | | | | | | | | | | | | | | | | | 0.1 | 5 |
| Bignoniaceae | *Pandorea pandorana* | Wonga Wonga Vine | | | | | | | | | | | | | | | | | 0.1 | 1 |
| Blechnaceae | *Blechnum nudum* | Fishbone Water Fern | | | | | | | | | | | | | | | | | | |
| Brassicaceae | *Lepidium* spp. | A Peppercress | | | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.10 | | B2L.11 | | B2L.12 | | B2L.13 | | B2L.14 | | B2L.15 | | B2L.16 | | B2L.17 | | B2L.18 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| **Native species** | | | | | | | | | | | | | | | | | | | | |
| Anthericaceae | *Thysanotus tuberosus* | Common Fringe-lily | | | | | | | | | | | | | | | | | | |
| Anthericaceae | *Sowerbaea juncea* | Vanilla Plant | | | | | | | | | | | | | | | | | | |
| Anthericaceae | *Tricoryne elatior* | Yellow Autumn-lily | | | | | | | | | | | | | | | | | | |
| Apiaceae | *Hydrocotyle hirta* | Hairy Pennywort | | | | | | | | | | | 1 | 100 | | | | | | |
| Apiaceae | *Platysace linearifolia* | None | 0.3 | 30 | | | | | | | | | 0.1 | 10 | | | | | | |
| Apiaceae | *Platysace lanceolata* | Shrubby Platysace | | | | | | | | | | | 0.1 | 10 | | | | | | |
| Apiaceae | *Xanthosia stellata* | Star Xanthosia | | | | | | | | | | | 0.3 | 50 | | | | | | |
| Apiaceae | *Hydrocotyle laxiflora* | Stinking Pennywort | | | | | | | | | | | | | | | 0.1 | 10 | | |
| Apiaceae | *Xanthosia pilosa* | Woolly Xanthosia | | | | | | | | | | | | | | | | | | |
| Apocynaceae | *Parsonsia straminea* | Common Silkpod | | | | | | | | | | | | | | | | | | |
| Araliaceae | *Polyscias sambucifolia* | Elderberry Panax | | | | | | | | | | | | | | | 0.1 | 5 | | |
| Asteraceae | *Euchiton* spp. | A Cudweed | | | | | 0.1 | 10 | | | | | | | | | | | | |
| Asteraceae | *Coronidium scorpioides* | Button Everlasting | 0.1 | 10 | | | | | | | | | | | | | | | | |
| Asteraceae | *Lagenophora stipitata* | Common Lagenophora | | | | | | | | | | | 0.1 | 1 | | | | | | |
| Asteraceae | *Senecio* spp. | Groundsel, Fireweed | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Senecio hispidulus* | Hill Fireweed | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Cassinia denticulata* | None | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Cassinia sifton* | None | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Cassinia* spp. | None | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Euchiton japonicus* | None | | | | | | | | | | | | | | | 0.5 | 10 | | |
| Asteraceae | *Senecio pinnatifolius* | None | | | | | | | | | | | | | | | 0.1 | 1 | | |
| Asteraceae | *Xerochrysum* spp. | None | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Lagenophora gracilis* | Slender Lagenophora | | | | | | | | | | | | | | | 0.1 | 5 | | |
| Asteraceae | *Cassinia uncata* | Sticky Cassinia | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Ozothamnus diosmifolius* | White Dogwood | | | | | | | | | | | | | | | 15 | 50 | | |
| Bignoniaceae | *Pandorea pandorana* | Wonga Wonga Vine | | | | | | | | | | | | | | | | | | |
| Blechnaceae | *Blechnum nudum* | Fishbone Water Fern | | | | | | | | | | | 15 | 100 | | | | | | |
| Brassicaceae | *Lepidium* spp. | A Peppercress | | | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.19 | | B2L.20 | | B2L.21 | | B2L.22 | | B2L.23 | | B2L.24 | | B2L.25 | | B2L.26 | | B2L.27 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| **Native species** | | | | | | | | | | | | | | | | | | | | |
| Anthericaceae | *Thysanotus tuberosus* | Common Fringe-lily | | | | | | | | | | | | | | | | | | |
| Anthericaceae | *Sowerbaea juncea* | Vanilla Plant | 0.1 | 3 | | | | | | | | | | | | | | | | |
| Anthericaceae | *Tricoryne elatior* | Yellow Autumn-lily | | | | | | | | | | | | | | | | | | |
| Apiaceae | *Hydrocotyle hirta* | Hairy Pennywort | | | | | 5 | 300 | | | | | 0.1 | 20 | | | | | | |
| Apiaceae | *Platysace linearifolia* | None | | | | | | | 0.1 | 20 | 0.1 | 20 | | | | | | | | |
| Apiaceae | *Platysace lanceolata* | Shrubby Platysace | | | | | | | | | | | | | | | | | | |
| Apiaceae | *Xanthosia stellata* | Star Xanthosia | | | | | | | | | | | | | | | | | | |
| Apiaceae | *Hydrocotyle laxiflora* | Stinking Pennywort | | | | | | | | | | | | | 0.1 | 100 | | | | |
| Apiaceae | *Xanthosia pilosa* | Woolly Xanthosia | | | 0.5 | 30 | | | 0.5 | 200 | | | | | | | | | | |
| Apocynaceae | *Parsonsia straminea* | Common Silkpod | | | | | | | | | | | 0.1 | 5 | | | | | | |
| Araliaceae | *Polyscias sambucifolia* | Elderberry Panax | | | | | 1 | 20 | | | 0.3 | 50 | 0.5 | 20 | | | | | | |
| Asteraceae | *Euchiton* spp. | A Cudweed | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Coronidium scorpioides* | Button Everlasting | | | | | | | | | | | 0.1 | 2 | | | | | | |
| Asteraceae | *Lagenophora stipitata* | Common Lagenophora | | | | | 0.1 | 5 | | | | | 0.1 | 5 | | | | | | |
| Asteraceae | *Senecio* spp. | Groundsel, Fireweed | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Senecio hispidulus* | Hill Fireweed | | | | | | | | | | | | | 0.1 | 3 | | | | |
| Asteraceae | *Cassinia denticulata* | None | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Cassinia sifton* | None | | | | | | | | | | | | | 0.1 | 2 | | | | |
| Asteraceae | *Cassinia* spp. | None | | | | | | | | | | | | | | | | | 0.1 | 2 |
| Asteraceae | *Euchiton japonicus* | None | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Senecio pinnatifolius* | None | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Xerochrysum* spp. | None | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Lagenophora gracilis* | Slender Lagenophora | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Cassinia uncata* | Sticky Cassinia | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Ozothamnus diosmifolius* | White Dogwood | | | | | 0.1 | 5 | | | | | 2 | 40 | | | | | | |
| Bignoniaceae | *Pandorea pandorana* | Wonga Wonga Vine | | | | | 0.1 | 2 | | | | | | | | | | | | |
| Blechnaceae | *Blechnum nudum* | Fishbone Water Fern | | | | | | | | | | | | | | | | | | |
| Brassicaceae | *Lepidium* spp. | A Peppercress | | | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.28 | | B2L.29 | | B2L.30 | | B2L.31 | | B2L.32 | | B2L.33 | | B2L.34 | | B2L.35 | | B2L.36 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| **Native species** | | | | | | | | | | | | | | | | | | | | |
| Anthericaceae | *Thysanotus tuberosus* | Common Fringe-lily | | | | | | | | | | | 0.1 | 10 | | | | | | |
| Anthericaceae | *Sowerbaea juncea* | Vanilla Plant | | | | | | | | | | | | | | | | | | |
| Anthericaceae | *Tricoryne elatior* | Yellow Autumn-lily | | | | | 0.1 | 1 | | | | | | | | | | | | |
| Apiaceae | *Hydrocotyle hirta* | Hairy Pennywort | | | | | | | | | | | | | | | | | | |
| Apiaceae | *Platysace linearifolia* | None | | | | | | | | | | | | | | | | | | |
| Apiaceae | *Platysace lanceolata* | Shrubby Platysace | | | | | | | | | | | | | 0.1 | 6 | | | | |
| Apiaceae | *Xanthosia stellata* | Star Xanthosia | | | | | | | | | | | | | | | | | | |
| Apiaceae | *Hydrocotyle laxiflora* | Stinking Pennywort | | | | | | | | | | | | | | | | | | |
| Apiaceae | *Xanthosia pilosa* | Woolly Xanthosia | | | | | | | | | | | | | | | | | | |
| Apocynaceae | *Parsonsia straminea* | Common Silkpod | | | | | | | | | | | | | | | | | | |
| Araliaceae | *Polyscias sambucifolia* | Elderberry Panax | | | | | | | | | | | 0.5 | 3 | | | | | | |
| Asteraceae | *Euchiton* spp. | A Cudweed | | | | | 0.1 | 20 | 0.1 | 20 | 0.1 | 20 | | | | | | | | |
| Asteraceae | *Coronidium scorpioides* | Button Everlasting | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Lagenophora stipitata* | Common Lagenophora | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Senecio* spp. | Groundsel, Fireweed | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Senecio hispidulus* | Hill Fireweed | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Cassinia denticulata* | None | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Cassinia sifton* | None | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Cassinia* spp. | None | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Euchiton japonicus* | None | | | | | 0.1 | 2 | | | | | | | | | | | | |
| Asteraceae | *Senecio pinnatifolius* | None | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Xerochrysum* spp. | None | 0.1 | 5 | | | | | | | | | | | | | | | | |
| Asteraceae | *Lagenophora gracilis* | Slender Lagenophora | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Cassinia uncata* | Sticky Cassinia | | | | | 0.1 | 2 | | | | | | | | | | | | |
| Asteraceae | *Ozothamnus diosmifolius* | White Dogwood | | | | | 0.1 | 5 | | | | | | | | | | | | |
| Bignoniaceae | *Pandorea pandorana* | Wonga Wonga Vine | | | | | | | | | | | | | | | | | | |
| Blechnaceae | *Blechnum nudum* | Fishbone Water Fern | | | | | | | | | | | | | | | | | | |
| Brassicaceae | *Lepidium* spp. | A Peppercress | | | | | | | | | 0.1 | 5 | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.01 | | B2L.02 | | B2L.03 | | B2L.04 | | B2L.05 | | B2L.06 | | B2L.07 | | B2L.08 | | B2L.09 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Campanulaceae | *Wahlenbergia gracilis* | Sprawling Bluebell | | | | | | | | | | | | | | | | | | |
| Campanulaceae | *Wahlenbergia stricta* | Tall Bluebell | | | | | | | | | | | | | | | | | | |
| Campanulaceae | *Lobelia purpurascens* | whiteroot | 1 | 100 | 0.1 | 5 | | | | | | | | | | | | | 0.1 | 5 |
| Casuarinaceae | *Allocasuarina nana* | Dwarf She-oak | | | | | | | | | | | 1 | | 1 | | | | | |
| Chenopodiaceae | *Einadia hastata* | Berry Saltbush | | | | | | | | | | | | | | | | | | |
| Chenopodiaceae | *Einadia nutans* | Climbing Saltbush | | | | | | | | | | | | | | | | | | |
| Chenopodiaceae | *Einadia polygonoides* | Knotweed Goosefoot | | | | | | | | | | | | | | | | | | |
| Clusiaceae | *Hypericum japonicum* | None | | | | | | | | | | | | | | | | | | |
| Clusiaceae | *Hypericum gramineum* | Small St John's Wort | | | | | | | | | | | | | | | | | | |
| Convolvulaceae | *Dichondra repens* | Kidney Weed | | | | | | | | | | | | | | | | | 0.1 | 20 |
| Cunoniaceae | *Callicoma serratifolia* | Black Wattle | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Gymnoschoenus sphaerocephalus* | Button Grass | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Isolepis inundata* | Club-rush | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Caustis flexuosa* | Curly Wig | | | 0.2 | 50 | 0.2 | 10 | | | | | | | | | | | | |
| Cyperaceae | *Schoenus apogon* | Fluke Bogrush | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Carex inversa* | Knob Sedge | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Isolepis cernua* | Nodding Club-rush | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Baumea rubiginosa* | None | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Carex iynx* | None | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Cyperus odoratus* | None | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Cyperus sanguinolentus* | None | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Gahnia microstachya* | None | | | | | | | 5 | 4 | | | 0.5 | 10 | 0.3 | 5 | | | | |
| Cyperaceae | *Lepidosperma limicola* | None | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Ptilothrix deusta* | None | | | | | | | | | | | | | 0.1 | 50 | | | | |
| Cyperaceae | *Schoenus melanostachys* | None | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Gahnia sieberiana* | Red-fruit Saw-sedge | | | | | | | | | 0.5 | 8 | | | | | | | | |
| Cyperaceae | *Gahnia aspera* | Rough Saw-sedge | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Carex appressa* | Tall Sedge | | | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.10 | | B2L.11 | | B2L.12 | | B2L.13 | | B2L.14 | | B2L.15 | | B2L.16 | | B2L.17 | | B2L.18 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Campanulaceae | *Wahlenbergia gracilis* | Sprawling Bluebell | | | | | | | | | | | 0.1 | 6 | | | | | | |
| Campanulaceae | *Wahlenbergia stricta* | Tall Bluebell | | | | | | | | | | | | | 0.1 | 2 | | | | |
| Campanulaceae | *Lobelia purpurascens* | whiteroot | | | | | | | | | | | | | | | | | | |
| Casuarinaceae | *Allocasuarina nana* | Dwarf She-oak | 1 | 10 | | | | | | | | | | | | | | | | |
| Chenopodiaceae | *Einadia hastata* | Berry Saltbush | | | | | | | | | | | | | | | | | | |
| Chenopodiaceae | *Einadia nutans* | Climbing Saltbush | | | | | | | | | | | | | | | | | | |
| Chenopodiaceae | *Einadia polygonoides* | Knotweed Goosefoot | | | | | | | | | | | | | | | | | | |
| Clusiaceae | *Hypericum japonicum* | None | | | | | | | | | | | | | | | | | 1 | 300 |
| Clusiaceae | *Hypericum gramineum* | Small St John's Wort | | | 0.1 | 20 | | | | | | | | | | | 0.1 | 5 | | |
| Convolvulaceae | *Dichondra repens* | Kidney Weed | | | | | | | | | | | | | 0.1 | 10 | | | | |
| Cunoniaceae | *Callicoma serratifolia* | Black Wattle | | | | | | | | | | | 0.3 | 2 | | | | | | |
| Cyperaceae | *Gymnoschoenus sphaerocephalus* | Button Grass | | | | | | | | | | | 0.1 | 5 | | | | | | |
| Cyperaceae | *Isolepis inundata* | Club-rush | | | | | 0.1 | 20 | 0.2 | 50 | 0.1 | 10 | 0.5 | 10 | | | | | 10 | 500 |
| Cyperaceae | *Caustis flexuosa* | Curly Wig | 0.1 | 10 | 0.1 | 10 | | | | | | | | | | | | | | |
| Cyperaceae | *Schoenus apogon* | Fluke Bogrush | | | | | | | 0.1 | 20 | | | | | | | | | | |
| Cyperaceae | *Carex inversa* | Knob Sedge | | | | | | | | | | | | | | | | | 15 | 300 |
| Cyperaceae | *Isolepis cernua* | Nodding Club-rush | | | | | | | 5 | 200 | | | | | | | | | | |
| Cyperaceae | *Baumea rubiginosa* | None | | | | | | | 10 | 200 | | | | | | | | | | |
| Cyperaceae | *Carex iynx* | None | | | | | | | 1 | 100 | | | | | | | | | | |
| Cyperaceae | *Cyperus odoratus* | None | | | 0.1 | 2 | | | | | | | | | | | | | 0.1 | 5 |
| Cyperaceae | *Cyperus sanguinolentus* | None | | | | | | | 0.3 | 50 | | | | | | | | | | |
| Cyperaceae | *Gahnia microstachya* | None | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Lepidosperma limicola* | None | | | | | | | | | | | 0.5 | 10 | | | | | | |
| Cyperaceae | *Ptilothrix deusta* | None | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Schoenus melanostachys* | None | 0.1 | 1 | | | | | | | | | | | | | | | | |
| Cyperaceae | *Gahnia sieberiana* | Red-fruit Saw-sedge | | | | | | | | | | | 2 | 10 | | | | | 2 | 5 |
| Cyperaceae | *Gahnia aspera* | Rough Saw-sedge | | | | | | | | | | | | | 0.1 | 1 | | | | |
| Cyperaceae | *Carex appressa* | Tall Sedge | | | | | | | 5 | 20 | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.19 | | B2L.20 | | B2L.21 | | B2L.22 | | B2L.23 | | B2L.24 | | B2L.25 | | B2L.26 | | B2L.27 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Campanulaceae | *Wahlenbergia gracilis* | Sprawling Bluebell | | | | | | | | | | | | | | | | | | |
| Campanulaceae | *Wahlenbergia stricta* | Tall Bluebell | | | | | | | | | | | | | | | | | | |
| Campanulaceae | *Lobelia purpurascens* | whiteroot | | | | | 2 | 50 | | | | | 0.1 | 5 | 0.1 | 20 | | | | |
| Casuarinaceae | *Allocasuarina nana* | Dwarf She-oak | | | | | | | | | | | | | | | | | | |
| Chenopodiaceae | *Einadia hastata* | Berry Saltbush | | | | | | | | | | | 0.2 | 20 | | | | | | |
| Chenopodiaceae | *Einadia nutans* | Climbing Saltbush | | | | | | | | | | | | | | | | | 0.1 | 10 |
| Chenopodiaceae | *Einadia polygonoides* | Knotweed Goosefoot | | | | | | | | | | | | | 0.1 | 100 | | | | |
| Clusiaceae | *Hypericum japonicum* | None | | | | | | | | | | | | | | | 0.1 | 10 | | |
| Clusiaceae | *Hypericum gramineum* | Small St John's Wort | | | | | 0.1 | 10 | | | 0.1 | 20 | | | | | | | | |
| Convolvulaceae | *Dichondra repens* | Kidney Weed | | | | | 1 | 50 | | | | | | | 0.1 | 200 | | | | |
| Cunoniaceae | *Callicoma serratifolia* | Black Wattle | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Gymnoschoenus sphaerocephalus* | Button Grass | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Isolepis inundata* | Club-rush | | | | | | | | | | | | | | | 0.5 | 50 | | |
| Cyperaceae | *Caustis flexuosa* | Curly Wig | 0.5 | 5 | 0.1 | 2 | | | 0.5 | 50 | 0.1 | 10 | | | | | | | | |
| Cyperaceae | *Schoenus apogon* | Fluke Bogrush | | | | | | | | | | | | | | | 0.1 | 20 | | |
| Cyperaceae | *Carex inversa* | Knob Sedge | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Isolepis cernua* | Nodding Club-rush | | | | | | | | | | | | | | | 5 | 200 | | |
| Cyperaceae | *Baumea rubiginosa* | None | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Carex iynx* | None | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Cyperus odoratus* | None | | | | | | | | | 0.1 | 20 | | | | | 0.1 | 10 | | |
| Cyperaceae | *Cyperus sanguinolentus* | None | | | | | | | | | | | | | | | 0.5 | 50 | | |
| Cyperaceae | *Gahnia microstachya* | None | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Lepidosperma limicola* | None | 5 | 20 | 1 | 10 | | | | | | | | | | | | | | |
| Cyperaceae | *Ptilothrix deusta* | None | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Schoenus melanostachys* | None | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Gahnia sieberiana* | Red-fruit Saw-sedge | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Gahnia aspera* | Rough Saw-sedge | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Carex appressa* | Tall Sedge | | | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.28 | | B2L.29 | | B2L.30 | | B2L.31 | | B2L.32 | | B2L.33 | | B2L.34 | | B2L.35 | | B2L.36 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Campanulaceae | *Wahlenbergia gracilis* | Sprawling Bluebell | 0.1 | 2 | | | | | | | | | | | | | | | | |
| Campanulaceae | *Wahlenbergia stricta* | Tall Bluebell | | | | | | | | | | | | | | | | | | |
| Campanulaceae | *Lobelia purpurascens* | whiteroot | | | | | | | | | | | | | | | | | | |
| Casuarinaceae | *Allocasuarina nana* | Dwarf She-oak | | | | | | | | | | | | | | | | | | |
| Chenopodiaceae | *Einadia hastata* | Berry Saltbush | 5 | 200 | | | | | 0.1 | 5 | 0.1 | 2 | | | | | | | | |
| Chenopodiaceae | *Einadia nutans* | Climbing Saltbush | | | | | | | | | | | | | | | | | | |
| Chenopodiaceae | *Einadia polygonoides* | Knotweed Goosefoot | | | | | | | | | | | | | | | | | | |
| Clusiaceae | *Hypericum japonicum* | None | | | | | | | | | | | | | | | 0.1 | 5 | | |
| Clusiaceae | *Hypericum gramineum* | Small St John's Wort | | | | | 0.1 | 2 | | | | | | | | | | | | |
| Convolvulaceae | *Dichondra repens* | Kidney Weed | 0.2 | 50 | | | | | | | | | | | | | | | | |
| Cunoniaceae | *Callicoma serratifolia* | Black Wattle | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Gymnoschoenus sphaerocephalus* | Button Grass | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Isolepis inundata* | Club-rush | | | | | | | | | | | | | | | 0.1 | 5 | 0.2 | 40 |
| Cyperaceae | *Caustis flexuosa* | Curly Wig | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Schoenus apogon* | Fluke Bogrush | | | 1 | 200 | | | 0.1 | 5 | | | | | | | 0.2 | 20 | | |
| Cyperaceae | *Carex inversa* | Knob Sedge | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Isolepis cernua* | Nodding Club-rush | | | | | | | | | | | | | 0.1 | 2 | 0.5 | 100 | | |
| Cyperaceae | *Baumea rubiginosa* | None | | | 0.2 | 100 | | | | | | | | | | | 0.5 | 50 | 0.5 | 10 |
| Cyperaceae | *Carex iynx* | None | | | 0.5 | 20 | | | | | | | | | | | | | | |
| Cyperaceae | *Cyperus odoratus* | None | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Cyperus sanguinolentus* | None | | | | | | | | | | | | | | | 1 | 50 | | |
| Cyperaceae | *Gahnia microstachya* | None | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Lepidosperma limicola* | None | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Ptilothrix deusta* | None | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Schoenus melanostachys* | None | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Gahnia sieberiana* | Red-fruit Saw-sedge | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Gahnia aspera* | Rough Saw-sedge | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Carex appressa* | Tall Sedge | | | | | | | | | | | | | | | | | 20 | 50 |

## Recorded flora

| Family | Scientific name | Common name | B2L.01 | | B2L.02 | | B2L.03 | | B2L.04 | | B2L.05 | | B2L.06 | | B2L.07 | | B2L.08 | | B2L.09 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Cyperaceae | *Eleocharis sphacelata* | Tall Spike Rush | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Lepidosperma laterale* | Variable Sword-sedge | | | | | | | | | | | | | | | | | | |
| Dennstaedtiaceae | *Pteridium esculentum* | Bracken | | | 0.1 | 1 | | | 2 | | 2 | | 1 | | | | | | | |
| Dilleniaceae | *Hibbertia bracteata* | None | | | | | | | | | | | | | | | | | 0.5 | 20 |
| Droseraceae | *Drosera binata* | Forked Sundew | | | | | | | | | | | | | | | | | | |
| Droseraceae | *Drosera auriculata* | None | | | | | | | | | 0.2 | 1000 | | | | | | | | |
| Droseraceae | *Drosera spatulata* | None | | | | | 0.1 | 5 | | | | | | | | | | | | |
| Elaeocarpaceae | *Elaeocarpus reticulatus* | Blueberry Ash | 0.1 | 5 | | | | | | | | | | | | | | | 5 | 5 |
| Ericaceae | *Epacris microphylla* | Coral Heath | | | | | 2 | 50 | 0.3 | 50 | 1 | | 1 | | 0.5 | 500 | | | | |
| Ericaceae | *Brachyloma daphnoides* | Daphne Heath | | | 0.5 | 20 | 0.1 | 2 | | | 0.1 | 3 | 0.1 | 50 | | | | | | |
| Ericaceae | *Leucopogon lanceolatus* | None | 0.1 | 7 | | | 0.1 | 2 | | | | | | | | | | | 0.5 | 20 |
| Ericaceae | *Monotoca scoparia* | None | | | 0.1 | 2 | | | | | | | | | 1 | | | | | |
| Ericaceae | *Monotoca* spp. | None | | | | | | | | | 1 | | | | | | | | | |
| Ericaceae | *Epacris pulchella* | Wallum Heath | | | | | 0.1 | 5 | 0.5 | 50 | 1 | | 0.5 | 100 | | | | | | |
| Euphorbiaceae | *Amperea xiphoclada* | None | | | 0.1 | 3 | 0.1 | 1 | | | 1 | | | | | | | | | |
| Fabaceae (Faboideae) | *Indigofera australis* | Australian Indigo | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Dillwynia sericea* | Egg and Bacon Peas, Parrot Peas | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Hardenbergia violacea* | False Sarsaparilla | 0.1 | 10 | | | | | | | | | | | | | | | 0.1 | 5 |
| Fabaceae (Faboideae) | *Daviesia ulicifolia* | Gorse Bitter Pea | | | 0.5 | 10 | 0.2 | 2 | | | | | 0.1 | 1 | | | | | | |
| Fabaceae (Faboideae) | *Mirbelia rubiifolia* | Heathy Mirbelia | | | | | 0.5 | 10 | 0.1 | 2 | 0.1 | 5 | 0.1 | 3 | | | | | | |
| Fabaceae (Faboideae) | *Dillwynia retorta* | None | | | 0.1 | 5 | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Lotus* spp. | None | | | | | | | | | | | | | | | 0.2 | 10 | | |
| Fabaceae (Faboideae) | *Platylobium formosum* | None | | | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.10 | | B2L.11 | | B2L.12 | | B2L.13 | | B2L.14 | | B2L.15 | | B2L.16 | | B2L.17 | | B2L.18 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Cyperaceae | *Eleocharis sphacelata* | Tall Spike Rush | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Lepidosperma laterale* | Variable Sword-sedge | 0.1 | 1 | | | | | | | | | | | | | | | | |
| Dennstaedtiaceae | *Pteridium esculentum* | Bracken | | | | | | | | | | | 0.1 | 5 | 0.5 | 30 | | | | |
| Dilleniaceae | *Hibbertia bracteata* | None | | | | | | | | | | | | | | | | | | |
| Droseraceae | *Drosera binata* | Forked Sundew | | | | | | | | | | | 0.1 | 20 | | | | | | |
| Droseraceae | *Drosera auriculata* | None | 0.1 | 10 | | | | | | | | | 0.1 | 10 | | | | | | |
| Droseraceae | *Drosera spatulata* | None | | | | | | | | | | | | | | | | | | |
| Elaeocarpaceae | *Elaeocarpus reticulatus* | Blueberry Ash | | | | | | | | | | | | | | | | | | |
| Ericaceae | *Epacris microphylla* | Coral Heath | 0.1 | 20 | | | | | | | | | 0.1 | 5 | | | 0.5 | 30 | | |
| Ericaceae | *Brachyloma daphnoides* | Daphne Heath | | | | | | | | | | | | | | | | | | |
| Ericaceae | *Leucopogon lanceolatus* | None | 1 | 20 | | | | | | | | | | | | | 10 | 30 | | |
| Ericaceae | *Monotoca scoparia* | None | | | | | | | | | | | 0.1 | 1 | | | | | | |
| Ericaceae | *Monotoca* spp. | None | | | | | | | | | | | | | | | | | | |
| Ericaceae | *Epacris pulchella* | Wallum Heath | 5 | 500 | | | | | | | | | | | | | | | | |
| Euphorbiaceae | *Amperea xiphoclada* | None | | | | | | | | | | | | | | | 0.1 | 2 | | |
| Fabaceae (Faboideae) | *Indigofera australis* | Australian Indigo | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Dillwynia sericea* | Egg and Bacon Peas, Par | | | | | | | | | | | | | | | 0.1 | 1 | | |
| Fabaceae (Faboideae) | *Hardenbergia violacea* | False Sarsaparilla | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Daviesia ulicifolia* | Gorse Bitter Pea | 0.2 | 10 | 0.1 | 1 | | | | | | | 0.1 | 1 | | | 0.5 | 20 | | |
| Fabaceae (Faboideae) | *Mirbelia rubiifolia* | Heathy Mirbelia | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Dillwynia retorta* | None | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Lotus* spp. | None | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Platylobium formosum* | None | 0.3 | 10 | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.19 | | B2L.20 | | B2L.21 | | B2L.22 | | B2L.23 | | B2L.24 | | B2L.25 | | B2L.26 | | B2L.27 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Cyperaceae | *Eleocharis sphacelata* | Tall Spike Rush | | | | | | | | | | | | | | | 5 | 50 | | |
| Cyperaceae | *Lepidosperma laterale* | Variable Sword-sedge | | | | | 0.5 | 10 | 0.1 | 5 | | | | | | | | | | |
| Dennstaedtiaceae | *Pteridium esculentum* | Bracken | | | | | 2 | 20 | | | | | 0.1 | 2 | | | | | | |
| Dilleniaceae | *Hibbertia bracteata* | None | | | | | 2 | 20 | | | | | | | | | | | | |
| Droseraceae | *Drosera binata* | Forked Sundew | | | | | | | | | | | | | | | | | | |
| Droseraceae | *Drosera auriculata* | None | 0.1 | 5 | 0.1 | 5 | | | 0.1 | 10 | | | | | | | | | | |
| Droseraceae | *Drosera spatulata* | None | | | | | | | | | | | | | | | | | | |
| Elaeocarpaceae | *Elaeocarpus reticulatus* | Blueberry Ash | | | | | 2 | 5 | | | | | 1 | 2 | | | | | | |
| Ericaceae | *Epacris microphylla* | Coral Heath | 2 | 100 | | | | | | | | | | | | | | | | |
| Ericaceae | *Brachyloma daphnoides* | Daphne Heath | | | | | | | | | | | | | | | | | | |
| Ericaceae | *Leucopogon lanceolatus* | None | 0.1 | 1 | 0.5 | 5 | 1 | 20 | 2 | 20 | | | 2 | 20 | | | | | | |
| Ericaceae | *Monotoca scoparia* | None | | | | | | | | | 0.1 | 1 | 0.1 | 5 | | | | | | |
| Ericaceae | *Monotoca* spp. | None | | | | | | | | | | | | | | | | | | |
| Ericaceae | *Epacris pulchella* | Wallum Heath | | | 0.5 | 10 | | | 1 | 100 | 0.1 | 10 | | | | | | | | |
| Euphorbiaceae | *Amperea xiphoclada* | None | | | | | | | | | 0.1 | 1 | | | | | | | | |
| Fabaceae (Faboideae) | *Indigofera australis* | Australian Indigo | | | | | | | | | | | | | 0.1 | 5 | | | | |
| Fabaceae (Faboideae) | *Dillwynia sericea* | Egg and Bacon Peas, Par | | | 0.1 | 1 | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Hardenbergia violacea* | False Sarsaparilla | | | | | 0.2 | 20 | | | | | 1 | 20 | | | | | | |
| Fabaceae (Faboideae) | *Daviesia ulicifolia* | Gorse Bitter Pea | | | | | | | 0.2 | 10 | | | | | | | | | | |
| Fabaceae (Faboideae) | *Mirbelia rubiifolia* | Heathy Mirbelia | 10 | 100 | | | | | 0.1 | 1 | | | | | | | | | | |
| Fabaceae (Faboideae) | *Dillwynia retorta* | None | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Lotus* spp. | None | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Platylobium formosum* | None | | | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.28 | | B2L.29 | | B2L.30 | | B2L.31 | | B2L.32 | | B2L.33 | | B2L.34 | | B2L.35 | | B2L.36 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Cyperaceae | *Eleocharis sphacelata* | Tall Spike Rush | | | | | | | | | | | | | 35 | 200 | | | | |
| Cyperaceae | *Lepidosperma laterale* | Variable Sword-sedge | | | | | | | | | | | | | 0.1 | 5 | | | | |
| Dennstaedtiaceae | *Pteridium esculentum* | Bracken | | | | | 1 | 70 | 5 | 50 | | | 0.2 | 20 | | | | | | |
| Dilleniaceae | *Hibbertia bracteata* | None | | | | | | | | | | | | | | | | | | |
| Droseraceae | *Drosera binata* | Forked Sundew | | | | | | | | | | | | | | | | | | |
| Droseraceae | *Drosera auriculata* | None | | | | | | | | | | | | | | | | | | |
| Droseraceae | *Drosera spatulata* | None | | | | | | | | | | | | | | | | | | |
| Elaeocarpaceae | *Elaeocarpus reticulatus* | Blueberry Ash | | | | | | | | | | | | | | | | | | |
| Ericaceae | *Epacris microphylla* | Coral Heath | | | | | | | | | | | | | | | | | | |
| Ericaceae | *Brachyloma daphnoides* | Daphne Heath | | | | | | | | | | | 0.1 | 4 | | | | | | |
| Ericaceae | *Leucopogon lanceolatus* | None | | | | | | | | | | | | | | | | | | |
| Ericaceae | *Monotoca scoparia* | None | | | | | | | | | | | | | | | | | | |
| Ericaceae | *Monotoca* spp. | None | | | | | | | | | | | | | | | | | | |
| Ericaceae | *Epacris pulchella* | Wallum Heath | | | | | | | | | | | | | 0.1 | 5 | | | | |
| Euphorbiaceae | *Amperea xiphoclada* | None | | | | | | | | | | | | | 0.1 | 1 | | | | |
| Fabaceae (Faboideae) | *Indigofera australis* | Australian Indigo | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Dillwynia sericea* | Egg and Bacon Peas, Par | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Hardenbergia violacea* | False Sarsaparilla | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Daviesia ulicifolia* | Gorse Bitter Pea | | | | | | | | | | | 0.2 | 7 | | | | | | |
| Fabaceae (Faboideae) | *Mirbelia rubiifolia* | Heathy Mirbelia | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Dillwynia retorta* | None | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Lotus* spp. | None | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Platylobium formosum* | None | | | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.01 | | B2L.02 | | B2L.03 | | B2L.04 | | B2L.05 | | B2L.06 | | B2L.07 | | B2L.08 | | B2L.09 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Fabaceae (Faboideae) | *Pultenaea scabra* | None | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Sphaerolobium minus* | None | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Dillwynia phylicoides* | Parrot-pea | | | | | | | 1 | | | | 0.5 | 10 | | | | | | |
| Fabaceae (Faboideae) | *Gompholobium pinnatum* | Pinnate Wedge Pea | | | | | | | 10 | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Podolobium ilicifolium* | Prickly Shaggy Pea | 0.1 | 1 | | | | | | | | | | | | | | | 0.1 | 1 |
| Fabaceae (Faboideae) | *Bossiaea ensata* | Sword Bossiaea | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Glycine clandestina* | Twining glycine | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Bossiaea heterophylla* | Variable Bossiaea | | | | | | | 0.2 | 4 | 0.1 | 3 | | | | | | | | |
| Fabaceae (Faboideae) | *Glycine tabacina* | Variable Glycine | | | | | | | | | | | | | | | | | 0.1 | 3 |
| Fabaceae (Mimosoideae) | *Acacia melanoxylon* | Blackwood | | | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia buxifolia* | Box-leaved Wattle | | | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia binervia* | Coast Myall | | | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia pycnantha* | Golden Wattle | 5 | 10 | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia brownii* | Heath Wattle | | | 0.1 | 1 | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia implexa* | Hickory Wattle | 0.5 | 1 | | | | | | | | | | | | | | | 0.2 | 5 |
| Fabaceae (Mimosoideae) | *Acacia longifolia* | None | | | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.10 | | B2L.11 | | B2L.12 | | B2L.13 | | B2L.14 | | B2L.15 | | B2L.16 | | B2L.17 | | B2L.18 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Fabaceae (Faboideae) | *Pultenaea scabra* | None | | | 2 | 8 | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Sphaerolobium minus* | None | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Dillwynia phylicoides* | Parrot-pea | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Gompholobium pinnatum* | Pinnate Wedge Pea | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Podolobium ilicifolium* | Prickly Shaggy Pea | | | | | | | | | | | 0.1 | 1 | | | 0.1 | 5 | | |
| Fabaceae (Faboideae) | *Bossiaea ensata* | Sword Bossiaea | | | | | | | | | | | 0.1 | 10 | | | | | | |
| Fabaceae (Faboideae) | *Glycine clandestina* | Twining glycine | | | 0.1 | 1 | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Bossiaea heterophylla* | Variable Bossiaea | 0.1 | 2 | | | | | | | | | 0.1 | 5 | | | | | 0.1 | 1 |
| Fabaceae (Faboideae) | *Glycine tabacina* | Variable Glycine | | | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia melanoxylon* | Blackwood | | | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia buxifolia* | Box-leaved Wattle | | | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia binervia* | Coast Myall | | | | | | | | | | | | | | | 0.5 | 10 | | |
| Fabaceae (Mimosoideae) | *Acacia pycnantha* | Golden Wattle | | | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia brownii* | Heath Wattle | | | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia implexa* | Hickory Wattle | | | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia longifolia* | None | | | | | | | | | | | | | 0.2 | 10 | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.19 | | B2L.20 | | B2L.21 | | B2L.22 | | B2L.23 | | B2L.24 | | B2L.25 | | B2L.26 | | B2L.27 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Fabaceae (Faboideae) | *Pultenaea scabra* | None | | | | | | | | | 0.1 | 10 | | | | | | | | |
| Fabaceae (Faboideae) | *Sphaerolobium minus* | None | 0.1 | 1 | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Dillwynia phylicoides* | Parrot-pea | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Gompholobium pinnatum* | Pinnate Wedge Pea | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Podolobium ilicifolium* | Prickly Shaggy Pea | | | | | | | 0.1 | 10 | | | 0.1 | 3 | | | | | | |
| Fabaceae (Faboideae) | *Bossiaea ensata* | Sword Bossiaea | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Glycine clandestina* | Twining glycine | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Bossiaea heterophylla* | Variable Bossiaea | | | | | | | 0.1 | 10 | | | | | | | | | | |
| Fabaceae (Faboideae) | *Glycine tabacina* | Variable Glycine | | | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia melanoxylon* | Blackwood | | | | | 5 | 10 | | | | | 1 | 2 | 7 | 1 | | | 5 | 9 |
| Fabaceae (Mimosoideae) | *Acacia buxifolia* | Box-leaved Wattle | | | | | | | | | | | 1 | 20 | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia binervia* | Coast Myall | 0.5 | 3 | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia pycnantha* | Golden Wattle | | | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia brownii* | Heath Wattle | | | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia implexa* | Hickory Wattle | | | | | 0.2 | 2 | | | | | 10 | 20 | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia longifolia* | None | | | | | | | | | | | 0.1 | 2 | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.28 | | B2L.29 | | B2L.30 | | B2L.31 | | B2L.32 | | B2L.33 | | B2L.34 | | B2L.35 | | B2L.36 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Fabaceae (Faboideae) | *Pultenaea scabra* | None | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Sphaerolobium minus* | None | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Dillwynia phylicoides* | Parrot-pea | | | | | | | | | | | 0.5 | 5 | | | | | | |
| Fabaceae (Faboideae) | *Gompholobium pinnatum* | Pinnate Wedge Pea | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Podolobium ilicifolium* | Prickly Shaggy Pea | | | | | 0.1 | 1 | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Bossiaea ensata* | Sword Bossiaea | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Glycine clandestina* | Twining glycine | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Bossiaea heterophylla* | Variable Bossiaea | | | | | | | | | | | 0.1 | 3 | | | | | | |
| Fabaceae (Faboideae) | *Glycine tabacina* | Variable Glycine | | | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia melanoxylon* | Blackwood | | | 1 | 1 | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia buxifolia* | Box-leaved Wattle | | | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia binervia* | Coast Myall | | | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia pycnantha* | Golden Wattle | | | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia brownii* | Heath Wattle | | | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia implexa* | Hickory Wattle | 5 | 10 | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia longifolia* | None | | | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.01 | | B2L.02 | | B2L.03 | | B2L.04 | | B2L.05 | | B2L.06 | | B2L.07 | | B2L.08 | | B2L.09 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Fabaceae (Mimosoideae) | *Acacia obtusifolia* | None | | | | | | | 0.2 | 1 | | | 7 | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia ptychoclada* | None | | | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia ulicifolia* | Prickly Moses | | | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia dealbata* | Silver Wattle | | | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia terminalis* | Sunshine Wattle | | | 3 | 40 | 0.1 | 1 | 3 | | 0.1 | 10 | 0.1 | 10 | 0.1 | 10 | | | | |
| Fabaceae (Mimosoideae) | *Acacia binervata* | Two-veined Hickory | | | | | | | | | | | | | | | | | | |
| Geraniaceae | *Geranium solanderi* | Native Geranium | 0.5 | 50 | | | | | | | | | | | | | 0.1 | 10 | 0.1 | 10 |
| Gleicheniaceae | *Gleichenia dicarpa* | Pouched Coral Fern | | | | | | | | | | | | | | | | | | |
| Goodeniaceae | *Goodenia hederacea* | Ivy Goodenia | | | | | | | | | | | | | | | | | | |
| Goodeniaceae | *Dampiera stricta* | None | | | | | 0.5 | 30 | 0.1 | 3 | | | | | 0.1 | 5 | | | | |
| Goodeniaceae | *Goodenia bellidifolia* | None | | | | | | | 0.5 | 200 | | | 0.1 | 50 | 0.3 | 50 | | | | |
| Goodeniaceae | *Goodenia bellidifolia* subsp. *argentea* | None | | | | | | | | | 0.2 | 100 | | | | | | | | |
| Goodeniaceae | *Scaevola ramosissima* | Purple Fan-flower | | | | | | | 0.1 | 1 | | | | | | | | | | |
| Haloragaceae | *Gonocarpus teucrioides* | Germander Raspwort | 0.1 | 5 | | | | | | | | | | | | | | | | |
| Haloragaceae | *Gonocarpus micranthus* | None | | | | | | | | | | | | | | | | | | |
| Haloragaceae | *Gonocarpus micranthus* subsp. *micranthus* | None | | | | | | | | | | | | | | | | | | |
| Haloragaceae | *Gonocarpus tetragynus* | Poverty Raspwort | | | | | | | 0.2 | 10 | 0.3 | 100 | 0.1 | 20 | 0.1 | 100 | | | 0.1 | 10 |
| Haloragaceae | *Haloragis heterophylla* | Variable Raspwort | | | | | | | | | | | | | | | | | | |
| Iridaceae | *Patersonia glabrata* | Leafy Purple-flag | | | | | | | 0.2 | 10 | | | | | | | | | | |
| Iridaceae | *Patersonia sericea* | Silky Purple-Flag | | | 0.1 | 5 | | | | | | | 0.1 | 10 | 0.1 | 50 | | | | |
| Juncaceae | *Juncus* spp. | A Rush | | | | | | | | | | | | | | | | | | |
| Juncaceae | *Juncus subsecundus* | Finger Rush | | | | | | | | | | | | | | | 3 | 30 | | |
| Juncaceae | *Juncus planifolius* | None | | | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.10 | | B2L.11 | | B2L.12 | | B2L.13 | | B2L.14 | | B2L.15 | | B2L.16 | | B2L.17 | | B2L.18 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Fabaceae (Mimosoideae) | *Acacia obtusifolia* | None | | | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia ptychoclada* | None | 0.1 | 1 | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia ulicifolia* | Prickly Moses | | | | | | | | | | | 0.1 | 2 | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia dealbata* | Silver Wattle | | | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia terminalis* | Sunshine Wattle | 0.1 | 10 | 0.1 | 5 | | | | | | | 0.1 | 10 | 0.1 | 1 | 0.5 | 10 | | |
| Fabaceae (Mimosoideae) | *Acacia binervata* | Two-veined Hickory | | | | | | | | | | | | | | | | | | |
| Geraniaceae | *Geranium solanderi* | Native Geranium | | | | | | | | | | | 0.3 | 20 | 0.1 | 30 | | | 0.1 | 20 |
| Gleicheniaceae | *Gleichenia dicarpa* | Pouched Coral Fern | | | | | | | | | | | 5 | 80 | | | | | | |
| Goodeniaceae | *Goodenia hederacea* | Ivy Goodenia | | | | | | | | | | | | | | | 1 | 20 | | |
| Goodeniaceae | *Dampiera stricta* | None | 0.1 | 2 | | | | | | | | | | | | | | | | |
| Goodeniaceae | *Goodenia bellidifolia* | None | 0.1 | 20 | | | | | | | | | 0.1 | 20 | | | | | | |
| Goodeniaceae | *Goodenia bellidifolia* subsp. *argentea* | None | | | | | | | | | | | | | | | | | | |
| Goodeniaceae | *Scaevola ramosissima* | Purple Fan-flower | | | | | | | | | | | | | | | | | | |
| Haloragaceae | *Gonocarpus teucrioides* | Germander Raspwort | | | | | | | | | | | | | | | | | | |
| Haloragaceae | *Gonocarpus micranthus* | None | | | | | | | | | | | 0.1 | 1 | | | | | | |
| Haloragaceae | *Gonocarpus micranthus* subsp. *micranthus* | None | | | | | | | 0.2 | 100 | | | | | | | | | | |
| Haloragaceae | *Gonocarpus tetragynus* | Poverty Raspwort | 0.1 | 20 | 0.1 | 1 | 0.1 | 1 | | | | | 0.3 | 50 | 0.1 | 1 | 0.5 | 30 | 1 | 200 |
| Haloragaceae | *Haloragis heterophylla* | Variable Raspwort | | | | | | | | | | | | | | | | | | |
| Iridaceae | *Patersonia glabrata* | Leafy Purple-flag | | | | | | | | | | | | | | | | | | |
| Iridaceae | *Patersonia sericea* | Silky Purple-Flag | | | | | | | | | | | 0.1 | 5 | | | | | | |
| Juncaceae | *Juncus* spp. | A Rush | | | | | 0.1 | 10 | | | | | | | | | | | | |
| Juncaceae | *Juncus subsecundus* | Finger Rush | | | | | | | 0.1 | 20 | | | | | | | | | | |
| Juncaceae | *Juncus planifolius* | None | 0.1 | 2 | | | | | 0.2 | 50 | | | 0.1 | 2 | | | | | 0.1 | 10 |

## Recorded flora

| Family | Scientific name | Common name | B2L.19 | | B2L.20 | | B2L.21 | | B2L.22 | | B2L.23 | | B2L.24 | | B2L.25 | | B2L.26 | | B2L.27 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Fabaceae (Mimosoideae) | *Acacia obtusifolia* | None | | | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia ptychoclada* | None | | | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia ulicifolia* | Prickly Moses | | | | | | | | | 0.1 | 2 | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia dealbata* | Silver Wattle | | | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia terminalis* | Sunshine Wattle | 0.1 | 1 | 0.5 | 10 | | | 5 | 30 | 0.1 | 20 | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia binervata* | Two-veined Hickory | | | | | | | | | | | | | | | | | | |
| Geraniaceae | *Geranium solanderi* | Native Geranium | | | | | 0.5 | 50 | | | 0.3 | 100 | | | 0.5 | 80 | | | 0.1 | 9 |
| Gleicheniaceae | *Gleichenia dicarpa* | Pouched Coral Fern | | | | | | | | | | | | | | | | | | |
| Goodeniaceae | *Goodenia hederacea* | Ivy Goodenia | | | | | | | | | | | | | | | | | | |
| Goodeniaceae | *Dampiera stricta* | None | 2 | 50 | 0.1 | 10 | | | 0.1 | 1 | | | | | | | | | | |
| Goodeniaceae | *Goodenia bellidifolia* | None | 0.5 | 50 | 0.1 | 10 | | | 0.1 | 20 | | | 0.1 | 30 | | | | | | |
| Goodeniaceae | *Goodenia bellidifolia* subsp. *argentea* | None | | | | | | | | | | | | | | | | | | |
| Goodeniaceae | *Scaevola ramosissima* | Purple Fan-flower | | | | | | | | | | | | | | | | | | |
| Haloragaceae | *Gonocarpus teucrioides* | Germander Raspwort | | | | | | | | | | | | | | | | | | |
| Haloragaceae | *Gonocarpus micranthus* | None | | | | | | | | | | | | | | | | | | |
| Haloragaceae | *Gonocarpus micranthus* subsp. *micranthus* | None | | | | | | | | | | | | | | | 0.1 | 20 | | |
| Haloragaceae | *Gonocarpus tetragynus* | Poverty Raspwort | 0.1 | 1 | 0.1 | 5 | 0.1 | 1 | 0.1 | 20 | 0.5 | 300 | 0.2 | 100 | | | 0.1 | 5 | | |
| Haloragaceae | *Haloragis heterophylla* | Variable Raspwort | | | | | | | | | | | | | | | | | | |
| Iridaceae | *Patersonia glabrata* | Leafy Purple-flag | | | | | | | | | | | | | | | | | | |
| Iridaceae | *Patersonia sericea* | Silky Purple-Flag | 0.1 | 1 | 0.1 | 5 | | | 0.1 | 1 | 0.1 | 20 | | | | | | | | |
| Juncaceae | *Juncus* spp. | A Rush | | | | | | | | | | | | | | | | | | |
| Juncaceae | *Juncus subsecundus* | Finger Rush | | | | | | | | | | | | | 0.1 | 5 | | | | |
| Juncaceae | *Juncus planifolius* | None | | | | | | | | | | | | | | | 2 | 100 | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.28 | | B2L.29 | | B2L.30 | | B2L.31 | | B2L.32 | | B2L.33 | | B2L.34 | | B2L.35 | | B2L.36 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Fabaceae (Mimosoideae) | *Acacia obtusifolia* | None | | | | | | | | | | | 0.1 | 1 | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia ptychoclada* | None | | | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia ulicifolia* | Prickly Moses | | | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia dealbata* | Silver Wattle | 1 | 20 | | | | | | | | | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia terminalis* | Sunshine Wattle | | | | | | | | | | | 0.2 | 4 | 0.1 | 2 | | | | |
| Fabaceae (Mimosoideae) | *Acacia binervata* | Two-veined Hickory | | | | | 0.2 | 2 | | | | | | | | | | | | |
| Geraniaceae | *Geranium solanderi* | Native Geranium | | | 0.1 | 20 | | | | | | | | | 0.1 | 2 | | | 0.1 | 5 |
| Gleicheniaceae | *Gleichenia dicarpa* | Pouched Coral Fern | | | | | | | | | | | | | | | | | | |
| Goodeniaceae | *Goodenia hederacea* | Ivy Goodenia | | | | | 1 | 300 | | | | | | | | | | | | |
| Goodeniaceae | *Dampiera stricta* | None | | | | | | | | | | | | | | | | | | |
| Goodeniaceae | *Goodenia bellidifolia* | None | 0.1 | 2 | | | | | | | | | 0.2 | 500 | | | | | | |
| Goodeniaceae | *Goodenia bellidifolia* subsp. *argentea* | None | | | | | | | | | | | | | | | | | | |
| Goodeniaceae | *Scaevola ramosissima* | Purple Fan-flower | | | | | | | | | | | | | | | | | | |
| Haloragaceae | *Gonocarpus teucrioides* | Germander Raspwort | | | | | | | | | | | | | | | | | | |
| Haloragaceae | *Gonocarpus micranthus* | None | | | | | | | | | | | | | | | | | | |
| Haloragaceae | *Gonocarpus micranthus* subsp. *micranthus* | None | | | | | | | | | | | | | | | | | 0.1 | 1 |
| Haloragaceae | *Gonocarpus tetragynus* | Poverty Raspwort | 0.1 | 10 | | | | | | | | | | | 0.1 | 5 | 0.1 | 5 | 0.3 | 50 |
| Haloragaceae | *Haloragis heterophylla* | Variable Raspwort | | | 0.1 | 20 | | | | | | | | | | | | | 0.1 | 30 |
| Iridaceae | *Patersonia glabrata* | Leafy Purple-flag | | | | | | | | | | | | | | | | | | |
| Iridaceae | *Patersonia sericea* | Silky Purple-Flag | | | | | | | | | | | 0.2 | 10 | 0.1 | 2 | | | | |
| Juncaceae | *Juncus* spp. | A Rush | | | | | | | | | | | | | | | | | | |
| Juncaceae | *Juncus subsecundus* | Finger Rush | | | 0.1 | 20 | | | | | | | | | | | | | | |
| Juncaceae | *Juncus planifolius* | None | | | 0.1 | 20 | | | | | | | | | 0.1 | 1 | 2 | 20 | 0.2 | 20 |

## Recorded flora

| Family | Scientific name | Common name | B2L.01 | | B2L.02 | | B2L.03 | | B2L.04 | | B2L.05 | | B2L.06 | | B2L.07 | | B2L.08 | | B2L.09 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Juncaceae | *Juncus polyanthemus* | None | | | | | | | | | | | | | | | | | | |
| Juncaceae | *Juncus prismatocarpus* | None | | | | | | | | | | | | | | | | | | |
| Juncaceae | *Juncus sarophorus* | None | | | | | | | | | | | | | | | | | | |
| Juncaceae | *Juncus usitatus* | None | | | | | | | | | | | | | | | | | | |
| Juncaceae | *Luzula modesta* | None | | | | | | | | | | | | | | | | | | |
| Juncaceae | *Juncus australis* | Rush | | | | | | | | | | | | | | | | | | |
| Lauraceae | *Cassytha pubescens* | Downy Dodder-laurel | | | | | | | | | | | | | | | | | | |
| Lauraceae | *Cassytha glabella* | None | | | | | | | 0.1 | 10 | 0.1 | 20 | | | 0.1 | 20 | | | | |
| Lindsaeaceae | *Lindsaea linearis* | Screw Fern | | | | | | | | | 0.2 | 500 | | | 0.1 | 2000 | | | | |
| Loganiaceae | *Mitrasacme polymorpha* | None | | | | | | | | | 0.2 | 50 | 0.1 | 10 | | | | | | |
| Lomandraceae | *Lomandra multiflora* subsp. *multiflora* | Many-flowered Mat-rush | 0.5 | 3 | | | | | | | | | | | | | | | | |
| Lomandraceae | *Lomandra cylindrica* | None | | | | | | | 0.5 | 100 | | | | | | | | | | |
| Lomandraceae | *Lomandra obliqua* | None | | | 0.1 | 1 | | | | | | | | | 0.1 | 50 | | | | |
| Lomandraceae | *Lomandra glauca* | Pale Mat-rush | 0.1 | 3 | 0.2 | 20 | 0.1 | 2 | 0.5 | 8 | 0.1 | 10 | 0.1 | 20 | 0.1 | 20 | | | | |
| Lomandraceae | *Lomandra longifolia* | Spiny-headed Mat-rush | 0.5 | 20 | | | | | 0.1 | 10 | 0.1 | 5 | | | | | | | | |
| Lomandraceae | *Lomandra filiformis* | Wattle Matt-rush | 0.1 | 3 | | | | | 0.3 | 20 | | | | | | | | | | |
| Luzuriagaceae | *Geitonoplesium cymosum* | Scrambling Lily | | | | | | | | | | | | | | | | | | |
| Lythraceae | *Lythrum hyssopifolia* | Hyssop Loosestrife | | | | | | | | | | | | | | | | | | |
| Malvaceae | *Malva* spp. | Mallow | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Eucalyptus blaxlandii* | Blaxland's Stringybark | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Eucalyptus oreades* | Blue Mountains Ash | | | | | | | | | 30 | | 10 | | | | | | | |
| Myrtaceae | *Eucalyptus stricta* | Blue Mountains Mallee Ash | | | | | | | | | | | | | 25 | | | | | |
| Myrtaceae | *Eucalyptus mannifera* | Brittle Gum | | | | | | | | | | | | | 5 | | | | | |
| Myrtaceae | *Eucalyptus haemastoma* | Broad-leaved Scribbly Gum | | | | | 10 | 50 | | | | | | | | | | | | |
| Myrtaceae | *Eucalyptus sclerophylla* | Hard-leaved Scribbly Gum | | | 5 | 1 | | | | | | | | | | | | | | |
| Myrtaceae | *Eucalyptus cypellocarpa* | Monkey Gum | 20 | 8 | | | | | | | | | | | | | | | 40 | 30 |
| Myrtaceae | *Eucalyptus radiata* | Narrow-leaved Peppermint | | | | | | | 1 | | | | | | | | | | | |
| Myrtaceae | *Eucalyptus sparsifolia* | Narrow-leaved Stringybarl | 5 | 3 | | | | | | | | | | | | | | | 15 | 10 |

## Recorded flora

| Family | Scientific name | Common name | B2L.10 | | B2L.11 | | B2L.12 | | B2L.13 | | B2L.14 | | B2L.15 | | B2L.16 | | B2L.17 | | B2L.18 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Juncaceae | *Juncus polyanthemus* | None | | | | | 0.1 | 10 | | | | | 10 | 200 | | | | | 25 | 500 |
| Juncaceae | *Juncus prismatocarpus* | None | | | | | | | 0.5 | 50 | | | | | | | | | | |
| Juncaceae | *Juncus sarophorus* | None | | | | | | | 0.2 | 30 | | | | | | | | | | |
| Juncaceae | *Juncus usitatus* | None | 0.1 | 10 | 0.1 | 20 | 0.1 | 20 | 15 | 100 | 0.1 | 5 | 1 | 30 | | | | | 1 | 200 |
| Juncaceae | *Luzula modesta* | None | | | | | | | 0.1 | 6 | | | | | | | | | | |
| Juncaceae | *Juncus australis* | Rush | | | | | | | 5 | 20 | | | | | | | | | | |
| Lauraceae | *Cassytha pubescens* | Downy Dodder-laurel | 0.1 | 5 | | | | | | | | | | | | | | | | |
| Lauraceae | *Cassytha glabella* | None | | | | | | | | | | | | | | | | | | |
| Lindsaeaceae | *Lindsaea linearis* | Screw Fern | 0.1 | 1 | | | | | | | | | 0.1 | 10 | | | | | | |
| Loganiaceae | *Mitrasacme polymorpha* | None | | | | | | | | | | | | | | | | | 0.1 | 10 |
| Lomandraceae | *Lomandra multiflora* subsp. *multiflora* | Many-flowered Mat-rush | | | | | | | | | | | | | | | | | | |
| Lomandraceae | *Lomandra cylindrica* | None | | | | | | | | | | | | | | | | | | |
| Lomandraceae | *Lomandra obliqua* | None | | | | | | | | | | | 0.1 | 5 | 0.1 | 1 | | | | |
| Lomandraceae | *Lomandra glauca* | Pale Mat-rush | 0.1 | 10 | | | | | | | | | 0.1 | 10 | | | 0.1 | 2 | | |
| Lomandraceae | *Lomandra longifolia* | Spiny-headed Mat-rush | 2 | 20 | | | | | | | | | 1 | 20 | 0.5 | 2 | | | | |
| Lomandraceae | *Lomandra filiformis* | Wattle Matt-rush | | | | | | | | | | | | | | | | | | |
| Luzuriagaceae | *Geitonoplesium cymosum* | Scrambling Lily | | | | | | | | | | | | | | | | | | |
| Lythraceae | *Lythrum hyssopifolia* | Hyssop Loosestrife | | | | | | | | | | | | | 0.1 | 10 | | | | |
| Malvaceae | *Malva* spp. | Mallow | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Eucalyptus blaxlandii* | Blaxland's Stringybark | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Eucalyptus oreades* | Blue Mountains Ash | | | | | | | | | | | | | | | 15 | 5 | | |
| Myrtaceae | *Eucalyptus stricta* | Blue Mountains Mallee As | 15 | 20 | | | | | | | | | | | | | | | | |
| Myrtaceae | *Eucalyptus mannifera* | Brittle Gum | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Eucalyptus haemastoma* | Broad-leaved Scribbly Gu | | | 15 | 8 | | | | | | | 5 | 2 | 15 | 10 | | | | |
| Myrtaceae | *Eucalyptus sclerophylla* | Hard-leaved Scribbly Gum | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Eucalyptus cypellocarpa* | Monkey Gum | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Eucalyptus radiata* | Narrow-leaved Peppermin | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Eucalyptus sparsifolia* | Narrow-leaved Stringybarl | | | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.19 | | B2L.20 | | B2L.21 | | B2L.22 | | B2L.23 | | B2L.24 | | B2L.25 | | B2L.26 | | B2L.27 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Juncaceae | *Juncus polyanthemus* | None | | | | | | | | | | | | | | | | | | |
| Juncaceae | *Juncus prismatocarpus* | None | | | | | | | | | | | | | | | 0.1 | 20 | | |
| Juncaceae | *Juncus sarophorus* | None | | | | | | | | | | | | | | | 0.3 | 50 | | |
| Juncaceae | *Juncus usitatus* | None | | | | | | | | | 0.1 | 10 | | | | | 15 | 500 | | |
| Juncaceae | *Luzula modesta* | None | | | | | | | | | | | | | | | | | | |
| Juncaceae | *Juncus australis* | Rush | | | | | | | | | | | | | | | | | | |
| Lauraceae | *Cassytha pubescens* | Downy Dodder-laurel | 0.5 | 10 | 0.5 | 10 | | | 0.1 | 10 | | | | | | | | | | |
| Lauraceae | *Cassytha glabella* | None | | | | | | | | | | | | | | | | | | |
| Lindsaeaceae | *Lindsaea linearis* | Screw Fern | 0.1 | 5 | 0.1 | 20 | | | 0.1 | 5 | 0.1 | 2 | | | | | | | | |
| Loganiaceae | *Mitrasacme polymorpha* | None | 0.1 | 10 | | | | | 0.1 | 10 | | | | | | | | | | |
| Lomandraceae | *Lomandra multiflora* subsp. *multiflora* | Many-flowered Mat-rush | | | | | | | | | | | 0.1 | 5 | | | | | | |
| Lomandraceae | *Lomandra cylindrica* | None | 0.1 | 3 | | | | | | | | | 0.1 | 5 | | | | | | |
| Lomandraceae | *Lomandra obliqua* | None | 0.1 | 2 | 0.5 | 40 | | | 0.1 | 10 | | | | | | | | | | |
| Lomandraceae | *Lomandra glauca* | Pale Mat-rush | 0.1 | 3 | | | 0.1 | 2 | 0.1 | 5 | | | 5 | 800 | | | | | | |
| Lomandraceae | *Lomandra longifolia* | Spiny-headed Mat-rush | | | 0.1 | 1 | 0.5 | 10 | | | 0.2 | 50 | 1 | 20 | | | | | | |
| Lomandraceae | *Lomandra filiformis* | Wattle Matt-rush | | | | | | | | | | | | | | | | | | |
| Luzuriagaceae | *Geitonoplesium cymosum* | Scrambling Lily | | | | | 0.1 | 2 | | | | | 0.1 | 2 | | | | | | |
| Lythraceae | *Lythrum hyssopifolia* | Hyssop Loosestrife | | | | | | | | | | | | | | | | | | |
| Malvaceae | *Malva* spp. | Mallow | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Eucalyptus blaxlandii* | Blaxland's Stringybark | | | | | | | | | | | | | 10 | 1 | | | | |
| Myrtaceae | *Eucalyptus oreades* | Blue Mountains Ash | 2 | 1 | | | | | | | 20 | 3 | | | | | | | | |
| Myrtaceae | *Eucalyptus stricta* | Blue Mountains Mallee As | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Eucalyptus mannifera* | Brittle Gum | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Eucalyptus haemastoma* | Broad-leaved Scribbly Gu | 30 | 6 | | | | | 15 | 60 | 2 | 1 | | | | | | | | |
| Myrtaceae | *Eucalyptus sclerophylla* | Hard-leaved Scribbly Gum | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Eucalyptus cypellocarpa* | Monkey Gum | | | | | 35 | 20 | | | | | 20 | 4 | 75 | 30 | | | 60 | 9 |
| Myrtaceae | *Eucalyptus radiata* | Narrow-leaved Peppermin | | | 10 | 2 | | | | | | | | | | | | | | |
| Myrtaceae | *Eucalyptus sparsifolia* | Narrow-leaved Stringybarl | | | | | 15 | 10 | | | | | 70 | 50 | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.28 | | B2L.29 | | B2L.30 | | B2L.31 | | B2L.32 | | B2L.33 | | B2L.34 | | B2L.35 | | B2L.36 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Juncaceae | *Juncus polyanthemus* | None | | | | | | | | | | | | | | | | | | |
| Juncaceae | *Juncus prismatocarpus* | None | | | 0.1 | 20 | | | | | | | | | | | 0.1 | 4 | | |
| Juncaceae | *Juncus sarophorus* | None | | | 0.2 | 20 | | | | | | | | | | | 0.3 | 40 | | |
| Juncaceae | *Juncus usitatus* | None | 0.1 | 2 | 0.3 | 20 | | | 0.1 | 40 | | | | | 1 | 100 | 10 | 100 | 0.1 | 10 |
| Juncaceae | *Luzula modesta* | None | | | | | | | | | | | | | | | | | | |
| Juncaceae | *Juncus australis* | Rush | | | 0.1 | 10 | | | | | | | | | | | 0.1 | 5 | | |
| Lauraceae | *Cassytha pubescens* | Downy Dodder-laurel | | | | | | | | | | | | | | | | | | |
| Lauraceae | *Cassytha glabella* | None | | | | | | | | | | | | | | | | | | |
| Lindsaeaceae | *Lindsaea linearis* | Screw Fern | | | | | | | | | | | | | | | | | | |
| Loganiaceae | *Mitrasacme polymorpha* | None | | | | | | | | | | | | | | | | | | |
| Lomandraceae | *Lomandra multiflora* subsp. *multiflora* | Many-flowered Mat-rush | | | | | | | | | | | | | | | | | | |
| Lomandraceae | *Lomandra cylindrica* | None | | | | | | | | | | | | | | | | | | |
| Lomandraceae | *Lomandra obliqua* | None | | | | | | | | | | | 0.2 | 500 | 0.1 | 1 | | | | |
| Lomandraceae | *Lomandra glauca* | Pale Mat-rush | 0.1 | 10 | | | | | | | | | 0.1 | 100 | | | | | | |
| Lomandraceae | *Lomandra longifolia* | Spiny-headed Mat-rush | 0.1 | 10 | | | | | | | | | 0.1 | 5 | 0.2 | 6 | | | | |
| Lomandraceae | *Lomandra filiformis* | Wattle Matt-rush | | | | | | | | | | | | | | | | | | |
| Luzuriagaceae | *Geitonoplesium cymosum* | Scrambling Lily | | | | | | | | | | | | | | | | | | |
| Lythraceae | *Lythrum hyssopifolia* | Hyssop Loosestrife | | | | | | | | | | | | | | | | | | |
| Malvaceae | *Malva* spp. | Mallow | | | | | | | | | 0.1 | 3 | | | | | | | | |
| Myrtaceae | *Eucalyptus blaxlandii* | Blaxland's Stringybark | | | | | | | | | 30 | 5 | | | | | | | | |
| Myrtaceae | *Eucalyptus oreades* | Blue Mountains Ash | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Eucalyptus stricta* | Blue Mountains Mallee As | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Eucalyptus mannifera* | Brittle Gum | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Eucalyptus haemastoma* | Broad-leaved Scribbly Gu | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Eucalyptus sclerophylla* | Hard-leaved Scribbly Gum | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Eucalyptus cypellocarpa* | Monkey Gum | 10 | 5 | | | | | 40 | 4 | | | | | | | | | | |
| Myrtaceae | *Eucalyptus radiata* | Narrow-leaved Peppermin | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Eucalyptus sparsifolia* | Narrow-leaved Stringybarl | 30 | 20 | | | 5 | 4 | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.01 | | B2L.02 | | B2L.03 | | B2L.04 | | B2L.05 | | B2L.06 | | B2L.07 | | B2L.08 | | B2L.09 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Myrtaceae | *Kunzea capitata* | None | | | | | | | | | | | | | 5 | | | | | |
| Myrtaceae | *Leptospermum arachnoides* | None | | | 10 | 20 | 15 | 50 | | | | | | | | | | | | |
| Myrtaceae | *Leptospermum obovatum* | None | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Leptospermum squarrosum* | None | | | | | 0.1 | 2 | | | | | | | | | | | | |
| Myrtaceae | *Leptospermum juniperinum* | Prickly Tea-tree | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Eucalyptus sieberi* | Silvertop Ash | | | 5 | 1 | | | 3 | | | | | | | | | | | |
| Myrtaceae | *Leptospermum trinervium* | Slender Tea-tree | | | | | | | 10 | | 55 | | 35 | | 1 | | | | | |
| Myrtaceae | *Eucalyptus piperita* | Sydney Peppermint | 2 | 3 | 30 | 10 | | | 40 | | 15 | | 35 | | 5 | | | | | |
| Myrtaceae | *Leptospermum polygalifolium* | Tantoon | | | 0.5 | 5 | 2 | 10 | | | | | 5 | | 40 | | | | 0.5 | 5 |
| Onagraceae | *Epilobium* spp. | None | | | | | | | | | | | | | | | | | | |
| Orchidaceae | *Acianthus pusillus* | Gnat Orchid | | | | | | | | | | | | | | | | | | |
| Orchidaceae | *Cryptostylis subulata* | Large Tongue Orchid | | | | | | | 0.1 | 2 | | | | | 0.1 | 3 | | | | |
| Orchidaceae | *Calochilus robertsonii* | Purplish Beard Orchid | | | | | | | | | | | | | | | | | | |
| Orchidaceae | *Thelymitra pauciflora* | Slender Sun Orchid | | | 0.1 | 5 | | | | | | | | | | | | | | |
| Orchidaceae | *Thelymitra carnea* | Tiny Sun Orchid | | | | | 0.1 | 1 | | | | | | | | | | | | |
| Orchidaceae | *Prasophyllum flavum* | Yellow Leek Orchid | | | | | | | | | | | | | | | | | | |
| Oxalidaceae | *Oxalis perennans* | None | 0.1 | 2 | | | | | | | | | | | | | | | | |
| Oxalidaceae | *Oxalis* spp. | None | | | | | | | | | | | | | | | 0.2 | 10 | | |
| Phormiaceae | *Dianella caerulea* | Blue Flax-lily | 0.5 | 10 | | | | | | | | | | | | | | | 0.1 | 5 |
| Phormiaceae | *Dianella longifolia* | Blueberry Lily | | | | | | | | | | | | | | | | | | |
| Phormiaceae | *Dianella revoluta* | Blueberry Lily | | | | | | | 0.2 | 5 | | | | | | | | | | |
| Phyllanthaceae | *Poranthera ericifolia* | None | | | | | | | 0.1 | 2 | | | | | | | | | | |
| Phyllanthaceae | *Poranthera microphylla* | Small Poranthera | 0.1 | 10 | 1 | 50 | | | 0.5 | 500 | | | 0.1 | 500 | 0.1 | 100 | | | | |
| Phyllanthaceae | *Phyllanthus hirtellus* | Thyme Spurge | | | | | | | 0.1 | 20 | 0.1 | 1 | 0.1 | 50 | 0.1 | 10 | | | | |
| Pittosporaceae | *Billardiera scandens* | Hairy Apple Berry | 0.1 | 5 | | | | | 0.2 | 7 | | | 0.2 | 10 | | | | | 0.1 | 4 |
| Pittosporaceae | *Bursaria spinosa* | Native Blackthorn | 0.5 | 3 | | | | | | | | | | | | | | | 0.1 | 1 |
| Plantaginaceae | *Plantago debilis* | Shade Plantain | | | | | | | | | | | | | | | | | | |
| Plantaginaceae | *Veronica plebeia* | Trailing Speedwell | 0.1 | 10 | | | | | | | | | | | | | | | 0.1 | 4 |
| Poaceae | *Austrostipa nodosa* | A Speargrass | | | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.10 | | B2L.11 | | B2L.12 | | B2L.13 | | B2L.14 | | B2L.15 | | B2L.16 | | B2L.17 | | B2L.18 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Myrtaceae | *Kunzea capitata* | None | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Leptospermum arachnoides* | None | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Leptospermum obovatum* | None | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Leptospermum squarrosum* | None | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Leptospermum juniperinum* | Prickly Tea-tree | | | 0.3 | 7 | | | | | | | 2 | 20 | | | | | | |
| Myrtaceae | *Eucalyptus sieberi* | Silvertop Ash | | | | | | | | | | | 15 | 4 | 10 | 1 | | | 2 | 1 |
| Myrtaceae | *Leptospermum trinervium* | Slender Tea-tree | | | | | | | | | | | | | | | 5 | 10 | | |
| Myrtaceae | *Eucalyptus piperita* | Sydney Peppermint | | | | | | | | | | | | | | | 60 | 20 | | |
| Myrtaceae | *Leptospermum polygalifolium* | Tantoon | 10 | 20 | | | | | | | | | 0.5 | 5 | | | 1 | 10 | 2 | 10 |
| Onagraceae | *Epilobium* spp. | None | | | | | | | | | | | | | | | | | 1 | 300 |
| Orchidaceae | *Acianthus pusillus* | Gnat Orchid | | | | | | | | | | | | | | | | | | |
| Orchidaceae | *Cryptostylis subulata* | Large Tongue Orchid | | | | | | | | | | | 0.1 | 5 | | | | | | |
| Orchidaceae | *Calochilus robertsonii* | Purplish Beard Orchid | | | | | | | | | | | | | | | | | | |
| Orchidaceae | *Thelymitra pauciflora* | Slender Sun Orchid | | | | | | | | | | | | | | | | | | |
| Orchidaceae | *Thelymitra carnea* | Tiny Sun Orchid | | | | | | | | | | | | | | | | | | |
| Orchidaceae | *Prasophyllum flavum* | Yellow Leek Orchid | | | | | | | | | | | | | | | | | | |
| Oxalidaceae | *Oxalis perennans* | None | | | 0.1 | 4 | 0.1 | 2 | | | | | | | | | 0.1 | 2 | 0.1 | 20 |
| Oxalidaceae | *Oxalis* spp. | None | | | | | | | | | | | | | | | | | | |
| Phormiaceae | *Dianella caerulea* | Blue Flax-lily | | | | | | | | | | | | | | | | | | |
| Phormiaceae | *Dianella longifolia* | Blueberry Lily | | | | | | | | | | | | | | | | | | |
| Phormiaceae | *Dianella revoluta* | Blueberry Lily | | | | | | | | | | | | | 0.5 | 30 | 0.1 | 5 | | |
| Phyllanthaceae | *Poranthera ericifolia* | None | 0.1 | 2 | | | | | | | | | 0.1 | 10 | | | 0.1 | 10 | | |
| Phyllanthaceae | *Poranthera microphylla* | Small Poranthera | 0.1 | 2 | | | | | | | | | 0.1 | 5 | 0.1 | 10 | 0.5 | 30 | | |
| Phyllanthaceae | *Phyllanthus hirtellus* | Thyme Spurge | | | | | | | | | | | | | | | | | | |
| Pittosporaceae | *Billardiera scandens* | Hairy Apple Berry | 0.1 | 2 | | | | | | | | | 0.1 | 5 | 0.1 | 5 | 0.5 | 20 | | |
| Pittosporaceae | *Bursaria spinosa* | Native Blackthorn | | | | | | | | | | | | | | | | | | |
| Plantaginaceae | *Plantago debilis* | Shade Plantain | | | | | | | | | | | | | | | | | | |
| Plantaginaceae | *Veronica plebeia* | Trailing Speedwell | | | | | | | | | | | | | 0.1 | 1 | 1 | 50 | | |
| Poaceae | *Austrostipa nodosa* | A Speargrass | | | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.19 | | B2L.20 | | B2L.21 | | B2L.22 | | B2L.23 | | B2L.24 | | B2L.25 | | B2L.26 | | B2L.27 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Myrtaceae | *Kunzea capitata* | None | 5 | 50 | | | | | | | | | | | | | | | | |
| Myrtaceae | *Leptospermum arachnoides* | None | 1 | 3 | 5 | 10 | | | 0.5 | 2 | | | | | | | | | | |
| Myrtaceae | *Leptospermum obovatum* | None | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Leptospermum squarrosum* | None | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Leptospermum juniperinum* | Prickly Tea-tree | | | | | | | | | 5 | 80 | | | | | | | | |
| Myrtaceae | *Eucalyptus sieberi* | Silvertop Ash | | | 10 | 2 | | | 45 | 200 | 15 | 2 | | | | | | | | |
| Myrtaceae | *Leptospermum trinervium* | Slender Tea-tree | 60 | 50 | 5 | 20 | | | 20 | 100 | | | | | | | | | | |
| Myrtaceae | *Eucalyptus piperita* | Sydney Peppermint | | | 50 | 50 | 5 | 2 | | | 10 | 1 | | | 6 | 1 | | | | |
| Myrtaceae | *Leptospermum polygalifolium* | Tantoon | 0.1 | 1 | | | | | 5 | 30 | 0.5 | 20 | | | | | | | | |
| Onagraceae | *Epilobium* spp. | None | | | | | | | | | | | | | | | | | | |
| Orchidaceae | *Acianthus pusillus* | Gnat Orchid | | | | | | | | | | | 0.1 | 30 | | | | | | |
| Orchidaceae | *Cryptostylis subulata* | Large Tongue Orchid | 0.1 | 3 | | | | | 0.1 | 10 | | | | | | | | | | |
| Orchidaceae | *Calochilus robertsonii* | Purplish Beard Orchid | | | | | | | | | | | | | | | | | | |
| Orchidaceae | *Thelymitra pauciflora* | Slender Sun Orchid | | | | | | | | | | | | | | | | | | |
| Orchidaceae | *Thelymitra carnea* | Tiny Sun Orchid | | | | | | | | | | | | | | | | | | |
| Orchidaceae | *Prasophyllum flavum* | Yellow Leek Orchid | | | | | | | | | | | | | | | | | | |
| Oxalidaceae | *Oxalis perennans* | None | | | | | | | | | | | | | | | | | | |
| Oxalidaceae | *Oxalis* spp. | None | | | | | | | | | | | | | 0.1 | 10 | | | | |
| Phormiaceae | *Dianella caerulea* | Blue Flax-lily | | | 0.2 | 10 | 0.5 | 20 | 0.1 | 10 | | | | | | | | | | |
| Phormiaceae | *Dianella longifolia* | Blueberry Lily | | | 0.1 | 1 | | | | | | | | | | | | | | |
| Phormiaceae | *Dianella revoluta* | Blueberry Lily | | | | | | | | | | | 0.1 | 5 | | | | | | |
| Phyllanthaceae | *Poranthera ericifolia* | None | 0.1 | 2 | | | | | 0.1 | 10 | | | | | | | | | | |
| Phyllanthaceae | *Poranthera microphylla* | Small Poranthera | | | | | 0.2 | 20 | 0.1 | 1 | | | 0.1 | 60 | | | | | | |
| Phyllanthaceae | *Phyllanthus hirtellus* | Thyme Spurge | | | | | | | | | | | | | | | | | | |
| Pittosporaceae | *Billardiera scandens* | Hairy Apple Berry | | | | | 0.3 | 20 | 0.1 | 5 | | | 0.2 | 50 | | | | | | |
| Pittosporaceae | *Bursaria spinosa* | Native Blackthorn | | | | | 0.2 | 10 | | | | | 0.2 | 5 | 0.1 | 1 | | | | |
| Plantaginaceae | *Plantago debilis* | Shade Plantain | | | | | | | | | | | | | 3 | 20 | | | | |
| Plantaginaceae | *Veronica plebeia* | Trailing Speedwell | | | | | | | | | 0.1 | 10 | | | 0.1 | 5 | | | | |
| Poaceae | *Austrostipa nodosa* | A Speargrass | | | | | | | | | | | | | | | | | 0.2 | 30 |

## Recorded flora

| Family | Scientific name | Common name | B2L.28 | | B2L.29 | | B2L.30 | | B2L.31 | | B2L.32 | | B2L.33 | | B2L.34 | | B2L.35 | | B2L.36 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Myrtaceae | *Kunzea capitata* | None | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Leptospermum arachnoides* | None | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Leptospermum obovatum* | None | | | 10 | 20 | | | | | | | | | | | | | | |
| Myrtaceae | *Leptospermum squarrosum* | None | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Leptospermum juniperinum* | Prickly Tea-tree | | | 2 | 10 | | | | | | | | | | | | | | |
| Myrtaceae | *Eucalyptus sieberi* | Silvertop Ash | | | | | | | | | | | | | | | | | | |
| Myrtaceae | *Leptospermum trinervium* | Slender Tea-tree | | | | | | | | | | | 0.1 | 5 | | | | | | |
| Myrtaceae | *Eucalyptus piperita* | Sydney Peppermint | 10 | 5 | | | 10 | 4 | | | | | 20 | | | | | | | |
| Myrtaceae | *Leptospermum polygalifolium* | Tantoon | | | | | | | | | | | | | 0.2 | 2 | | | | |
| Onagraceae | *Epilobium* spp. | None | | | | | | | | | | | | | | | | | | |
| Orchidaceae | *Acianthus pusillus* | Gnat Orchid | | | | | | | | | | | | | | | | | | |
| Orchidaceae | *Cryptostylis subulata* | Large Tongue Orchid | | | | | | | | | | | | | | | | | | |
| Orchidaceae | *Calochilus robertsonii* | Purplish Beard Orchid | | | | | | | | | | | 0.1 | 1 | | | | | | |
| Orchidaceae | *Thelymitra pauciflora* | Slender Sun Orchid | | | | | | | | | | | | | | | | | | |
| Orchidaceae | *Thelymitra carnea* | Tiny Sun Orchid | | | | | | | | | | | | | | | | | | |
| Orchidaceae | *Prasophyllum flavum* | Yellow Leek Orchid | | | | | | | | | | | 0.1 | 1 | | | | | | |
| Oxalidaceae | *Oxalis perennans* | None | | | | | | | | | | | | | | | 0.1 | 5 | | |
| Oxalidaceae | *Oxalis* spp. | None | | | | | | | | | | | | | | | | | | |
| Phormiaceae | *Dianella caerulea* | Blue Flax-lily | | | | | | | | | | | | | | | | | | |
| Phormiaceae | *Dianella longifolia* | Blueberry Lily | | | | | | | | | | | | | | | | | | |
| Phormiaceae | *Dianella revoluta* | Blueberry Lily | | | | | | | | | | | | | | | | | | |
| Phyllanthaceae | *Poranthera ericifolia* | None | | | | | | | | | | | 0.1 | 10 | | | | | | |
| Phyllanthaceae | *Poranthera microphylla* | Small Poranthera | | | | | 0.1 | 30 | | | | | 0.1 | 500 | | | | | | |
| Phyllanthaceae | *Phyllanthus hirtellus* | Thyme Spurge | | | | | | | | | | | 0.1 | 50 | | | | | | |
| Pittosporaceae | *Billardiera scandens* | Hairy Apple Berry | | | | | | | | | | | | | 0.1 | 1 | | | | |
| Pittosporaceae | *Bursaria spinosa* | Native Blackthorn | | | | | | | | | | | | | | | | | | |
| Plantaginaceae | *Plantago debilis* | Shade Plantain | | | | | | | | | | | | | | | | | | |
| Plantaginaceae | *Veronica plebeia* | Trailing Speedwell | 0.1 | 10 | | | 0.1 | 20 | 0.1 | 10 | | | | | 0.1 | 1 | | | | |
| Poaceae | *Austrostipa nodosa* | A Speargrass | | | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.01 | | B2L.02 | | B2L.03 | | B2L.04 | | B2L.05 | | B2L.06 | | B2L.07 | | B2L.08 | | B2L.09 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Poaceae | *Austrostipa* spp. | A Speargrass | | | | | | | | | | | | | | | | | | |
| Poaceae | *Rytidosperma tenuius* | A Wallaby Grass | 0.1 | 1 | | | | | | | | | | | | | | | 0.1 | 5 |
| Poaceae | *Entolasia marginata* | Bordered Panic | | | | | | | | | | | | | | | | | | |
| Poaceae | *Eragrostis brownii* | Brown's Lovegrass | | | | | | | | | | | | | | | | | | |
| Poaceae | *Echinopogon caespitosus* | Bushy Hedgehog-grass | | | | | | | | | | | | | 0.1 | 10 | | | | |
| Poaceae | *Cynodon dactylon* | Common Couch | | | | | | | | | | | | | | | 10 | 200 | | |
| Poaceae | *Echinopogon ovatus* | Forest Hedgehog Grass | | | | | | | | | | | | | | | | | 0.1 | 1 |
| Poaceae | *Austrostipa pubescens* | None | | | 0.5 | 5 | | | 0.3 | 50 | 0.1 | 7 | 0.1 | 10 | 0.1 | 20 | | | | |
| Poaceae | *Poa affinis* | None | | | | | | | | | | | | | | | | | | |
| Poaceae | *Themeda triandra* | None | | | | | | | | | | | | | | | | | | |
| Poaceae | *Rytidosperma pallidum* | Redanther Wallaby Grass; Silvertop Wallaby Grass | | | | | | | | | | | | | 0.2 | 50 | | | | |
| Poaceae | *Poa sieberiana* | Snowgrass | | | | | | | 0.1 | 5 | 1 | | | | 0.2 | 10 | | | | |
| Poaceae | *Isachne globosa* | Swamp Millet | | | | | | | | | | | | | | | | | | |
| Poaceae | *Aristida vagans* | Threeawn Speargrass | | | | | 0.1 | 1 | | | | | | | | | | | | |
| Poaceae | *Poa labillardierei* var. *labillardierei* | Tussock | | | | | | | | | | | | | | | 3 | 30 | | |
| Poaceae | *Microlaena stipoides* | Weeping Grass | 1 | 50 | 5 | 500 | | | 0.1 | 50 | 0.5 | 100 | | | 0.1 | 50 | 2 | 40 | 30 | 300 |
| Poaceae | *Chloris truncata* | Windmill Grass | | | | | | | | | | | | | | | | | | |
| Poaceae | *Entolasia stricta* | Wiry Panic | 0.1 | 10 | | | | | 1 | | 0.1 | 50 | 0.1 | 50 | 0.2 | 100 | | | | |
| Polygalaceae | *Comesperma ericinum* | Pyramid Flower | | | | | | | | | | | | | | | | | | |
| Polygonaceae | *Persicaria decipiens* | Slender Knotweed | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Isopogon anemonifolius* | Broad-leaf Drumsticks | | | 1 | 5 | | | 2 | | 1 | | 5 | | 2 | | | | | |
| Proteaceae | *Persoonia levis* | Broad-leaved Geebung | | | | | | | 1 | | | | | | | | | | | |
| Proteaceae | *Petrophile pulchella* | Conesticks | | | | | 2 | 30 | 2 | | 1 | | 3 | | 10 | | | | | |
| Proteaceae | *Lomatia silaifolia* | Crinkle Bush | | | 3 | 20 | | | 1 | | | | 0.1 | 5 | | | | | | |
| Proteaceae | *Hakea dactyloides* | Finger Hakea | | | 0.5 | 2 | | | 20 | | 15 | | 20 | | 15 | | | | | |
| Proteaceae | *Banksia spinulosa* | Hairpin Banksia | | | 5 | 10 | 5 | 5 | | | | | 10 | | 3 | | | | | |
| Proteaceae | *Banksia ericifolia* | Heath-leaved Banksia | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Persoonia lanceolata* | Lance Leaf Geebung | | | | | | | 3 | | 0.1 | 1 | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.10 | | B2L.11 | | B2L.12 | | B2L.13 | | B2L.14 | | B2L.15 | | B2L.16 | | B2L.17 | | B2L.18 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Poaceae | *Austrostipa* spp. | A Speargrass | | | | | | | | | | | | | | | | | | |
| Poaceae | *Rytidosperma tenuius* | A Wallaby Grass | 0.5 | 80 | 0.5 | 100 | | | | | 0.1 | 5 | 0.5 | 20 | 0.1 | 5 | 0.1 | 10 | 0.5 | 20 |
| Poaceae | *Entolasia marginata* | Bordered Panic | | | | | | | | | | | | | | | | | | |
| Poaceae | *Eragrostis brownii* | Brown's Lovegrass | | | | | | | | | | | | | 0.1 | 5 | | | | |
| Poaceae | *Echinopogon caespitosus* | Bushy Hedgehog-grass | | | | | | | | | | | | | | | | | | |
| Poaceae | *Cynodon dactylon* | Common Couch | | | | | 20 | 500 | | | 2 | 50 | | | | | | | | |
| Poaceae | *Echinopogon ovatus* | Forest Hedgehog Grass | | | | | | | | | | | | | | | 0.1 | 1 | | |
| Poaceae | *Austrostipa pubescens* | None | | | 0.1 | 5 | | | | | | | | | | | | | | |
| Poaceae | *Poa affinis* | None | | | | | 1 | 300 | | | 10 | 100 | | | | | | | | |
| Poaceae | *Themeda triandra* | None | | | | | | | | | | | | | | | | | | |
| Poaceae | *Rytidosperma pallidum* | Redanther Wallaby Grass | 0.5 | 20 | 0.1 | 3 | | | | | | | 2 | 30 | 0.1 | 4 | | | | |
| Poaceae | *Poa sieberiana* | Snowgrass | | | | | | | | | | | | | 0.1 | 5 | | | | |
| Poaceae | *Isachne globosa* | Swamp Millet | | | | | | | 0.1 | 10 | | | | | | | | | | |
| Poaceae | *Aristida vagans* | Threeawn Speargrass | | | | | | | | | | | | | | | | | | |
| Poaceae | *Poa labillardierei* var. *labillardierei* | Tussock | | | | | | | 0.5 | 5 | | | | | | | | | | |
| Poaceae | *Microlaena stipoides* | Weeping Grass | 0.1 | 5 | 0.1 | 3 | 5 | 100 | 0.1 | 20 | 25 | 300 | | | 0.1 | 20 | 5 | 100 | 0.1 | 10 |
| Poaceae | *Chloris truncata* | Windmill Grass | | | | | 0.3 | 40 | | | | | | | | | | | | |
| Poaceae | *Entolasia stricta* | Wiry Panic | 0.1 | 20 | | | | | 0.1 | 5 | | | 0.1 | 10 | 0.1 | 10 | 0.5 | 30 | 0.1 | 20 |
| Polygalaceae | *Comesperma ericinum* | Pyramid Flower | | | | | | | | | | | | | | | | | | |
| Polygonaceae | *Persicaria decipiens* | Slender Knotweed | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Isopogon anemonifolius* | Broad-leaf Drumsticks | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Persoonia levis* | Broad-leaved Geebung | | | | | | | | | | | 0.5 | 4 | | | 0.1 | 2 | | |
| Proteaceae | *Petrophile pulchella* | Conesticks | 1 | 10 | | | | | | | | | | | | | | | | |
| Proteaceae | *Lomatia silaifolia* | Crinkle Bush | | | | | | | | | | | 0.1 | 5 | | | | | | |
| Proteaceae | *Hakea dactyloides* | Finger Hakea | 15 | 90 | 0.5 | 3 | | | | | | | 0.1 | 10 | | | | | | |
| Proteaceae | *Banksia spinulosa* | Hairpin Banksia | 5 | 20 | | | | | | | | | | | | | | | | |
| Proteaceae | *Banksia ericifolia* | Heath-leaved Banksia | 2 | 10 | | | | | | | | | 1 | 10 | | | | | | |
| Proteaceae | *Persoonia lanceolata* | Lance Leaf Geebung | | | 0.1 | 3 | | | | | | | | | | | 0.5 | 2 | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.19 | | B2L.20 | | B2L.21 | | B2L.22 | | B2L.23 | | B2L.24 | | B2L.25 | | B2L.26 | | B2L.27 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Poaceae | *Austrostipa* spp. | A Speargrass | | | | | | | | | 0.1 | 2 | | | | | | | 5 | 40 |
| Poaceae | *Rytidosperma tenuius* | A Wallaby Grass | 0.1 | 5 | | | 2 | 100 | | | 2 | 300 | 1 | 60 | | | | | | |
| Poaceae | *Entolasia marginata* | Bordered Panic | | | | | 0.1 | 10 | | | | | 1 | 200 | | | | | | |
| Poaceae | *Eragrostis brownii* | Brown's Lovegrass | 0.5 | 10 | | | | | | | | | | | 0.2 | 30 | | | | |
| Poaceae | *Echinopogon caespitosus* | Bushy Hedgehog-grass | | | | | | | | | | | | | | | | | | |
| Poaceae | *Cynodon dactylon* | Common Couch | | | | | | | | | | | | | | | 0.5 | 50 | 3 | 90 |
| Poaceae | *Echinopogon ovatus* | Forest Hedgehog Grass | | | | | 0.1 | 20 | | | | | 0.2 | 20 | 5 | 100 | | | | |
| Poaceae | *Austrostipa pubescens* | None | | | | | | | | | | | 0.1 | 10 | | | | | | |
| Poaceae | *Poa affinis* | None | | | | | | | | | | | | | | | 0.5 | 100 | | |
| Poaceae | *Themeda triandra* | None | | | | | | | | | | | 0.1 | 2 | | | | | 0.3 | 10 |
| Poaceae | *Rytidosperma pallidum* | Redanther Wallaby Grass | 60 | 200 | 60 | 100 | 0.2 | 20 | 25 | 200 | 1 | 50 | | | | | | | | |
| Poaceae | *Poa sieberiana* | Snowgrass | | | | | | | | | | | | | | | | | | |
| Poaceae | *Isachne globosa* | Swamp Millet | | | | | | | | | | | | | | | | | | |
| Poaceae | *Aristida vagans* | Threeawn Speargrass | | | | | | | | | | | | | | | | | | |
| Poaceae | *Poa labillardierei* var. *labillardierei* | Tussock | | | | | | | | | | | | | 2 | 10 | 1 | 10 | | |
| Poaceae | *Microlaena stipoides* | Weeping Grass | | | 0.5 | 30 | 30 | 200 | | | 0.1 | 10 | 40 | 400 | 6 | 200 | 0.2 | 20 | 15 | 200 |
| Poaceae | *Chloris truncata* | Windmill Grass | | | | | | | | | | | | | | | 0.2 | 20 | | |
| Poaceae | *Entolasia stricta* | Wiry Panic | 0.1 | 5 | | | 0.2 | 10 | 0.1 | 5 | 0.2 | 50 | | | | | 0.1 | 10 | | |
| Polygalaceae | *Comesperma ericinum* | Pyramid Flower | | | 0.1 | 2 | | | | | | | | | | | | | | |
| Polygonaceae | *Persicaria decipiens* | Slender Knotweed | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Isopogon anemonifolius* | Broad-leaf Drumsticks | 0.1 | 1 | 0.5 | 5 | | | 0.1 | 1 | | | | | | | | | | |
| Proteaceae | *Persoonia levis* | Broad-leaved Geebung | | | 0.5 | 2 | | | | | | | | | | | | | | |
| Proteaceae | *Petrophile pulchella* | Conesticks | 10 | 50 | 0.5 | 5 | | | 10 | 20 | | | | | | | | | | |
| Proteaceae | *Lomatia silaifolia* | Crinkle Bush | | | 0.5 | 10 | | | | | | | | | | | | | | |
| Proteaceae | *Hakea dactyloides* | Finger Hakea | 0.1 | 2 | 0.5 | 5 | | | 5 | 20 | 0.1 | 10 | | | | | | | | |
| Proteaceae | *Banksia spinulosa* | Hairpin Banksia | 5 | 10 | 1 | 5 | | | 15 | 30 | | | | | | | | | | |
| Proteaceae | *Banksia ericifolia* | Heath-leaved Banksia | | | | | | | 1 | 10 | | | 1 | 5 | | | | | | |
| Proteaceae | *Persoonia lanceolata* | Lance Leaf Geebung | | | | | | | | | 0.1 | 2 | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.28 | | B2L.29 | | B2L.30 | | B2L.31 | | B2L.32 | | B2L.33 | | B2L.34 | | B2L.35 | | B2L.36 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Poaceae | *Austrostipa* spp. | A Speargrass | | | | | | | | | | | | | | | | | | |
| Poaceae | *Rytidosperma tenuius* | A Wallaby Grass | 0.2 | 20 | | | 0.1 | 30 | 0.5 | 100 | 0.1 | 20 | | | | | | | | |
| Poaceae | *Entolasia marginata* | Bordered Panic | | | | | 0.1 | 10 | | | | | | | | | | | | |
| Poaceae | *Eragrostis brownii* | Brown's Lovegrass | | | | | | | | | | | | | | | | | | |
| Poaceae | *Echinopogon caespitosus* | Bushy Hedgehog-grass | | | | | | | | | | | 0.5 | 50 | | | | | | |
| Poaceae | *Cynodon dactylon* | Common Couch | | | | | | | | | | | | | | | 0.5 | 20 | 5 | 50 |
| Poaceae | *Echinopogon ovatus* | Forest Hedgehog Grass | 0.1 | 10 | | | 0.1 | 20 | | | | | | | | | | | | |
| Poaceae | *Austrostipa pubescens* | None | 0.1 | 10 | | | | | | | | | 3 | | 0.2 | 10 | | | | |
| Poaceae | *Poa affinis* | None | | | | | | | | | | | | | | | | | | |
| Poaceae | *Themeda triandra* | None | | | | | | | 0.1 | 20 | | | | | | | | | | |
| Poaceae | *Rytidosperma pallidum* | Redanther Wallaby Grass | 0.1 | 2 | | | | | | | | | 1 | | | | | | | |
| Poaceae | *Poa sieberiana* | Snowgrass | | | | | | | | | | | 0.2 | 10 | | | | | | |
| Poaceae | *Isachne globosa* | Swamp Millet | | | 0.2 | 30 | | | | | | | | | | | | | | |
| Poaceae | *Aristida vagans* | Threeawn Speargrass | | | | | | | | | | | | | | | | | | |
| Poaceae | *Poa labillardierei* var. *labillardierei* | Tussock | | | 1 | 30 | | | | | | | | | | | 0.5 | 10 | 0.5 | 10 |
| Poaceae | *Microlaena stipoides* | Weeping Grass | 65 | 500 | 5 | 200 | 20 | 200 | 50 | 400 | 40 | 200 | 0.5 | 100 | 0.1 | 20 | 0.2 | 20 | | |
| Poaceae | *Chloris truncata* | Windmill Grass | 0.3 | 50 | | | | | | | | | | | | | 0.3 | 20 | | |
| Poaceae | *Entolasia stricta* | Wiry Panic | 1 | 100 | 0.1 | 50 | | | | | | | 1 | | | | 0.1 | 5 | 0.1 | 20 |
| Polygalaceae | *Comesperma ericinum* | Pyramid Flower | | | | | | | | | | | | | | | | | | |
| Polygonaceae | *Persicaria decipiens* | Slender Knotweed | | | | | | | | | | | | | | | | | 0.1 | 5 |
| Proteaceae | *Isopogon anemonifolius* | Broad-leaf Drumsticks | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Persoonia levis* | Broad-leaved Geebung | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Petrophile pulchella* | Conesticks | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Lomatia silaifolia* | Crinkle Bush | | | | | | | | | | | 0.1 | 3 | | | | | | |
| Proteaceae | *Hakea dactyloides* | Finger Hakea | | | | | | | | | | | 1 | | 0.1 | 5 | | | | |
| Proteaceae | *Banksia spinulosa* | Hairpin Banksia | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Banksia ericifolia* | Heath-leaved Banksia | | | | | | | | | | | | | 0.3 | 2 | | | | |
| Proteaceae | *Persoonia lanceolata* | Lance Leaf Geebung | | | | | | | | | | | | | 0.1 | 1 | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.01 | | B2L.02 | | B2L.03 | | B2L.04 | | B2L.05 | | B2L.06 | | B2L.07 | | B2L.08 | | B2L.09 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Proteaceae | *Grevillea laurifolia* | Laurel-leaf Grevillea | | | | | | | 4 | | | | 0.1 | 10 | 15 | | | | | |
| Proteaceae | *Persoonia chamaepitys* | Mountain Geebung | | | | | | | | | | | 0.1 | 4 | | | | | | |
| Proteaceae | *Persoonia linearis* | Narrow-leaved Geebung | | | 0.5 | 1 | | | | | | | | | | | | | | |
| Proteaceae | *Hakea teretifolia* | Needlebush | | | | | | | | | 5 | | 5 | | 7 | | | | | |
| Proteaceae | *Conospermum ericifolium* | None | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Grevillea acanthifolia* | None | | | | | 0.1 | 1 | | | | | | | | | | | | |
| Proteaceae | *Hakea laevipes* | None | | | | | | | 1 | | | | | | | | | | | |
| Proteaceae | *Hakea propinqua* | None | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Persoonia hindii* | None | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Banksia marginata* | Silver Banksia | | | 0.5 | 1 | | | | | | | | | | | | | | |
| Proteaceae | *Conospermum taxifolium* | Variable Smoke-bush | | | | | | | | | | | | | 0.2 | 7 | | | | |
| Proteaceae | *Telopea speciosissima* | Waratah | | | | | | | 2 | | | | 1 | | | | | | | |
| Ranunculaceae | *Clematis glycinoides* | Headache Vine | 2 | 10 | | | | | | | | | | | | | | | | |
| Ranunculaceae | *Clematis aristata* | Old Man's Beard | 0.2 | 5 | | | | | | | | | | | | | | | 5 | 50 |
| Ranunculaceae | *Ranunculus inundatus* | River Buttercup | | | | | | | | | | | | | | | | | | |
| Restionaceae | *Chordifex fastigiatus* | None | | | | | | | | | | | | | 0.3 | 100 | | | | |
| Restionaceae | *Empodisma minus* | None | | | | | | | | | | | | | | | | | | |
| Restionaceae | *Leptocarpus tenax* | None | | | | | | | | | | | | | | | | | | |
| Restionaceae | *Lepyrodia scariosa* | None | | | | | | | | | 8 | | | | | | | | | |
| Rhamnaceae | *Cryptandra amara* | Bitter Cryptandra | | | | | | | | | | | 0.1 | 1 | | | | | | |
| Rhamnaceae | *Pomaderris andromedifolia* | None | | | | | | | | | | | | | | | | | | |
| Rhamnaceae | *Pomaderris lanigera* | Woolly Pomaderris | | | | | 0.1 | 1 | | | | | | | | | | | | |
| Rosaceae | *Acaena novae-zelandiae* | Bidgee-widgee | | | | | | | | | | | | | | | | | | |
| Rosaceae | *Rubus parvifolius* | Native Raspberry | | | | | | | | | | | | | | | | | | |
| Rubiaceae | *Pomax umbellata* | Pomax | | | | | | | | | | | | | | | | | | |
| Rutaceae | *Phebalium* spp. | None | | | | | | | | | | | | | | | | | | |
| Rutaceae | *Phebalium squamulosum* | Scaly Phebalium | | | | | | | | | 5 | | 7 | | 1 | | | | | |
| Santalaceae | *Exocarpos cupressiformis* | Cherry Ballart | 1 | 2 | | | | | | | | | | | | | | | | |
| Santalaceae | *Leptomeria acida* | Sour Currant Bush | | | | | | | | | 0.1 | 1 | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.10 | | B2L.11 | | B2L.12 | | B2L.13 | | B2L.14 | | B2L.15 | | B2L.16 | | B2L.17 | | B2L.18 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Proteaceae | *Grevillea laurifolia* | Laurel-leaf Grevillea | 0.3 | 10 | | | | | | | | | | | | | | | | |
| Proteaceae | *Persoonia chamaepitys* | Mountain Geebung | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Persoonia linearis* | Narrow-leaved Geebung | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Hakea teretifolia* | Needlebush | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Conospermum ericifolium* | None | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Grevillea acanthifolia* | None | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Hakea laevipes* | None | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Hakea propinqua* | None | 1 | 10 | | | | | | | | | | | | | | | | |
| Proteaceae | *Persoonia hindii* | None | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Banksia marginata* | Silver Banksia | | | | | | | | | | | 0.5 | 10 | | | | | | |
| Proteaceae | *Conospermum taxifolium* | Variable Smoke-bush | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Telopea speciosissima* | Waratah | | | | | | | | | | | | | | | | | | |
| Ranunculaceae | *Clematis glycinoides* | Headache Vine | | | | | | | | | | | | | | | | | | |
| Ranunculaceae | *Clematis aristata* | Old Man's Beard | | | | | | | | | | | | | | | | | | |
| Ranunculaceae | *Ranunculus inundatus* | River Buttercup | | | | | | | | | | | | | | | | | | |
| Restionaceae | *Chordifex fastigiatus* | None | | | | | | | | | | | | | | | | | | |
| Restionaceae | *Empodisma minus* | None | | | | | | | | | | | 2 | 100 | | | | | | |
| Restionaceae | *Leptocarpus tenax* | None | | | | | | | | | | | 0.2 | 30 | | | | | | |
| Restionaceae | *Lepyrodia scariosa* | None | | | | | | | | | | | 0.5 | 100 | | | | | | |
| Rhamnaceae | *Cryptandra amara* | Bitter Cryptandra | | | | | | | | | | | | | | | | | | |
| Rhamnaceae | *Pomaderris andromedifolia* | None | | | | | | | | | | | | | 0.1 | 5 | | | | |
| Rhamnaceae | *Pomaderris lanigera* | Woolly Pomaderris | | | | | | | | | | | | | | | | | | |
| Rosaceae | *Acaena novae-zelandiae* | Bidgee-widgee | | | | | | | | | | | | | | | | | 0.5 | 200 |
| Rosaceae | *Rubus parvifolius* | Native Raspberry | | | | | | | | | | | | | | | | | | |
| Rubiaceae | *Pomax umbellata* | Pomax | | | 0.3 | 50 | | | | | | | | | | | 0.5 | 40 | | |
| Rutaceae | *Phebalium* spp. | None | | | | | | | | | | | | | | | | | | |
| Rutaceae | *Phebalium squamulosum* | Scaly Phebalium | 0.1 | 5 | 0.1 | 10 | | | | | | | | | | | | | | |
| Santalaceae | *Exocarpos cupressiformis* | Cherry Ballart | | | | | | | | | | | | | | | | | | |
| Santalaceae | *Leptomeria acida* | Sour Currant Bush | | | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.19 | | B2L.20 | | B2L.21 | | B2L.22 | | B2L.23 | | B2L.24 | | B2L.25 | | B2L.26 | | B2L.27 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Proteaceae | *Grevillea laurifolia* | Laurel-leaf Grevillea | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Persoonia chamaepitys* | Mountain Geebung | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Persoonia linearis* | Narrow-leaved Geebung | | | | | 0.1 | 10 | | | | | 0.1 | 20 | | | | | | |
| Proteaceae | *Hakea teretifolia* | Needlebush | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Conospermum ericifolium* | None | 2 | 20 | | | | | | | | | | | | | | | | |
| Proteaceae | *Grevillea acanthifolia* | None | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Hakea laevipes* | None | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Hakea propinqua* | None | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Persoonia hindii* | None | | | | | | | | | | | 0.1 | 3 | | | | | | |
| Proteaceae | *Banksia marginata* | Silver Banksia | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Conospermum taxifolium* | Variable Smoke-bush | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Telopea speciosissima* | Waratah | | | | | | | | | | | | | | | | | | |
| Ranunculaceae | *Clematis glycinoides* | Headache Vine | | | | | | | | | | | | | | | | | | |
| Ranunculaceae | *Clematis aristata* | Old Man's Beard | | | | | 0.5 | 20 | | | | | 2 | 20 | | | | | | |
| Ranunculaceae | *Ranunculus inundatus* | River Buttercup | | | | | | | | | | | | | | | | | | |
| Restionaceae | *Chordifex fastigiatus* | None | | | | | | | | | | | | | | | | | | |
| Restionaceae | *Empodisma minus* | None | | | | | | | | | | | | | | | | | | |
| Restionaceae | *Leptocarpus tenax* | None | | | | | | | | | | | | | | | | | | |
| Restionaceae | *Lepyrodia scariosa* | None | | | | | | | | | | | | | | | | | | |
| Rhamnaceae | *Cryptandra amara* | Bitter Cryptandra | | | | | | | | | | | | | | | | | | |
| Rhamnaceae | *Pomaderris andromedifolia* | None | | | | | | | | | 0.1 | 10 | | | | | | | | |
| Rhamnaceae | *Pomaderris lanigera* | Woolly Pomaderris | | | | | | | | | | | | | | | | | | |
| Rosaceae | *Acaena novae-zelandiae* | Bidgee-widgee | | | | | | | | | 0.1 | 5 | | | | | | | | |
| Rosaceae | *Rubus parvifolius* | Native Raspberry | | | | | | | | | | | | | 0.1 | 1 | | | | |
| Rubiaceae | *Pomax umbellata* | Pomax | | | | | | | | | 0.1 | 20 | | | | | | | | |
| Rutaceae | *Phebalium* spp. | None | | | | | | | | | 0.1 | 2 | | | | | | | | |
| Rutaceae | *Phebalium squamulosum* | Scaly Phebalium | | | | | | | 0.1 | 5 | | | | | | | | | | |
| Santalaceae | *Exocarpos cupressiformis* | Cherry Ballart | | | | | | | | | | | 10 | 5 | | | | | | |
| Santalaceae | *Leptomeria acida* | Sour Currant Bush | | | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.28 | | B2L.29 | | B2L.30 | | B2L.31 | | B2L.32 | | B2L.33 | | B2L.34 | | B2L.35 | | B2L.36 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Proteaceae | *Grevillea laurifolia* | Laurel-leaf Grevillea | | | | | | | | | | | 6 | | | | | | | |
| Proteaceae | *Persoonia chamaepitys* | Mountain Geebung | | | | | | | | | | | 0.5 | 5 | | | | | | |
| Proteaceae | *Persoonia linearis* | Narrow-leaved Geebung | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Hakea teretifolia* | Needlebush | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Conospermum ericifolium* | None | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Grevillea acanthifolia* | None | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Hakea laevipes* | None | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Hakea propinqua* | None | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Persoonia hindii* | None | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Banksia marginata* | Silver Banksia | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Conospermum taxifolium* | Variable Smoke-bush | | | | | | | | | | | | | | | | | | |
| Proteaceae | *Telopea speciosissima* | Waratah | | | | | | | | | | | 0.2 | 3 | | | | | | |
| Ranunculaceae | *Clematis glycinoides* | Headache Vine | | | | | | | | | | | | | | | | | | |
| Ranunculaceae | *Clematis aristata* | Old Man's Beard | 0.3 | 50 | | | | | | | | | | | | | | | | |
| Ranunculaceae | *Ranunculus inundatus* | River Buttercup | | | 0.1 | 10 | | | | | | | | | | | | | 0.1 | 10 |
| Restionaceae | *Chordifex fastigiatus* | None | | | | | | | | | | | | | | | | | | |
| Restionaceae | *Empodisma minus* | None | | | | | | | | | | | | | | | | | | |
| Restionaceae | *Leptocarpus tenax* | None | | | | | | | | | | | | | | | | | | |
| Restionaceae | *Lepyrodia scariosa* | None | | | | | | | | | | | | | | | | | | |
| Rhamnaceae | *Cryptandra amara* | Bitter Cryptandra | | | | | | | | | | | | | | | | | | |
| Rhamnaceae | *Pomaderris andromedifolia* | None | | | | | | | | | | | | | | | | | | |
| Rhamnaceae | *Pomaderris lanigera* | Woolly Pomaderris | | | | | | | | | | | | | | | | | | |
| Rosaceae | *Acaena novae-zelandiae* | Bidgee-widgee | | | | | | | | | | | | | | | | | | |
| Rosaceae | *Rubus parvifolius* | Native Raspberry | | | | | | | | | | | | | | | | | | |
| Rubiaceae | *Pomax umbellata* | Pomax | | | | | | | | | | | 0.1 | 50 | 0.1 | 5 | | | | |
| Rutaceae | *Phebalium* spp. | None | | | | | | | | | | | | | | | | | | |
| Rutaceae | *Phebalium squamulosum* | Scaly Phebalium | | | | | | | | | | | | | 0.1 | 3 | | | | |
| Santalaceae | *Exocarpos cupressiformis* | Cherry Ballart | | | | | | | | | | | 2 | | | | | | | |
| Santalaceae | *Leptomeria acida* | Sour Currant Bush | | | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.01 | | B2L.02 | | B2L.03 | | B2L.04 | | B2L.05 | | B2L.06 | | B2L.07 | | B2L.08 | | B2L.09 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Selaginellaceae | *Selaginella uliginosa* | Swamp Selaginella | | | | | | | | | | | | | | | | | | |
| Solanaceae | *Solanum stelligerum* | Devil's Needles | 0.1 | 1 | | | | | | | | | | | | | | | | |
| Stackhousiaceae | *Stackhousia viminea* | Slender Stackhousia | | | | | | | | | | | | | | | | | | |
| Stylidiaceae | *Stylidium graminifolium* | Grass Triggerplant | | | | | | | | | | | | | | | | | | |
| Stylidiaceae | *Stylidium lineare* | Narrow-leaved Triggerplant | | | | | 0.1 | 1 | | | 0.2 | 50 | 0.1 | 5 | | | | | | |
| Thymelaeaceae | *Pimelea linifolia* | Slender Rice Flower | | | 1 | 50 | 0.1 | 1 | | | 0.1 | 50 | 0.1 | 100 | | | | | | |
| Violaceae | *Viola hederacea* | Ivy-leaved Violet | | | | | | | 0.2 | 500 | | | | | | | | | | |
| Violaceae | *Hybanthus monopetalus* | Slender Violet-bush | | | | | | | 0.1 | 100 | | | 0.1 | 100 | | | | | | |
| Violaceae | *Viola caleyana* | Swamp Violet | | | | | | | | | | | | | | | | | | |
| Xanthorrhoeaceae | *Xanthorrhoea australis* | None | | | | | | | | | | | | | | | | | | |
| Xanthorrhoeaceae | *Xanthorrhoea resinosa* | None | | | | | | | 0.3 | 1 | | | | | | | | | | |
| Xyridaceae | *Xyris operculata* | None | | | | | | | | | | | | | | | | | | |
| **Introduced species** | | | | | | | | | | | | | | | | | | | | |
| Polygonaceae | *Acetosella vulgaris* | Sheep Sorrel | | | | | | | | | | | | | | | | | | |
| Poaceae | *Anthoxanthum odoratum* | Sweet Vernal Grass | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Aster subulatus* | Wild Aster | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Bidens pilosa* | Cobbler's Pegs | | | | | | | | | | | | | | | | | 0.1 | 1 |
| Poaceae | *Bromus catharticus* | Praire Grass | | | | | | | | | | | | | | | | | | |
| Poaceae | *Cenchrus clandestinus* | Kikuyu Grass | | | | | | | | | | | | | | | | | | |
| Gentianaceae | *Centaurium erythraea* | Common Centaury | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Cirsium vulgare* | Spear Thistle | | | | | | | | | | | | | | | | | 1 | 20 |
| Asteraceae | *Conyza bonariensis* | Flaxleaf Fleabane | 1 | 5 | | | 0.1 | 5 | | | | | | | | | 3 | 40 | 0.5 | 20 |
| Asteraceae | *Conyza parva* | Fleabane | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Coreopsis lanceolata* | Coreopsis | | | | | | | | | | | | | | | | | | |
| Malaceae | *Cotoneaster glaucophyllus* | None | | | | | | | | | | | | | | | | | | |
| Malaceae | *Crataegus monogyna* | Hawthorn | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Cyperus eragrostis* | Umbrella Sedge | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Cytisus scoparius* subsp. *scoparius* | English Broom | | | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.10 | | B2L.11 | | B2L.12 | | B2L.13 | | B2L.14 | | B2L.15 | | B2L.16 | | B2L.17 | | B2L.18 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Selaginellaceae | *Selaginella uliginosa* | Swamp Selaginella | | | | | | | | | | | 0.1 | 1 | | | | | | |
| Solanaceae | *Solanum stelligerum* | Devil's Needles | | | | | | | | | | | | | | | | | | |
| Stackhousiaceae | *Stackhousia viminea* | Slender Stackhousia | | | | | | | | | | | | | | | | | | |
| Stylidiaceae | *Stylidium graminifolium* | Grass Triggerplant | | | | | | | | | | | | | | | 0.5 | 20 | | |
| Stylidiaceae | *Stylidium lineare* | Narrow-leaved Triggerplai | 0.1 | 5 | | | | | | | | | | | | | | | | |
| Thymelaeaceae | *Pimelea linifolia* | Slender Rice Flower | | | | | | | | | | | 0.1 | 1 | 0.1 | 2 | | | | |
| Violaceae | *Viola hederacea* | Ivy-leaved Violet | | | | | | | | | | | | | | | | | | |
| Violaceae | *Hybanthus monopetalus* | Slender Violet-bush | | | | | | | | | | | | | | | | | | |
| Violaceae | *Viola caleyana* | Swamp Violet | | | | | | | | | | | | | | | | | | |
| Xanthorrhoeaceae | *Xanthorrhoea australis* | None | | | | | | | | | | | | | | | | | | |
| Xanthorrhoeaceae | *Xanthorrhoea resinosa* | None | | | | | | | | | | | | | | | | | | |
| Xyridaceae | *Xyris operculata* | None | | | | | | | | | | | 1 | 20 | | | | | | |
| **Introduced species** | | | | | | | | | | | | | | | | | | | | |
| Polygonaceae | *Acetosella vulgaris* | Sheep Sorrel | | | | | 0.2 | 50 | | | 1 | 50 | | | | | 0.1 | 2 | | |
| Poaceae | *Anthoxanthum odoratum* | Sweet Vernal Grass | | | | | 0.1 | 10 | | | 0.1 | 10 | | | 0.1 | 20 | 0.1 | 5 | | |
| Asteraceae | *Aster subulatus* | Wild Aster | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Bidens pilosa* | Cobbler's Pegs | | | | | | | | | | | | | | | | | | |
| Poaceae | *Bromus catharticus* | Praire Grass | | | | | | | | | | | | | | | | | | |
| Poaceae | *Cenchrus clandestinus* | Kikuyu Grass | | | | | | | | | | | | | | | | | | |
| Gentianaceae | *Centaurium erythraea* | Common Centaury | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Cirsium vulgare* | Spear Thistle | | | | | 0.1 | 4 | | | 0.1 | 5 | | | | | | | 0.1 | 5 |
| Asteraceae | *Conyza bonariensis* | Flaxleaf Fleabane | | | 0.1 | 5 | 0.1 | 1 | | | 0.2 | 20 | | | | | 0.1 | 2 | 0.1 | 10 |
| Asteraceae | *Conyza parva* | Fleabane | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Coreopsis lanceolata* | Coreopsis | 0.5 | 50 | 20 | 200 | | | | | | | | | 95 | 500 | | | 0.1 | 20 |
| Malaceae | *Cotoneaster glaucophyllus* | None | | | | | | | | | | | | | | | | | | |
| Malaceae | *Crataegus monogyna* | Hawthorn | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Cyperus eragrostis* | Umbrella Sedge | | | | | 0.1 | 10 | | | | | | | | | | | 0.1 | 5 |
| Fabaceae (Faboideae) | *Cytisus scoparius* subsp. *scoparius* | English Broom | | | | | | | | | | | | | 0.2 | 30 | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.19 | | B2L.20 | | B2L.21 | | B2L.22 | | B2L.23 | | B2L.24 | | B2L.25 | | B2L.26 | | B2L.27 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Selaginellaceae | *Selaginella uliginosa* | Swamp Selaginella | | | | | | | | | | | | | | | | | | |
| Solanaceae | *Solanum stelligerum* | Devil's Needles | | | | | | | | | | | | | | | | | | |
| Stackhousiaceae | *Stackhousia viminea* | Slender Stackhousia | | | 0.1 | 10 | | | | | | | | | | | | | | |
| Stylidiaceae | *Stylidium graminifolium* | Grass Triggerplant | | | | | | | | | | | | | | | | | | |
| Stylidiaceae | *Stylidium lineare* | Narrow-leaved Triggerplar | 1 | 50 | 0.1 | 10 | | | 0.1 | 20 | | | | | | | | | | |
| Thymelaeaceae | *Pimelea linifolia* | Slender Rice Flower | 0.1 | 10 | 0.1 | 20 | | | 0.1 | 10 | 0.1 | 20 | 0.5 | 50 | | | | | | |
| Violaceae | *Viola hederacea* | Ivy-leaved Violet | | | | | 0.1 | 10 | | | | | | | | | | | | |
| Violaceae | *Hybanthus monopetalus* | Slender Violet-bush | | | | | | | | | | | | | | | | | | |
| Violaceae | *Viola caleyana* | Swamp Violet | | | | | | | | | | | | | | | 0.1 | 20 | | |
| Xanthorrhoeaceae | *Xanthorrhoea australis* | None | 1 | 3 | | | | | | | | | | | | | | | | |
| Xanthorrhoeaceae | *Xanthorrhoea resinosa* | None | | | | | | | | | | | | | | | | | | |
| Xyridaceae | *Xyris operculata* | None | | | | | | | | | | | | | | | | | | |
| **Introduced species** | | | | | | | | | | | | | | | | | | | | |
| Polygonaceae | *Acetosella vulgaris* | Sheep Sorrel | | | | | | | | | | | | | | | | | | |
| Poaceae | *Anthoxanthum odoratum* | Sweet Vernal Grass | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Aster subulatus* | Wild Aster | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Bidens pilosa* | Cobbler's Pegs | | | | | | | | | | | | | | | | | | |
| Poaceae | *Bromus catharticus* | Praire Grass | | | | | | | | | | | | | | | | | | |
| Poaceae | *Cenchrus clandestinus* | Kikuyu Grass | | | | | | | | | | | | | | | | | | |
| Gentianaceae | *Centaurium erythraea* | Common Centaury | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Cirsium vulgare* | Spear Thistle | | | | | | | | | | | | | 0.1 | 3 | | | 0.1 | 5 |
| Asteraceae | *Conyza bonariensis* | Flaxleaf Fleabane | | | | | | | | | 0.1 | 5 | | | | | | | 7 | 100 |
| Asteraceae | *Conyza parva* | Fleabane | | | | | | | | | | | | | 0.1 | 20 | | | | |
| Asteraceae | *Coreopsis lanceolata* | Coreopsis | | | | | | | | | 20 | 300 | | | | | | | | |
| Malaceae | *Cotoneaster glaucophyllus* | None | | | | | | | | | | | 0.1 | 1 | | | | | | |
| Malaceae | *Crataegus monogyna* | Hawthorn | | | | | | | | | | | | | | | | | 0.2 | 1 |
| Cyperaceae | *Cyperus eragrostis* | Umbrella Sedge | | | | | | | | | 0.1 | 10 | | | | | 0.1 | 10 | | |
| Fabaceae (Faboideae) | *Cytisus scoparius* subsp. *scoparius* | English Broom | | | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.28 | | B2L.29 | | B2L.30 | | B2L.31 | | B2L.32 | | B2L.33 | | B2L.34 | | B2L.35 | | B2L.36 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Selaginellaceae | *Selaginella uliginosa* | Swamp Selaginella | | | | | | | | | | | | | | | | | | |
| Solanaceae | *Solanum stelligerum* | Devil's Needles | | | | | | | | | | | | | | | | | | |
| Stackhousiaceae | *Stackhousia viminea* | Slender Stackhousia | | | | | | | | | | | | | | | | | | |
| Stylidiaceae | *Stylidium graminifolium* | Grass Triggerplant | | | | | | | | | | | | | | | | | | |
| Stylidiaceae | *Stylidium lineare* | Narrow-leaved Triggerplar | | | | | | | | | | | | | | | | | | |
| Thymelaeaceae | *Pimelea linifolia* | Slender Rice Flower | 0.1 | 5 | | | 0.1 | 30 | | | | | | | | | | | | |
| Violaceae | *Viola hederacea* | Ivy-leaved Violet | | | | | | | | | | | 0.1 | 100 | | | | | | |
| Violaceae | *Hybanthus monopetalus* | Slender Violet-bush | | | | | | | | | | | 0.1 | 100 | | | | | | |
| Violaceae | *Viola caleyana* | Swamp Violet | | | | | | | | | | | | | | | 0.1 | 5 | 0.1 | 1 |
| Xanthorrhoeaceae | *Xanthorrhoea australis* | None | | | | | | | | | | | | | | | | | | |
| Xanthorrhoeaceae | *Xanthorrhoea resinosa* | None | | | | | | | | | | | | | | | | | | |
| Xyridaceae | *Xyris operculata* | None | | | | | | | | | | | | | | | | | | |
| **Introduced species** | | | | | | | | | | | | | | | | | | | | |
| Polygonaceae | *Acetosella vulgaris* | Sheep Sorrel | 2 | 200 | | | | | | | | | | | | | | | | |
| Poaceae | *Anthoxanthum odoratum* | Sweet Vernal Grass | | | 20 | 200 | 10 | 200 | 20 | 200 | | | | | | | | | | |
| Asteraceae | *Aster subulatus* | Wild Aster | | | | | | | | | | | | | | | 0.1 | 1 | 0.1 | 1 |
| Asteraceae | *Bidens pilosa* | Cobbler's Pegs | 0.1 | 2 | | | | | | | | | | | | | | | | |
| Poaceae | *Bromus catharticus* | Praire Grass | | | | | | | | | 0.5 | 20 | | | | | | | | |
| Poaceae | *Cenchrus clandestinus* | Kikuyu Grass | | | | | | | | | 1 | 20 | | | | | | | | |
| Gentianaceae | *Centaurium erythraea* | Common Centaury | | | | | 0.1 | 10 | | | | | | | | | | | | |
| Asteraceae | *Cirsium vulgare* | Spear Thistle | 0.1 | 10 | | | | | 0.1 | 20 | | | | | | | | | | |
| Asteraceae | *Conyza bonariensis* | Flaxleaf Fleabane | 0.1 | 2 | | | 0.1 | 5 | 0.1 | 10 | | | | | 0.1 | 8 | | | | |
| Asteraceae | *Conyza parva* | Fleabane | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Coreopsis lanceolata* | Coreopsis | | | | | | | | | | | 1 | | 0.5 | 50 | | | | |
| Malaceae | *Cotoneaster glaucophyllus* | None | | | | | | | | | | | | | | | | | | |
| Malaceae | *Crataegus monogyna* | Hawthorn | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Cyperus eragrostis* | Umbrella Sedge | | | | | | | | | | | | | 0.1 | 5 | 0.1 | 5 | | |
| Fabaceae (Faboideae) | *Cytisus scoparius* subsp. *scoparius* | English Broom | | | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.01 | | B2L.02 | | B2L.03 | | B2L.04 | | B2L.05 | | B2L.06 | | B2L.07 | | B2L.08 | | B2L.09 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Poaceae | *Dactyloctenium aegyptium* | Coast Button Grass | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Delairea odorata* | Cape Ivy | 0.1 | 3 | | | | | | | | | | | | | | | | |
| Poaceae | *Ehrharta erecta* | Panic Veldtgrass | 5 | 50 | | | | | | | | | | | | | | | 2 | 50 |
| Onagraceae | *Epilobium ciliatum* | None | | | | | | | | | | | | | | | | | | |
| Poaceae | *Eragrostis curvula* | African Lovegrass | | | | | | | | | | | | | | | | | | |
| Ericaceae | *Erica lusitanica* | None | | | | | | | | | | | | | | | | | | |
| Apiaceae | *Foeniculum vulgare* | Fennel | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Gamochaeta calviceps* | Cudweed | | | | | | | | | | | | | | | 0.2 | 100 | | |
| Asteraceae | *Gamochaeta coarctata* | None | | | | | | | | | | | | | | | 0.3 | 100 | | |
| Asteraceae | *Gnaphalium polycaulon* | Many-stemmed Cudweed, Indian Cudweed | | | | | | | | | | | | | | | | | | |
| Araliaceae | *Hedera helix* | English Ivy | | | | | | | | | | | | | | | | | 1 | 50 |
| Poaceae | *Holcus lanatus* | Yorkshire Fog | | | | | | | | | | | | | | | 5 | 30 | | |
| Clusiaceae | *Hypericum perforatum* | St. Johns Wort | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Hypochaeris radicata* | Catsear | 0.1 | 10 | | | 0.5 | 20 | | | | | | | | | | | 2 | 80 |
| Asteraceae | *Hypochaeris* spp. | A Catsear | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Isolepis levynsiana* | None | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Isolepis prolifera* | None | | | | | | | | | | | | | | | | | | |
| Caprifoliaceae | *Leycesteria formosa* | Himalayan Honeysuckle | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Lotus angustissimus* | Slender Birds-foot Trefoil | | | | | | | | | | | | | | | | | | |
| Primulaceae | *Lysimachia arvensis* | Scarlet Pimpernel | | | | | | | | | | | | | | | | | 0.1 | 1 |
| Fabaceae (Faboideae) | *Medicago polymorpha* | Burr Medic | | | | | | | | | | | | | | | | | | |
| Oxalidaceae | *Oxalis articulata* | None | | | | | | | | | | | | | | | | | | |
| Oxalidaceae | *Oxalis corniculata* | Creeping Oxalis | | | | | | | | | | | | | | | | | | |
| Poaceae | *Paspalum dilatatum* | Paspalum | | | | | | | | | | | | | | | 10 | 100 | 5 | 100 |
| Poaceae | *Phalaris aquatica* | Phalaris | | | | | | | | | | | | | | | | | | |
| Phytolaccaceae | *Phytolacca octandra* | Inkweed | | | | | | | | | | | | | | | | | | |
| Plantaginaceae | *Plantago lanceolata* | Lamb's Tongues | 0.1 | 10 | | | | | | | | | | | | | 5 | 40 | 0.1 | 10 |
| Polygonaceae | *Polygonum aviculare* | Wireweed | | | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.10 | | B2L.11 | | B2L.12 | | B2L.13 | | B2L.14 | | B2L.15 | | B2L.16 | | B2L.17 | | B2L.18 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Poaceae | *Dactyloctenium aegyptium* | Coast Button Grass | | | | | 0.3 | 50 | | | 1 | 50 | | | | | | | | |
| Asteraceae | *Delairea odorata* | Cape Ivy | | | | | | | | | | | | | | | | | | |
| Poaceae | *Ehrharta erecta* | Panic Veldtgrass | | | 0.3 | 100 | 2 | 100 | | | 0.2 | 20 | | | | | | | | |
| Onagraceae | *Epilobium ciliatum* | None | | | | | | | | | | | | | | | | | | |
| Poaceae | *Eragrostis curvula* | African Lovegrass | | | 0.1 | 1 | 0.1 | 2 | | | | | | | | | | | | |
| Ericaceae | *Erica lusitanica* | None | 0.1 | 2 | | | | | | | | | | | | | | | | |
| Apiaceae | *Foeniculum vulgare* | Fennel | | | | | | | | | | | | | 0.1 | 2 | | | | |
| Asteraceae | *Gamochaeta calviceps* | Cudweed | | | | | | | | | 0.1 | 10 | | | | | | | | |
| Asteraceae | *Gamochaeta coarctata* | None | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Gnaphalium polycaulon* | Many-stemmed Cudweed | | | | | | | | | | | | | | | | | | |
| Araliaceae | *Hedera helix* | English Ivy | | | | | | | | | | | | | | | | | | |
| Poaceae | *Holcus lanatus* | Yorkshire Fog | | | | | | | | | | | | | | | | | | |
| Clusiaceae | *Hypericum perforatum* | St. Johns Wort | | | | | 0.1 | 1 | | | 0.1 | 10 | | | | | | | | |
| Asteraceae | *Hypochaeris radicata* | Catsear | 0.2 | 20 | 0.3 | 4 | 0.1 | 20 | 0.1 | 20 | 0.5 | 50 | | | 0.2 | 20 | 0.1 | 5 | 0.1 | 10 |
| Asteraceae | *Hypochaeris* spp. | A Catsear | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Isolepis levynsiana* | None | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Isolepis prolifera* | None | | | | | | | 1 | 100 | | | | | | | | | | |
| Caprifoliaceae | *Leycesteria formosa* | Himalayan Honeysuckle | | | | | | | | | | | | | | | | | 0.1 | 5 |
| Fabaceae (Faboideae) | *Lotus angustissimus* | Slender Birds-foot Trefoil | | | | | 0.1 | 20 | | | | | | | | | | | | |
| Primulaceae | *Lysimachia arvensis* | Scarlet Pimpernel | | | 0.1 | 3 | | | | | 0.1 | 5 | | | 0.1 | 20 | | | 0.1 | 2 |
| Fabaceae (Faboideae) | *Medicago polymorpha* | Burr Medic | | | | | | | | | | | | | 0.1 | 2 | | | | |
| Oxalidaceae | *Oxalis articulata* | None | | | | | | | | | | | | | 0.1 | 20 | | | | |
| Oxalidaceae | *Oxalis corniculata* | Creeping Oxalis | | | | | | | | | | | | | | | | | | |
| Poaceae | *Paspalum dilatatum* | Paspalum | | | | | 5 | 300 | 2 | 100 | 5 | 200 | | | | | | | 0.3 | 20 |
| Poaceae | *Phalaris aquatica* | Phalaris | | | | | | | 0.1 | 5 | | | | | | | | | | |
| Phytolaccaceae | *Phytolacca octandra* | Inkweed | | | | | | | | | | | | | | | | | | |
| Plantaginaceae | *Plantago lanceolata* | Lamb's Tongues | 0.1 | 20 | 0.2 | 6 | 0.5 | 30 | | | 0.2 | 20 | | | | | | | | |
| Polygonaceae | *Polygonum aviculare* | Wireweed | | | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.19 | | B2L.20 | | B2L.21 | | B2L.22 | | B2L.23 | | B2L.24 | | B2L.25 | | B2L.26 | | B2L.27 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Poaceae | *Dactyloctenium aegyptium* | Coast Button Grass | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Delairea odorata* | Cape Ivy | | | | | | | | | | | | | | | | | | |
| Poaceae | *Ehrharta erecta* | Panic Veldtgrass | | | | | | | | | 1 | 100 | | | | | | | | |
| Onagraceae | *Epilobium ciliatum* | None | | | | | | | | | | | | | | | | | | |
| Poaceae | *Eragrostis curvula* | African Lovegrass | | | | | | | | | | | | | | | 0.1 | 10 | | |
| Ericaceae | *Erica lusitanica* | None | | | | | | | | | 0.1 | 2 | | | | | | | | |
| Apiaceae | *Foeniculum vulgare* | Fennel | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Gamochaeta calviceps* | Cudweed | | | | | | | | | | | | | | | | | 0.1 | 7 |
| Asteraceae | *Gamochaeta coarctata* | None | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Gnaphalium polycaulon* | Many-stemmed Cudweed | | | | | | | | | | | | | 0.1 | 10 | | | | |
| Araliaceae | *Hedera helix* | English Ivy | | | | | 2 | 60 | | | | | | | | | | | | |
| Poaceae | *Holcus lanatus* | Yorkshire Fog | | | | | | | | | | | | | 0.2 | 50 | | | 4 | 40 |
| Clusiaceae | *Hypericum perforatum* | St. Johns Wort | | | | | | | | | | | | | | | 0.1 | 10 | | |
| Asteraceae | *Hypochaeris radicata* | Catsear | | | | | | | | | 0.5 | 200 | 0.2 | 20 | 0.2 | 10 | 0.1 | 20 | | |
| Asteraceae | *Hypochaeris* spp. | A Catsear | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Isolepis levynsiana* | None | | | | | | | | | | | | | | | | | | |
| Cyperaceae | *Isolepis prolifera* | None | | | | | | | | | | | | | | | 0.1 | 10 | | |
| Caprifoliaceae | *Leycesteria formosa* | Himalayan Honeysuckle | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Lotus angustissimus* | Slender Birds-foot Trefoil | | | | | | | | | | | | | | | 0.5 | 50 | | |
| Primulaceae | *Lysimachia arvensis* | Scarlet Pimpernel | | | | | 0.1 | 5 | | | 0.1 | 1 | | | | | | | | |
| Fabaceae (Faboideae) | *Medicago polymorpha* | Burr Medic | | | | | | | | | | | | | | | | | | |
| Oxalidaceae | *Oxalis articulata* | None | | | | | | | | | | | | | | | | | | |
| Oxalidaceae | *Oxalis corniculata* | Creeping Oxalis | | | | | | | | | | | | | | | | | | |
| Poaceae | *Paspalum dilatatum* | Paspalum | | | | | | | | | 2 | 200 | | | | | 5 | 300 | 0.1 | 20 |
| Poaceae | *Phalaris aquatica* | Phalaris | | | | | | | | | | | | | | | 0.1 | 2 | | |
| Phytolaccaceae | *Phytolacca octandra* | Inkweed | | | | | | | | | | | | | | | | | | |
| Plantaginaceae | *Plantago lanceolata* | Lamb's Tongues | 0.1 | 1 | | | 0.1 | 10 | | | 0.3 | 100 | | | | | 0.1 | 10 | | |
| Polygonaceae | *Polygonum aviculare* | Wireweed | | | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.28 | | B2L.29 | | B2L.30 | | B2L.31 | | B2L.32 | | B2L.33 | | B2L.34 | | B2L.35 | | B2L.36 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Poaceae | *Dactyloctenium aegyptium* | Coast Button Grass | 0.2 | 50 | | | | | | | | | | | | | | | | |
| Asteraceae | *Delairea odorata* | Cape Ivy | | | | | | | | | | | | | | | | | | |
| Poaceae | *Ehrharta erecta* | Panic Veldtgrass | 2 | 200 | | | | | | | | | | | | | | | | |
| Onagraceae | *Epilobium ciliatum* | None | | | | | | | | | | | | | | | | | 0.2 | 40 |
| Poaceae | *Eragrostis curvula* | African Lovegrass | | | | | | | | | | | | | | | | | | |
| Ericaceae | *Erica lusitanica* | None | | | | | | | | | | | | | 0.5 | 20 | | | | |
| Apiaceae | *Foeniculum vulgare* | Fennel | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Gamochaeta calviceps* | Cudweed | | | | | | | | | | | 0.1 | 20 | | | | | | |
| Asteraceae | *Gamochaeta coarctata* | None | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Gnaphalium polycaulon* | Many-stemmed Cudweed | | | | | | | | | | | | | | | | | | |
| Araliaceae | *Hedera helix* | English Ivy | | | | | | | | | | | | | | | | | | |
| Poaceae | *Holcus lanatus* | Yorkshire Fog | | | | | | | | | | | | | | | | | | |
| Clusiaceae | *Hypericum perforatum* | St. Johns Wort | 0.1 | 2 | | | | | | | | | 0.1 | 5 | | | | | | |
| Asteraceae | *Hypochaeris radicata* | Catsear | 0.1 | 20 | 0.5 | 30 | | | 0.5 | 100 | 0.1 | 20 | 0.1 | 20 | | | 0.2 | 20 | | |
| Asteraceae | *Hypochaeris* spp. | A Catsear | | | | | 0.1 | 20 | | | | | | | | | | | | |
| Cyperaceae | *Isolepis levynsiana* | None | | | | | | | | | | | | | | | 0.1 | 5 | | |
| Cyperaceae | *Isolepis prolifera* | None | | | | | | | | | | | | | | | 0.1 | 5 | | |
| Caprifoliaceae | *Leycesteria formosa* | Himalayan Honeysuckle | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Lotus angustissimus* | Slender Birds-foot Trefoil | | | 0.1 | 20 | | | 0.1 | 10 | | | | | | | 0.1 | 5 | 0.1 | 20 |
| Primulaceae | *Lysimachia arvensis* | Scarlet Pimpernel | | | 0.1 | 20 | | | 0.1 | 2 | | | | | | | | | | |
| Fabaceae (Faboideae) | *Medicago polymorpha* | Burr Medic | | | | | | | | | | | | | | | | | | |
| Oxalidaceae | *Oxalis articulata* | None | | | | | | | 0.1 | 20 | 0.1 | 10 | | | | | | | | |
| Oxalidaceae | *Oxalis corniculata* | Creeping Oxalis | | | | | 0.1 | 10 | | | | | | | | | | | | |
| Poaceae | *Paspalum dilatatum* | Paspalum | | | 0.5 | 30 | | | | | | | | | 0.5 | 20 | 5 | 60 | 5 | 100 |
| Poaceae | *Phalaris aquatica* | Phalaris | | | 10 | 200 | | | | | | | | | | | | | 0.1 | 1 |
| Phytolaccaceae | *Phytolacca octandra* | Inkweed | | | | | | | 0.1 | 2 | | | | | | | | | | |
| Plantaginaceae | *Plantago lanceolata* | Lamb's Tongues | | | 0.1 | 10 | | | 0.1 | 20 | 0.1 | 20 | | | 0.1 | 5 | | | | |
| Polygonaceae | *Polygonum aviculare* | Wireweed | | | | | | | | | 0.1 | 5 | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.01 | | B2L.02 | | B2L.03 | | B2L.04 | | B2L.05 | | B2L.06 | | B2L.07 | | B2L.08 | | B2L.09 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Lamiaceae | *Prunella vulgaris* | Self-heal | | | | | | | | | | | | | | | | | | |
| Ranunculaceae | *Ranunculus repens* | Creeping Buttercup | | | | | | | | | | | | | | | | | | |
| Rosaceae | *Rosa rubiginosa* | Sweet Briar | | | | | | | | | | | | | | | | | 2 | 20 |
| Rosaceae | *Rubus anglocandicans* | Blackberry | | | | | | | | | | | | | | | | | | |
| Rosaceae | *Rubus fruticosus* sp. agg. | Blackberry complex | 1 | 1 | | | | | | | | | | | | | | | 25 | 100 |
| Polygonaceae | *Rumex obtusifolius* | Broadleaf Dock | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Senecio madagascariensis* | Fireweed | | | | | | | | | | | | | | | | | | |
| Poaceae | *Setaria parviflora* | None | | | | | | | | | | | | | | | 5 | 100 | | |
| Poaceae | *Setaria pumila* | Pale Pigeon Grass | | | | | | | | | | | | | | | | | | |
| Iridaceae | *Sisyrinchium rosulatum* | Scourweed | | | | | | | | | | | | | | | | | | |
| Solanaceae | *Solanum mauritianum* | Wild Tobacco Bush | | | | | | | | | | | | | | | | | | |
| Solanaceae | *Solanum nigrum* | Black-berry Nightshade | | | | | | | | | | | | | | | | | 0.1 | 10 |
| Asteraceae | *Sonchus oleraceus* | Common Sowthistle | | | | | | | | | | | | | | | | | | |
| Poaceae | *Sporobolus africanus* | Parramatta Grass | | | | | | | | | | | | | | | 10 | 100 | | |
| Poaceae | *Stenotaphrum secundatum* | Buffalo Grass | | | | | | | | | | | | | | | 0.2 | 10 | | |
| Asteraceae | *Tagetes minuta* | Stinking Roger | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Taraxacum officinale* | Dandelion | | | | | | | | | | | | | | | 5 | 90 | | |
| Fabaceae (Faboideae) | *Trifolium* spp. | A Clover | | | | | | | | | | | | | | | 0.2 | 30 | | |
| Scrophulariaceae | *Verbascum virgatum* | Twiggy Mullein | | | | | | | | | | | | | | | | | | |
| Verbenaceae | *Verbena bonariensis* | Purpletop | | | | | | | | | | | | | | | | | 0.5 | 20 |
| Apocynaceae | *Vinca major* | Periwinkle | | | | | | | | | | | | | | | | | 5 | 100 |
| Poaceae | *Vulpia myuros* | Rat's Tail Fescue | | | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.10 | | B2L.11 | | B2L.12 | | B2L.13 | | B2L.14 | | B2L.15 | | B2L.16 | | B2L.17 | | B2L.18 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Lamiaceae | *Prunella vulgaris* | Self-heal | | | 0.1 | | | | | | | | | | | | | | | |
| Ranunculaceae | *Ranunculus repens* | Creeping Buttercup | | | | | | | | | | | | | | | | | 5 | 500 |
| Rosaceae | *Rosa rubiginosa* | Sweet Briar | | | | | | | | | | | | | | | | | | |
| Rosaceae | *Rubus anglocandicans* | Blackberry | | | | | | | | | | | | | | | | | | |
| Rosaceae | *Rubus fruticosus* sp. agg. | Blackberry complex | | | | | | | 0.5 | 5 | | | | | 0.1 | 1 | | | 0.1 | 1 |
| Polygonaceae | *Rumex obtusifolius* | Broadleaf Dock | | | | | | | | | | | | | | | | | 0.1 | 2 |
| Asteraceae | *Senecio madagascariensis* | Fireweed | | | | | | | | | | | | | | | | | 0.1 | 2 |
| Poaceae | *Setaria parviflora* | None | | | | | 5 | 500 | | | 5 | 200 | | | | | | | | |
| Poaceae | *Setaria pumila* | Pale Pigeon Grass | | | 0.3 | 100 | | | | | | | | | | | 0.1 | 2 | | |
| Iridaceae | *Sisyrinchium rosulatum* | Scourweed | | | | | | | | | 0.1 | 5 | | | | | | | 0.1 | 2 |
| Solanaceae | *Solanum mauritianum* | Wild Tobacco Bush | | | | | | | | | | | | | | | | | | |
| Solanaceae | *Solanum nigrum* | Black-berry Nightshade | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Sonchus oleraceus* | Common Sowthistle | | | | | | | | | | | | | | | | | | |
| Poaceae | *Sporobolus africanus* | Parramatta Grass | | | | | 30 | 500 | | | 30 | 200 | | | | | | | | |
| Poaceae | *Stenotaphrum secundatum* | Buffalo Grass | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Tagetes minuta* | Stinking Roger | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Taraxacum officinale* | Dandelion | | | | | | | | | 2 | 50 | | | | | | | 0.1 | 2 |
| Fabaceae (Faboideae) | *Trifolium* spp. | A Clover | | | | | | | | | | | | | | | | | | |
| Scrophulariaceae | *Verbascum virgatum* | Twiggy Mullein | | | | | | | | | | | | | | | 0.1 | 1 | | |
| Verbenaceae | *Verbena bonariensis* | Purpletop | | | | | 0.1 | 4 | | | 0.1 | 5 | | | 0.1 | 5 | | | 0.1 | 5 |
| Apocynaceae | *Vinca major* | Periwinkle | | | | | | | | | | | | | | | | | | |
| Poaceae | *Vulpia myuros* | Rat's Tail Fescue | | | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.19 | | B2L.20 | | B2L.21 | | B2L.22 | | B2L.23 | | B2L.24 | | B2L.25 | | B2L.26 | | B2L.27 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Lamiaceae | *Prunella vulgaris* | Self-heal | | | | | | | | | | | | | | | | | | |
| Ranunculaceae | *Ranunculus repens* | Creeping Buttercup | | | | | | | | | | | | | | | 0.1 | 5 | | |
| Rosaceae | *Rosa rubiginosa* | Sweet Briar | | | | | | | | | | | | | | | | | | |
| Rosaceae | *Rubus anglocandicans* | Blackberry | | | | | | | | | | | | | | | | | 4 | 20 |
| Rosaceae | *Rubus fruticosus* sp. agg. | Blackberry complex | | | | | 25 | 50 | | | | | | | 1 | 20 | | | | |
| Polygonaceae | *Rumex obtusifolius* | Broadleaf Dock | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Senecio madagascariensis* | Fireweed | | | | | | | | | | | | | | | | | | |
| Poaceae | *Setaria parviflora* | None | | | | | | | | | | | | | 0.2 | 30 | | | 6 | 40 |
| Poaceae | *Setaria pumila* | Pale Pigeon Grass | | | | | | | | | 5 | 200 | | | | | | | | |
| Iridaceae | *Sisyrinchium rosulatum* | Scourweed | | | | | | | | | | | | | | | | | | |
| Solanaceae | *Solanum mauritianum* | Wild Tobacco Bush | | | | | | | | | | | | | | | | | | |
| Solanaceae | *Solanum nigrum* | Black-berry Nightshade | | | | | | | | | | | | | 0.1 | 5 | | | 4 | 20 |
| Asteraceae | *Sonchus oleraceus* | Common Sowthistle | | | | | | | | | | | 0.1 | 5 | | | | | | |
| Poaceae | *Sporobolus africanus* | Parramatta Grass | | | | | | | | | | | | | 0.7 | 40 | | | | |
| Poaceae | *Stenotaphrum secundatum* | Buffalo Grass | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Tagetes minuta* | Stinking Roger | | | | | | | | | | | | | 0.1 | 3 | | | | |
| Asteraceae | *Taraxacum officinale* | Dandelion | | | | | | | | | | | | | 0.2 | 30 | | | 0.1 | 20 |
| Fabaceae (Faboideae) | *Trifolium* spp. | A Clover | | | | | | | | | | | | | | | | | | |
| Scrophulariaceae | *Verbascum virgatum* | Twiggy Mullein | | | | | | | | | | | | | | | | | | |
| Verbenaceae | *Verbena bonariensis* | Purpletop | | | | | | | | | 0.1 | 2 | | | | | | | | |
| Apocynaceae | *Vinca major* | Periwinkle | | | | | | | | | | | | | | | | | | |
| Poaceae | *Vulpia myuros* | Rat's Tail Fescue | | | | | | | | | | | | | | | | | | |

## Recorded flora

| Family | Scientific name | Common name | B2L.28 | | B2L.29 | | B2L.30 | | B2L.31 | | B2L.32 | | B2L.33 | | B2L.34 | | B2L.35 | | B2L.36 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun | Cvr% | Abun |
| Lamiaceae | *Prunella vulgaris* | Self-heal | | | | | | | | | | | | | | | | | | |
| Ranunculaceae | *Ranunculus repens* | Creeping Buttercup | | | | | | | | | | | | | | | | | | |
| Rosaceae | *Rosa rubiginosa* | Sweet Briar | | | | | | | | | | | | | | | | | | |
| Rosaceae | *Rubus anglocandicans* | Blackberry | | | | | | | | | | | | | | | | | | |
| Rosaceae | *Rubus fruticosus* sp. agg. | Blackberry complex | 0.1 | 10 | 15 | 50 | 0.5 | 5 | 5 | 50 | 2 | 1 | | | | | 0.1 | 1 | 15 | 20 |
| Polygonaceae | *Rumex obtusifolius* | Broadleaf Dock | | | | | | | | | | | | | | | 0.1 | 10 | 0.1 | 5 |
| Asteraceae | *Senecio madagascariensis* | Fireweed | | | | | | | | | | | | | | | | | | |
| Poaceae | *Setaria parviflora* | None | 0.2 | 20 | | | | | | | | | | | | | 0.1 | 5 | | |
| Poaceae | *Setaria pumila* | Pale Pigeon Grass | | | | | | | | | | | | | 0.1 | 1 | | | | |
| Iridaceae | *Sisyrinchium rosulatum* | Scourweed | | | 0.1 | 20 | | | 0.1 | 20 | | | | | | | | | | |
| Solanaceae | *Solanum mauritianum* | Wild Tobacco Bush | 0.1 | 1 | | | | | | | | | | | | | | | | |
| Solanaceae | *Solanum nigrum* | Black-berry Nightshade | 0.2 | 30 | | | | | | | | | | | | | | | | |
| Asteraceae | *Sonchus oleraceus* | Common Sowthistle | 0.1 | 10 | | | | | | | | | | | | | | | | |
| Poaceae | *Sporobolus africanus* | Parramatta Grass | | | | | | | | | 0.1 | 10 | | | | | | | | |
| Poaceae | *Stenotaphrum secundatum* | Buffalo Grass | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Tagetes minuta* | Stinking Roger | | | | | | | | | | | | | | | | | | |
| Asteraceae | *Taraxacum officinale* | Dandelion | | | | | | | | | | | | | | | | | | |
| Fabaceae (Faboideae) | *Trifolium* spp. | A Clover | | | | | | | | | | | | | | | | | | |
| Scrophulariaceae | *Verbascum virgatum* | Twiggy Mullein | | | | | | | | | | | | | | | | | | |
| Verbenaceae | *Verbena bonariensis* | Purpletop | | | | | | | | | | | | | | | | | | |
| Apocynaceae | *Vinca major* | Periwinkle | | | | | | | | | | | | | | | | | | |
| Poaceae | *Vulpia myuros* | Rat's Tail Fescue | | | | | | | | | 0.1 | 5 | | | | | | | | |

# Annexure C – Species recorded

## Recorded fauna

| Scientific name | Common name | Status | |
|---|---|---|---|
| | | BC Act | EPBC Act |
| **Birds** | | | |
| *Alectura lathami* | Australian Brush-turkey | - | - |
| *Platycercus elegans* | Crimson Rosella | - | - |
| *Callocephalon fimbriatum* | Gang-gang Cockatoo | Vulnerable | Endangered |
| *Dacelo novaeguineae* | Laughing Kookaburra | - | - |
| *Vanellus miles* | Masked Lapwing | - | - |
| *Anthochaera carunculata* | Red Wattlebird | - | - |
| *Neochmia temporalis* | Red-browed Finch | - | - |
| *Tyto tenebricosa* | Sooty Owl | Vulnerable | - |
| *Ninox novaeseelandiae* | Southern Boobook | - | - |
| *Malurus cyaneus* | Superb Fairy-wren | - | - |
| *Menura novaehollandiae* | Superb Lyrebird | - | - |
| *Calyptorhynchus funereus* | Yellow-tailed Black-Cockatoo | - | - |
| *Cormobates leucophaea* | White-throated Treecreeper | - | - |
| **Mammals** | | | |
| *Rattus rattus* | Black Rat | - | - |
| *Antechinus stuartii* | Brown Antechinus | - | - |
| *Rattus fuscipes* | Bush Rat | - | - |
| *Chalinolobus morio* | Chocolate Wattled Bat | - | - |
| *Trichosurus vulpecula*. | Common Brushtail Possum | - | - |
| *Pseudocheirus peregrinus* | Common Ringtail Possum | - | - |
| *Vombatus ursinus* | Common Wombat | - | - |
| *Vespadelus troughtoni* | Eastern Cave Bat | Vulnerable | - |
| *Falsistrellus tasmaniensis* | Eastern False Pipistrelle | Vulnerable | - |
| *Macropus giganteus* | Eastern Grey Kangaroo | - | - |
| *Rhinolophus megaphyllus* | Eastern Horseshoe Bat | - | - |
| *Vulpes vulpes* | Fox | - | - |
| *Scoteanax rueppellii* | Greater Broad-nosed Bat | Vulnerable | - |
| *Nyctophilus gouldi* | Gould's Long-eared Bat | - | - |
| *Chalinolobus gouldii* | Gould's Wattled Bat | - | - |
| *Petauroides volans* | Greater Glider | - | Endangered |
| *Miniopterus orianae oceanensis* | Large Bent-winged Bat | Vulnerable | - |
| *Chalinolobus dwyeri* | Large-eared Pied Bat | Vulnerable | Vulnerable |
| *Vespadelus darlingtoni* | Large Forest Bat | - | - |
| *Nyctophilus geoffroyi* | Lesser Long-eared Bat | - | - |

| Scientific name | Common name | Status | |
|---|---|---|---|
| | | BC Act | EPBC Act |
| *Vespadelus vulturnus* | Little Forest Bat | - | - |
| *Ozimops ridei* | Ride's Free-tailed Bat | - | - |
| *Tachyglossus aculeatus* | Shore-beaked Echidna | - | - |
| *Scotorepens orion* | South-eastern Broad-nosed Bat | - | - |
| *Vespadelus regulus* | Southern Forest Bat | - | - |
| *Myotis macropus* | Southern Myotis | Vulnerable | - |
| *Petaurus breviceps* | Sugar Glider | - | - |
| *Wallabia bicolor* | Swamp Wallaby | - | - |
| *Austronomus australis* | White-striped Free-tailed Bat | - | - |
| **Frogs** | | | |
| *Limnodynastes peronii* | Brown-striped Frog | - | - |
| *Crinia signifera* | Common Eastern Froglet | - | - |
| *Limnodynastes dumerilii* | Eastern Banjo Frog | - | - |
| *Litoria peronii* | Peron's Tree Frog | - | - |
| *Limnodynastes tasmaniensis* | Spotted Grass Frog | - | - |

# Annexure D – GDE assessment

This section details the assessment GDE’s within the study area, undertaken in accordance with *Methods for the identification of high probability groundwater dependent vegetation ecosystems* (Kuginis et al. 2016). Included are the methods and result of the Level 1, 2, and 3 assessments requiring under the method.

Level 1 assessments, aligned with Kuginis et al (2016), have been applied to current assessment as follows:

- depth to groundwater data:
    - groundwater depth data available in the GIS dataset Spatial Layer of Probable Vegetation Groundwater Dependent Ecosystems in NSW – Hawkesbury Nepean (DPE Water 2022) supported by groundwater depth data collected for the project as part of the Technical Report – Groundwater (included as Appendix I of the EIS).
- woody and non-woody vegetation:
    - PCT mapping of the subject land developed for this BDAR has been used to determine woody / non-woody nature of the vegetation
- remote sensing indicating potential groundwater use:
    - remote sensing data available in the GIS dataset Spatial Layer of Probable Vegetation Groundwater Dependent Ecosystems in NSW – Hawkesbury Nepean (DPE Water 2022) was applied to the study area
- application of decision rules outlined in Kuginis et al (2016) based on site specific and remote sensing data as outlined above

Level 2 assessments, aligned with Kuginis et al (2016), have been applied to current assessment as follows:

- vegetation community mapping, and vegetation descriptions and landscape information:
    - PCT mapping of the study area developed for this BDAR has been used to determine type and location of vegetation within the study area
- vegetation and landscape analysis using published scientific knowledge has been applied using the data on PCT specific GDE probability information contained in the GIS dataset Spatial Layer of Probable Vegetation Groundwater Dependent Ecosystems in NSW – Hawkesbury Nepean (DPE Water 2022).

Level 3 assessments (final GDE probability) have been applied to current assessment based on the application of the decision rules outlined in Kuginis et al (2016).

### Level 1 assessment

Kuginis et al (2016) uses the following matrices for predicating the probability of groundwater dependence of vegetation based on Level 1 considerations (groundwater depth, woody / non-woody vegetation, remote sensed groundwater use frequency). Level 1 results are given a probability of groundwater use ranking of 1 to 4 (with 1= high, 2 = medium, 3 = low and 4 = other source [non-GDE]).

Table App D-0-1: Matrix 1 - decision rules used to identify potential groundwater dependent woody ecosystems, including woody wetlands (Kuginis et al. 2016)

| | | Potential frequency of groundwater use from remote sensing (number of years in a 10 yr period) | | |
|---|---|---|---|---|
| | | 1-4 | 5-8 | 9-10 |
| Groundwater level (m) | 0-8 | 3 | 2 | 1 |
| | 8-12 | 3 | 2 | 2 |
| | 12-16 | 3 | 3 | 2 |
| | 16-20 | 4 | 3 | 3 |
| | >20 | 4 | 4 | 3 |

Table App D-0-2: Matrix 3 - decision rules used to identify potential non-woody groundwater dependent ecosystems, excluding wetlands (Kuginis et al. 2016)

| | | Potential frequency of groundwater use from remote sensing (number of years in a 10 yr period) | | |
|---|---|---|---|---|
| | | 1-4 | 5-8 | 9-10 |
| Groundwater level (m) | 0-8 | 4 | 3 | 2 |
| | 8-12 | 4 | 4 | 3 |
| | 12-16 | 4 | 4 | 4 |
| | 16-20 | 4 | 4 | 4 |
| | >20 | 4 | 4 | 4 |

Table App D-0-3: Matrix 3 - decision rules used to identify potential non-woody groundwater dependent wetlands (Kuginis et al. 2016)

| | | Potential frequency of groundwater use from remote sensing (number of years in 10 yr period) | | |
|---|---|---|---|---|
| | | 1-4 | 5-8 | 9-10 |
| Groundwater level (m) | 0-8 | 4 | 2 | 1 |
| | 8-12 | 4 | 4 | 2 |
| | 12-16 | 4 | 4 | 3 |
| | 16-20 | 4 | 4 | 4 |
| | >20 | 4 | 4 | 4 |

Groundwater depth across the study area is predominantly mapped as category 4 (16-20 metres deep) with some small pockets of category 3 (12-16 metres deep) occurring within the Little Hartley study area. This is supported by data collected as part of the Technical Report – Groundwater (included as Appendix I of the EIS). This report details a groundwater depth of 13.93 metres below ground level at bore BH500A within the Blackheath subject land; a range of 9.91 (BH103) and 16.27 (BH505A) metres below ground level within the vicinity of the Soldiers Pinch subject land; and a range of 8.41 (BH115), 16.27 (BH22A) and 23.15 (BH622) metres below ground level within the vicinity of the Little Hartley subject land. Remote sensing data indicating potential groundwater use is patchy across the study area with several areas (including the entirety of the Blackheath study area) occurring within areas identified as category 11 (i.e., locality not covered). Where data exists the remote sensing categories predominantly indicated are 5, 6, 7, and 8 (i.e., considered moderate possibility).

Using these matrices above it is considered that the following probabilities for groundwater dependence may apply to the vegetation within the subject land:

- woody vegetation – PCT 708, PCT 1248, PCT 1615
  - based on the available groundwater depth and remote sensing data a score of 3 is returned based on Matrix 1 (Table App D-0-1) above. Therefore, woody vegetation across the majority of the site is considered to have a low probability of being a GDE.
- non-woody vegetation – PCT 766
  - based on the available groundwater depth and remote sensing data a score of 4 is returned based on Matrix 2 (Table App D-0-2) above. Therefore, non-woody (excluding wetland) vegetation across the majority of the site is considered to have an “alternative water source” (non-GDE) probability.
- non-woody (wetland) vegetation –PCT 1078, PCT 1256, PCT 1740
  - based on the available groundwater depth and remote sensing data a score of 4 is returned based on Matrix 3 (Table App D-0-3) above. Therefore, non-woody (wetland) vegetation across the majority of the site is considered to have an “alternative water source” (non-GDE) probability.

Based on the results of the Level 1 assessment undertaken using the methodology outlined in Kuginis et al (2016), the probability of the majority of the vegetation present within the study area being a GDE is low. However, it should be noted that groundwater depth and remote sensing data across the study area is incomplete which is a limitation for this assessment.

### Level 2 assessment

Information contained in the GDE probability GIS dataset (DPE Water 2022) was used to determine the Level 2 results for GDE probability of the vegetation present with the subject land based on scientific knowledge and expert opinion. As outlined above the information contain in the dataset is based on an assessment of PCTs from the recent East Coast PCT Revision SVTM layer, and as such direct comparison of the PCTs in the dataset and those mapped within the subject land was not possible. To address this the PCT lineage information contained in the BioNet Vegetation Classification was interrogated to ascertain the East Coast PCT Revision SVTM PCTs equivalent to those mapped for the current assessment.

The dataset provides the following information on GDE probability based on scientific knowledge and expert opinion:

- PCT 708 (equiv. PCT 3863) returned a score of 2 and is therefore considered a moderate probability GDE
- PCT 766 (equiv. PCT 3932) returned a score of 1 and is therefore considered a high probability GDE
- PCT 1078 (equiv. PCT 3929) returned a score of 1 and is therefore considered a high probability GDE
- PCT 1248 (equiv. PCT 3694) returned a score of 3 and is therefore considered a low probability GDE
- PCT 1256 (equiv. PCT 3932) returned a score of 1 and is therefore considered a high probability GDE
- PCT 1615 (equiv. PCT 3226) returned a score of 2 and is therefore considered a moderate probability GDE
- PCT 1740 (equiv. PCT 3975) data is not available for this PCT within the prescribed region.

### Level 3 assessment

Level 3 assessments comprise an analysis of the results of the Level 1 and Level 2 assessments based on rules sets outlined in Kuginis et al (2016) to determine the final GDE probability for a patch of vegetation. These rule sets have been applied to the results derived from site-based data and assessment (where available) of the vegetation present within the subject land, as described above.

The following rule sets outlined in Kuginis et al (2016) are relevant to the current assessment:

- where Level 1 result is a score of 3 (low probability GDE) and depth is 12-16, 16-20 and >20 m, then accept Level 1 result (i.e., low probability GDE)
- where Level 1 result is a score of 4 (alternative water source) non- GDE and depth is 12-16, 16-20 and >20 m, then accept level 1 result.

Based on application of these decision rules the probability of the vegetation within the subject land being a GDE is considered to be as follows:

- PCT 708 is a low probability GDE
- PCT 766 is an alternative water source non-GDE
- PCT 1078 is an alternative water source non-GDE
- PCT 1248 is a low probability GDE
- PCT 1256 is an alternative water source non-GDE
- PCT 1615 is a low probability GDE
- PCT 1740 is an alternative water source non-GDE.

# Annexure E – Habitat suitability assessment

## Habitat suitability assessment table

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
|---|---|---|---|---|---|---|---|
| | **BC Act** | **EPBC Act** | | | | | |
| **Plants** | | | | | | | |
| ***Acacia baueri* subsp. *aspera*** | V | -- | Species | Low, well branched shrub occurring on the Kings Tableland, the Woronora Plateau, Mt Kiera district and in Wedderburn. Grows in low heath, primarily on exposed sandstone ridges in Sydney Coastal Dry Sclerophyll Forests, Sydney Montane Dry Sclerophyll Forests, Sydney Coastal Heaths, Sydney Montane Heaths and Wallum Sand Heaths. Grows in open, exposed conditions on infertile sandy loams.<br>Occurs in low, damp heathlands, often on exposed rocky outcrops over a wide range of climatic and topographical conditions. | 2 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate**<br>The species is associated with PCTs 708 and 1248. It has also been previously recorded on two occasions within a 10 km radius of the study area.<br><br>Targeted surveys for this species were undertaken within the study area in January 2022 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence of this species within the study area the species does not require any further consideration. |
| ***Acacia bynoeana*** Bynoe's Wattle | E | V | Species | Semi prostrate shrub growing in central eastern NSW spanning from the Hunter District, west to the Blue Mountains and south to the Southern Highlands. Grows in a variety of communities including; Southern Tableland Dry Sclerophyll Forests, Sydney Hinterland Dry Sclerophyll Forests, Coastal Valley Grassy Woodlands and Sydney Coastal Heaths. Prefers open, slightly disturbed sites on sandy soils. | 5 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate**<br>The species is associated with PCT 1248. It has also been previously recorded on five occasions within a 10 km radius of the study area.<br><br>Targeted surveys for this species were undertaken within the study area in January 2022 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence of this species within the study area the species does not |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
|---|---|---|---|---|---|---|---|
| | **BC Act** | **EPBC Act** | | | | | |
| | | | | Associated overstorey species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum *Eucalyptus parramattensis*, Saw Banksia and Narrow-leaved Apple *Angophora bakeri*. | | | require any further consideration. |
| ***Acacia flocktoniae*** Flockton Wattle | V | V | Species | Erect or pendulous shrub confined to Mount Victoria, Megalong Valley and Yerranderie in the Southern Blue Mountains. Grows in a variety of communities including Central Gorge Dry Sclerophyll Forests, Sydney Hinterland Dry Sclerophyll Forests, Southern Tableland Grassy Woodlands and North Coast Wet Sclerophyll Forests. Grows on sandstone. | 11 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate** The species is associated with PCT 1248. It has also been previously recorded on 11 occasions within a 10 km radius of the study area.<br><br>A species expert report has been secured for this species.<br><br>It understood that a comprehensive review is underway for this species, and that potentially there never was legitimate records at Mount Victoria or Little Hartley and that the closet records exist at Kanimbla Valley (pers. Comm. Dr Steven Douglas BAM Species Expert July 2022) |
| ***Acacia gordonii*** | E | E | Species | An erect or spreading shrub, 0.5 - 1.5 m high, with smooth grey bark. Restricted to the north-west of Sydney, it has a disjunct distribution occurring in the lower Blue Mountains in the west, and in the Maroota/Glenorie area in the east. This species is known from only a few locations and current information suggests the total number of individuals may be less than 2000, with | 0 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate** The species is associated with PCTs 708 and 1248. It has not been previously recorded within a 10 km radius of the study area.<br><br>Targeted surveys for this species were undertaken within the study area in January 2022 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
|---|---|---|---|---|---|---|---|
| | **BC Act** | **EPBC Act** | | | | | |
| | | | | only one population supporting greater than 400 individuals. A relatively large proportion of individuals (approximately 850) occur on conservation reserve within Blue Mountains National Park. This species is found within the Hawkesbury, Blue Mountains and Baulkham Hills local government areas. Grows in dry sclerophyll forest and heathlands amongst or within rock platforms on sandstone outcrops. | | | of this species within the study area the species does not require any further consideration. |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
|---|---|---|---|---|---|---|---|
| | **BC Act** | **EPBC Act** | | | | | |
| ***Acacia meiantha*** | E | E | Species | This species is an erect or sometimes straggling shrub to 1.5 m high (sometimes to 2.5 m) with a root suckering habit. It is only known from three disjunct locations, all within the Central Tablelands and each separated by more than 60 km. These disjunct populations include Clarence, which covers an area of approximately 1 hectare; Mullions Range State Forest north of Orange; and Carcalgong, which is confined to 2.5km of road easements and appears to occur within several adjacent private properties. Of the three populations, the majority (96%) are known to occur in Mullions Range State Forest occurring both within remnant native forest and in plantation forests. | 0 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate** The species is associated with PCT 1248. It has not been previously recorded within a 10 km radius of the study area. <br><br> A species expert report has been secured for this species. <br><br> It understood that the current record of *Acacia meiantha* in the locality is anthropogenic in nature, in a location below a transmission line likely having been brought in with foreign fill. This record occurs outside of the associated PCT in the wrong climate and that it is not at all likely to occur within the study area (pers. Comm. Dr Steven Douglas BAM Species Expert July 2022). |
| ***Astrotricha crassifolia*** Thick-leaf Star-hair | V | V | Species | Root-suckering shrub growing near Patonga in Gosford, the Royal National Park, the Woronora Plateau and an outlier population at Glen Davis. Grows in a variety of communities including Sydney Coastal Dry Sclerophyll Forests, Eastern Riverine Forests, Western Slopes Grasslands and Sydney Coastal Heaths. Grows on sandstone substrates. | 0 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate** The species is associated with PCT 1248. It has not been previously recorded within a 10 km radius of the study area. <br><br> Targeted surveys for this species were undertaken within the study area in November 2021 during the approved survey period. No individuals of this species were detected. <br><br> Based on the absence of this species within the study area the species does not require any further |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
|---|---|---|---|---|---|---|---|
| | **BC Act** | **EPBC Act** | | | | | |
| | | | | | | | consideration. |
| ***Baloskion longipes*** Dense Cord-rush | V | V | Species | Dense Cord-rush has been recorded from the Kanangra-Boyd area to the Southern Tablelands but all populations are small. Populations have been recorded in Blue Mountains National Park, Kanangra-Boyd National Park, Penrose State Forest (in Hanging Rock Swamp), Morton National Park (The Vines), the Clyde Mountain area and Ballalaba (south of Braidwood). Commonly found in swamps or depressions in sandy alluvium, sometimes growing with sphagnum moss. | 0 – BioNet (DPE 2022b) | Burragorang | **Included as a BAM candidate** The species is associated with PCTs 766 and 1256. It has not been previously recorded within a 10 km radius of the study area.<br><br>Targeted surveys for this species were undertaken within the study area in November 2021 and January 2022 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence of this species within the study area the species does not require any further consideration. |
| ***Boronia deanei*** Deane's Boronia | V | V | Species | Small, erect shrub with a scattered distribution spanning the far south-east of NSW and the Blue Mountains. Grows in wet heath adjacent to streams or swamps at the margins of open forests and occasionally in drier, open forest in a variety of communities including South East Dry Sclerophyll Forests, Coastal Heath Swamps, Sydney Coastal Heaths and Southern Escarpment Wet Sclerophyll Forest. Grows on granite or sandstone in poorly drained peat soils. The species' SPRAT profile notes that the species grows on the margins of high | 0 – BioNet (DPE 2022b) | - | **Not identified by BAM-C as a candidate species** The species is associated with PCT 1256, however it is known to be associated with high altitude swamps (1,000 m – 1,100 m), which do not occur within the study area. PCT 1256 vegetation within the study area occurs at much lower altitudes of 800 m – 850 m and occurs in a degraded condition state. The species has not been previously recorded within a 10 km radius of the study area.<br><br>Incidental surveys for this species were undertaken within the study area in November 2021 during the approved survey period. No individuals of this species were |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
|---|---|---|---|---|---|---|---|
| | **BC Act** | **EPBC Act** | | | | | |
| | | | | altitude swamps, which coincides with records approximately 10 - 25 km to the north of the study area, that occur around swamps at altitudes of between 1,000 m – 1,100m elevation. | | | detected.<br><br>There is a lack of suitable microhabitats within the study area, and any potential habitat occurs in a degraded state. No areas of PCT 1256 are being directly impacted by the proposed project. The species does not require any further consideration. |
| ***Caesia parviflora* var. *minor*** Small Pale Grass-lily | E | -- | Species | Small herb primarily occurs in Tasmania, southern Victoria and south-east South Australia. The NSW population is situated in Barcoongere State Forest between Grafton and Coffs Harbour. Grows in damp places in a variety of communities including Sydney Coastal Dry Sclerophyll Forests, Sydney Montane Dry Sclerophyll Forests, Coastal Valley Grassy Woodlands and Southern Escarpment Wet Sclerophyll Forests. Grows on sandstone substrate. | 1 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate**<br>The species is associated with PCT 1248. It has also been previously recorded on one occasion within a 10 km radius of the study area.<br><br>Targeted surveys for this species were undertaken within the study area in November 2021 and January 2022 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence of this species within the study area the species does not require any further consideration. |
| ***Callistemon megalongensis*** Megalong Valley Bottlebrush | CE | CE | Species | Shrub recorded from eight sites within the Megalong Valley in the Blue Mountains. Restricted to shrub swamps and along downstream watercourses in Upper Riverina Dry Sclerophyll Forests, Sydney Sand Flats Dry Sclerophyll Forests, Eastern Riverine Forests and Coastal Heath Swamps. | 114 – BioNet (DPE 2022b) | - | **Not identified by BAM-C as a candidate species**<br>The species is associated with PCT 1078. It has also been previously recorded on 114 occasions within a 10 km radius of the study area.<br><br>Incidental surveys for this species were undertaken within the study area in November 2021 during the approved survey period. No individuals of this species were detected. |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
|---|---|---|---|---|---|---|---|
| | **BC Act** | **EPBC Act** | | | | | |
| | | | | | | | Based on the absence of this species within the study area the species does not require any further consideration. |
| ***Carex klaphakei*** Klaphake's Sedge | E | -- | Species | Perennial sedge confined to three locations in NSW, Blackheath and Mt Werong in the Blue Mountains and Penrose in the Southern Highlands. Grows in swamp communities at altitudes of between 600-1200 m above sea level in Coastal Heath Swamps, Montane Bogs and Fens and Montane Lakes. | 5 – BioNet (DPE 2022b) | Burragorang | **Included as a BAM candidate** The species is associated with PCTs 766 and 1256. It has also been previously recorded on five occasions within a 10 km radius of the study area.<br><br>Targeted surveys for this species were undertaken within the study area in November 2021 and January 2022 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence of this species within the study area the species does not require any further consideration. |
| ***Darwinia peduncularis*** | V | -- | Species | A broadly spreading shrub to 1.5 m high. Occurs as local disjunct populations in coastal NSW with a couple of isolated populations in the Blue Mountains. It has been recorded from Brooklyn, Berowra, Galston Gorge, Hornsby, Bargo River, Glen Davis, Mount Boonbourwa and Kings Tableland. Usually grows on or near rocky outcrops on sandy, well drained, low nutrient soil over sandstone. | 0 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate** The species is associated with PCTs 708 and 1248. It has not been previously recorded within a 10 km radius of the study area.<br><br>Targeted surveys for this species were undertaken within the study area in November 2021 and January 2022 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence of this species within the study area the species does not require any further |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
|---|---|---|---|---|---|---|---|
| | **BC Act** | **EPBC Act** | | | | | |
| | | | | | | | consideration. |
| ***Epacris hamiltonii*** | E | E | Species | Small shrub confined to the Blue Mountains distributed throughout 72 sites within a radius of 5 kilometres of one another within three creek catchments flowing into the Grose Valley. Grows in sheltered areas at the base of cliffs, near perennial creeks or underneath plateau hanging swamps, located on the northern sides of the escarpment at altitudes of between 810 - 940m. Associated with a variety of communities including Sydney Montane Dry Sclerophyll Forests, Eastern Riverine Forests, Coastal Heath Swamps, Sydney Montane Heaths, and South Warm Temperate Rainforests. Grows in skeletal sandy soils on Narabeen sandstone substrates. | 154 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate**<br>The species is associated with PCTs 708 and 1248. It has also been previously recorded on 154 occasions within a 10 km radius of the study area.<br><br>Targeted surveys for this species were undertaken within the study area in November 2021 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence of this species within the study area the species does not require any further consideration. |
| ***Eucalyptus aggregata*** Black Gum | V | V | Species | Small to medium sized woodland tree growing in the NSW Central and Southern Tablelands in the south eastern highlands bioregion and on the western fringe of the Sydney Basin. Grows in the wetter, cooler areas of the Southern Highlands on the lowest parts of the landscape in poorly drained flats and hollows adjacent to creeks and small rivers. Associated with a variety of communities | 7 – BioNet (DPE 2022b) | Burragorang | **Included as a BAM candidate**<br>The species is associated with PCTs 766 and 1256. It has also been previously recorded on seven occasions within a 10 km radius of the study area.<br><br>Targeted surveys for this species were undertaken within the study area in November 2021 during the approved survey period. No individuals of this species were detected. |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
|---|---|---|---|---|---|---|---|
| | **BC Act** | **EPBC Act** | | | | | |
| | | | | including Eastern Riverine Forests, Montane Bogs and Fens, Temperate Montane Grasslands, Subalpine Woodlands and Southern Tableland Wet Sclerophyll Forest. Grows in alluvial soils. | | | Based on the absence of this species within the study area the species does not require any further consideration. |
| ***Eucalyptus aquatica*** Broad-leaved Sally | V | V | Species | The Broad-leaved Sally is a tree to 7 m tall. Found primarily in the Penrose area near Goulburn where all records are either from State Forest or private property. There is also one record from within Morton National Park. Occurs as scattered plants on open, swampy flats. | 0 – BioNet (DPE 2022b) | - | **Not identified by BAM-C as a candidate species** The species is associated with PCT 1256, however the known area of occurrence is over 100 km to the south of the study area. No direct impacts to PCT 1256 are proposed as part of the project.<br><br>Incidental surveys for this species were undertaken within the study area in November 2021 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence of this species within the study area the species does not require any further consideration. |
| ***Eucalyptus cannonii*** Capertee Stringybark | V | -- | Species | Usually occurs as a tree 10 – 15 m high with persistent, stringy bark. The Capertee Stringybark is predominantly restricted to the central tablelands and slopes of NSW between the Golden Highway in the north, and the Mitchell Highway in the south. The species' distribution is bounded from east of Bathurst, to Wallerwang near | 0 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate** The species is associated with PCT 1248. It has not been previously recorded within a 10 km radius of the study area.<br><br>Targeted surveys for this species were undertaken within the study area in November 2021 and January 2022 during the approved survey period. No individuals of this species were detected. |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
|---|---|---|---|---|---|---|---|
| | **BC Act** | **EPBC Act** | | | | | |
| | | | | Lithgow, north along the western edge of Wollemi National Park and north-west to Mudgee; isolated occurrences are known from a short way north of Goulburn River National Park between Dunedoo and Merriwa. Within this area the species is often locally frequent. | | | Based on the absence of this species within the study area the species does not require any further consideration. |
| ***Eucalyptus copulans*** | E | E | Species | Mallee tree, with only two individuals growing in a Council Reserve along Jamison Creek at Wentworth Falls in the Blue Mountains. Grows in swampy areas adjacent to Jamison Creek in Sydney Montane Dry Sclerophyll Forests, Coastal Heath Swamps and Sydney Montane Heaths. Grows on swampy, sandy soils. | 2 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate** The species is associated with PCTs 708 and 1248. It has also been previously recorded on two occasions within a 10 km radius of the study area.<br><br>Targeted surveys for this species were undertaken within the study area in November 2021 and January 2022 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence of this species within the study area the species does not require any further consideration. |
| ***Eucalyptus macarthurii*** Paddys River Box, Camden Woollybutt | E | E | Species | Tall tree, distributed from the Moss Vale District to Kanangra Boyd National Park. Grows on broad, cold flats in a variety of communities including Sydney Montane Dry Sclerophyll Forests, Temperate Montane Grasslands, Subalpine Woodlands, Montane Bogs and Fens and Tableland Clay Grassy Woodlands. Grows | 0 – BioNet (DPE 2022b) | - | **Not identified by BAM-C as a candidate species** The species is associated with PCT 1248. It has not been previously recorded within a 10 km radius of the study area.<br><br>Incidental surveys for this species were undertaken within the study area in November 2021 during the approved survey period. No individuals of this species were |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
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| | **BC Act** | **EPBC Act** | | | | | |
| | | | | on fertile soils. | | | detected.<br><br>Based on the absence of this species within the study area the species does not require any further consideration. |
| ***Euphrasia bowdeniae*** Blue Mountains Cliff Eyebright | V | V | Species | Semiparasitic, perennial herb endemic to the upper Blue Mountains. Grows on wet or damp vertical sandstone rock faces and major cliff lines facing south or east at elevations of between 600 m - 750 m in Sydney Montane Dry Sclerophyll Forests, Eastern Riverine Forests, Sydney Coastal Heaths, Sydney Montane Heaths, and Northern Warm Temperate Rainforests. Grows on Narrabeen Sandstone substrates in shallow sandy soils of the Hassans Walls soil landscape. | 12 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate** The species is associated with PCTs 708 and 1248. It has also been previously recorded on 12 occasions within a 10 km radius of the study area.<br><br>Targeted surveys for this species were undertaken within the study area in November 2021 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence of this species within the study area the species does not require any further consideration. |
| ***Gentiana wingecarribiensis*** Wingecarribee Gentian | CE | E | Species | Wingecarribee Gentian is an erect annual herb, to 9 cm tall, with a reddish, unbranched or sparsely-branched stem. Wingecarribee Gentian is known only from Hanging Rock Swamp and Wingecarribee Swamp on the Southern Highlands. Wingecarribee Gentian grows in bogs, in Sphagnum Moss humps and in sedge communities. | 0 – BioNet (DPE 2022b) | - | **Not identified by BAM-C as a candidate species** The species is associated with PCT 1256 however the known area of occurrence is over 100 km to the south of the study area. No direct impacts to PCT 1256 are proposed as part of the project.<br><br>Incidental surveys for this species were undertaken within the study area in November 2021 during the approved survey period. No individuals of this species were detected. |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
|---|---|---|---|---|---|---|---|
| | **BC Act** | **EPBC Act** | | | | | |
| | | | | | | | Based on the absence of this species within the study area the species does not require any further consideration. |
| ***Grammitis stenophylla*** Narrow-leaf Finger Fern | E | -- | Species | Small fern growing on the south, central and north coasts of NSW with records from Mount Kaputar National Park at Narrabri forming its western limit. Grows near streams in moist places on rocks or in trees in a variety of communities including Sydney Montane Dry Sclerophyll Forest, Dry Rainforest, Littoral Rainforest, Northern Warm Temperate Forests and North Coast Wet Sclerophyll Forests. | 2 – BioNet (DPE 2022b) | - | **Not identified by BAM-C as a candidate species** The species is associated with PCT 1078. It has also been previously recorded on two occasions within a 10 km radius of the study area.<br><br>Incidental surveys for this species were undertaken within the study area in November 2021 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence of this species within the study area the species does not require any further consideration. |
| ***Grevillea evansiana*** Evans Grevillea | V | V | Species | A dense spreading shrub, rarely more than 0.5 m high, but can grow to 1.5 m, with white hairy stems. Restricted to mostly within Wollemi National Park principally around the Dunns Swamp area in the central west, but also in outlying locations around Glen Davis and northern section of Newnes Plateau. Grows in a range of habitats including pagoda heath, dry sclerophyll forest or woodland and hanging swamps in sandy soils, usually over Hawkesbury sandstone. | -- | Wollemi | **Excluded as a BAM candidate** The study area is outside the species' area of occurrence.<br><br>BioNet notes the species is restricted to mostly within Wollemi National Park principally around the Dunns Swamp area, but also in outlying locations around Glen Davis and northern section of Newnes Plateau, with all occurrences of the species being 40 km to 90 km north of the study area.<br><br>Based on the absence of this species within the study area the species does not require any further |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
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| | **BC Act** | **EPBC Act** | | | | | |
| | | | | | | | consideration. |
| ***Isopogon fletcheri*** Fletcher's Drumsticks | V | V | Species | Small, multistemmed shrub restricted to a single population growing in Blue Mountains National Park near the Blackheath District. Grows near moist, sheltered cliffs within the spray zones of waterfalls in Central Gorge Dry Sclerophyll Forests, Sydney Montane Dry Sclerophyll Forests, Eastern Riverine Forests and Coastal Heath Swamps. Grows on sandstone substrates. | 65 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate** The species is associated with PCT 1248. It has also been previously recorded on 65 occasions within a 10 km radius of the study area.<br><br>Targeted surveys for this species were undertaken within the study area in November 2021 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence of this species within the study area the species does not require any further consideration. |
| ***Kunzea cambagei*** Cambage Kunzea | V | V | Species | Low shrub with four populations of between 20 to 150 individuals growing on the western and southern extents of the Blue Mountains including Yerranderie and the Mt Werong area. Populations also found growing west of Berrima, along the Wingecarribee River, Loombah Plateau east of Mount Werong, the Oberon-Colong Stock Route within Kanangra-Boyd National Park and Wanganderry Plateau within the Nattai National Park. Grows at high elevations on sandstone outcrops in South East Dry Sclerophyll Forests, Sydney Montane Dry Sclerophyll Forests, Sydney Coastal Heaths and Sydney Montane Heaths. | 3 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate** The species is associated with PCTs 708 and 1248. It has also been previously recorded on 3 occasions within a 10 km radius of the study area.<br><br>Targeted surveys for this species were undertaken within the study area in November 2021 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence of this species within the study area the species does not require any further consideration. |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
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| | **BC Act** | **EPBC Act** | | | | | |
| | | | | Grows in damp, sandy soils derived from silurian sediments. | | | |
| ***Leionema lachnaeoides*** | E | E | Species | Medium sized shrub restricted to 10 sites in the upper Blue Mountains within a 12 kilometre range spanning from Katoomba to Blackheath. Grows on the south-east to south-west facing aspects of rocky, barren areas at elevations of between 960 m to 1000 m in Sydney Montane Dry Sclerophyll Forests, Eastern Riverine Forests, Sydney Montane Heaths and Northern Warm Temperate Forests. BioNet habitat constraints noted as Narrabeen Group sandstone cliffs, pagodas, platforms, shelves and/or terraces or within 200 m. | 42 – BioNet (DPE 2022b) | Wollemi | **Excluded as a BAM candidate**<br>The study area does not support the species microhabitat / habitat constraints (Narrabeen Group sandstone cliffs, pagodas, platforms shelves and/or terraces or within 200 m). Species is known to grow on the top of, and adjacent to, large sandstone cliff faces which do not occur within the study area or development footprint.<br><br>The species does not require any further consideration. |
| ***Leionema sympetalum*** Rylstone Bell | V | V | Species | A shrub (formerly known as Phebalium sympetalum) 2 - 3 metres high, with angled stems which have star-shaped hairs. BioNet notes that the Rylstone Bell is restricted to an area of western Wollemi National Park, from east of Rylstone to north of Glen Davis. Restricted to exposed rocky sandstone formations known as pagodas. The species occurs in dry sclerophyll forest and probably also occurs in open or closed heathland communities. | 0 – BioNet (DPE 2022b) | Wollemi | **Excluded as a BAM candidate**<br>The study area is outside the species' area of occurrence.<br><br>BioNet notes the species is restricted to the Wollemi National Park between Rylestone to Glen Davis, with all occurrences of the species being 50 km to 80 km north of the study area.<br><br>Pagoda formations utilised by the species are also not present within the subject land. The species does not require any further consideration. |
| ***Lepidosperma evansianum*** | V | -- | Species | Tufted perennial herb currently only | 16 – BioNet | - | **Not identified by BAM-C as a** |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
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| | **BC Act** | **EPBC Act** | | | | | |
| Evans Sedge | | | | known from three locations at Blackheath and Wentworth Falls in Blue Mountains National Park. Grows on wet sandstone cliff faces in Eastern Riverine Forests and Northern Warm Temperate Rainforests. | (DPE 2022b) | | **candidate species** The species is associated with PCTs 1078. It has also been previously recorded on 16 occasions within a 10 km radius of the study area.<br><br>Incidental surveys for this species were undertaken within the study area in November 2021 and January 2022 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence of this species within the study area the species does not require any further consideration. |
| ***Leucopogon exolasius*** Woronora Beard-heath | V | V | Species | Erect shrub confined to the upper Georges River area and Heathcote National Park. Grows in a variety of communities including Sydney Coastal Dry Sclerophyll Forests, Sydney Hinterland Dry Sclerophyll Forests, Sydney Montane Dry Sclerophyll Forests, Eastern Riverine Forests, and Sydney Coastal Heaths. Grows on sandstone substrates. | 2 – BioNet (DPE 2022b) | Wollemi | **Excluded as a BAM candidate** The study area is outside the species' area of occurrence.<br><br>The species SPRAT profile notes that its Blue Mountains distribution is restricted to the Grose River area, and to an altitude of up to 100 m. Recent records occur within the Grose River valley approximately 9 km to the north-east of the study area at 400 m altitude. This is a substantially lower elevation than the headwaters of the river, which occur near the study area at approximately 950 m altitude, and the elevation of the study area generally which occurs around 1,000 m altitude.<br>As such the study area does not occur within the required environmental constraints of the species, which has as |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
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| | **BC Act** | **EPBC Act** | | | | | |
| | | | | | | | such been excluded as a candidate.<br><br>The species does not require any further consideration. |
| ***Persoonia acerosa*** Needle Geebung | V | V | Species | Small, erect shrub found growing around the central coast and in the Blue Mountains from Mount Tomah to Hill Top. Grows in heathy or scrubby woodland including disturbed areas in Sydney Coastal Dry Sclerophyll Forests, Sydney Hinterland Dry Sclerophyll Forests, Sydney Montane Dry Sclerophyll Forests and Sydney Montane Heaths. Grows on sandstone substrates in low fertility soils. | 154 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate**<br>The species is associated with PCT 708. It has also been previously recorded on 154 occasions within a 10 km radius of the study area.<br><br>Targeted surveys for this species were undertaken within the study area in January 2022 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence of this species within the study area the species does not require any further consideration. |
| ***Persoonia hindii*** | E | -- | Species | Multi-stemmed, suckering shrub restricted to the Newnes State Forest on the Newnes Plateau, north of Lithgow in the Blue Mountains. Grows in South East Dry Sclerophyll Forests, Sydney Montane Dry Sclerophyll Forests, Coastal Heath Swamps, Sydney Montane Heaths and Southern Tableland Wet Sclerophyll Forests. Grows in sandy soils derived from Narrabeen sandstone. | 1 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate**<br>The species is associated with PCTs 708 and 1248. It has also been previously recorded on one occasion within a 10 km radius of the study area.<br><br>Targeted surveys for this species were undertaken within the study area in January 2022 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence of this species within the study area the species does not require any further consideration. |
| ***Persoonia hirsuta*** Hairy Geebung | E | E | Species | The Hairy Geebung is best distinguished | 0 – BioNet | Wollemi | **Included as a BAM candidate** |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
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| | **BC Act** | **EPBC Act** | | | | | |
| | | | | by its hairiness - long coarse hairs on flowers and branchlets and short stiff ones on the leaves. It has a scattered distribution around Sydney. The species is distributed from Singleton in the north, along the east coast to Hilltop in the south west, Dombarton in the south east and the Blue Mountains to the west. The Hairy Geebung has a large area of occurrence, but occurs in small populations or isolated individuals, increasing the species' fragmentation in the landscape. The Hairy Geebung is found in clayey and sandy soils in dry sclerophyll open forest, woodland and heath, primarily on the Mittagong Formation and on the upper Hawkesbury Sandstone. | (DPE 2022b) | | The species is associated with PCTs 708, and 1248. It has not been previously recorded within a 10 km radius of the study area.<br><br>Targeted surveys for this species were undertaken within the study area in January 2022 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence of this species within the study area the species does not require any further consideration. |
| ***Persoonia marginata*** Clandulla Geebung | V | V | Species | A spreading shrub that grows to 50 cm high and up to 1 m across. The Clandulla Geebung occurs between Kandos and Clarence in the western Blue Mountains. Populations are largely disjunct and include Clandulla, Ben Bullen and Sunny Corner State Forests; isolated populations have also been recorded from Turon and Gardens of Stone National Parks. Grows in dry sclerophyll forest and woodland | 0 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate** The species is associated with PCT 1248. It has not been previously recorded within a 10 km radius of the study area.<br><br>Targeted surveys for this species were undertaken within the study area in January 2022 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence of this species within the study area the species does not require any further |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
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| | **BC Act** | **EPBC Act** | | | | | |
| | | | | communities on sandstone. | | | consideration. |
| ***Pherosphaera fitzgeraldii*** Dwarf Mountain Pine | E | E | Species | Medium sized, erect shrub restricted to a nine kilometre area in the upper Blue Mountains between Wentworth Falls and Katoomba. Found growing along southerly aspects within the spray zone of waterfalls or associated drip lines and seepage areas at elevations between 680 and 1000 metres in Eastern Riverine Forests, Coastal Heath Swamps and Northern Warm Temperate Rainforests. Grows on sandstone substrates. | 62 – BioNet (DPE 2022b) | - | **Not identified by BAM-C as a candidate species** The species is associated with PCT 1078. It has also been previously recorded on 62 occasions within a 10 km radius of the study area.<br><br>Incidental surveys for this species were undertaken within the study area in November 2021 and January 2022 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence of this species within the study area the species does not require any further consideration. |
| ***Prasophyllum fuscum*** Slaty Leek Orchid | CE | V | Species | Terrestrial orchid restricted to the George's River area in Sydney although Harden (2003) states that it also occurs in the Blue Mountains area and some authorities believe it is identical *to P. uroglossum* from the Wingecarribee Area. Found growing in boggy soils, in running water, in drainage lines or moist, open heath amongst sedges and grasses in Sydney Coastal Dry Sclerophyll Forests, Sydney Hinterland Dry Sclerophyll Forests, Coastal Valley Grassy Woodlands, Wallum Sand Heaths, Sydney Coastal Heaths and Sydney Montane Heaths. A | 6 – BioNet (DPE 2022b) | - | **Not identified by BAM-C as a candidate species** The species is associated with PCT 1256. It has also been previously recorded on six occasions within a 10 km radius of the study area. No direct impacts to PCT 1256 are proposed as part of the project.<br><br>Incidental surveys for this species were undertaken within the study area in November 2021 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence of this species within the study area the species does not require any further consideration. |

| *Scientific name* Common name | Status | | BAM credit type | Distribution and habitat (DPE 2022b) | Number of records (DPE 2022b) | IBRA subregions | Likelihood of occurrence and inclusion or exclusion from assessment |
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| | BC Act | EPBC Act | | | | | |
| | | | | cryptic species which is visible as a leaf from April to December, and by flower from September to December. Grows in moist sandy soils over sandstone substrates. | | | |
| ***Prasophyllum pallens*** Musty Leek Orchid | V | -- | Species | The Mount Remarkable leek orchid grows in woodland on slopes and gullies in the Mount Remarkable National Park although it had a wider distribution in the past. | 2 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate** The species is associated with PCT 708. It has also been previously recorded on two occasions within a 10 km radius of the study area.<br><br>Targeted surveys for this species were undertaken within the study area in November 2021 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence of this species within the study area the species does not require any further consideration. |
| ***Prostanthera cryptandroides* subsp. *cryptandroides*** Wollemi Mint-bush | V | V | Species | A low-spreading shrub with a distinctive, pleasant aroma commonly growing 0.5 - 1 m tall and up to 1 m wide. Distributed between Lithgow and Sandy Hollow on the NSW central west slopes, central tablelands and western parts of the central coast botanical regions. Populations occur in Wollemi National Park and Gardens of Stone National Park. A voucher specimen exists for the far northern tablelands near Tenterfield; however, this may represent subsp. | 0 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate** The species is associated with PCTs 708 and 1248. It has not been previously recorded within a 10 km radius of the study area.<br><br>Targeted surveys for this species were undertaken within the study area in November 2021 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence of this species within the study area the species does not require any further |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
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| | **BC Act** | **EPBC Act** | | | | | |
| | | | | euphrasioides. | | | consideration. |
| ***Pultenaea elusa*** Elusive Bush-pea | CE | E | Species | The Elusive Bush-pea is a low shrub with trailing stems to 60 cm long. The Elusive Bush-pea has only been recorded twice, in 1938 at Penrose and Wingello on the Southern Tablelands. Both collections of the Elusive Bush-pea record the habitat only as swamp. | 0 – BioNet (DPE 2022b) | - | **Not identified by BAM-C as a candidate species** The species is associated with PCT 1256, however the only known area of occurrence is over 100 km to the south of the study area. No direct impacts to PCT 1256 are proposed as part of the project.<br><br>Incidental surveys for this species were undertaken within the study area in November 2021 during the approved survey period. No individuals of this species were detected. PCT 1256 habitats are also considered degraded within the study area.<br><br>The species does not require any further consideration. |
| ***Pultenaea glabra*** Smooth Bush-Pea | V | V | Species | Small, erect shrub restricted to the Blue Mountains mainly recorded from the Hazelbrook and Mount Victoria areas with unconfirmed records from the Mount Wilson and Mount Irvine areas. Found growing near swamp margins, on hillslopes, gullies and creekbanks in Southern Tableland Dry Sclerophyll Forests, Sydney Coastal Dry Sclerophyll Forests, Sydney Hinterland Dry Sclerophyll Forests, Sydney Montane Dry Sclerophyll Forests, Coastal Heath Swamps, Sydney Montane Heaths and Southern Lowland Wet Sclerophyll | 100 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate** The species is associated with PCTs 708 and 1248. It has also been previously recorded on 100 occasions within a 10 km radius of the study area.<br><br>Targeted surveys for this species were undertaken within the study area in November 2021 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence of this species within the study area the species does not require any further consideration. |

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| | **BC Act** | **EPBC Act** | | | | | |
| | | | | Forests. Grows on sandstone substrates. | | | |
| ***Pultenaea sp. Olinda*** | E | -- | Species | An erect to procumbent shrub reaching a height of 0.5 to occasionally 2 m tall with spreading hairy stems. Known only within a restricted distribution east of Rylstone with the majority of known individuals occur within Wollemi National Park. Confined to ledges and clefts associated with pagoda rock formations. It occurs as a component of heath communities with or without a sparse *Eucalyptus* and/or *Callitris* canopy on shall, sandy and infertile soils. | -- | Wollemi | **Excluded as a BAM candidate**<br>The study area is outside the species' area of occurrence. Habitat constraints (Ledges and crevices associated with pagoda formations on Narrabeen sandstone of within 50 m) are not present in subject land.<br><br>BioNet notes the species is restricted to east of Rylstone with the majority of known individuals occur within Wollemi National Park, with all occurrences of the species being 75 km to 1,000 km north of the study area.<br><br>The species does not require any further consideration. |
| ***Tetratheca glandulosa*** | V | -- | Species | Small, spreading shrub which grows 20 - 50cm in height. Restricted to the following Local Government Areas: Baulkham Hills, Gosford, Hawkesbury, Hornsby, Ku-ring-gai, Pittwater, Ryde, Warringah, and Wyong. There are approximately 150 populations of this plant ranging from Sampons Pass (Yengo NP) in the north to West Pymble (Lane Cove NP) in the south. The eastern limit is at Ingleside (Pittwater LGA) and the western limit is at East Kurrajong (Wollemi NP). Associated with shale-sandstone transition habitat where shale- | 0 – BioNet (DPE 2022b) | Wollemi | **Excluded as a BAM candidate**<br>The study area is outside the species' area of occurrence.<br><br>BioNet notes the species is restricted to 9 LGAs, which does not include the Blue Mountains, with the species area of occurrence is clearly well east of the study area. BioNet notes it western limit is East Kurrajong.<br>The species is associated with PCT 708. It has not been previously recorded within a 10 km radius of the study area.<br><br>Incidental surveys for this species were undertaken within the study area in November 2021 during the approved survey period. No individuals |

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| | **BC Act** | **EPBC Act** | | | | | |
| | | | | cappings occur over sandstone, with associated soil landscapes such as Lucas Heights, Gymea, Lambert and Faulconbridge. Topographically, the plant occupies ridgetops, upper-slopes and to a lesser extent mid-slope sandstone benches. Soils are generally shallow, consisting of a yellow, clayey/sandy loam. Stony lateritic fragments are also common in the soil profile on many of these ridgetops. | | | of this species were detected.<br><br>Based on the absence of this species within the study area the species does not require any further consideration. |
| ***Velleia perfoliata*** | V | V | Species | Small herb confined to the Hawkesbury district and the Upper Hunter Valley. Found growing in shallow depressions on rocky shelves, rocky hill sides, under cliffs or on rocky / sandy tracks and trails, often amongst mosses and lichen mats in a variety of communities including Central Gorge Dry Sclerophyll Forests, Sydney Coastal Dry Sclerophyll Forests, Coastal Valley Grassy Woodlands, Sydney Coastal Heaths and North Coast Wet Sclerophyll Forests. Grows in shallow, sandy or sandy loam soils over Hawkesbury sandstone substrates. | 1 – BioNet (DPE 2022b) | Wollemi | **Excluded as a BAM candidate**<br>The study area is outside the species' area of occurrence.<br><br>BioNet notes the species is restricted to the Hawkesbury district and upper Hunter Valley.<br><br>A single historical record (from 1788) with the location remarks "Blue Mtns Specified Map No: 8930" occurs within 10 km of the study area, however it is highly inaccurate in terms of GPS location, and is considered an outlier, as confirmed by the BioNet statement above regarding the species distribution.<br><br>The species does not require any further consideration. |
| ***Veronica blakelyi*** | V | -- | Species | Occurs in eucalypt forest, often in moist and sheltered areas. Associated canopy species include Broad-leaved Peppermit, *E.* | 7 – BioNet (DPE 2022b) | Burragorang Wollemi | **Included as a BAM candidate**<br>The species is associated with PCT 1248 and PCT 1615. It has also been previously recorded on |

| *Scientific name* Common name | Status | | BAM credit type | Distribution and habitat (DPE 2022b) | Number of records (DPE 2022b) | IBRA subregions | Likelihood of occurrence and inclusion or exclusion from assessment |
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| | BC Act | EPBC Act | | | | | |
| | | | | *dalrympleana,* White Gum *Eucalyptus rossii* and Snow Gum. Flowers in late Spring through to early Summer. | | | 7 occasions within a 10 km radius of the study area.<br><br>Targeted surveys for this species were undertaken within the study area in January 2022 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence of this species within the study area the species does not require any further consideration. |
| ***Xanthosia scopulicola*** | V | -- | Species | Small, compact shrub, with a scattered distribution between Kings Tableland at Wentworth Falls and Boars Head rock west of Katoomba with most populations occurring within Blue Mountains National Park. Found growing in cracks and crevices of sandstone cliff faces or on rocky outcrops above cliffs in Sydney Montane Dry Sclerophyll Forests, Eastern Riverine Forests, Sydney Montane Heaths and North Coast Wet Sclerophyll Forests. Grows on sandstone substrates. | 11 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate**<br>The species is associated with PCT 1248. It has also been previously recorded on 11 occasions within a 10 km radius of the study area.<br><br>Targeted surveys for this species were undertaken within the study area in November 2021 and January 2022 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence of this species within the study area the species does not require any further consideration. |
| ***Zieria covenyi*** | E | E | Species | A strongly aromatic erect branching shrub to 2 m high (but often much smaller), proliferating from root suckers, with star-shaped hairs on branches. Has been recorded from only one location, Narrow Neck Peninsula within Blue Mountains National | -- | - | **Not identified by BAM-C as a candidate species**<br>The species is associated with PCTs 708 and 1248. It has not been previously recorded within a 10 km radius of the study area.<br><br>Incidental surveys for this species were undertaken within the |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
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| | **BC Act** | **EPBC Act** | | | | | |
| | | | | Park, south-west of Katoomba in the Central Blue Mountains. Two populations on Narrow Neck Peninsula have been detected, several kilometres apart. Both consist of approximately 100 and 170 individual stems. Occurs in open sclerophyll forest dominated by Silvertop Ash. The species occurs on gentle east and south-facing slopes and on ridges in shallow sandy soil. | | | study area in November 2021 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence of this species within the study area the species does not require any further consideration. |
| ***Zieria murphyi*** Velvet Zieria | V | V | Species | Medium sized velvety shrub found in the Blue Mountains at Mount Tomah and in the southern highlands in Morton National Park near Bundanoon and at Penrose. Found growing in sheltered positions in moist gullies in Central Gorge Dry Sclerophyll Forests, South East Dry Sclerophyll Forests, Sydney Coastal Dry Sclerophyll Forests, Sydney Montane Dry Sclerophyll Forests, Sydney Montane Heaths and North Coast Wet Sclerophyll Forests. Grows in sandy soils. | 0 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate**<br>The species is associated with PCTs 708 and 1248. It has not been previously recorded within a 10 km radius of the study area.<br><br>Targeted surveys for this species were undertaken within the study area in November 2021 during the approved survey period. No individuals of this species were detected.<br><br>Based on the absence of this species within the study area the species does not require any further consideration. |
| **Birds** | | | | | | | |
| ***Anthochaera phrygia*** Regent Honeyeater | CE | CE | Species/ Ecosystem | Mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years.<br>Once recorded between Adelaide | 0 – BioNet (DPE 2022b) | - | **Not identified by BAM-C as a candidate species, included for EPBC Act assessments only**<br>The species has not been previously recorded within a 10 km radius of the study area. |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
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| | **BC Act** | **EPBC Act** | | | | | |
| | | | | and the central coast of Queensland, its range has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern Queensland. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. In some years flocks converge on flowering coastal woodlands and forests. | | | The study area is not located within an area mapped by DPE as important (breeding) habitat for this species.<br><br>The species is not associated with PCTs within the study area. |
| ***Callocephalon fimbriatum*** Gang-gang Cockatoo (breeding) | V | E | Species/ Ecosystem | In summer, occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. Also occurs in subalpine Snow Gum woodland and occasionally in temperate or regenerating forest. In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. It requires tree hollows in which to breed. | 126 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate** The species has been previously recorded on 126 occasions within a 10 km radius of the study area, including multiple times within the study area.<br><br>Potential breeding habitat in the form of hollow-bearing trees with suitably sized hollows (i.e. diameter of > 10 cm and at least 9 m above the ground) within Eucalyptus species occur within the study area. Targeted surveys, consisting of stag watches at potential breeding habitat, were undertaken during the species breeding season survey period. No breeding individuals were detected. |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
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| | **BC Act** | **EPBC Act** | | | | | |
| | | | | | | | Foraging habitat is supported by PCTs 708 and 1248 within the development footprint. |
| ***Calyptorhynchus lathami*** Glossy Black-Cockatoo (Breeding) | V | -- | Species/ Ecosystem | Inhabits forest with low nutrients, characteristically with key *Allocasuarina* species. Tends to prefer drier forest types. Often confined to remnant patches in hills and gullies. Breeds in hollows stumps or limbs, either living or dead. | 24 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate** The species has been previously recorded on 24 occasions within a 10 km radius of the study area.<br><br>Potential breeding habitat in the form of hollow-bearing trees with suitably sized hollows (i.e. diameter of > 15cm and at least 8 m above the ground) within living or dead trees occur within the study area. Targeted surveys, consisting of stag watches at potential breeding habitat, were undertaken during the species breeding season survey period. No breeding individuals were detected.<br><br>Foraging habitat is supported by PCTs 708 and 1248 within the development footprint. |
| ***Haliaeetus leucogaster*** White-bellied Sea-Eagle (Breeding) | V | -- | Species/ Ecosystem | A migratory species that is generally sedentary in Australia, although immature individuals and some adults are dispersive. Found in terrestrial and coastal wetlands; favouring deep freshwater swamps, lakes and reservoirs; shallow coastal lagoons and saltmarshes. It hunts over open terrestrial habitats. Feeds on birds, reptiles, fish, mammals, crustaceans and carrion. Roosts and makes nest in trees. | 1 – BioNet (DPE 2022b) | - | **Not identified by BAM-C as a candidate species** The species has been previously recorded on one occasion within a 10 km radius of the study area.<br><br>Suitable vegetation to support breeding occurs within the study area, defined as vegetation within 1 km of rivers, lakes, large dams, creeks or wetlands. However no stick nests of appropriate size to be utilised by this species were observed during the field investigations. |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
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| | **BC Act** | **EPBC Act** | | | | | |
| | | | | | | | Foraging habitat is supported by PCT 1256 within the study area. No direct impacts to PCT 1256 are proposed as part of the project. |
| ***Hieraaetus morphnoides*** Little Eagle (Breeding) | V | -- | Species/ Ecosystem | The Little Eagle is most abundant in lightly timbered areas with open areas nearby providing an abundance of prey species. It has often been recorded foraging in grasslands, crops, treeless dune fields, and recently logged areas. The Little Eagle nests in tall living trees within farmland, woodland and forests. | 2 – BioNet (DPE 2022b) | Burragorang Wollemi | **Included as a BAM candidate** The species has been previously recorded on two occasions within a 10 km radius of the study area.<br><br>Suitable vegetation to support breeding occurs within the study area. However no stick nests of appropriate size to be utilised by this species were observed during the field investigations.<br><br>Foraging habitat is supported by PCTs 708, 1248 and 1256 within the development footprint. |
| ***Lathamus discolor*** Swift Parrot | E | CE | Species/ Ecosystem | Migrates to the Australian south-east mainland between February and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood, Forest Red Gum *Eucalyptus tereticornis*, Mugga Ironbark *E. sideroxylon*, and White Box. Commonly used lerp infested trees include Inland Grey | 3 – BioNet (DPE 2022b) | - | **Not identified by BAM-C as a candidate species, included for EPBC Act assessments only** The species has been previously recorded on three occasions within a 10 km radius of the study area.<br><br>The study area is not located within an area mapped by DPE as important (breeding) habitat for this species.<br><br>The species is not associated with PCTs within the study area. |

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| | | | | Box *E. microcarpa*, Grey Box *E. moluccana*, Blackbutt *E. pilularis*, and Yellow Box. Returns to some foraging sites on a cyclic basis depending on food availability. | | | |
| ***Lophoictinia isura*** Square-tailed Kite (Breeding) | V | -- | Species/ Ecosystem | Typically inhabits coastal forested and wooded lands of tropical and temperate Australia. In NSW it is often associated with ridge and gully forests dominated by *Eucalyptus longifolia,* Spotted Gum, *E. elata,* or *E. smithii*. Individuals appear to occupy large hunting ranges of more than 100 km2. They require large living trees for breeding, particularly near water with surrounding woodland /forest close by for foraging habitat. Nest sites are generally located along or near watercourses, in a tree fork or on large horizontal limbs. | 1 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate**<br>The species has been previously recorded on one occasion within a 10 km radius of the study area.<br><br>Suitable vegetation to support breeding occurs within the study area. However, no stick nests of appropriate size to be utilised by this species were observed during the field investigations.<br><br>Foraging habitat is supported by PCT 708 within the development footprint. |
| ***Ninox connivens*** Barking Owl (Breeding) | V | -- | Species/ Ecosystem | Generally found in open forests, woodlands, swamp woodlands, farmlands and dense scrub. Can also be found in the foothills and timber along watercourses in otherwise open country. Territories are typically 2000 ha in NSW habitats. Hunts small arboreal mammals or birds and terrestrial mammals when tree hollows are absent. | 2 – BioNet (DPE 2022b) | Burragorang Wollemi | **Included as a BAM candidate**<br>The species has been previously recorded on two occasions within a 10 km radius of the study area.<br><br>Potential breeding habitat in the form of hollow-bearing trees with suitably sized hollows (i.e. diameter of > 20 cm and at least 4 m above the ground) within living or dead trees occur within the study area. Targeted surveys, consisting of call-playback surveys at potential breeding habitat locations, were |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
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| | **BC Act** | **EPBC Act** | | | | | |
| | | | | | | | undertaken during the species breeding season survey period. No breeding individuals were detected.<br><br>Foraging habitat is supported by PCTs 1248 and 1615 within the development footprint. |
| ***Ninox strenua*** Powerful Owl (Breeding) | V | -- | Species/ Ecosystem | The Powerful Owl occupies wet and dry eucalypt forests and rainforests. It may inhabit both un-logged and lightly logged forests as well as undisturbed forests where it usually roosts on the limbs of dense trees in gully areas. Large mature trees with hollows at least 0.5 m deep are required for nesting. Tree hollows are particularly important for the Powerful Owl because a large proportion of the diet is made up of hollow-dependent arboreal marsupials. Nest trees for this species are usually emergent with a diameter at breast height of at least 100 cm. It has a large home range of between 450 and 1450 ha. | 20 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate**<br>The species has been previously recorded on 20 occasions within a 10 km radius of the study area.<br><br>Potential breeding habitat in the form of hollow-bearing trees with suitably sized hollows (i.e. diameter of > 20 cm) within living or dead trees occur within the study area. Targeted surveys, consisting of call-playback surveys at potential breeding habitat locations, were undertaken during the species breeding season survey period. No breeding individuals were detected.<br><br>Foraging habitat is supported by PCT 1248 within the development footprint. |
| ***Tyto novaehollandiae*** Masked Owl (Breeding) | V | -- | Species/ Ecosystem | Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. There is no seasonal variation in its distribution. | 0 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate**<br>The species has not been previously recorded within a 10 km radius of the study area.<br><br>Potential breeding habitat in the form of hollow-bearing trees with suitably sized hollows (i.e. diameter of > 20 cm) within living or dead trees occur within the study area. Targeted surveys, |

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| | **BC Act** | **EPBC Act** | | | | | |
| | | | | | | | consisting of call-playback surveys at potential breeding habitat locations, were undertaken during the species breeding season survey period. No breeding individuals were detected.<br><br>Foraging habitat is supported by PCT 1248 within the development footprint. |
| ***Tyto tenebricosa*** Sooty Owl (Breeding) | V | -- | Species/ Ecosystem | The Sooty Owl is often found in tall old-growth forests, including temperate and subtropical rainforests. It is mostly found on escarpments with a mean altitude <500 m. This species nests and roosts in hollows of emergent trees, mainly eucalypts often located in gullies. | 15 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate**<br>The species has been previously recorded on 15 occasions within a 10 km radius of the study area.<br><br>Potential breeding habitat in the form of hollow-bearing trees with suitably sized hollows (i.e. diameter of > 20 cm) within living or dead trees occur within the study area. Targeted surveys, consisting of call-playback surveys at potential breeding habitat locations, were undertaken during the species breeding season survey period. No breeding individuals were detected.<br><br>Foraging habitat is supported by PCT 1248 within the development footprint. |
| **Mammals** | | | | | | | |
| ***Cercartetus nanus*** Eastern Pygmy-possum | V | -- | Species | Patchily distributed from the coast to the Great Dividing Range, and as far as Pillaga, Dubbo, Parkes and Wagga Wagga on the western slopes. Inhabits rainforest through to sclerophyll forest and tree heath. Banksias and myrtaceous shrubs and trees are a | 14 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate**<br>The species has been previously recorded on 15 occasions within a 10 km radius of the study area.<br><br>Moderate and high condition PCTs 708 and 1248 represent potential breeding and foraging habitat for this species. These areas may support tree |

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| | | | | favoured food source. Soft fruits are eaten when flowers are unavailable and it also feeds on insects. Will often nest in tree hollows, but can also construct its own nest. Because of its small size it is able to utilise a range of hollow sizes including very small hollows. Individuals will use a number of different hollows and an individual has been recorded using up to 9 nest sites within a 0.5 ha area over a 5 month period. | | | hollows, rotten stumps, possum dreys and thickets of vegetation.<br><br>Targeted surveys were undertaken between November 2021 to January 2022 (remote cameras) and May 2022 (spotlighting) and the species was not detected. |
| ***Chalinolobus dwyeri*** Large-eared Pied Bat | V | V | Species | Occurs from the Queensland border to Ulladulla, with largest numbers from the sandstone escarpment country in the Sydney Basin and Hunter Valley. Primarily found in dry sclerophyll forests and woodlands, but also found in rainforest fringes and subalpine woodlands. Forages on small, flying insects below the forest canopy. Roosts in colonies of between three and 80 in caves, Fairy Martin nests and mines, and beneath rock overhangs, but usually less than 10 individuals. Likely that it hibernates during the cooler months. The only known existing maternity roost is in a sandstone cave near Coonabarabran. | 7 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate**<br>The species has been previously recorded on seven occasions within a 10 km radius of the study area.<br><br>Study area occurs within 2 km of high quality rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, which could provide potential breeding habitat for this species.<br><br>Foraging habitat for this species occurs throughout the development footprint in the form of high and moderate condition PCTs 708 and 1248.<br><br>Targeted surveys were undertaken between November 2021 to February 2022 which consisted of ultrasonic call recording and harp trapping. The species was detected by ultrasonic call recording and analysis but not by harp |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
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| | **BC Act** | **EPBC Act** | | | | | |
| | | | | | | | trapping. A species polygon has been generated for this species. |
| ***Dasyurus maculatus*** Spotted-tailed Quoll | V | E | Ecosystem | Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the subalpine zone to the coastline. Quolls use hollow-bearing trees, fallen logs, other animal burrows, small caves and rock outcrops as den sites. Mostly nocturnal, although will hunt during the day; spend most of the time on the ground, although also an excellent climber and will hunt possums and gliders in tree hollows and prey on roosting birds. Use communal 'latrine sites', often on flat rocks among boulder fields, rocky cliff-faces or along rocky stream beds or banks. | 171 – BioNet (DPE 2022b) | - | **Not identified by BAM-C as a candidate species, included for EPBC Act assessments only** The species has been previously recorded on 171 occasions within a 10 km radius of the study area, including within the study area.<br><br>Native vegetation conforming to PCTs 708, 1078, 1248, 1256 and 1615 present within the development footprint represents potential foraging habitat for this species. |
| ***Isoodon obesulus obesulus*** Southern Brown Bandicoot (eastern) | E | E | Species | Generally only found in heath or open forest with a heathy understorey. This species prefers sandy soils with scrubby vegetation and/or areas with low ground cover that are burnt from time to time. A mosaic of post fire vegetation is important for this species. Nest during the day in a shallow depression in the ground covered by leaf litter, grass or other plant material. Nests may be located under Grass trees, blackberry | 2 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate** The species has been previously recorded on two occasions within a 10 km radius of the study area.<br><br>Potential habitat for the species within the study area is represented by areas of heathy understorey, which could provide potential breeding and foraging habitat for this species.<br><br>Targeted surveys were undertaken in May 2022 which consisted of remote cameras and spotlighting. The |

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| | **BC Act** | **EPBC Act** | | | | | |
| | | | | bushes and other shrubs, or in rabbit burrows. | | | species was not detected during targeted survey. |
| ***Miniopterus australis*** Little Bent-winged Bat (Breeding) | V | -- | Species/ Ecosystems | Occurs from Northern Queensland to the Hawkesbury River near Sydney. Roost sites encompass a range of structures including caves, tunnels and stormwater drains. Young are raised by the females in large maternity colonies in caves in summer. Shows a preference for well-timbered areas including rainforest, wet and dry sclerophyll forests, Melaleuca swamps and coastal forests. The Little Bentwing bat forages for small insects (such as moths, wasps and ants) beneath the canopy of densely vegetated habitats. | 2 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate** The species has been previously recorded on two occasions within a 10 km radius of the study area.<br><br>Potential breeding habitat occurs in the form of rocky outcrops and cliff lines outside of the study area. Foraging habitat is represented by high and moderate condition PCT 1248 within the development footprint.<br><br>Targeted surveys were undertaken between November 2021 and February 2022 which consisted of ultrasonic call recording and harp trapping. The species was not detected with either survey technique. |
| ***Miniopterus orianae oceanensis*** Large Bent-winged Bat (Breeding) | V | -- | Species/ Ecosystems | Occurs from Victoria to Queensland, on both sides of the Great Dividing Range. Forms large maternity roosts (up to 100,000 individuals) in caves and mines in spring and summer. Individuals may fly several hundred kilometres to their wintering sites, where they roost in caves, culverts, buildings, and bridges. They occur in a broad range of habitats including rainforest, wet and dry sclerophyll forest, paperbark forest and open grasslands. Has a fast, direct flight and forages for flying insects (particularly moths) above the | 26 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate** The species has been previously recorded on 26 occasions within a 10 km radius of the study area.<br><br>Potential breeding habitat occurs in the form of rocky outcrops and cliff lines outside of the study area. Foraging habitat is represented by high and moderate condition PCTs 708 and 1248 within the development footprint.<br><br>Targeted surveys were undertaken between November 2021 and February 2022 which consisted of ultrasonic call recording and harp trapping. The species was detected by ultrasonic call |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
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| | | | | tree canopy and along waterways. | | | recording and analysis but not by harp trapping.<br><br>As no breeding individuals were detected, and no breeding habitat occurs within the development footprint, no further action is required for this species. |
| ***Myotis macropus*** Southern Myotis | V | -- | Species | Scattered, mainly coastal distribution extending to South Australia along the Murray River. Roosts in caves, mines or tunnels, under bridges, in buildings, tree hollows, and even in dense foliage. Colonies occur close to water bodies, ranging from rainforest streams to large lakes and reservoirs. They catch aquatic insects and small fish with their large hind claws, and also catch flying insects. | 7 – BioNet (DPE 2022b) | - | **Not identified by BAM-C as a candidate species** The species has been previously recorded on seven occasions within a 10 km radius of the study area.<br><br>Potential breeding and roosting habitat for the species is represented by hollow-bearing-trees located within 200m of riparian zones and water features. Foraging habitat is well represented by several large dams that occur within the Little Hartley study area.<br><br>Targeted surveys were undertaken between November 2021 and February 2022 which consisted of ultrasonic call recording and harp trapping. Members of this species group were detected by ultrasonic call recording, however due to overlap in call characteristics with similar species, these could not be confirmed to species level. As this is a possible identification of this threatened species the species is assumed to have been detected by ultrasonic call recording for the purposes of this BDAR and a species polygon has been generated. No individuals were detected by harp |

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| | **BC Act** | **EPBC Act** | | | | | |
| | | | | | | | trapping. |
| ***Petauroides volans*** Greater Glider | -- | E | Species | The distribution of the Greater Glider includes the ranges and coastal plain of eastern Australia, where it inhabits a variety of eucalypt forests and woodlands. Presence and density of Greater Gliders is related to soil fertility, eucalypt tree species, disturbance history and density of suitable tree hollows. Feeds exclusively on eucalypt leaves, buds, flowers and mistletoe. | 52 – BioNet (DPE 2022b) | Wollemi | **Not identified by BAM-C as a candidate species, included for EPBC Act assessments only** The species has been previously recorded on 52 occasions within a 10 km radius of the study area, including within the study area.<br><br>Native vegetation conforming to PCT 1248 present within the development footprint represents potential foraging habitat for this species. Hollow-bearing trees also represent potential roosting habitat.<br><br>Targeted surveys for the species were undertaken in May 2022 (spotlighting). The species was detected during these surveys at both the Little Hartley and Blackheath study areas. |
| ***Petaurus norfolcensis*** Squirrel Glider | V | -- | Species | Generally occurs in dry sclerophyll forests and woodlands but is absent from dense coastal ranges in the southern part of its range. Requires abundant hollow-bearing trees and a mix of eucalypts, banksias and acacias. Within a suitable vegetation community at least one species should flower heavily in winter and one species of eucalypt should be smooth barked. | 6 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate** The species has been previously recorded on six occasions within a 10 km radius of the study area.<br><br>Native vegetation conforming to PCT 1248 present within the development footprint represents potential foraging habitat for this species. Hollow-bearing trees also represent potential roosting habitat.<br><br>Targeted surveys for the species were undertaken in November 2021 to January 2022 which consisted of remote camera deployment. |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
|---|---|---|---|---|---|---|---|
| | **BC Act** | **EPBC Act** | | | | | |
| | | | | | | | Spotlighting was also undertaken in May 2022. The species was not detected during targeted survey. |
| ***Petrogale penicillata*** Brush-tailed Rock-wallaby | E | V | Species | Occurs along the Great Dividing Range south to the Shoalhaven, and also occurs in the Warrumbungle's and Mt Kaputar. Habitats range from rainforest to open woodland. It is found in areas with numerous ledges, caves and crevices particularly with northern aspects. The species forages on grasses and forbs. | 3 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate** The species has been previously recorded on three occasions within a 10 km radius of the study area.<br><br>Potential habitat for the species is represented by areas with 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops and cliff lines. These are particularly prevalent in the vicinity of the Little Hartley study area.<br><br>Areas of potential habitat for this species were mapped across the study area. Remote cameras were also deployed within these areas to establish species presence. The species was not detected during these surveys. |
| ***Phascolarctos cinereus*** Koala | V | E | Species | In NSW the Koala mainly occurs on the central and north coasts with some populations in the western region. Koalas feed almost exclusively on eucalypt foliage, and their preferences vary regionally. Primary feed trees include Swamp Mahogany, Forest Red Gum, Grey Gum, Scribbly Gum and *E. signata.* They are solitary with varying home ranges. | 11 – BioNet (DPE 2022b) | Burragorang Wollemi | **Included as a BAM candidate** The species has been previously recorded on 3 occasions within a 10 km radius of the study area.<br><br>Foraging habitat and potential breeding habitat occurs throughout the development footprint in the form of high and moderate condition PCTs 708, 1248 and 1615.<br><br>Targeted surveys were undertaken in May 2022 which consisted of spotlighting surveys. The species was not detected during these surveys. |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
|---|---|---|---|---|---|---|---|
| | **BC Act** | **EPBC Act** | | | | | |
| ***Potorous tridactylus*** Long-nosed Potoroo | V | V | Species | The long-nosed potoroo is found on the south-eastern coast of Australia, from Queensland to eastern Victoria and Tasmania, including some of the Bass Strait islands. There are geographically isolated populations in western Victoria. In NSW it is generally restricted to coastal heaths and forests east of the Great Dividing Range, with an annual rainfall exceeding 760 mm. Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature. | 0 – BioNet (DPE 2022b) | - | **Not identified by BAM-C as a candidate species** The species has not been previously recorded within a 10 km radius of the study area.<br><br>Potential habitat for the species within the study area is represented by areas of dense heathy understorey, which could provide potential breeding and foraging habitat for this species.<br><br>Targeted surveys were undertaken in May 2022 which consisted of remote cameras and spotlighting. The species was not detected during targeted survey.<br><br>The species does not require any further consideration. |
| ***Pteropus poliocephalus*** Grey-headed Flying-fox (Breeding) | V | V | Species/ Ecosystem | Occurs along the NSW coast, extending further inland in the north. This species is a canopy-feeding frugivore and nectarivore of rainforests, open forests, woodlands, melaleuca swamps and banksia woodlands. Roosts in large colonies, commonly in dense riparian vegetation. | 58 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate** The species has been previously recorded on 58 occasions within a 10 km radius of the study area.<br><br>No camps (communal breeding/roosting sites) representing potential breeding habitat were identified within the study area during the field investigations.<br><br>Foraging habitat occurs throughout the development footprint, represented by high and moderate condition PCTs 708 and 1248. |
| **Amphibians** | | | | | | | |
| ***Heleioporus australiacus*** | V | V | Species | Prefers hanging swamps on | 4 – BioNet | Wollemi | **Included as a BAM candidate** |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
|---|---|---|---|---|---|---|---|
| | **BC Act** | **EPBC Act** | | | | | |
| Giant Burrowing Frog | | | | sandstone shelves adjacent to perennial non-flooding creeks. Can also occur within shale outcrops within sandstone formations. Known from wet and dry forests and montane woodland in the southern part range. Individuals can be found around sandy creek banks or foraging along ridge-tops during or directly after heavy rain. Males often call from burrows located in sandy banks next to water. Spends the majority of its time in non-breeding habitat 20-250m from breeding sites. | (DPE 2022b) | | The species has been previously recorded on four occasions within a 10 km radius of the study area.<br><br>Several creek lines with dense overhanging vegetation occur throughout the study area which may provide habitat for this species. These areas are within vegetation conforming to PCTs 708 and 1248 which are associated with this species.<br><br>Targeted surveys were undertaken in December 2021 and January 2022 which consisted of call playback and active spotlighting searches. The species was not detected during these surveys. |
| ***Litoria aurea*** Green and Golden Bell Frog | E | V | Species | Formerly distributed from the NSW north coast near Brunswick Heads, southwards along the NSW coast to Victoria where it extends into east Gippsland. Records from west to Bathurst, Tumut and the ACT region. Since 1990 there have been approximately 50 recorded locations in NSW, most of which are small, coastal, or near coastal populations. These locations occur over the species' former range; however they are widely separated and isolated. Large populations in NSW are located around the metropolitan areas of Sydney, Shoalhaven and mid north coast (one an island population). There is only one | 0 – BioNet (DPE 2022b) | Burragorang | **Excluded as a BAM candidate**<br>The species has not been previously recorded within a 10 km radius of the study area, with the nearest record approximately 38 kilometres to the south-west.<br><br>The aquatic habitat present within the study area were not considered to represent potential habitat for the species. Both Greaves Creek and Bell Creek were degraded and did not contain bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.) which are preferred by the species. Bells Creek in particularly was particularly degraded due to the presence of cattle within the area.<br><br>The species is highly characteristic and |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
|---|---|---|---|---|---|---|---|
| | **BC Act** | **EPBC Act** | | | | | |
| | | | | known population on the NSW Southern Tablelands.<br><br>Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). | | | easily distinguishable from other frog species based on both its colouration and call. Opportunistic call broadcasting as part of targeted survey for other frog species did not elicit a response. |
| ***Litoria booroolongensis*** Booroolong Frog | E | E | Species | The species is restricted to NSW and north-eastern VIC, predominantly along the western-flowing streams of the Great Dividing Range. The most recent records occur on the south-west slopes of NSW. The species is found in upland rivers, montane creeks and lowland rivers and creeks, particularly in permanent rocky western-flowing streams and rivers on the slopes and tablelands of NSW, with some fringing vegetation cover such as ferns, sedges or grasses. The Booroolong Frog is often found in daylight on rocks by the water's edge or sheltering under rocks or amongst vegetation. Breeding occurs in spring and early summer when eggs are laid in submerged rock crevices. Tadpoles develop in slow-flowing connected or isolated pools and metamorphose in late summer to early autumn | 0 – BioNet (DPE 2022b) | Wollemi | **Excluded as a BAM candidate** The species has not been previously recorded within a 10 km radius of the study area, with the nearest record approximately 19 kilometres to the south-west.<br><br>The species requires permanent, or near permanent river environment with rocky structures (bedrock or cobble). Suitable breeding habitat consists of rocky structures in shallow water along the riparian zone, and non-breeding habitat is any habitat within the riparian zone (generally within 50 metres of the high water mark) (DPIE 2020c). These microhabitats were not present within the subject land.<br><br>Advice received from Dr Francis Lemckert (a listed BAM species expert for several frog species, and published author of papers relating to the species) regarding this species is that habitat for this species is not present within the study area (pers. comm. 13 April 2022). |
| ***Litoria littlejohni*** Littlejohn's Tree Frog | V | V | Species | The species is distributed along the eastern slopes of the Great Dividing Range from | 0 – BioNet (DPE 2022b) | Wollemi | **Not identified by BAM-C as a candidate species** The species has not been previously |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
|---|---|---|---|---|---|---|---|
| | **BC Act** | **EPBC Act** | | | | | |
| | | | | Watagan State Forest near Wyong, south to Buchan in north-eastern VIC. It is not known from coastal habitats. Occurs in wet and dry sclerophyll forests and heath communities associated with sandstone outcrops between 280 and 1000 m. Littlejohn's Tree Frog prefers permanent and semi-permanent rock flowing streams, but individuals have also been collected from semi-permanent dams with some emergent vegetation. Forages both in the tree canopy and on the ground, and has been observed sheltering under rocks on high exposed ridges during summer. The species breeds in autumn but will also breed after heavy rainfall in spring and summer. The species has been recorded calling in all seasons with variously reported peak calling periods. Eggs are laid in loose gelatinous masses attached to submerged twigs; eggs and tadpoles are most often recorded in slow-flowing pools that receive extended exposure to sunlight. | | | recorded within a 10 km radius of the study area.<br><br>Several creek lines with dense overhanging vegetation occur throughout the study area which may provide habitat for this species. These areas are within vegetation conforming to PCTs 708 and 1248 which are associated with this species.<br><br>A species expert report has been secured for this species. |
| ***Mixophyes balbus*** Stuttering Frog | E | V | Species | This species is usually associated with mountain streams, wet mountain forests and rainforests. It rarely moves very far from the banks of permanent forest | 1 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate** The species has been previously recorded on one occasion within a 10 km radius of the study area.<br><br>Several creek lines |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
|---|---|---|---|---|---|---|---|
| | **BC Act** | **EPBC Act** | | | | | |
| | | | | streams, although it will forage on nearby forest floors. Eggs are deposited in leaf litter on the banks of streams and are washed into the water during heavy rains. | | | with dense overhanging vegetation occur throughout the study area which may provide habitat for this species. These areas are within vegetation conforming to PCT 708 which is associated with this species.<br><br>Targeted surveys were undertaken in January 2022 which consisted of call playback and active spotlighting searches. The species was not detected during these surveys. |
| ***Pseudophryne australis*** Red-crowned Toadlet | V | -- | Species | Occurs on wetter ridge tops and upper slopes of sandstone formations on which the predominant vegetation is dry open forests and heaths. This species typically breeds within small ephemeral creeks characterised by a series of shallow pools that feed into larger semi-perennial streams. | 14 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate**<br>The species has been previously recorded on 14 occasions within a 10 km radius of the study area.<br><br>Several creek lines with dense overhanging vegetation occur throughout the study area which may provide habitat for this species. These areas are within vegetation conforming to PCTs 708 and 1248 which are associated with this species.<br><br>Targeted surveys were undertaken in December 2021 which consisted of call playback and active spotlighting searches. The species was not detected during these surveys. |
| **Reptiles** | | | | | | | |
| ***Eulamprus leuraensis*** Blue Mountains Water Skink | E | E | Species | Swampy heaths over sandstone at Wentworth falls, Leura and Newnes Plateau in the Blue Mountains. Basks on dense grass tussocks, sheltering beneath them or in burrows, including those of | 74 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate**<br>The species has been previously recorded on 74 occasions within a 10 km radius of the study area.<br><br>The study area contains the swampy heath habitat within the |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
|---|---|---|---|---|---|---|---|
| | **BC Act** | **EPBC Act** | | | | | |
| | | | | crustaceans, when disturbed. | | | Blue Mountains region that represents potential habitat for this this species.<br><br>Targeted survey was undertaken in December 2021. The species was not detected as part of these surveys. |
| ***Hoplocephalus bungaroides*** Broad-headed Snake (breeding) | E | V | Species/ Ecosystem | Mainly occurs in association with communities occurring on Triassic sandstone within the Sydney Basin. Typically found among exposed sandstone outcrops with vegetation types ranging from woodland to heath. Within these habitats they generally use rock crevices and exfoliating rock during the cooler months and tree hollows during summer. | 11 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate** The species has been previously recorded on 11 occasions within a 10 km radius of the study area, including within the study area.<br><br>Areas of potential breeding habitat for this species are represented by rocky outcrops within Sydney sandstone formations. No such habitats were mapped within the development footprint. Foraging habitat is represented by high and moderate condition PCTs 708 and 1248 within the development footprint. |
| **Invertebrates** | | | | | | | |
| ***Paralucia spinifera*** Purple Copper Butterfly, Bathurst Copper Butterfly | E | V | Species | Commonly found in open woodland or open forest with a sparse understorey dominated by Blackthorn (*Bursaria spinosa subsp. lasiophylla*). Found in locations above 850 m altitude and is associated with exposure to full day sun, often with a west to north aspect. Also associated with extremes of cold. | 6 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate** The species has been previously recorded on six occasions within a 10 km radius of the study area.<br><br>Potential habitat for this species is represented within the study area where Native Blackthorn is present. The occurrence of Native Blackthorn was therefore mapped across the entire study area. Areas of native vegetation containing PCTs associated with the species (i.e. PCT 1248) within 40 metres of these occurrences have been mapped as habitat for this species. |

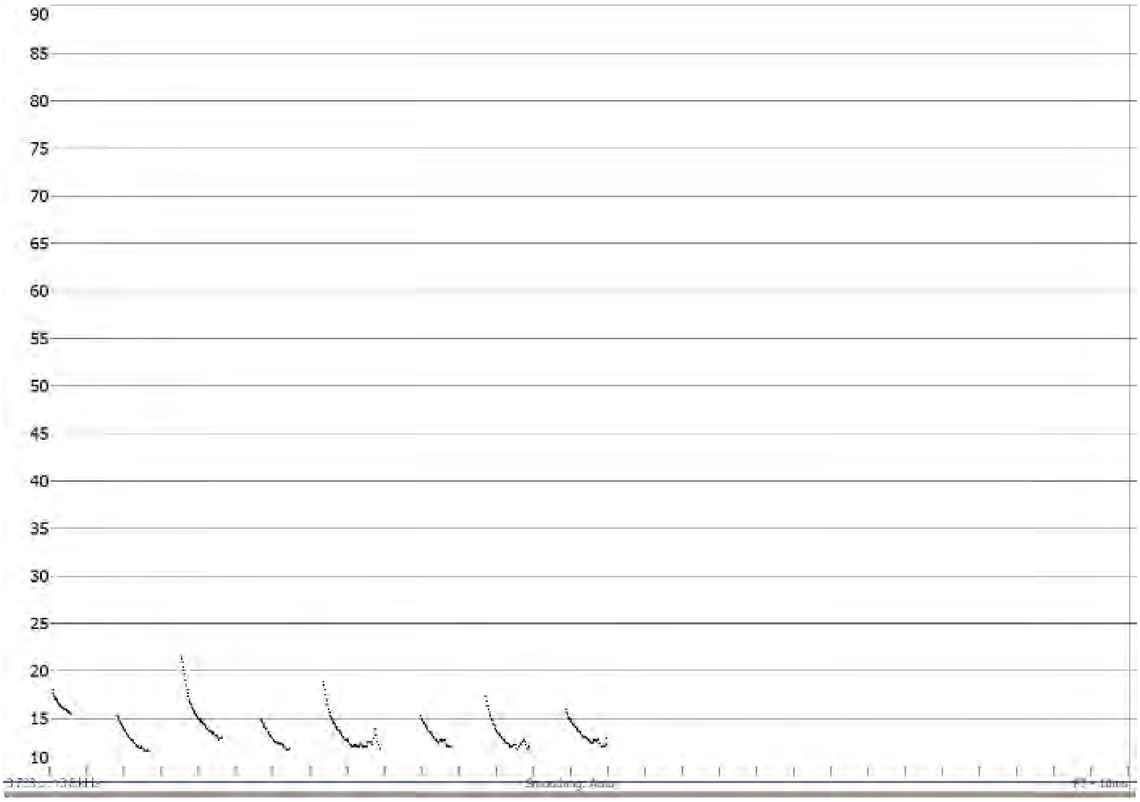
| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
|---|---|---|---|---|---|---|---|
| | **BC Act** | **EPBC Act** | | | | | |
| | | | | | | | The species has been assumed to be present within these areas. |
| ***Petalura gigantea*** Giant Dragonfly | E | -- | Species | Live in permanent swamps and bogs with some free water and open vegetation. Adults spend most of their time settled on low vegetation on or adjacent to the swamp. | 87 – BioNet (DPE 2022b) | Wollemi | **Included as a BAM candidate** The species has been previously recorded on 87 occasions within a 10 km radius of the study area.<br><br>The study area occurs within 500m of permanent swamps that could potentially provide breeding and foraging habitat for this species.<br><br>Targeted surveys were undertaken in December 2021 for this species, within potential swamp habitats. The species was not detected as part of these surveys. |
| **Fungi** | | | | | | | |
| ***Hygrocybe anomala* var. *ianthinomarginata*** | V | -- | Species | Known from the locality, Lane Cove Bushland Park, Lane Cove and from other locations in the Sydney regional including Royal National Park, Chatswood, Castle Hill and the Blue Mountains (Springwood). Occurs in gallery warm temperate forests dominated by Lilly Pilly (*Acmena smithii*), Grey Myrtle (*Backhousia myrtifolia*), Cheese Tree (*Glochidion ferdinandi*) and Sweet Pittosporum (*Pittosporum undulatum*). Associated with alluvial sandy soils of the Hawkesbury Soil Landscapes with naturally low fertility and erodible. | -- | Wollemi | **Excluded as candidate.** BioNet notes the species is only known from the lower Blue Mountains (Springwood, Hazelbrook) and to the north of the study area at Mt Wilson proximal to the study area. Furthermore, BioNet states that the species is known to occur in gallery warm temperate forests with mesic species not present within the study area.<br><br>Advice received from Dr Steven Douglas (a listed BAM species expert for flora) regarding this species is that habitat for this species is not likely to be present within the study area due to the; different sub region, the considerably higher elevations, the difference in geology and lastly distance |

| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
|---|---|---|---|---|---|---|---|
| | **BC Act** | **EPBC Act** | | | | | |
| | | | | | | | from the temperate coastal environments of the known locations (pers. comm. July 2022).<br><br>The study area is considered to occur outside the species area of occurrence and does not support the suitable microhabitats required for the species presence.<br><br>The species does not require any further consideration. |
| ***Hygrocybe aurantipes*** | V | -- | Species | Known from type locality, Lane Cove Bushland Park, Lane Cove, and other locations in the Sydney region including Royal National Park, Chatswood, Northbridge and the Blue Mountains (Mount Wilson, Hazelbrook, Springwood). Occurs in gallery warm temperate forests dominated by Lilly Pilly (*Acmena smithii*), Grey Myrtle (*Backhousia myrtifolia*), Cheese Tree (*Glochidion ferdinandi*) and Sweet Pittosporum (*Pittosporum undulatum*). Associated with alluvial sandy soils of the Hawkesbury Soil Landscapes with naturally low fertility and erodible. | -- | Wollemi | **Excluded as candidate.** BioNet notes the species is only known from the lower Blue Mountains (Springwood, Hazelbrook) and to the north of the study area at Mt Wilson proximal to the study area. Furthermore, BioNet states that the species is known to occur in gallery warm temperate forests with mesic species not present within the study area.<br><br>Advice received from Dr Steven Douglas (a listed BAM species expert for flora) regarding this species is that habitat for this species is not likely to be present within the study area due to the; different sub region, the considerably higher elevations, the difference in geology and lastly distance from the temperate coastal environments of the known locations (pers. comm. July 2022).<br><br>The study area is considered to occur outside the species area of occurrence and does not support the |

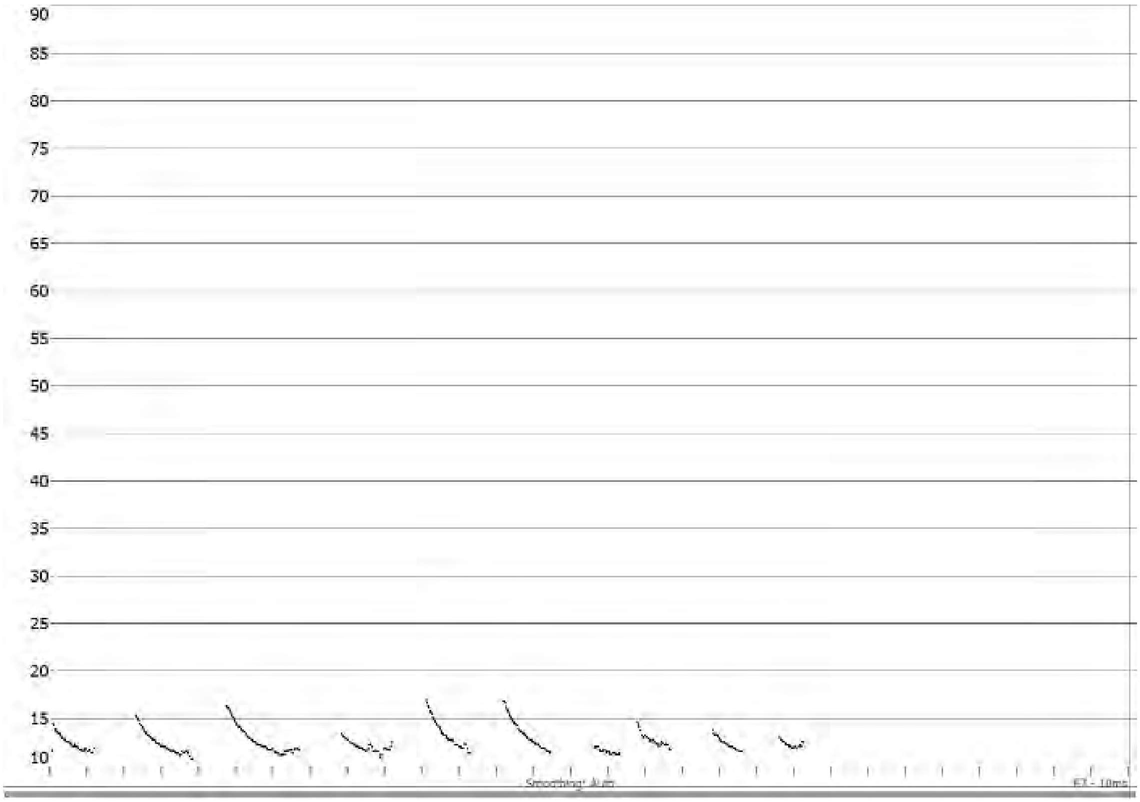
| ***Scientific name*** **Common name** | **Status** | | **BAM credit type** | **Distribution and habitat (DPE 2022b)** | **Number of records (DPE 2022b)** | **IBRA subregions** | **Likelihood of occurrence and inclusion or exclusion from assessment** |
|---|---|---|---|---|---|---|---|
| | **BC Act** | **EPBC Act** | | | | | |
| | | | | | | | suitable microhabitats required for the species presence.<br><br>The species does not require any further consideration. |
| ***Hygrocybe reesiae*** | V | -- | Species | Known from type locality, Lane Cove Bushland Park, Lane Cove and other locations in the Sydney region including Royal National Park, Chatswood, Castle Hill, Northbridge, Marsfield, East Linfield and the Blue Mountains (Mount Wilson, Hazelbrook). Also found in Tasmania. Occurs in gallery warm temperate forests dominated by Lilly Pilly (*Acmena smithii*), Grey Myrtle (*Backhousia myrtifolia*), Cheese Tree (*Glochidion ferdinandi*) and Sweet Pittosporum (*Pittosporum undulatum*). Associated with alluvial sandy soils of the Hawkesbury Soil Landscapes with naturally low fertility and erodible. | -- | Wollemi | **Excluded as candidate.** BioNet notes the species is only known from the lower Blue Mountains (Springwood, Hazelbrook) and to the north of the study area at Mt Wilson proximal to the study area. Furthermore, BioNet states that the species is known to occur in gallery warm temperate forests with mesic species not present within the study area.<br><br>Advice received from Dr Steven Douglas (a listed BAM species expert for flora) regarding this species is that habitat for this species is not likely to be present within the study area due to the; different sub region, the considerably higher elevations, the difference in geology and lastly distance from the temperate coastal environments of the known locations (pers. comm. July 2022).<br><br>The study area is considered to occur outside the species area of occurrence and does not support the suitable microhabitats required for the species presence.<br><br>The species does not require any further consideration. |

# Annexure F – Microbat call graphs

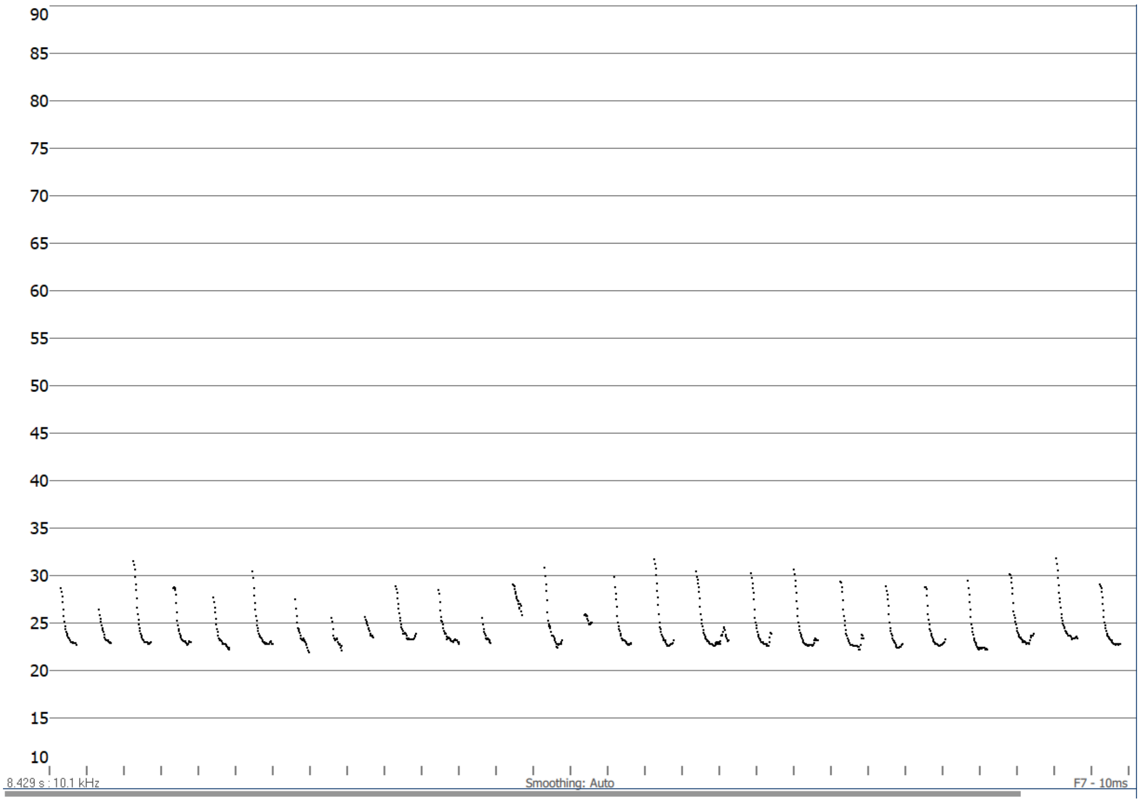
Example time versus frequency graphs from calls recorded during the survey are shown in the following graphs. Calls are displayed in compressed mode unless otherwise stated.



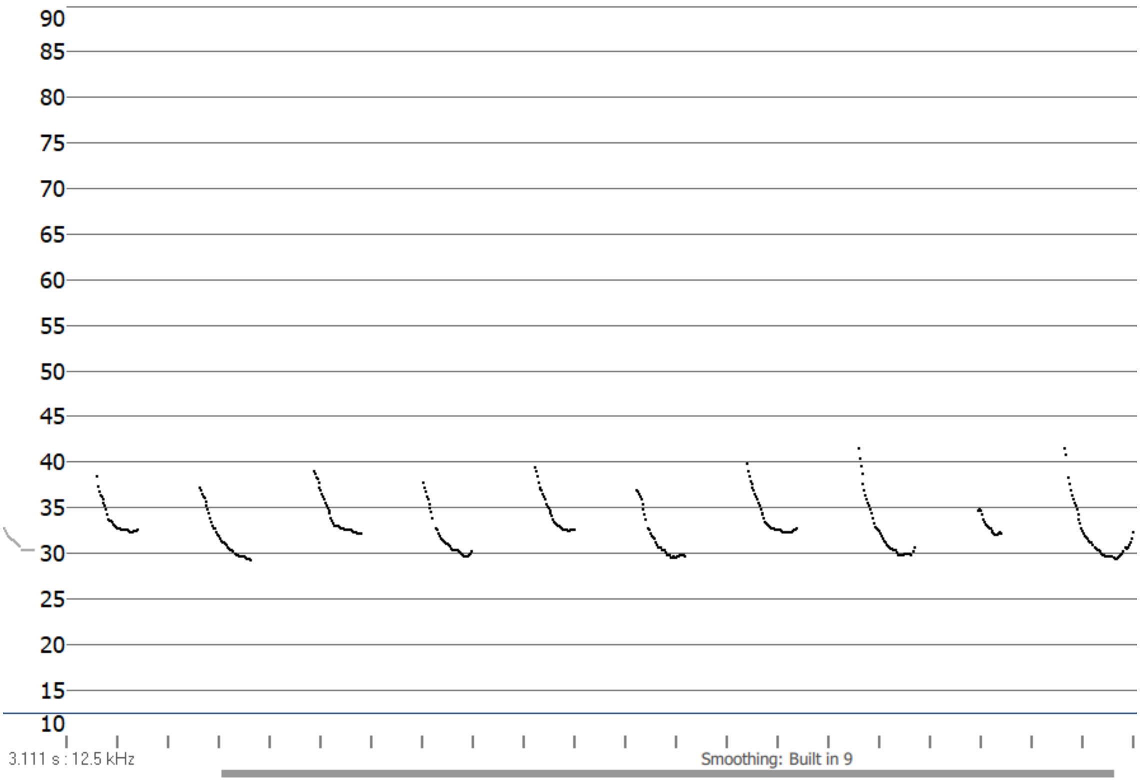
Graph A.E-1: Time versus frequency call graph for White-striped Free-tailed Bat (1 of 2)



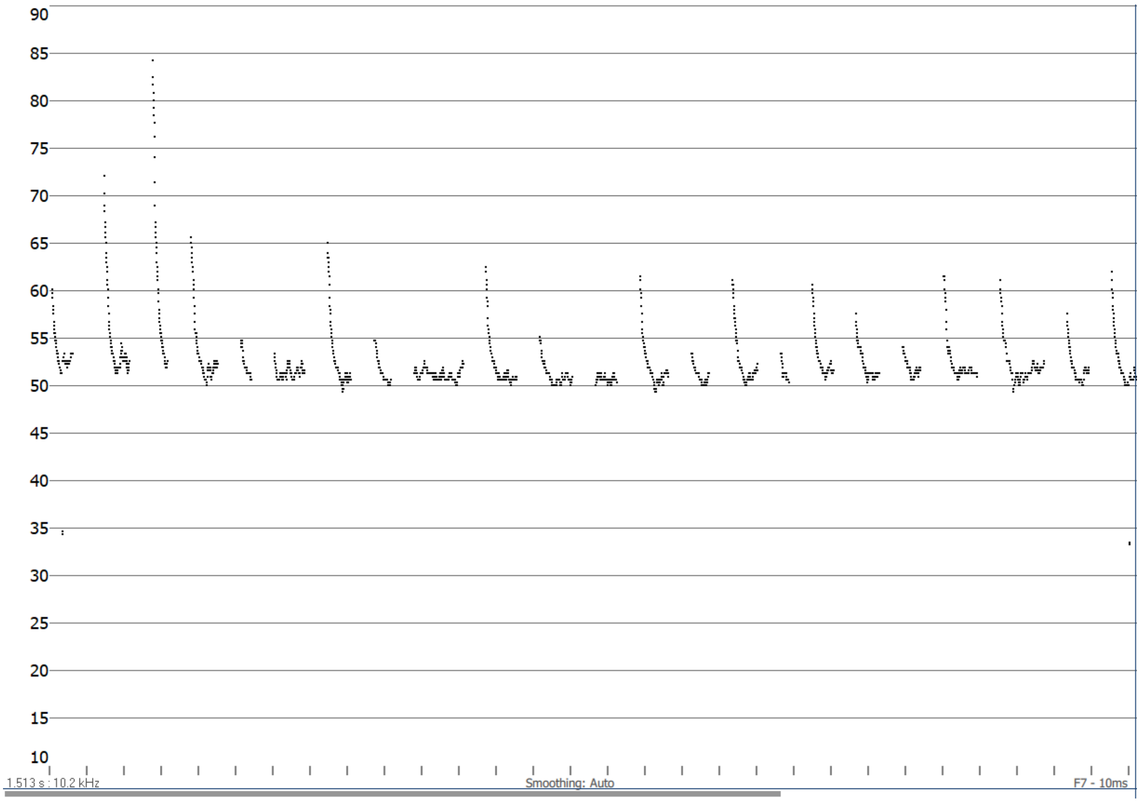
Graph A.E-2: Time versus frequency call graph for White-striped Free-tailed Bat (2 of 2)



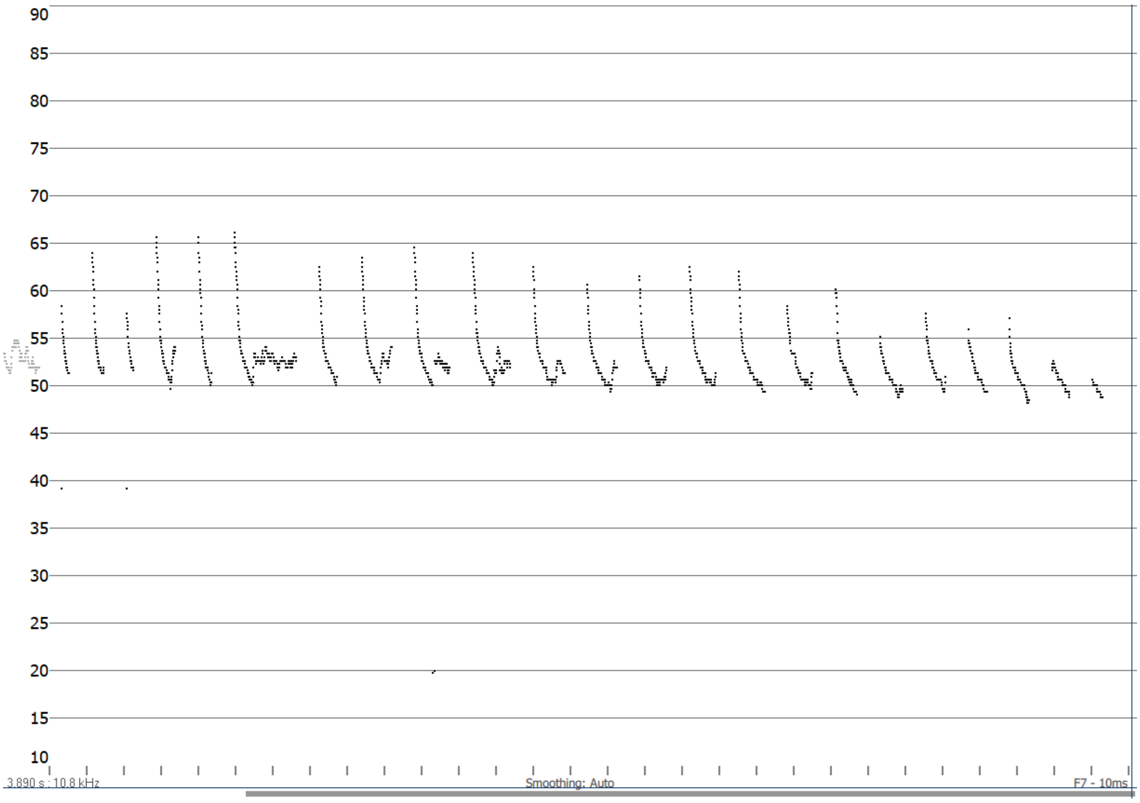

Graph A.E-3: Time versus frequency call graph for Large-eared Pied Bat



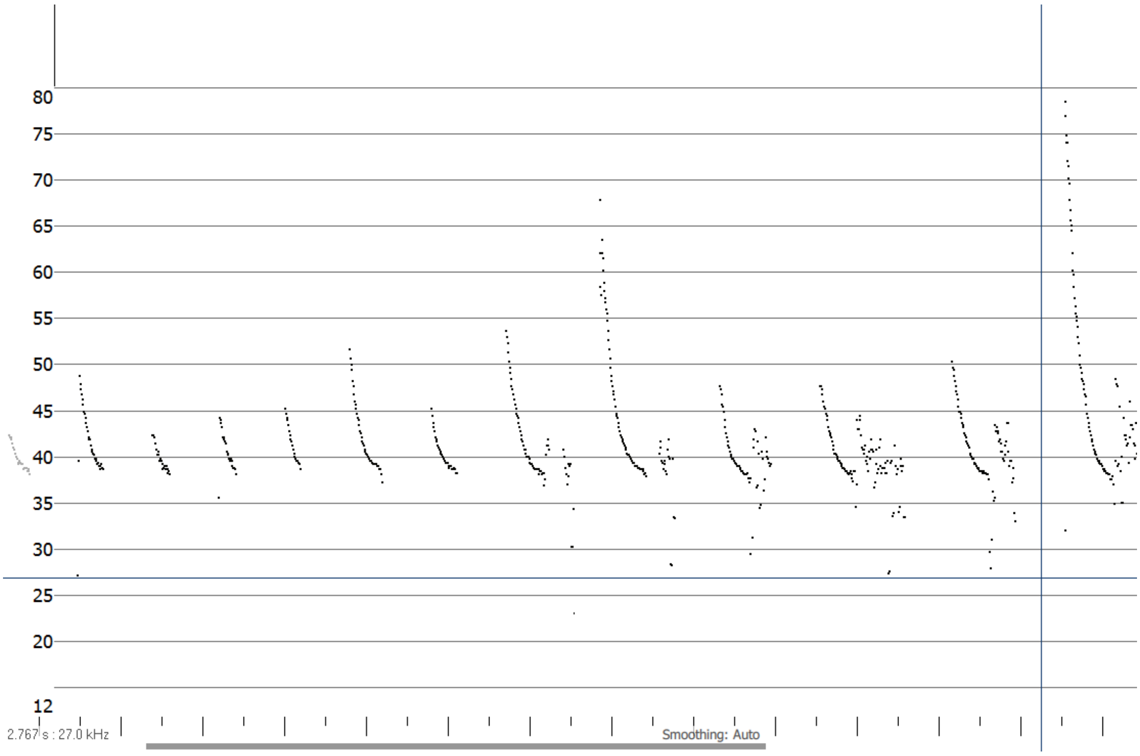

Graph A.E-4: Time versus frequency call graph for Gould's Wattled Bat



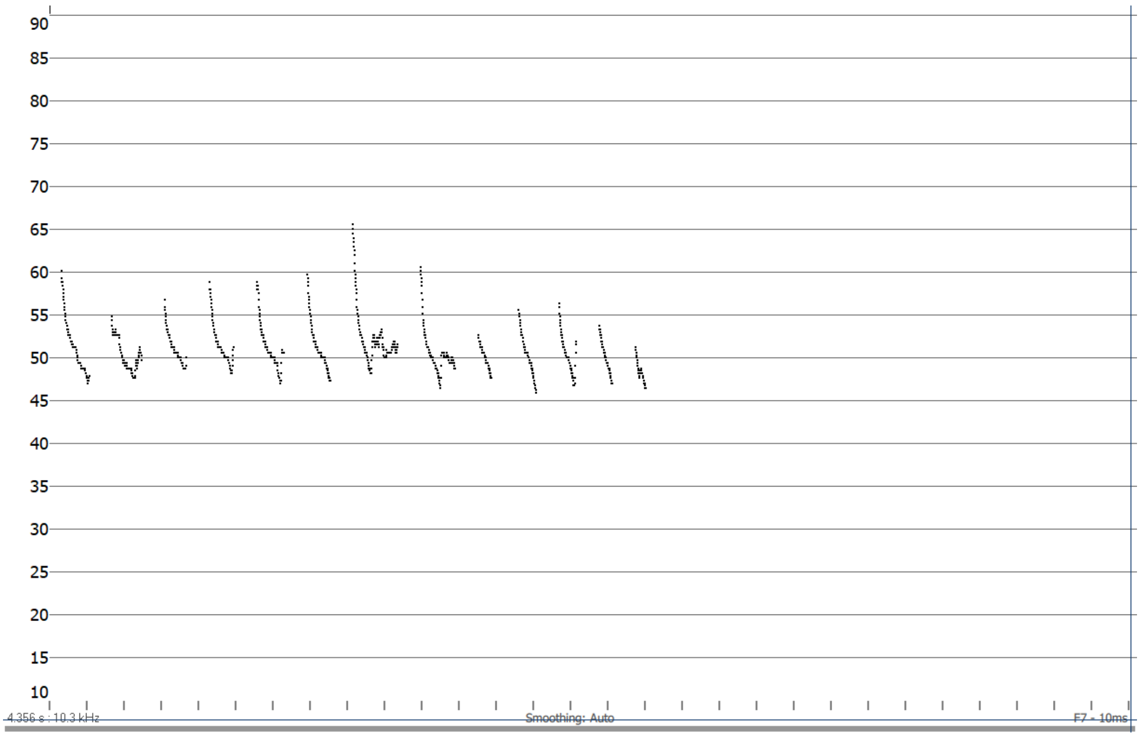

Graph A.E-5: Time versus frequency call graph for Chocolate Wattled Bat (1 of 2)



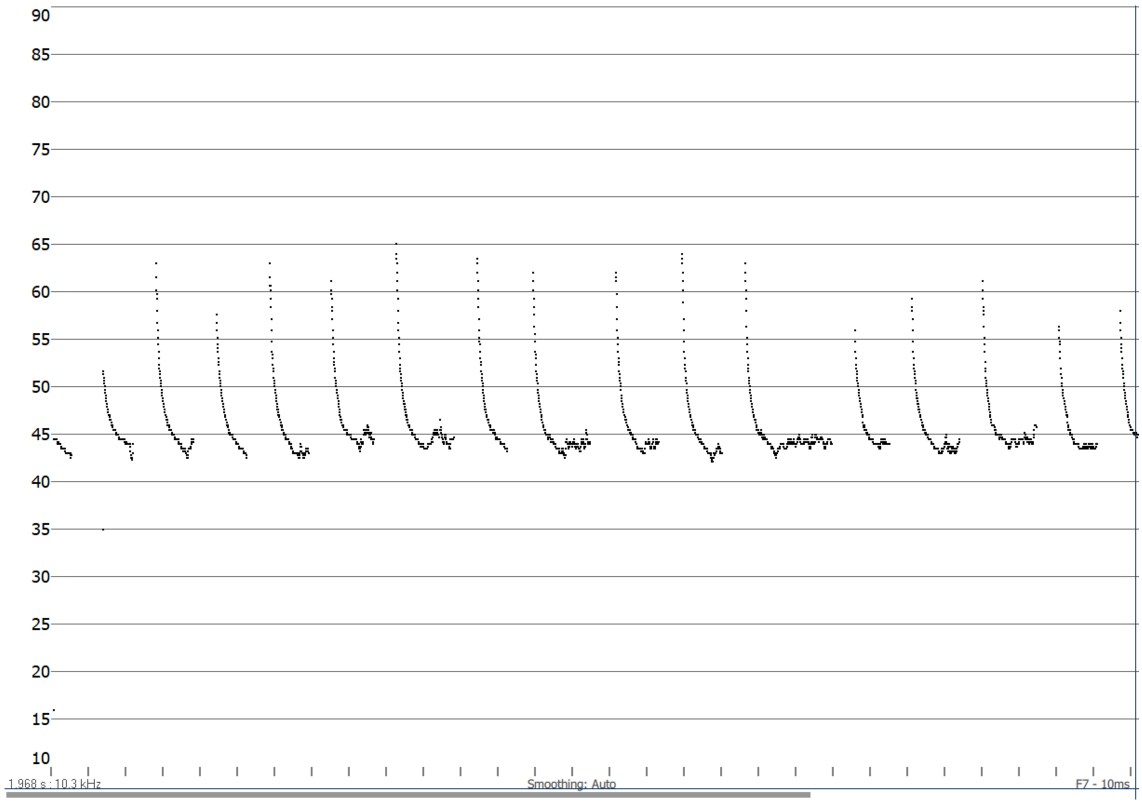

Graph A.E-6: Time versus frequency call graph for Chocolate Wattled Bat (2 of 2)



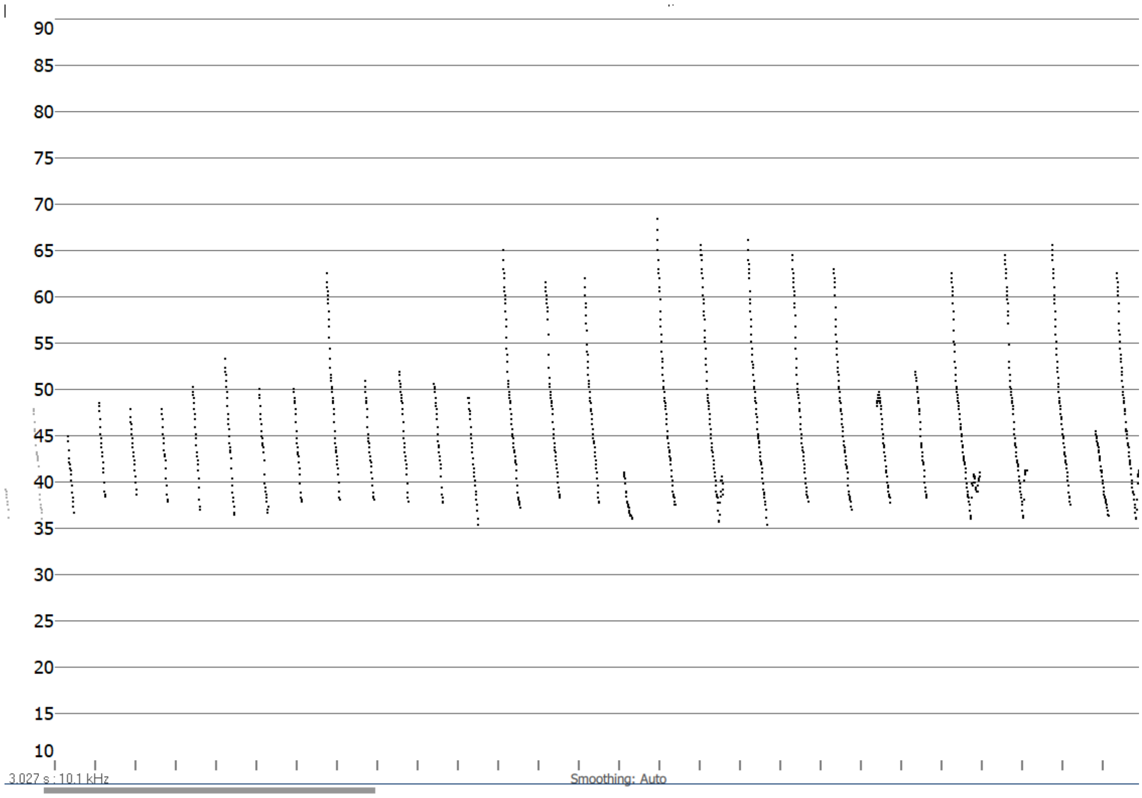

Graph A.E-7: Time versus frequency call graph for Eastern False Pipistrelle



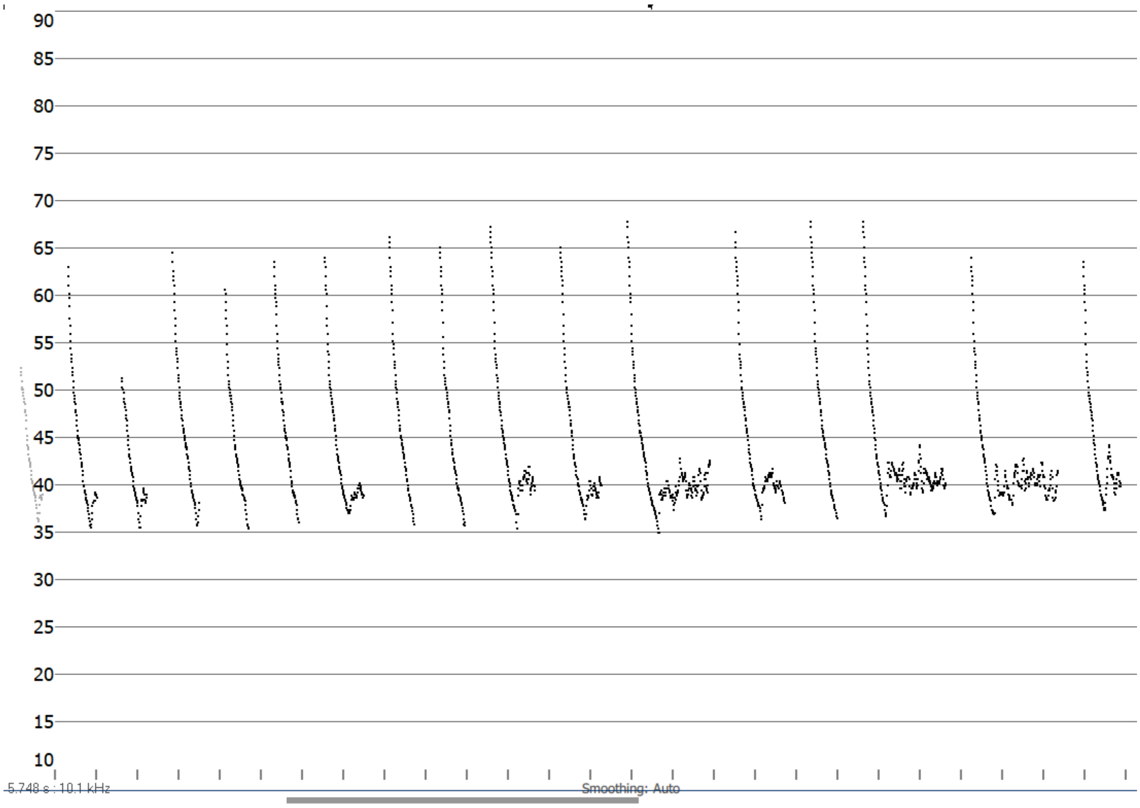

Graph A.E-8: Time versus frequency call graph for Large Bent-winged Bat (1 of 2)



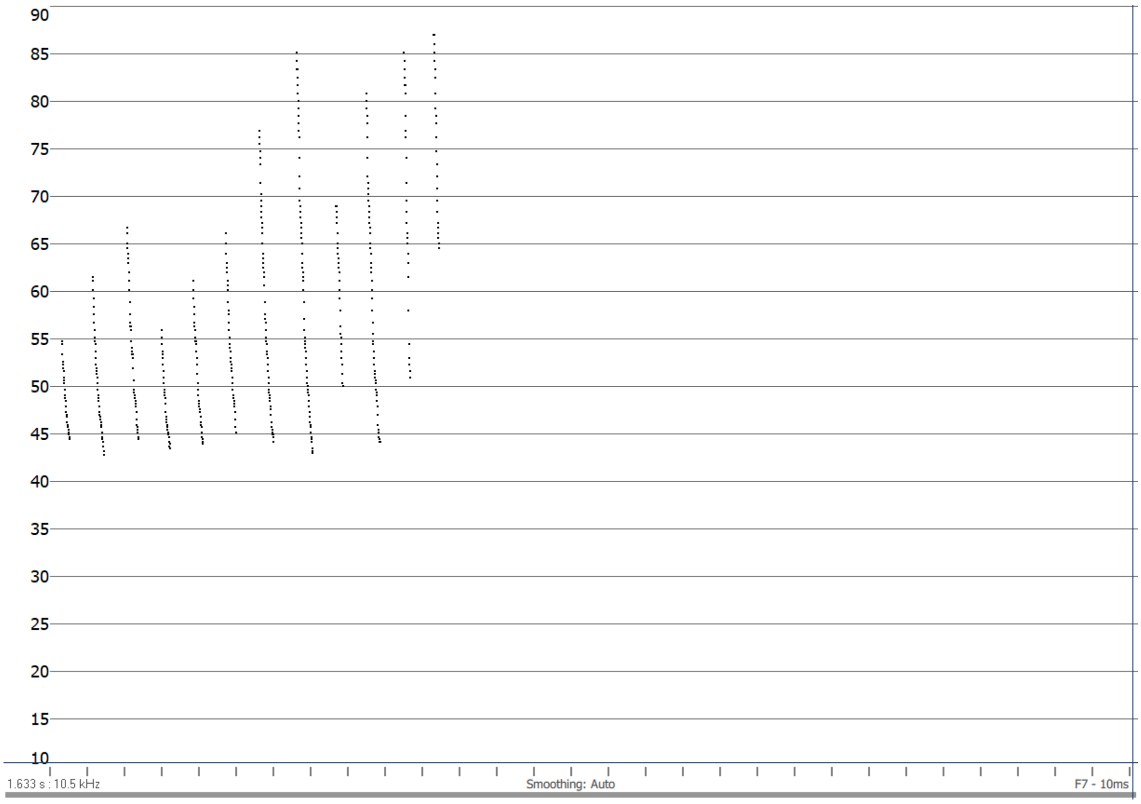

Graph A.E-9: Time versus frequency call graph for Large Bent-winged Bat (2 of 2)



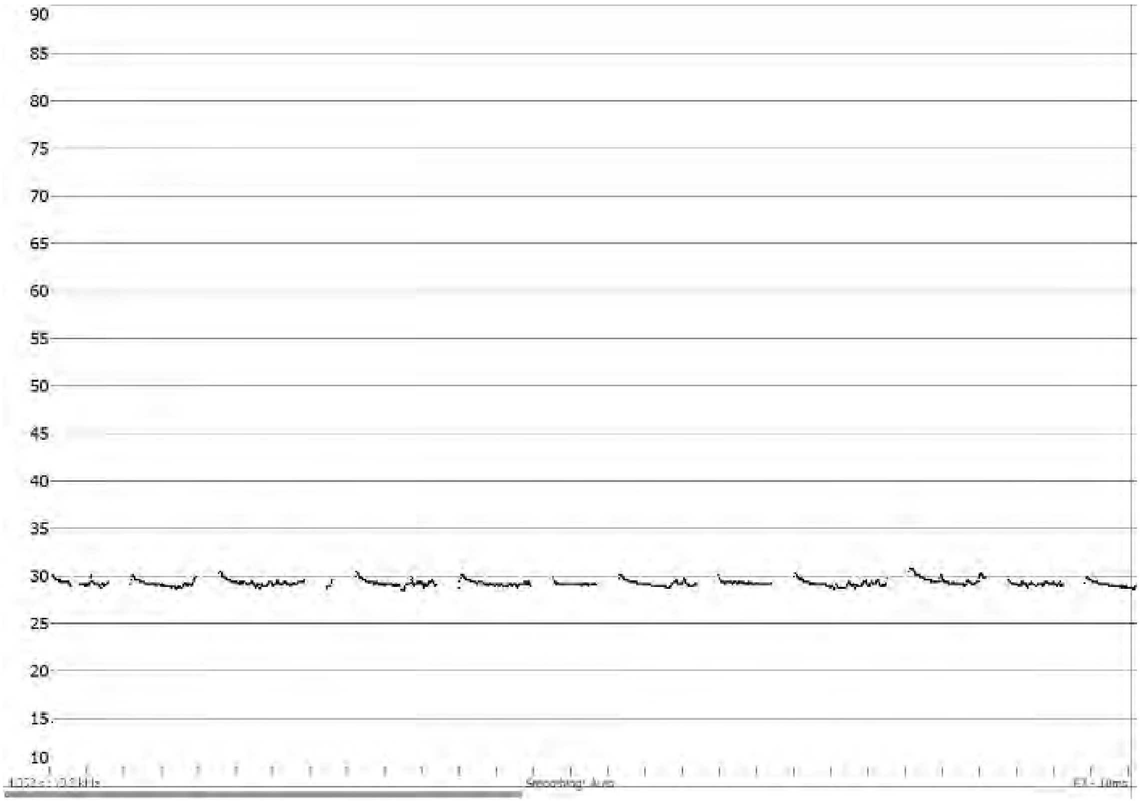

Graph A.E-10: Time versus frequency call graph for species group related to Southern Myotis (1 of 2)



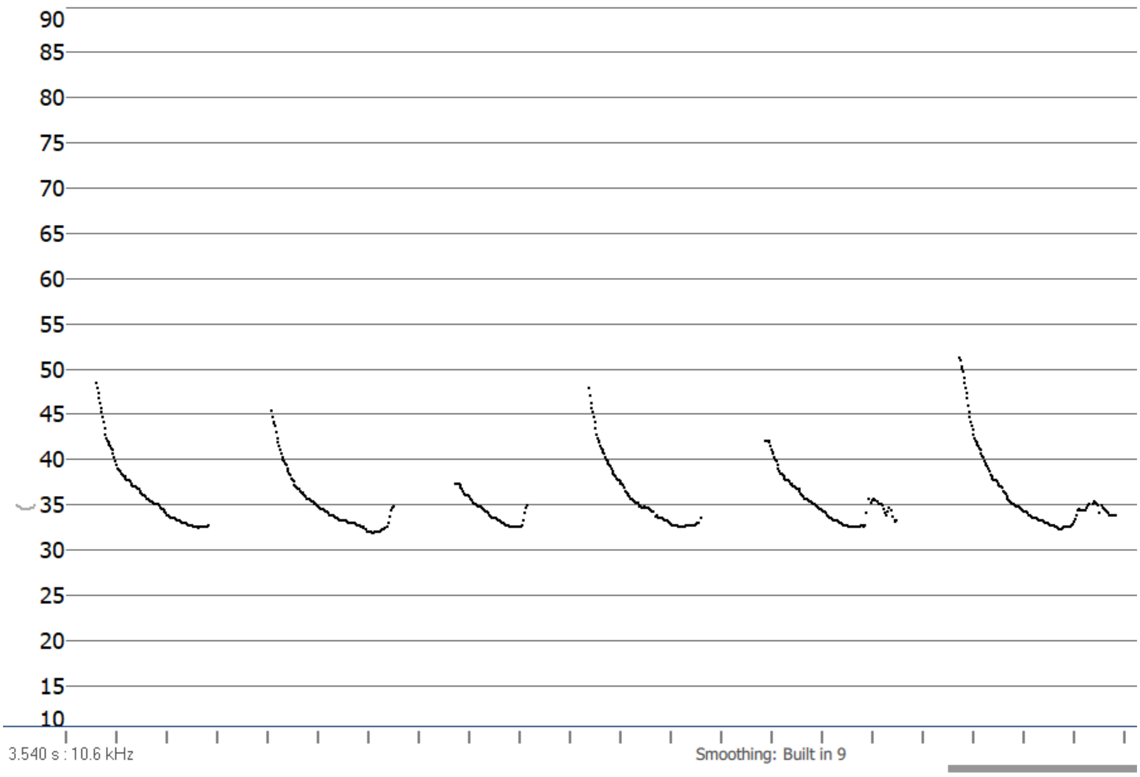

Graph A.E-11: Time versus frequency call graph for species group related to Southern Myotis (2 of 2)



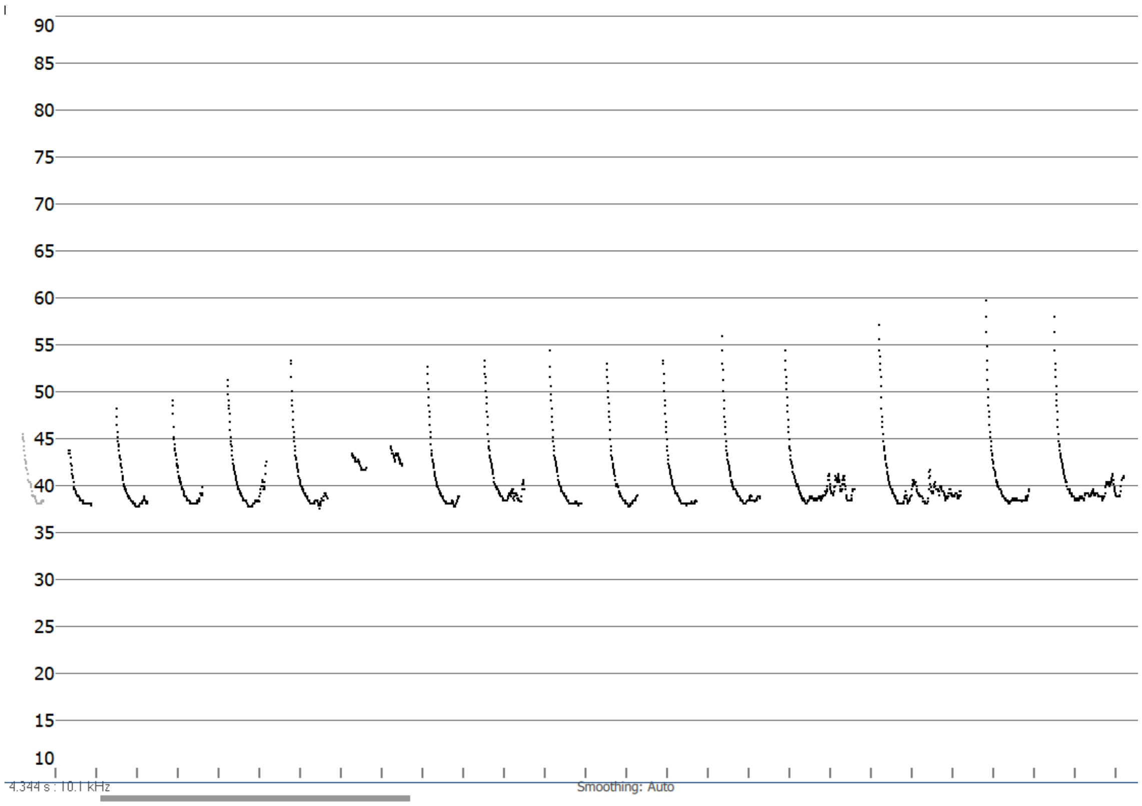

Graph A.E-12: Time versus frequency call graph for *Nyctophilus* species group



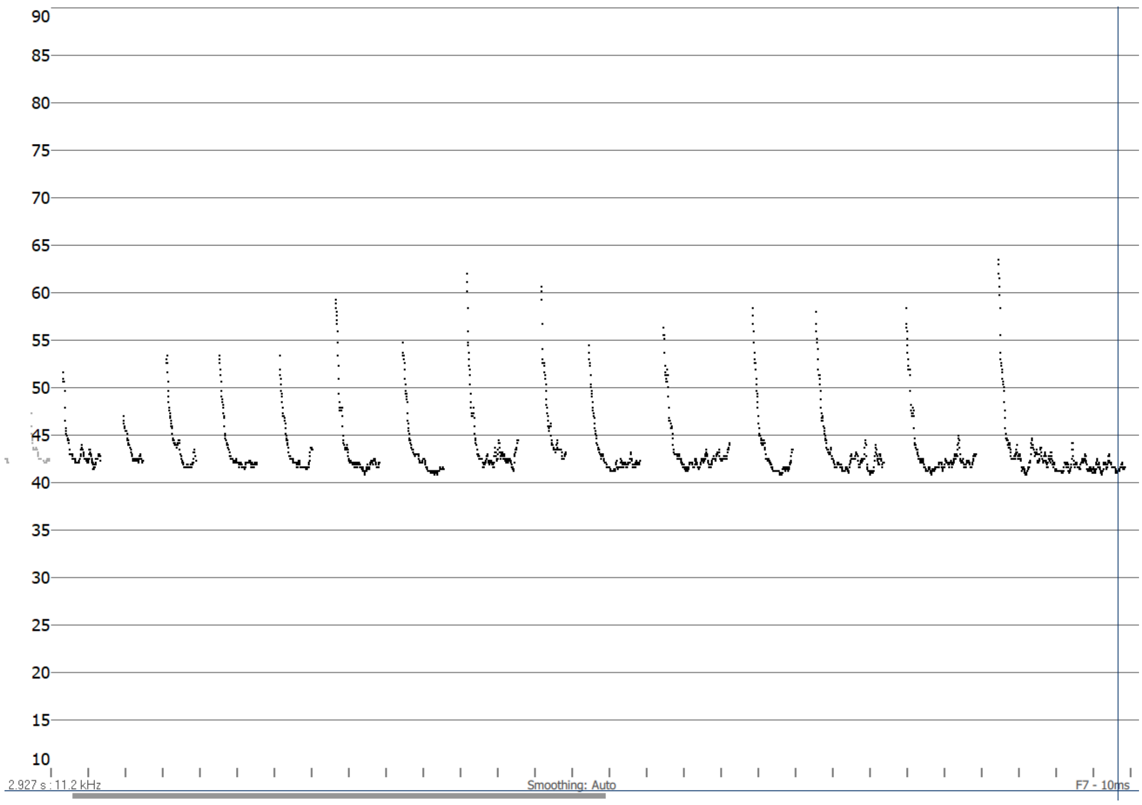
Graph A.E-13: Time versus frequency call graph for Ride's Free-tailed Bat



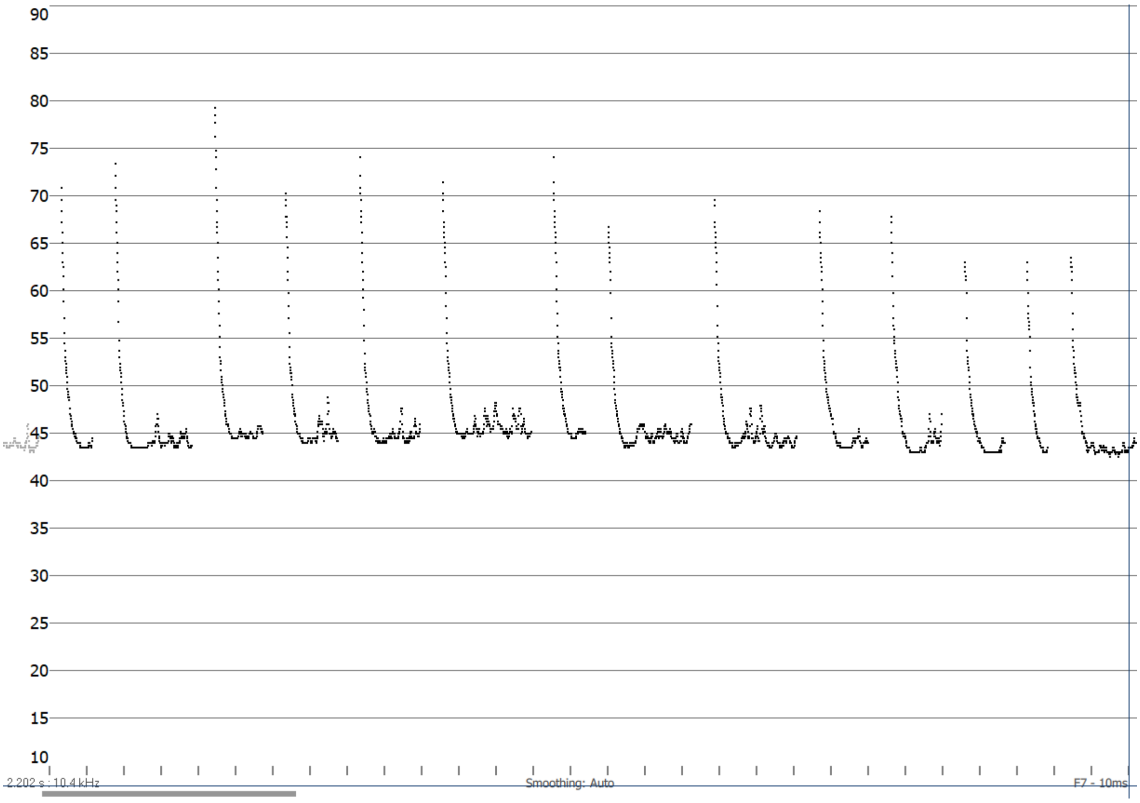

Graph A.E-14: Time versus frequency call graph for Greater Broad-nosed Bat



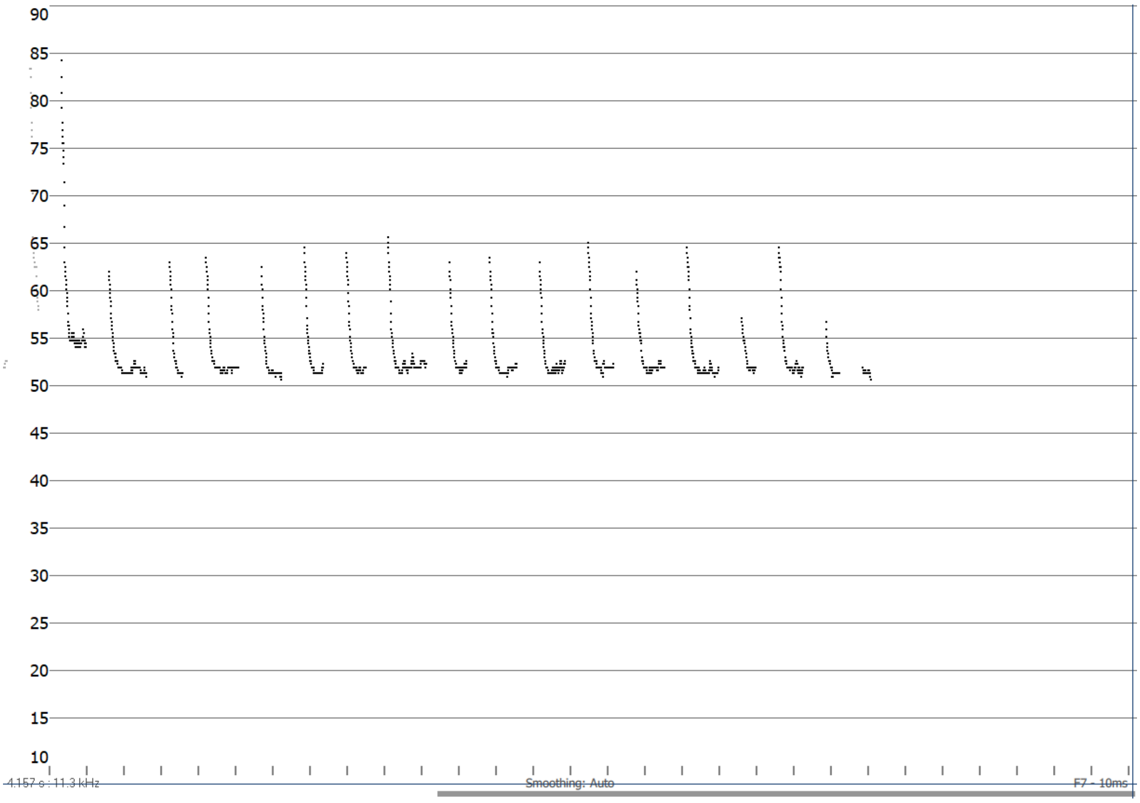

Graph A.E-15: Time versus frequency call graph for South-eastern Broad-nosed Bat




Graph A.E-16: Time versus frequency call graph for Large Forest Bat




Graph A.E-17: Time versus frequency call graph for Southern Forest Bat




Graph A.E-18: Time versus frequency call graph for Eastern Cave Bat and Little Forest Bat species group